

Food and Other Crops in Fiji: an Annotated Bibliography

T.K. Lim and E.M. Fleming

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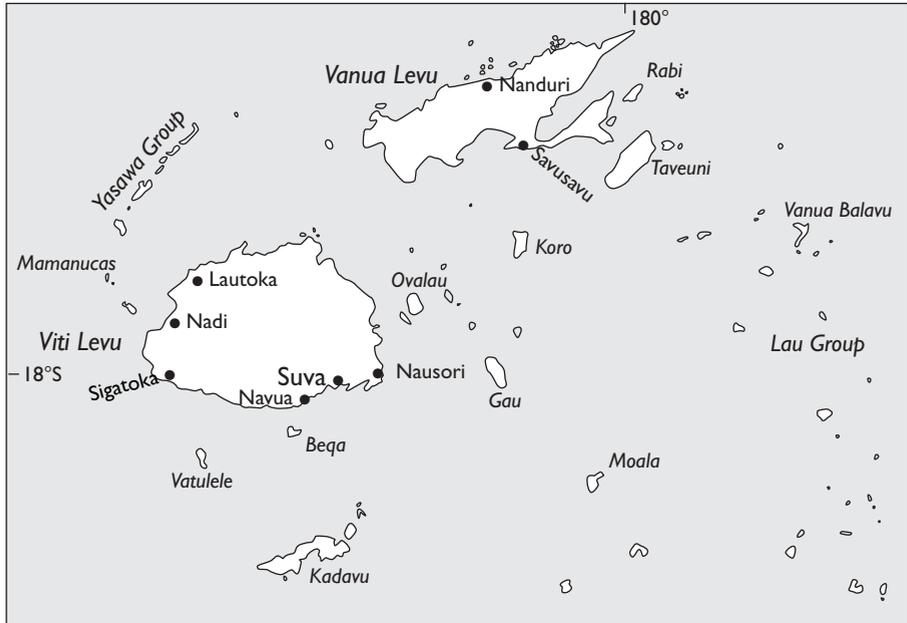
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Map of Fiji

INTRODUCTION

This bibliographic study is a part of a range of strategic approaches used in a feasibility study on the status, constraints and solutions in the production, marketing and consumption of nutritious food crops in Fiji. The primary objective of this annotated bibliography is to assist in the identification of pre- and post-production activities on food crops that have received considerable research and development emphasis and, conversely, highlight those important areas that have received inadequate emphasis and require greater focus and more action.

The scope of the bibliography includes published and unpublished (mimeograph) documents on research and development activities that are readily accessible or available to us. These documents report on work carried out in relation to all aspects of production, marketing and consumption of nutritious food crops in Fiji. An attempt was made to scan publications from the early years of European visitations to Fiji in the 1860s until the present. However, this literature survey is not exhaustive, as many publications are unavailable or inaccessible. For similar reasons, some citations were not annotated. Annotations were also not provided in a few cases where the title is self-explanatory, as in the cases of a number of pamphlets and lists that are included. An attempt is also made to include associated literature from other Pacific countries where it is relevant to food and agriculture in Fiji.

It is hoped that this bibliographic study will be useful to researchers, scientists, policy makers, planners, nutritionists and health workers. Also, we hope it will be relevant to consumers of nutritious food crops and those who are interested in finding out more about Fiji.

The bibliography is arranged according to key production activities and crops, as outlined below. Entries are arranged chronologically in 10-year segments and then alphabetically according to the first author's surname. We found this format to be useful for our feasibility study and feel that it would also be useful to other researchers.

Production topics covered in this bibliography are grouped into:

- ▶ Agricultural development planning and policies
- ▶ Land tenure
- ▶ Agricultural economics, marketing, geography and statistics
- ▶ Agricultural extension, education, information and research techniques
- ▶ Agricultural production practices and farming systems —irrigation and water management, cultural practices and farming systems
- ▶ Soil management, soil conservation and plant nutrition
- ▶ Crop introduction, distribution and description
- ▶ Insect pests, plant diseases and weeds (including general plant protection)
- ▶ Weedicides, pesticides and their application technology
- ▶ Plant tissue culture and biotechnology
- ▶ Post-harvest handling, grading, processing and technology
- ▶ Food and human nutrition.

Crop categories covered are:

- ▶ Pulses, legumes and leguminous trees
- ▶ Vegetables
- ▶ Rice and other cereals
- ▶ Fruits (bananas, papaya, pineapple, breadfruit, citrus, passionfruit, guava, mango, melons)
- ▶ Nut crops
- ▶ Beverages (cocoa, coffee, tea, kava)
- ▶ Spices (vanilla, pepper, turmeric)
- ▶ Sugarcane
- ▶ Root and tuber crops (ginger, taro, tannia, giant swamp taro, yams, cassava, sweet potato, potato, miscellaneous)
- ▶ Coconut and other palms
- ▶ Miscellaneous cash crops.

A special category is included for annual reports of the Department of Agriculture/Ministry of Primary Industries/Ministry of Agriculture, Fisheries and Forests (MAFF). An index of authors is also included. Scientific names of crops are entered in italics.

Information for this bibliography was extracted from the published and unpublished works held in the library collections in Fiji of MAFF; National Food and Nutrition Committee; the University of South Pacific, Suva—South Pacific and General Collections; and the Trade Forum Secretariat. Other sources include publications of the South Pacific Commission, Pacific Regional Agricultural Programme (PRAP), Soil and Crop Evaluation Project (SCEP), United Nations Development Programme (UNDP), Institute for Research, Extension and Training in Agriculture (IRETA), Bureau of Statistics, and consultants in Fiji; library collections of the University of New England, the Australian Centre for International Agricultural Research (ACIAR) and the Department of Primary Industry and Fisheries, Northern Territory, and from CD-ROM databases of CAB (1972+), AGRICOLA (1970-1994), Current Contents (Agriculture, Biology and Environmental Science), and Australian-Based Agriculture and Natural Resources.

The authors express their thanks for assistance rendered in this compilation to staff of ACIAR, especially to Dr Padma Lal, Dr Greg Johnson and Dr Paul Ferrar for their valued assistance, to Mr Paula Taukei and staff in his division and in the library of MAFF, Ms Seini Seiniloli and the staff of NFNC, Dr Malcolm Hazelman of the South Pacific Commission, Mr Peter Walton and Dr Mecki Kronen of PRAP, Mr J. Widdowson of SCEP, and Mr Andrew McGregor, a private consultant in Suva.

AGRICULTURAL DEVELOPMENT PLANNING AND POLICIES

1930–1939

Roth, G. K. 1936. *Fiji: Handbook of the Colony*. Government Printer, Suva, 163 pp.

Separate chapters are included on the sugar industry, coconuts and copra industry, banana cultivation, canned pineapples, citrus fruits, rice production, cotton growing and subsidiary crops. In the chapter on subsidiary crops, there are brief notes recorded on tobacco, coffee, pulses, maize, sweet potato, oilseeds, cassava, rubber, citronella oil, spices, tomatoes, cucumbers, melons pumpkins, papaya, grenadillas and avocado.

Stockdale, F. 1938. *Report on Visit to Fiji 1937*. Colonial Office, London.

This is an early document on agricultural planning that begins with a short history of agricultural development and agricultural activities at the time of the visit. Analyses are made of the coconut, sugar and banana industries, other existing crops are mentioned, and notes are made on crops showing potential for introduction and development. The work of the Fiji Department of Agriculture comes under scrutiny, and recommendations are made for its future organisation. A short description is given of plant import regulations. A set of recommendations is made that covers all aspects of agricultural activity in Fiji.

1940–1949

Jack, H. W. 1940. Local food production. *Fiji Agricultural Journal*, 11(2), 33–35.

The author expresses puzzlement over the need to import so much food given the bountiful land resources in Fiji. He expresses the opinion that local farmers need greater incentives to produce more food for the welfare of the whole population. He is particularly concerned about the import of so much rice, and details efforts to stimulate local rice production that had met with little success. He mentions the potential advantages of irrigated rice production. Details are provided on a number of other foods that could be remunerative for farmers while acknowledging the many obstacles to greater food self-sufficiency. It is an early example of the underestimation of the important role of traditional staples, and of the confusion between self-sufficiency and nutrition security.

Harvey, C. 1941. Food crops and the 1941 hurricane. *Fiji Agricultural Journal*, 12(2), 35–37.

A report is presented on the relative damage to different crops of a cyclone in 1941. The importance is emphasised of maintaining reserves, either in the ground or storehouse. Yams are perceived as having a vital role in this respect.

Parham, B. E. V. 1946. Fiji and the Food and Agriculture Organization. *Fiji Agricultural Journal*, 17:96–101.

The author summarises the general position and principles of the Food and Agriculture Organization of the United Nations, and reviews the situation for the production and local use or export of major existing and potential crops in Fiji. Crops covered include sugar, copra, bananas, peanuts, soya beans, pulses, rice, grain sorghum, maize, cassava and starch foods, sweet potato, cottonseed and other oils, and pineapples and other fruits.

Blackie, W. J. 1949. Agriculture research and policy in Fiji. *Fiji Agricultural Journal*, 20:98–120.

The author provides a general account of agricultural development with tabulated data on crop area and exports for 1948, history of the Department of Agriculture, research achievements and policy measures adopted. Crops listed for research attention include coconut, citrus, other fruit crops, coffee, tea, sugar, bananas, tobacco and vegetables.

1950–1959

Roth, G. K. 1953. *Fijian way of life*. Oxford University Press, London, reprinted 1973, 176 pp.

Roth describes the physical background of village life and land custom. An appendix is provided on Fijian plant names and their botanical equivalents.

Spate, O. H. K. 1959. *The Fijian People: Economic Problems and Prospects*. Council Paper No. 13, Legislative Council of Fiji, Suva.

A major thrust of this report concerned the perceived need for land reform to hasten agricultural development. The author felt that the structure of indigenous Fijian society was closely linked to the land tenure system in impeding rural development. A movement away from a

communitarian system to one based more on individual initiative in production was considered necessary. Access to alienable land was seen as an integral part of this process.

1960–1969

Burns, A., Watson, T. Y. and Peacock, A. T. 1960. Report of the Commission of Enquiry into the Natural Resources and Population Trends in the Colony of Fiji. Council Paper No. 1 of 1960, Legislative Council of Fiji, Suva.

The findings on agricultural and rural development in this report largely supported those by Spate a year earlier. It was recommended that individualism should be given greater emphasis in agricultural production, with implications for the land tenure system.

Central Planning Office 1966. Fiji Development Plan 1966–1970: Agriculture and Forestry. Suva.

Included in this plan are agricultural policy aims, details of export crops and domestic products, production targets for agriculture, land development, activities of the Department of Agriculture, marketing cooperatives, and research program and expenditure estimates for the plan period.

1970–1979

Adams, M. E. 1970. Land use planning, physical resource surveys and agricultural development in Fiji. *Fiji Agricultural Journal*, 32:22–26.

Three stages of surveying physical, social and economic resources are outlined as a means to determine the potential of different resource combinations and implementing development policies. In Fiji, the first stage had been piecemeal and uncoordinated in the field, leading to difficulties in the second and third stages. It is argued that agricultural shortcomings in Fiji have been attributed to poor soil and climatic conditions while social and institutional factors have been overlooked.

Central Planning Office 1970. Fiji's Sixth Development Plan 1971–1975. Suva, 264 pp.

A chapter is included in the plan on agriculture, fisheries and forests, with a separate section on each plus an annex on programs for major agricultural commodities. Details are provided on the agricultural sector plan and policies. Separate sections are devoted to the research program,

extension division and agricultural training. Policies covered in some depth include marketing and price policy, rural credit, financial services, irrigation, land tenure and sugar.

Chandra, S. 1972. Agriculture, land use and smallholder farming problems in the Sigatoka Valley (Fiji). *Fiji Agricultural Journal*, 34:21–26.

A survey made of 54 farms totalling 203 ha showed a very dense population with a high proportion of youth. Each year an increasing proportion of farm produce was being used for home consumption leaving little for cash income. Cropping is very inefficient because subsistence crops do not realise the full soil potential. The main barriers to development identified were: over-population, insecurity of tenure, the slow rate of adoption of innovations, lack of capital and the low yield and unsuitability for summer cropping of most crop varieties.

Government of Fiji. 1975. *Fiji's Seventh Development Plan 1976–1980*. Central Planning Office, Suva, 267 pp.

The seventh development plan contained a brief chapter on food and nutrition in the first part of the plan in which development objectives and strategies were outlined. In the second part on sectoral plans, the agricultural plan is outlined first. The outline begins with the observation that agricultural performance was not as good as expected in the previous plan period, with some implied criticism of lack of motivation by farmers. Nevertheless, the seventh development plan largely follows the format of previous plans.

Fisk, E. K., Hardaker, J. B. and Thaman, R. R. ed. 1976. *The R. W. Parkinson Memorial Lectures: Food Production in the South Pacific*. University of the South Pacific, Suva.

These lectures were delivered in August and September 1974, and their main theme was the inappropriateness of some of the current agricultural development strategies in the South Pacific and the need to use indigenous agricultural systems as stable bases for development rather than considering them as inefficient obstacles in need of radical modernisation. The three lectures were: traditional agriculture as a source of food in a development situation (E. K. Fisk); agricultural policies for development in South Pacific countries (J. B. Hardaker); and the role of indigenous agricultural systems in fulfilling the needs of Pacific Island societies (R. R. Thaman).

Haynes, P. H., Brookfield, H. C. and Hardaker, J. B. 1976. Population and Environment Project: Eastern Islands of Fiji(Papers on Agriculture and Marketing. UNESCO/UNFPA Man in the Biosphere Project. Australian National University for UNESCO, Canberra.

This publication contains three project working papers and appendices on smallholder crop production in the Eastern Islands of Fiji. The first paper by Haynes is an account of some aspects of agriculture in Taveuni and Lakeba. Crop production processes are described, details are given on taro yields, and the issue of choice of appropriate technology is discussed. Brookfield's paper begins with a background of land sub-division in Fiji, and is followed by a description of the farming activities of five blockholders on settlement schemes, three in official schemes, one in an unregistered scheme and one settled on a piece of estate back-land. Discussion focuses on a comparison of the farms and the evolution of a production system that makes good use of the natural resources. Hardaker discusses some economic aspects of agricultural production and marketing in Taveuni, dealing with production methods and economic characteristics, the organisation of marketing and marketing reform, land tenure policy and extension programs. Appendices contain data on the main smallholder crops, estate crop production, technical considerations of rehabilitating coconuts, and notes on crop density and diversity.

Brookfield, H. C. 1977. Population, Resources and Development in the Eastern Islands of Fiji: Information for Decision-Making. General Report No. 1, UNESCO/UNFPA Man in the Biosphere Project. Australian National University for UNESCO, Canberra.

This report deals with all factors expected to influence the rate of development in the Eastern Islands of Fiji. Issues covered include ecology, resources and their use, population dynamics, hazards, economics and marketing, transport links and tourism. Agricultural change is reviewed, and a description is given of past agricultural systems covering copra and other export crops, subsistence crops and livestock. The commercialisation processes for indigenous crops are observed.

Chandra, S. 1979. Smallholder farm resource inventory and agricultural development planning in the Sigatoka Valley, Fiji. *Fiji Agricultural Journal*, 41(1), 1-19.

The author presents an inventory of farm resources for a sample of semi-subsistence Fijian and Indian farmers in the Sigatoka Valley, Fiji. He derives optimum resource allocation for the farms based on allocative and

technical efficiency analyses. A discussion is presented on the level of resource readjustments on the farms, followed by examples of crop mixes and calculation of gains in gross farm output. This study focuses on the need for detailed inventories of farm resources for agricultural development planning.

1980–1989

Chandra, S. 1980. Root crops in Fiji: Part 2 Development and future food production strategy. *Fiji Agricultural Journal*, 42(1), 11–17.

A food production strategy based on root crops is described that will give maximum returns in terms of kilojoules of food energy produced per unit of agricultural input. Energy relations in crop production are discussed. A two-goods model of semi-subsistence agricultural production is developed to show the need for the allocation research resources into root crops. Some general policy recommendations on the development of root crops in Fiji are also drawn from the analysis.

Government of Fiji. 1980. Eighth Development Plan 1981–1985: Policies and Programmes for Social and Economic Development. Central Planning Office, Suva, 369 pp.

The eighth development plan contains a chapter on increasing economic production with a sizeable section on agriculture. Agricultural development during the period of the seventh development plan is reviewed, and objectives and strategies for DP8 are outlined. Brief descriptions are given of the main agricultural programs that are planned for the period, concentrating on crops that have most export potential.

Ward, R. G. and Proctor, A. 1980. Fiji. In: Ward, R. G. and Proctor, A. ed. *South Pacific Agriculture: Choices and Constraints*. Australian National University Press, Canberra, pp. 421–430.

The chapter provides a brief description of the agricultural sector in Fiji. Issues covered include the base for agricultural diversification and the main agricultural options for planners.

Bourke, R. M. 1981. Self-sufficiency in horticultural crops. *South Pacific Journal of Natural Science*, 3:31–43.

The author discusses the factors that make South Pacific agriculture so diversified, then briefly reviews horticultural production in a number of South Pacific countries, including Fiji. The major constraints to smallholder agricultural development in Papua New Guinea and Cook Islands are analysed.

Cull, B. W. 1981. Utilising advanced technology in tree crops to improve productivity in the South Pacific. *South Pacific Journal of Natural Science*, 3:9–30.

The main purpose of this paper is to identify the main opportunities for, and constraints to, adoption of improved technologies in tree crop production in South Pacific countries, including Fiji. Factors influencing technology adoption relate to the characteristics of the farm population, environmental factors, infrastructure, markets, and availability of finance and resources.

Patel, N. P. 1981. Agriculture in Fiji. *Alafua Agricultural Bulletin*, 6:9–11.

Agricultural policies and strategies under the eighth development plan (1981–1985) in Fiji are elucidated. Agricultural diversification to reduce the dependence on sugarcane, development of a variety of export commodities and emphasis on the production of food for domestic consumption are the highlights of agricultural policy.

Sivan, P. 1981. Self-sufficiency in food production in the Pacific: opportunities and constraints—field crops. *South Pacific Journal of Natural Science*, 3:44–53.

The main field crops grown in South Pacific countries are outlined, with emphasis on root crops. Some references are made to the production of root crops in Fiji.

Ward, R. G. 1981. Dilemmas in South Pacific agriculture. *South Pacific Journal of Natural Science*, 3:9–30.

The focus of this article is the set of dilemmas facing smallholders in developing their farming systems in South Pacific countries. Alternative modes of agricultural production are assessed, especially of crops for commercial sale.

Chandra, S. 1982. Food production and consumption in a Fijian village and an Indian settlement in the Sigatoka Valley, Fiji. *Agricultural Systems*, 9:1–13.

A survey of the two different ethnic communities showed distinct differences in the dietary patterns and sources of food energy and protein among different food commodities. Indians were more efficient than Fijians in meeting their food requirements from the farms. Fijians tend to purchase more store food and more expensive sources of food energy and protein to supplement their diets. Results are used to formulate food policies for Fiji and other developing nations.

Institute for Research, Extension and Training in Agriculture 1982–present. IRETA's Agriculture News. University of the South Pacific, Alafua.

IRETA's Agriculture News is the agricultural newsletter of the Institute for Research, Extension and Training in Agriculture. It provides summaries of happenings in the areas of agricultural research, training and extension throughout the South Pacific, including Fiji. Its publication is aimed at spreading agricultural information from individual countries throughout the region.

Chandra, S. 1983. *Agricultural Development in Fiji*. Australian Universities International Development Program (AUIDP), Canberra, 172 pp.

This book covers farming systems in Fiji, broader environmental factors of land, soils and climate, and the socioeconomic factors of marketing, credit, ethnic composition, food preferences and livestock.

Hardaker, J. B., Fleming, E. M. and Harris, G. T. 1984. Smallholder modes of agricultural production in the South Pacific: prospects for development. *Pacific Viewpoint*, 25(2), 196–211.

The relative merits are assessed of smallholder, plantation and nucleus estates as modes of production for agricultural development in the South Pacific. The principal thrust of the paper is to support the village-based semi-subsistence system as a suitable one for agricultural development in countries such as Fiji.

Hardaker, J. B., Fleming, E. M. and Harris, G. T. 1984. Modes of agricultural production in the South Pacific: a rejoinder. *Pacific Viewpoint*, 25(2), 223–226.

Further support is offered for the village-based semi-subsistence system as suitable for agricultural development in the South Pacific in response to criticisms by Watters and Ward.

McGregor, A. 1984. A Program for the Development of the Batiri Citrus Project. School of Social and Economic Development, University of the South Pacific, Suva.

The report begins with a description of the project, the terms of reference and methodology. Major findings are presented on the orange juice enterprise, juice quality, ex-factory revenues and costs, and orchard costs. Details are provided of a number of potential diversification crops. Detailed projections are given, along with a financial analysis, for oranges, pineapples, passionfruit and tomatoes.

Ward, R. G. 1984. Production or management —where is the problem? *Pacific Viewpoint*, 25(2), 196–211

Criticisms are made of the arguments put by Hardaker, Fleming and Harris in favour of the village-based semi-subsistence system as a suitable one for agricultural development in South Pacific countries. Attention is given to the potentially valuable role that nucleus estates could play in the commercialisation of agricultural production in countries such as Fiji.

Government of Fiji. 1985. Fiji's Ninth Development Plan 1986–1990: Policies, Strategies and Programmes for National Development. Central Planning Office, Suva, 191 pp.

The ninth development plan contains a chapter on the primary production sectors, with 19 pages devoted to agriculture. Agricultural development during the period of the eighth development plan is reviewed, and objectives and strategies for DP9 are outlined. Brief descriptions are given of the main agricultural industries although virtually the only emphasis on food crops is placed on rice and maize.

Hardaker, J. B. and Fleming, E. M. 1986. Policy issues in agricultural market development in the South Pacific Region. Islands/Australia Working Paper No. 86/17, National Centre for Development Studies, Australian National University, Canberra.

The main policy issues concerning agricultural market development in the South Pacific are discussed. Particular attention is paid to the relative merits of different modes of agricultural marketing and the role of the public sector.

International Service for National Agricultural Research 1985. Agricultural Research Plan: Fiji. Ministry of Primary Industries, Suva.

This is one of a number of country studies in the South Pacific describing the national agricultural research system and recommending a research plan to improve food and cash crop production.

Fleming, E. M., Hardaker, J. B. and Jones, S. C. 1987. Agrarian development strategies for South Pacific island countries. Paper presented at the 31st Annual Conference of the Australian Agricultural Economics Society Conference, Adelaide, February.

The authors present and evaluate the major strategic options for agricultural development in South Pacific countries.

Morrison, R. J. 1987. Environmental problems associated with agricultural development on atolls. *Alafua Agricultural Bulletin*, 12:117–120.

Atolls represent a unique but very fragile environment. This paper briefly overviews the atoll environment in the South Pacific region and discusses the likely problems of agricultural development resulting from the introduction of new plant species, the increased use of fertilisers and other agricultural chemicals, the extraction of groundwater, vegetation removal and erosion, and some general development-related activities.

Persley, G. J. and Ferrar, P. 1987. South Pacific Agriculture: Challenges and Opportunities for ACIAR and its Research Partners. ACIAR Technical Reports 5, Australian Centre for International Agricultural Research, Canberra.

This edited collection describes a one-day seminar held in conjunction with the Policy Advisory Council of ACIAR meeting in Apia, Western Samoa from 17–21 June 1985. The agriculture sector of the South Pacific is described to council members, ACIAR's activities in the region are

outlined and views of other agencies working in the Pacific on agricultural research needs and possible areas of collaboration are sought. Policy issues related to ACIAR's activities are raised for Council's considerations and views are sought on the future direction of ACIAR's program in the South Pacific.

Asian Development Bank 1988. Agricultural research in the Asian and Pacific Region: Current situation and outlook. Asian Development Bank, Manila.

This publication brings together the findings of a number of country studies of national agricultural research systems, including Fiji, and suggests ways in which agricultural research can be improved on a regional basis.

Bayliss-Smith, T. and Haynes, P. 1988. Land settlement as a rural development strategy. In: Overton, J. ed., Rural Fiji. Institute of Pacific Studies, Suva, pp. 123–146.

The authors are concerned with regional imbalances and the impacts that modern settlement and resettlement schemes on these imbalances. They discuss in general terms local resettlement, inter-regional resettlement and intensification of productive activities. Land settlement in Fiji is examined from the viewpoint of the so-called 'Indian frontier'. Phase 1 of this frontier is termed the 'haphazard frontier', while phase 2 represents sugar company settlements. The origins of state involvement are explored in this process. Land settlements for Fijians are also discussed and examples are mentioned of British colonial experiments. Details are provided on the Seaqaqa scheme which is evaluated in terms of efficiency and equity by income and racial groups. Implications are provided for development planning.

Fleming, E. M. and Piggott, R. R. 1988. Assessment of policy options for agricultural export stabilisation in the South Pacific. *Journal of Developing Areas*, 23(2), 271–90.

Measures of sources of export earnings instability in selected South Pacific countries, including Fiji, are used to assess the options available to South Pacific governments to stabilise export earnings and incomes.

Crocombe, R. 1989. Constraints and opportunities for small-scale farmers in the Pacific Islands. In: *Transfer of Technology to Small Scale Farmers: Meeting of FFTC/ASPAC*. ASPAC Food and Fertiliser Technology Centre, Taipei, pp. 37–45.

Haynes, R. J. and Naidu, R. ed. 1989. *Agricultural Development in the Pacific Islands in the 90s: Proceedings of the International Conference and Workshop*, Suva, 31 March to 1 April 1989, Institute of Agricultural Science, Suva.

Ministry of Primary Industries, Fiji and Food and Agriculture Organization of the United Nations 1989. *Fiji and the Food and Agriculture Organization of the United Nations: A Partnership in Development*. Suva.

Details are provided on the FAO Technical Cooperation Programme and Special Action Programmes in Fiji. Relations are outlined between FAO and the Ministry and details are given on FAO's contributions. Specific initiatives outlined include rice progress, revitalising the land, battling malnutrition, a plan for coconuts, plant protection and strengthening of root crops, cocoa growing, commodity planning, development through water and the World Food Programme in Fiji.

Reeve, P. P. 1989. *On Fiji Soil: Memories of an Agriculturist*. Institute of Pacific Studies, University of the South Pacific, Suva.

This volume is compiled from the journals of W. L. Parham by his daughter. Parham was an agriculturalist in Fiji from 1918 to 1942. Interesting sections are included on his times at Naduruloulou, Ra, Sigatoka and Tailevu.

1990–present

United Nations Development Programme 1990. *UNDP Regional Workshop on Environmental Management and Sustainable Development*, 17–21 April, 1990, Suva.

Country reviews and technical papers on environmental management and sustainable development were presented at a regional workshop. The proceedings are published in this report.

Eyzaguirre, P. 1991. *The scale and scope of national agricultural research in small developing countries: concepts and methodology*. ISNAR Small Countries Study Paper No. 1, International Service for National Agricultural Research, The Hague.

The ideas in this paper were presented for discussion at the International Workshop on Issues and Methodology for the Analysis of National Agricultural Research Systems (NARS) in small countries, held from 29 January to 2 February at the International Service for National

Agricultural Research in The Hague. This methodology is being used in seven countries, including Fiji. Generally the methodology for the analysis of NARS comprises three parts. Part 1 contains the statement of the problem, focus of study and definition of a small country NARS. Part 2 is the analytical methodology in which the concepts used in study are defined. It provides common terminology and classifies areas of information needed to conduct analyses. Part 3 defines specific categories of information required to substantiate the analysis and contains conclusions of the study.

South Pacific Commission 1992–present. SPC Agricultural News. South Pacific Commission, Suva.

This is a quarterly newsletter for dissemination of agricultural information, especially of the South Pacific Commission agricultural program and projects, regional programs, institutions and country activities. It provides summaries of happenings in agriculture throughout the South Pacific, including Fiji.

Government of Fiji. 1993. Opportunities for Growth: Policies and Strategies for Fiji in the Medium Term. Parliamentary Paper No. 2, Ministry of Finance and Economic Planning, Government of the Republic of Fiji, Suva.

This government publication outlines the market-oriented development strategy being pursued by the government. Its implications for agriculture are drawn out in that there is to be growing emphasis on export-oriented agricultural development and less protection and subsidies for agricultural industries. However, in the section on agriculture in Chapter 12 on primary production, there is still a tendency for the government to assume the role of selecting those agricultural activities for expansion. Some details are given for major activities under the headings: background; constraints; and development prospects. Categories covered are sugar, coconut products, fresh fruit and vegetables, and livestock.

World Bank 1993. Pacific Island Economies: Toward Efficient and Sustainable Growth. World Bank, Washington, D.C.

Fiji is among the countries for which the World Bank analyses economic performance and suggests policies for improvements. The role expected to be played by the agricultural sector in these improvements is spelt out.

Hardaker, J. B. and Fleming, E. M. 1994. Pacific 2010: Strategies for Melanesian Agriculture for 2010: Tough Choices. Pacific Policy Paper 13, National Centre for Development Studies, Australian National University; Canberra, 156 pp.

This study addresses strategic questions about the development of Melanesian agriculture to the year 2010 in the light of both current problems and emerging trends in the environment in which agricultural enterprises operate. The countries studied are Fiji, Papua New Guinea, Solomon Islands and Vanuatu. The discussion covers: (1) strategic decision making for agricultural development, which requires recognition of the importance of agricultural development in the economy; (2) strategic agricultural planning, including agricultural development goals and the nature of government intervention; (3) inter-sectoral strategies concerning production sector emphasis and the balance of rural and regional development; (4) agricultural sector strategies, including mode of agricultural production, land tenure, farm size, agricultural research and choice of technology, degree of commodity specialisation or diversification, and level of factor intensity; (5) agricultural marketing strategies and marketing regulations, and (6) government capacity to implement agricultural development strategies.

Narayan, D. 1994. Gender awareness in agricultural development. Paper presented at a Gender Awareness Workshop, Ministry of Agriculture, Fisheries, Forests and ALTA /UNIFEM/SCEP/AusAID, Suva.

Emphasis is placed on the important roles played by women in agricultural development in Fiji, and the need to incorporate their activities in agricultural development planning processes.

Wood, I. M. 1994. Case study 2: planning a new crop project. Proceedings of a Crop Research Planning Seminar, Fiji, 10–11 August 1994.

Asian Productivity Organization 1995. Improvement of Farm-Level Infrastructures, Report of an APO Seminar, 31 August–10 September 1993, Tokyo, 381 pp.

The objectives of the seminar were: (1) to assess the current situation of farm-level infrastructures (particularly irrigation, but also including land improvement, farm input supply, farm roads, marketing and processing facilities) in APO member countries; and (2) to identify and appraise the major problems and suggest measures for improving organisation and management of farm-level infrastructure systems. Eight resource papers and 16 country papers were presented. The country papers cover:

Bangladesh, Fiji, India (two papers), Iran, South Korea, Malaysia, Mongolia, Nepal, Pakistan, Philippines (two papers), Sri Lanka, Taiwan (two papers) and Thailand. The resource papers cover: Japanese experience in improving farm-level infrastructures; government policy on irrigation system development in Asia; the role of farmers' organisations in improving infrastructure; and problems and prospects of operation and maintenance of irrigation facilities in Japan.

Kumar, J., Field, S. P., Dowling, A. J., Wood, I. M., Widdowson, J. P. and Hine, P. T. 1995. Setting priorities for an agricultural research program in Fiji. *Fiji Agricultural Journal*, 51(2), 43–52.

The authors suggest that the most appropriate method for MAFF to set its research priorities—both between new and established industries and within an established industry—is a scoring system whereby all factors considered to be key indicators of the national value of each industry are rated. These ratings are then added to give a score that can be used as a quantitative measure to compare the relative importance of each option. If considered necessary, a weighting can be given to the factors so that the more important factors have a greater impact on the total score.

McGregor, A. and MacCarney, J. 1995. *Fiji Agricultural Sector Study*. Asian Development Bank, Suva.

This report is an insightful look into the way ahead for agricultural development in Fiji. Objectives and strategies are spelt out in detail. The general thesis is that agricultural development should be market-led, and the government should confine its inputs to a supporting role. Details are provided of important crops, their characteristics and scope for development.

Ministry of Agriculture, Fisheries and Forests, Fiji 1995. *Sigatoka Valley Rural Development Project: Annual Report 1994*. Sigatoka Research Station, Suva.

This is the final report for the Sigatoka Valley Rural Development Project which officially ended on 30 June 1994. It reports on project activities such as roads, drainage, irrigation, farm buildings, trials carried out and the production situation of major crops grown in the valley, namely maize, rice, broom corn, vegetables, potatoes, passionfruit, papaya, watermelon, peanut, pulses and root crops.

Pacific Regional Agricultural Programme 1995. Report of the Annual Meeting of the Regional Advisory Board, Nadi, Fiji, 10–14 July 1995. Suva.

Progress reports and work programs are presented on the various projects of the Pacific Regional Agricultural Programme in the South Pacific. There are numerous comments made and questions asked by country representatives, including Fiji, which were directed towards the need for project outcomes to benefit the individual countries. Statements are included on agroforestry, agricultural information, intellectual property rights and plant germplasm, and agricultural extension.

Asian Development Bank 1996. Fiji Agriculture Sector Review—A Strategy for Growth and Diversification. Pacific Studies Series, Asian Development Bank, Manila.

This report reviews the performance of the agricultural sector in Fiji over the previous decade and suggests a revised strategy for growth and diversification in light of recent events. The report highlights a strategy based on private sector-led development with the government and other public agencies modifying their activities to play a facilitating role.

Asian Productivity Organization 1996. Agricultural Trade Policy in Asia-Pacific—A Study Meeting Report, 24–31 October 1995, Seoul. Asian Productivity Organization, Tokyo, 329 pp.

Papers presented at the study meeting assessed the current status of trade in agricultural products in APO member countries, discussed the impact of the GATT/WTO agreements on the future growth and direction of agricultural trade in the Asia-Pacific region, identified emerging issues and suggested remedial measures on technical barriers to agricultural trade. The country papers presented by the participants provide information on the status of policies relating to agricultural trade and measures being taken by governments to adopt an open market economy and introduce trade reforms. Country papers were presented for China, Fiji, India, Indonesia, Iran, Malaysia, Mongolia, Myanmar, Nepal, Papua New Guinea, Philippines and Thailand.

Fairbairn-Dunlop, P. 1996. The broadening role of agriculture: women's role. Paper presented at a Gender Sensitising Workshop, Dreketi, Fiji. Soil and Crop Evaluation Project, Ministry of Agriculture, Fisheries & Forests, Suva.

It is posited that the contributions by women in agriculture in South Pacific countries are many and varied. Much still needs to be done to meet their needs and increase their contribution to agricultural development.

Eyzaguirre, P. 1996. *Agriculture and Environmental Research in Small Countries: Innovative Strategies to Strategic Planning*. Wiley, New York, 231 pp.

This book contains 11 chapters covering key issues for planning agricultural research in small developing countries. The first chapter deals with defining the 'small country' problem, and is followed by a chapter detailing how to work with small and diverse institutions. Chapters 3 and 4 deal with national research portfolios, with Fiji used as one of the case study countries in the fourth chapter. The fifth chapter covers research on natural resource management. Chapter 6 is particularly relevant to South Pacific countries as it is concerned with diversification and high-value non-traditional export crops. Biotechnology is the subject of Chapter 7 and planning for the information revolution is dealt with in the eighth chapter. The scope for regional partnerships is examined in Chapter 9, and the key role of agricultural research networks is discussed in Chapter 9. A conclusion completes the study, and contains a summary of some key lessons for agricultural research in small developing countries.

Pacific Regional Agricultural Programme 1996. Report of the annual meeting of the Regional Advisory Board, Suva, 30 September–4 October 1996. Pacific Regional Agricultural Programme, Suva.

This is a report of the presentations to the Regional Advisory Board of the Pacific region in Suva, Fiji. Project work in 11 PRAP projects is outlined, and programs and budgets are reviewed. Recommendations of the PRAP Transition Review are detailed and the idea of a meeting of ministers was mooted.

Pacific Regional Agricultural Programme 1996. Report of the meeting of Ministers of Agriculture of the Pacific ACP countries, 8–9 October, Suva. Pacific Regional Agricultural Programme, Suva.

Ministers presented statements on the economic framework in their countries and the status of agricultural research and development. They also reviewed achievements of the Pacific Regional Agricultural Programme (PRAP) and their shortcomings, addressed the issue of post-PRAP activities, and offered suggestions for improvements to PRAP. They also concurred on the final resolutions, which covered issues and concerns raised in the 1996 Regional Advisory Board meeting about the

declining interest in agricultural research, development and services, agroforestry, agricultural information, plant genetic diversity and resource conservation, and national agricultural extension services.

Fairbairn-Dunlop, P. 1997. Pacific Women and Household Food Production. UNICEF Pacific, Suva, 70 pp.

Two case studies were undertaken of household food security among poor urban Indian and Fijian families. The first was of a project implemented by the Housing Assistance and Relief Trust which was established in 1970. A household survey was undertaken that covered employment in the household, gardening activities by crop type and use of output. Labour was found to be an important constraint, especially for aged and solo mothers. A number of other factors were identified as affecting production: group motivation, economic need, demand for produce, regular and sound technical support, availability of seed and good returns. The second study was of the Wailea WOSSED group in Vatuwaqa. Results showed the viability of women's systems in providing for their families in an area where there are few gardening possibilities. A small loan made a big difference, and income security was found to lead to food security. Training needs were identified.

LAND TENURE

Before 1940

Fison, L. 1881. Land tenure in Fiji. *Journal of the Royal Anthropological Institute*, 10:333–352.

1940–1949

Harwood, L. W. 1945. An agricultural survey of Indian farmers in Navua. *Fiji Agricultural Journal*, 16(2), 50–55.

A total of 366 Indian farmers were surveyed of which 81 per cent held annual tenancies. An historical sketch is given of the area of the survey and land tenure types in Navua, and a table is presented containing details of farm size, areas cultivated, rentals, livestock numbers and details of rice plantings.

1960–1969

Ward, R. G. 1965. *Land Use and Population in Fiji: A Geographical Study*. Overseas Research Publication No. 9, Department of Technical Cooperation, HMSO, London.

This book is an important source of information on the basis for land use, predominantly for agriculture, in Fiji. Chapters are included on the course of settlement and land use, the resource base, population, land tenure, the patterns and systems of commercial farming, and village agriculture. In the latter chapter, interesting sections are included on so-called banana, coconut and sugarcane villages. The book closes with an appraisal of the different regions in the country and a summary. The conclusion is drawn that it is difficult to foresee any changes in existing pattern of rural land use and population distribution to cater for more than a small proportion of the increase in the workforce unless major changes take place in the land tenure situation.

1970–1979

Nayacakalou, R. R. 1971. Fiji: manipulating the system. In: Crocombe, R. ed., *Land Tenure in the Pacific*. Oxford University Press, London, pp. 206–226.

The theme of this chapter on the land tenure system in Fiji is set in the first sentence: 'Recent studies of Fijian society have demonstrated that the official view of Fijian social structure is starkly at variance with Fijian social practice, and since socially recognised rights and obligations in regard to land have no backing in statute law, individuals may manipulate this field of divergence to advantage'. Sections are included on native land and relevant public agencies, law and custom in land tenure, and land use and modern development. In a conclusion, the author states that the divergences between social and legal norms are changing over time, opening up new opportunities to manipulate the land tenure system.

Crocombe, R. 1975. Customary tenures and incentives to produce. In: Hardaker, J. B. ed., *The Subsistence Sector in the South Pacific*. University of the South Pacific/University of New England, Armidale, pp. 31–46.

This paper comprises a succinct and very useful coverage of customary tenures in South Pacific countries and their effects on incentives to produce, with relevance to Fiji. It commences with a clarification of the meaning of customary tenure: there are no pre-European contact tenures left in Pacific island countries and current tenure systems are more

appropriately referred to as colonial tenure. Another important observation concerns the traditional agricultural production mode in these island countries: most farmers operated as individuals or families, and not communally. It is also explained that the best lands are not under customary tenure. The question of the relationship between land tenure system and production incentives is addressed in detail. It is obviously a complex issue to resolve, and the point is made that limitations on land transfer reduce incentives to produce. Legal equality is considered a disincentive, and tying land to social groups as a means of increasing production has its disadvantages which are spelt out. The leasing of land provides much-needed flexibility, but this is limited in a number of ways that are detailed. The paper ends with an assessment of the scope for improving the tenure system. There are prospects for improvement through some fairly small but useful changes.

Chappelle, T. 1978. Customary land tenure in Fiji: old truths and middle-aged myths. *Journal of the Polynesian Society*, 87(2), 71–88.

It is observed that the most important characteristic of traditional tenure systems in Fiji is their flexibility. Efforts by Fiji's first governor, Sir Arthur Gordon, to simplify and rationalise customary land tenure revealed that he had not understood much about these systems. The fact that there has been little acknowledgment since of this fact reflects a general lack of appreciation of land tenure systems in Fiji. This article is an attempt to remedy this situation. Sections are included on descent groups, rights to direct land use and categories of landholders, status and rights, rights to indirect economic gains, rights to control and transfer land, residual and symbolic rights, and population movements and the concept of ancestral lands.

Rutz, H. J. 1978. Fiji land tenure and agricultural growth. *Oceania*, 49(1), 20–34.

This paper is mainly concerned with Fijian communal land tenure and the perception of its negative consequences on agricultural growth. The issue is examined in the context of land use in the district of Waimaro in the Waidina Valley, Viti Levu. It was found that communal tenure did have an effect on ideas about land rights; these ideas are discussed in detail. The responses by villagers to alternative land tenure strategies are also examined. It is concluded that far too much emphasis had been placed on kinship groups to the exclusion of households as important units of

production, exchange and consumption. Communal tenure can be expected to function as effective tenure to the extent that it provides security for the aspirations of households.

Walter, M. A. H. B. 1978. The conflict of the traditional and the traditionalised: an analysis of Fiji land tenure. *Journal of the Polynesian Society*, 87(2), 89–108.

The author argues that the most dire effects of not viewing traditional society as capable of undergoing innovative change had been felt where an 'omnipotent alien administration has seen fit to codify a traditional social system—thereby ossifying it'. He presents the results of a case study in which he examined the effects of 'traditionalisation' on a society of the land tenure system in Mualevu, in the Lau Islands in Fiji. He shows how the people in this village adapted traditional principles to cope with new economic pressures as they became more involved in cash cropping. Sections are included on the rights of territoriality, right of prior access from customary rights established by original cultivation, changes effected by Tongan conquest, establishment of an official traditional tenurial system, the initial effects of growing coconuts and effects of involvement in the cash economy.

1980–1989

Ushman, S. 1984. Fiji: land tenure and productivity. In: Crocombe, R. and Acquaye, B. ed. *Land Tenure and Rural Productivity in the Pacific Islands*. University of the South Pacific, Suva, pp. 97–101.

Land tenure arrangements, legislation and registration in Fiji are described, and the issue of tenure security and productivity in land use is addressed.

Utrecht, E. 1984. Land and agriculture, fishing and mining. In: Utrecht, E., ed., *Fiji: Client State of Australasia? Transnational Corporations Research Project*, University of Sydney, pp. 119–178.

Descriptions are provided of the land tenure and ownership situation in Fiji. Production of the following commodities are described: rice, sugar, copra, tobacco, coffee, ginger, cocoa, passionfruit, citrus and pineapple.

Bolabola, C. 1986. Fiji: customary constraints and legal progress. In: Land Rights of Pacific Women, Institute of Pacific Studies. Suva, pp. 1–67.

The author identifies land ownership patterns among Fijians, outlines the customary or traditional land rights of women, identifies ways in which land institutions in Fiji have affected the land rights of women, and identifies contemporary practices and attitudes in the exercise of land rights by women in Fiji.

Kamikamica, J. 1987. Fiji: making native land productive. In: Crocombe, R. and Arutangai, S. ed. Land Tenure in the Pacific. Third edition, Institute of Pacific Studies, University of the South Pacific, Suva, pp. 226–239.

This is a new chapter in the revised version of the 1971 book that features a chapter on land tenure in Fiji by Nayacakalou. In this chapter, the Native Lands Trust Board is described and some emerging problems are discussed associated with the dual land tenure systems operating side by side. New opportunities and initiatives are identified for the leasing of Native Lands Trust land.

Overton, J. 1987. Fijian land: pressing problems, possible tenure solutions. Singapore Journal of Tropical Geography, 8(2), 139–151.

This paper begins with the premise that Fiji is facing a major land shortage and gives an overview of existing land leasing processes and land tenure arrangements. A distinction is drawn between *de jure* land tenure and *de facto* land use, with case study evidence supplied for Draubuta village in the Rewa delta. It is found that tenancy-at-will (Vakavanua leasing) does free up some land, uses recognised and respected customs and can relate rents to market values. This is despite tenure insecurity, an absence of written agreements and increased likelihood of land degradation on short-term leases. The paper also contains a discussion of sharecropping and group farming. Five potential solutions to land tenure problems are offered and analysed. A major reform of the NLTB leasing system is the most desirable but politically difficult solution. Extension of Vakavanua leasing and sharecropping would be desirable to complement a reformed NLTB leasing structure. The *status quo* is the least desirable option given that the present land tenure system is in need of change.

Eaton, C. 1988. Vakavanua land tenure and tobacco farming. In: Overton, J. ed., *Rural Fiji*. Institute of Pacific Studies, Suva, pp. 19–30.

Land use patterns are determined not only by the natural environment but also by the nature of ownership and the form of customary land use arrangements in the study area. Evolution and current status of land tenure are described, covering the Native Lands Commission, Native Land Trust Board, native reserve land, native leases and traditional arrangements and Vakavanua arrangements. There is a section on the relationship between land tenure and agricultural development and a case study of tobacco farming in the Sabeto Valley in southwest Viti Levu.

Mitchell, S. 1988. Agricultural legislation and leasehold land in Fiji. *Journal of Pacific Studies*, 14:97–111.

The system of land tenure in Fiji is described in fairly general terms, along with the Agricultural Landlords and Tenants Act. Data are examined relating to leasehold transactions that demonstrate that improvements could be made to the Act as well as the dissemination to tenants of information contained in it. The current system of rent assessment is considered to be rigid and archaic.

1990–present

Prasad, B. C. and Tisdell, C. 1996. Getting property rights ‘right’: land tenure in Fiji. *Pacific Economic Bulletin*, 11(1), 31–46.

The slow pace of economic reforms in Fiji has been blamed for the economy’s poor performance. A discussion is presented of reforms to the land tenure system in Fiji, with the Agricultural Landlords and Tenants Act central to that process. The insecurity of land tenure in all sectors has discouraged new investment and entrepreneurship. The impending expiry of leases in the sugar industry and the way this is resolved will determine the future of the industry. The role of the Native Land Trust Board and the government in successfully resolving the leases under the Agricultural Landlords and Tenants Act is critical. Security of tenure for tourism, industrial and residential development also needs to be considered. It is concluded that long-term leases and proper contractual enforcement can create an overall climate conducive to investment and entrepreneurship in all sectors of the Fijian economy.

Barbour, P. 1997. The 'ALTA issue' and its impact on investment in Fiji's sugar industry. *Journal of South Pacific Agriculture*, 4(1/2), 109–120.

It is observed that the ALTA issue currently dominates the agricultural sector and the sugar industry in particular. Seventy-four per cent of sugarcane farms are on native land leases, and the majority are covered by ALTA regulations. Almost all of these leases will have expired by 2024. The implications of this for sugarcane and general agricultural development are explored. An outline is presented of options for future reform of the land tenure system. Also, an historical review is given of the land tenure system and the sugar industry in Fiji.

AGRICULTURAL ECONOMICS, MARKETING, GEOGRAPHY AND STATISTICS

1930–1939

Barnes, A. C. 1931. Citrus exports—experimental shipments. *Fiji Agricultural Journal*, 4(2), 55–61.

This study reflects growing interest at the time in the commercialisation of citrus production, notably oranges and mandarins. Prospective seasonal markets were thought to exist for oranges in Australia, New Zealand, USA, Tahiti and Norfolk Island. Supplies from a small plantation at Nasinu were used to secure shipments to New Zealand for experimental purposes. Shipment procedures and results were considered satisfactory given the condition of the oranges and season of shipment. The shipment was commercially unattractive but showed promise. It is concluded that careful attention to marketing matters is needed for commercial success.

Anon. 1932. Marketing of Fiji bananas in Vancouver. *Fiji Agricultural Journal*, 5(2), 74–83.

A detailed account is given of experiences of exporters marketing bananas in Vancouver from 1932. It is a good example of early efforts to meet buyer requirements in respect of various quality dimensions. The conclusion was drawn that 'a ready market at satisfactory prices awaits supplies of Fiji bananas in Vancouver, provided that the fruit can be landed in a condition comparable with Central American bananas, i.e., free from blemishes and skin markings'. Recommendations are given as to the standards reached for successful export marketing.

Barnes, A. C. 1932. Fruit and minor crops. *Fiji Agricultural Journal*, 5(2), 55–58.

The author outlines export marketing problems and prospects for fruit and minor crops, concentrating mainly on the disease problems in bananas. He expects an expansion in the production and export of fruits, especially canned pineapples. Prospects for the cotton industry are considered in the light of the introduction of a new strain to revive commercial operations. Concern is expressed about the need to improve production methods for rice. Brief mention is made of tomato and maize production.

Ackland, A. B. 1937. The international sugar agreement. *Fiji Agricultural Journal*, 8(4), 42–46.

The major features of the five-year international sugar agreement are described and its implications drawn for the Fiji industry. Commencing in 1937 and signed by 21 producing and consuming countries, the agreement was aimed at regulating the production and marketing of sugar.

1940–1949

Ackland, A. B. 1940. The banana export trade. *Fiji Agricultural Journal*, 11(2), 43–46.

Details are given of banana exports in 1939, with estimates of returns per case.

Parham, B. E. V. 1940. Fijian farmers' co-operative market at Nausori. *Fiji Agricultural Journal*, 11(1), 7–9.

The author recounts the processes in getting approval for the Fijian farmers' co-operative market at Nausori, and provides details of its construction.

Surridge, H. R. 1940. A note on the Lawaqa market. *Fiji Agricultural Journal*, 11(2), 32.

The author describes activities at the Lawaqa market, commenting on the small throughputs of Fijian and Indian produce. He expressed concern that the market may be destroyed by a new traffic ordinance covering the carriage of produce on local buses.

Harvey, C. 1942. Survey of Indian farmers in the Central district. Fiji Agricultural Journal, 13(4), 120.

This is a report on survey of non-sugarcane growers in the Indian farming population in the Ra, Tavua and Ba sub-districts in late 1939 and early 1940. Information was collected on farm size, farming type and their relative efficiencies.

Harvey, C. 1943. A further note on the Nausori Fijian co-operative market. Fiji Agricultural Journal, 14(2), 36.

This update of the activities of the Nausori Fijian co-operative market reports that membership had risen to 206. The important role of fresh produce in agricultural development is highlighted.

Harvey, C. 1943 Copra notes. Fiji Agricultural Journal, 14(1), 29–30.

A progress report is given on the volumes and origins of copra exports.

Jack, H. W. 1943. Fresh food supplies. Fiji Agricultural Journal, 14(1), 2–7.

An update is given of quantities of fresh food supplies, plus a repeated call for increased food production.

Surridge, H. R. 1943. Vegetable and fruit prices. Fiji Agricultural Journal, 14(3), 88–89.

A range of prices are presented for 11 native vegetables and 17 European vegetables.

Harvey, C. 1944. Export of fruit and vegetables to New Zealand. Fiji Agricultural Journal, 15(1), 24–25.

World War 2 led to increased exports of fruit and vegetables to New Zealand. In 1939, minor exports included fresh pineapples, pumpkins, watermelon, papaya, yams, sweet potato, taro, green ginger, cucumbers, tomatoes, mangoes and fresh coconut together with seasonal small shipments of grenadilla and avocado pear.

Surridge, H. R. 1944. Fruit and vegetable supplies in 1944. Fiji Agricultural Journal, 15(4), 116.

An update is provided on the supplies of different items of fresh produce from local farmers in Fiji, as part of government efforts directed to encourage increased food production.

Surridge, H. R. 1946. Peanuts for export. *Fiji Agricultural Journal*, 17(4), 116.

The internal marketing division of the Department of Agriculture had considered peanuts for export to New Zealand. Replies had been received to questions on demand and the type of peanut preferred, prices, import restrictions and other supply sources.

Harvey, C. 1947. Agriculture and other industries in Fiji—the 1946 census. *Fiji Agricultural Journal*, 18(4), 93–96.

Tables are presented on the numbers of males engaged in each industry by race and principal activities, and numbers of Fijian and Indian males engaged on their own account or as wage-earners in agricultural production.

Parham, B. E. V. 1947. Brief history of cooperation in Fiji. *Fiji Agricultural Journal*, 18(1), 8–9.

The author recounts the administrative action taken to develop cooperation in Fiji among European and Fijian farmers. Details are provided on agricultural clubs, the Planters' Association, the Fijian Cooperative Market Association Ltd and other Fijian cooperatives. There is also a section on Indian cooperation.

1950–1959

South Pacific Commission 1952. Current Research in the South Pacific in the Field of Economic Development. Technical Paper No. 29, Noumea.

This technical paper gives details of research undertaken on coconut in Fiji among other items. A survey had been undertaken of coconut and copra production, copra drying, testing for moisture and the status of potash of coconuts on Viti Levu. There are also reports relating to Fiji on a survey of banana production, proposals for the development of the cocoa industry, research into sugar production by CSR, quite a deal of material on rice production and research, current pests and diseases, and general farming practices and land use.

Harvey, C. 1953. A cool store at Suva wharf. *Fiji Agricultural Journal*, 24(3/4), 100–101.

With increased volumes of banana exports, fruit was being packed earlier and left standing on the wharf longer. The case is put here for the usefulness of a cool store at Suva wharf to overcome this growing problem. The purpose of the cool store was to pre-cool the bananas. Details are given on plans for construction.

Nield, J. 1954. Quarterly report—marketing officer, 2nd quarter 1954. *Fiji Agricultural Journal*, 25(3/4), 93–96.

This is an early reference to procedures followed to report prices and availability of fruits and vegetables in frequent demand in Suva. Details are also given on the grading and packing of export crops, statistics and surveys, and new export projects. The latter covered dried ginger, coir, banana flour, vau (a fibre) and fruit juices.

O'Loughlin, C. 1956. *The Pattern of the Fiji Economy: The National Income 1950–53*. Government Press, Suva, 80 pp.

This analysis of the pattern of the Fiji economy contains useful statistics on the agricultural economy and its importance in the general economy in the early post-war period. Output is valued for the agriculture, fisheries and forests sector as a whole and separate sections are included on sugarcane, bananas, copra, root crops, rice, kava and fruits and vegetables in which values of output are estimated. There is also an interesting analysis of the Fijian village economy in Chapter 10 that covers the effects of monetisation, and a note in the appendices on hurricane damage to crops.

1960–1969

McPaul, J. W. 1960. Some aspects of banana cultivation in Fiji: II The economics of banana growing on a plantation scale. *Fiji Agricultural Journal*, 30(1), 5–13.

An economic analysis of banana production was undertaken. The production of 200 cases/ac gives returns of 250 Sterling pounds per annum. Costs were estimated for establishment and production where yield is 200 cases/acre/day. Three methods of selling output are considered. Banana cultivation is also considered as an activity in an interplanting system with two rows of taro between paired rows of bananas. Results of the economic analysis are summarised in a table, and it

is concluded that there is scope for reasonable returns to the small producer on good land and with regular input levels. It is concluded that a 3-acre block is an economic area for a small-scale farmer to maintain.

Frazer, R. M. 1964. Changing Fijian agriculture. *Australian Geographer*, 9(3), 148–155.

The author begins by describing the pre-contact setting in Fiji, describing which crops were grown, land use and social obligations. Coverage then moves to the period of early contact and its effects on crops grown and land use patterns. The present, covering the period from the late 1930s, is dominated by the growing importance of commercial crops. It is noted that current crops that resemble traditional crops in their attributes and make no great demands for change in land use technology or land holding are the most readily accepted and most easily disseminated.

Ward, R. G. 1964. Cash cropping and the Fijian village. *Geographical Journal*, 130(4), 484–506.

This is a seminal paper that examines some of the changes that were taking place in the transition from subsistence to cash cropping and a commercial rural economy in Fijian villages. This transition is discussed in terms of new attitudes to the allocation of labour and time, socio-economic organisation, value systems and the appraisal of land. A description is given of the typical Fijian village based on subsistence production, and the rise of cash cropping and the changes it had brought about in agriculture. Some of the first important changes that occurred because of an increase in cash cropping influenced subsistence production practices. Land quality was reappraised by villagers in the light of the new requirements of cash crops which led to changes in land settlement. Larger and more consolidated agricultural holdings are forecast, along with movement of population towards areas with better soils and market access, and a decline in the amount of bush fallowing. It is thought that an increasing proportion of the population would have to find employment in non-agricultural pursuits.

Belshaw, C. S. 1964. *Under the Ivi Tree: Society and Economic Growth in Rural Fiji*. University of California Press, Berkeley, 336 pp.

This book comprises four parts. In the first part, descriptions are given of the Fijian way of life, the village and social structure. A specific description is given of the Sigatoka region. Emergent enterprise in rural Fiji is the focus of Part 2. This part includes discussions on the Nadroga banana venture, the role of bureaucracy in guiding enterprise, Fijian corporate organi-

sations, enterprise and corporatism in the sugar industry, experiments of Fijian farmers and the activities of marketers. Part 3 contains an analysis of factors influencing change in rural Fiji, and the final part is a short conclusion.

Ward, R. G. 1964. A geographical study of population and land use in Fiji: interim report. Research School of Pacific Studies, Australian National University, Canberra.

This report contains material similar to that provided in Ward's major publication.

Nand, S. 1965. Fiji islands land settlement cooperatives: a testing challenge to co-operation in its traditional forms. *South Pacific Commission Quarterly Bulletin*, 15(2), 41–43.

This article deals with the challenge created by a recent upsurge in enthusiasm for land settlement cooperatives in Fiji. The land settlement cooperative schemes are described with specific details on the Bubalevu Landholding Co-operative Society Ltd and the Drasa Land-Purchase Co-operative Society Ltd. A sanguine view is portrayed for the future of the cooperative movement in Fiji.

Biggs, H. C. 1967. Report on the Marketing of Agricultural Produce in Fiji. Ministry of Overseas Development, London.

Anderson, A. G. 1969. Duality in Indo-Fijian small-farming. In: Bassett, I. G. ed., *Pacific Peasantry*, Manawatu Branch, New Zealand Geographical Society, Palmerston North, pp. 23–47.

The duality of Indian small-scale farming between sugar and non-sugar production is highlighted. Separate sections are provided on sugar production and domestic food production. Changes in the labour force are briefly analysed and it is concluded that agriculture was continuing to absorb a large proportion of the growth in the Indian labour force. The dominant position of sugar cultivation is discussed but it is also acknowledged that growth had occurred in other agricultural activities. Land tenure conditions are contrasted between the sugarcane belt and elsewhere. Some notes are added on management and marketing in the sugar and non-sugar industries.

Nand, S. 1969. The cooperative movement in Fiji. *South Pacific Commission Quarterly Bulletin*, 19(2), 41–44.

The author presents a general history of the cooperative movement worldwide and explains the meaning of the term, cooperative. He records the growth of the cooperative movement in Fiji between 1949 and 1967. Details are also given on thrift and credit societies, which commenced in 1961, and land-purchase societies. The focus of the article is on Lami Co-operative Education Centre which was established in 1964.

Watters, R. F. 1969. *Koro: Economic Development and Social Change in Fiji*. Clarendon Press, Oxford, 305 pp.

Case studies were undertaken in four Fijian villages which are compared in this book for the purpose of assessing economic development and social change. Special attention is given to increases in individualistic farming and rural-urban migration. Chapters on entrepreneurship, leadership in a transitional society, and cooperatives and community development touch on agricultural matters. The author opines that rural-urban migration should not be seen as a deleterious process in Fiji. Emergence of the 'independent farmer' is described in detail by relying on material from the case study villages. He concludes that the government should encourage a more dispersed settlement pattern that leads to a more widely distributed and more intensive agricultural system: 'the villager of today is the independent farmer or townsman of tomorrow'.

Watters, R. F. 1969. Tribesman or peasant? The evolution of rural society in Fiji. In: Bassett, I. G. ed., *Pacific Peasantry*, Manawatu Branch, New Zealand Geographical Society, Palmerston North, pp. 7–21.

Case studies of Nalotawa, in the Ba hills in the dry zone, and Sorolevu, 30 miles from Nalotawa, are used to show the changes being wrought in rural society in Fiji. By comparing the two villages at distinct stages of development, the author shows that peasantry was emerging as a product of the historical processes of capitalism and feudalism. This was allowing Fijians to participate in the capitalistic market economy.

1970–1979

Rhodes, P. L. 1970. Report on the first season's operation of the Clayson 975 combine for harvesting rice in Fiji. *Fiji Agricultural Journal*, 32(1), 18–19.

Records for one season of operating costs form the basis of an economic analysis of operating costs of the Clayson 975 combine for harvesting rice in Fiji. These costs compare unfavourably with those in Malaysia; but losses in hand harvesting cover the hire charges.

Rhodes, P. L. 1970. Mechanical rice production costs, Koronivia 1968–69. *Fiji Agricultural Journal*, 32(1), 20–21.

Partial mechanisation allows savings when labour cannot be costed at its full rate.

Crocombe, R. 1971. Review article: Watters, R. F.: *Koro: economic development and social change in Fiji*. *Journal of the Polynesian Society*, 80(4), 505–520.

This thorough review of Watters' book on economic development and social change in Fiji contains an interesting critique of the analysis by Watters of land tenure, the independent farmer and factors that motivate rural villagers. It points up the risk of loose use of important terms and the need for inter-disciplinary studies of rural village life.

Ward, M. 1971. *The Role of Investment in the Development of Fiji*. Cambridge University Press, 349 pp.

In a chapter on market demand factors, the author describes the agricultural sector, covering the main agricultural activities and assessing the scope for development of subsidiary crops. There are also sections on land, labour and capital in which each of these factors is assessed as a determinant of agricultural development. Among the special problems that are analysed, attention is given to agricultural loan finance and security for agricultural credit.

Fisk, E. K. 1972. Motivation and modernization. *Pacific Perspective*, 1(1), 21–33.

The strength and nature of motivation that compels people to leave subsistence farming and infiltrate the monetary sector of the economy are discussed in the Pacific Islands context where subsistence farming is the main source of livelihood. Fiji is used as an example in the microeconomic analysis of farm households and peasant farms. Rapid growth of the labour

force is causing considerable underemployment in agriculture, compounded by too few jobs in tourism and processing. Availability of land is another crucial factor. A simple model of factors influencing motivation is set up, showing the satisfaction and problems derived from applying varying amounts of family labour to farming. It is shown that dissatisfactions are small at very low levels of labour input.

Fisk, E. K. and Honeybone, D. 1972. Belshaw's 'emergent Fijian enterprise' after ten years. In: Epstein, T. S. and Penny, D. H. ed. *Opportunity and Response: Case Studies in Economic Development*. Hurst, London, pp. 173–192.

Belshaw's taxonomy of emergent Fijian enterprise is examined and found to be of value in explaining the impact of the institutional framework in which Fijians enter the exchange economy and become important producers of goods and services for exchange. Of contemporary relevance is the finding that, where bureaucracy has guided enterprise, as in the case of agricultural land development schemes, the new schemes tend to compete with the old. The authors find that traditional forms of Fijian corporate activity have considerable potential to mobilise surplus land and labour, but only for a limited level of economic activity beyond which substantial adaptation and modification of these forms is required. Another finding is that the institution of the independent semi-subsistent farmer provides an operational framework that works well for Fijians.

Frazer, R. 1973. The Fijian village and the independent farmer. In: Brookfield, H. C. ed., *The Pacific in Transition: Geographical Perspectives on Adaptation and Change*. St. Martin's Press, New York, 75–96.

A description is given of the Fijian village and how it has changed over time from a highly cohesive entity to a looser organisation with a diversity of individual goals. As government restrictions on village structure become less stringent, the village is likely to change as its members seek greater freedom in making economic decisions while retaining the social benefits that the village provides.

Barnard, R. 1974. Deuba: economic change in a Fijian village. *Oceania*, 45(1), 1–17.

This paper reports on a village study carried out in 1972. The main problem of Fijian village development is argued to be the transformation from a subsistence economy to an exchange economy. The village has easy access to urban markets. It is also close to two big projects, an irrigation scheme and a harbour modernisation program, both of which

promise new cash-earning opportunities for villagers. Commercial agriculture has developed rapidly since 1942, although not on a cooperative basis. The village is characterised by its livestock and crop combinations with dairying a preferred enterprise since cash returns are higher than for root crops. Wage work is also taken out of farming and women are becoming more involved in farming. In 1947 two cooperatives were established. Growing urban markets make farming in the area more attractive although the prospect of industrialisation raises farm labour problems.

Chandra, S., de Boer, A. J. and Evenson, J. P. 1974. Economics and energetics: Sigatoka Valley, Fiji. *World Crops*, 26(1), 34–37.

This study is based on data collected in 1970–71 on densely populated smallholder villages comprising Fijians and Indian immigrants in southwest Viti Levu. The two groups of smallholders operate under virtually identical ecological conditions yet they produce different results. In order to assess these differences and help improve incomes, two efficiency tests were carried out: (1) economic efficiency; and (2) biological efficiency. By use of simple measures to compare the subsistence of commercial crops produced in the 1970–71 crop season, it was hypothesised that the much higher levels of efficiency in energy use in one area for subsistence crops had an influence on economic performance. Differences were found between the two areas. In neither of the villages was labour used in quantities sufficient to approach an economically efficient level.

Kidston, W. 1974. Co-operation: development without change. *South Pacific Commission Quarterly Bulletin*, 24(1), 16–18.

Fiji is used as an example to illustrate the main problems confronting the growth and development of cooperatives in a developing country. Cooperatives involved in the production, processing and credit operations of copra are studied where copra production is the main source of income. They are argued to play a vital role in social and economic development of emerging societies but the development must take place within the bounds of local traditions and outlooks. The main problem seems to be lack of education. Analysis is based on Lakeba Cooperatives.

Anderson, A. G. 1975. *Indo-Fijian Small Farming: Profiles of a Peasantry*. Oxford University Press, London, 199 pp.

The objective of this study was to illustrate the evolution of the small farm sector. Stabilisation of the small-scale peasant farm resulted from governmental influence and the role of the Colonial Sugar Refining Company which adopted a leasing policy favouring small plots. Apart from diseconomies arising from difficulties of adopting innovations, the policy has been criticised for protecting endowed peasant farmers at the expense of the progressive, innovating larger scale farm sector. The nature of the rural society in Fiji is also discussed. The introduction of cooperative farms has generally met with failure, largely as a result of traditional village society suspecting new organised institutions. Kinship alignments are still important in this respect. The author stresses the persistence of economic dualism in Fiji.

Desai, A. V. 1975. Commercialization of subsistence agriculture in Fiji. In: Hardaker, J. B. ed., *The Subsistence Sector in the South Pacific*. University of the South Pacific/University of New England, Armidale, pp. 11–30.

It is observed that the subsistence sector in Fiji conforms to the general subsistence model in many respects, particularly in terms of the importance of family labour as a resource for the analysis undertaken in this paper. In examining the commercialisation of the subsistence sector in Fiji, attention is paid to the determinants of an agricultural marketed surplus, cropping patterns and labour use. The progress made in commercialising agriculture in Fiji is assessed, and it is noted that the data do not support any relationship between commercialisation and population pressure.

Goneyali, E. 1975. Who wants to stay on the farm? In: Tupouniua, S., Crocombe, R. and Slatter, C. ed. *The Pacific Way: Social Issues in National Development*. South Pacific Social Sciences Association, Suva, pp. 58–62.

The paper examines the role of the village in farming and the factors influencing young people's decisions to move away from the farm in the rural community of Ra in Fiji.

Haynes, P. H. 1975. Some aspects of technology in subsistence agriculture. In: Hardaker, J. B. ed., *The Subsistence Sector in the South Pacific*. University of the South Pacific/University of New England, Armidale, pp. 123–130.

This paper is written to encompass all South Pacific countries but has particular relevance to Fiji from which some examples are drawn. A good discussion is given of the ways in which subsistence producers protect themselves against adversity, maintain soil fertility and mobilise household labour. An assessment is made of the opportunities for introducing new technologies in a subsistence cropping system.

Ram, T. 1975 Some aspects of technology in subsistence agriculture. In: Hardaker, J. B. ed., *The Subsistence Sector in the South Pacific*. University of the South Pacific/University of New England, Armidale, pp. 207–210.

Details are provided on efforts by the Bureau of Statistics to impute values of non-monetary outputs in the economy of Fiji. This imputation was based on the 1968 Census of Agriculture and the 1968 Urban Household Budget Survey. The method is described, and estimates are presented for agricultural subsistence output for the years, 1968–1971. They show that the value of agricultural subsistence output is about 10 per cent of gross domestic product.

Rutz, H. J. 1975. Household production performance and entrepreneurship: incentives to work in the Waidina Valley, Fiji. University of the South Pacific, Suva (mimeograph).

The relationship between household production performance and entrepreneurship in traditional agriculture is the focus of this study. It is concluded that this relationship works through existing organisation forms above the household level, shown through the economic strategies selected by the households. According to the author, 'the dynamic for production performance does not stem solely from differential access to resources or some attitude about acceptable level of output to meet consumption, but rather from the ability of leaders to be organisational innovators, bringing together the assets of the household into more efficient units for saving and investment'.

Chandra, S. and de Boer, A. J. 1976. Food production efficiency in Fijian semi-subsistence agriculture. *Agricultural Economics Discussion Papers Series No. 8*, Department of Agriculture, University of Queensland, Brisbane, 32 pp.

A conventional production function was fitted to a two-year cross-section of farm management data from Indian and Fijian smallholders in the Sigatoka Valley. The results indicated very large differences in productivity between the two groups that were not adequately explained by resource endowments. The relative technical efficiency of each farm was determined through the production frontier approach that revealed few large differences within or between racial groups. It was therefore postulated that resource productivity variations were related to underlying differences in utility between the two groups and a two-good model (subsistence and commercial crops) was developed. This model was applied in a utility analysis framework associated with the subsistence affluence concept. The results adequately represent the differences in social, cultural and dietary patterns between the two groups that were the ultimate determinants of productivity.

Chandra, S., Evenson, J. P. and de Boer, A. J. 1976. Incorporating energetic measures in an analysis of crop production practices in Sigatoka Valley, Fiji. *Agricultural Systems*, 1(4), 301–311.

This paper describes how energetic measures applied to farm-level crop production data can be used to explain some differences between Indian and Fijian farm households in the Sigatoka Valley. The main attributes of the two groups are presented, some details are provided on farming patterns, and some insights are offered on the slow rate of technological progress in the area. The energy relationships in agriculture are summarised and the efficiency ratios of the two groups compared to reveal very large differences. Market prices were used to derive estimates of earning power which again revealed large differences between the groups. No direct relationship was discerned between the energy efficiency of a crop and its value. Cropping intensity was analysed in energetic terms. Results are used to consider the pressing policy issues of population, food supplies, income distribution, dietary preferences and agricultural employment.

Knapman, B. 1976. Indigenous involvement in the cash economy of Lau, Fiji, 1840–1946. *Journal of Pacific History*, 11(3), 167–188.

The author assesses the major policy aim of the government of Fiji to integrate rural Fijians into the 'modern' market economy specifically in relation to cooperatives in the eastern Lau group of islands. He finds that the demand for production inputs sets a minimum level to personal cash expenditure, determined by the copra price and personal preferences. It is concluded that planners are unwittingly trying to accelerate a process that began over a century ago.

Rutz, H. J. 1976. The efficiency of traditional agriculture, phases of development, and induced economic change in the Waidina Valley, Fiji. In: Pitt, D. ed., *Development from Below*. Mouton, The Hague, pp. 167–188.

A case study of the Waidina Valley is used to demonstrate the confusion between a 'traditional' and 'modern' production organisation and its relation to efficient and intensive cultivation. Details are provided of a plan in 1969 to sub-divide Waidina into smallholder plots that would be leased by smallholder-cultivators from the landowners. It is argued that the change in organisation might entail capital improvements beyond the immediate means of the cultivators and high labour costs, and is thought unlikely to appeal to producer-cultivators.

Basha, M. J., de Boer, A. J. and Chandra, S. 1977. A model of production and consumption for Indian farms in the Sigatoka Valley, Fiji. *Agricultural Economics Discussion Papers Series No. 6–77*, Department of Agriculture, University of Queensland, 24 pp.

The study entails an examination of the effect on the supplies of traditional staple food crops when more efficient farm plans are generated. The framework used is linear programming, where both farm production and consumption activities are included. This methodology is then applied to two groups of farmers operating under very similar environmental conditions in the Sigatoka Valley, Fiji, but possessing very different staple food crop consumption patterns. Data were collected during farm management studies among Indian and Fijian farmers in 1970–72. The model is considered useful because it shows production and consumption activities on small-scale farms. It incorporates elements of both the farm management problem and the diet problem that are usefully integrated for analysing semi-subsistence farms.

Chandra, S. 1977. Productive efficiency of Fijian and Indian farming systems in semi-subsistence agriculture: Part 1 Review of the problem and research approach. *Fiji Agricultural Journal*, 39(1), 1–11.

A review of studies carried out on agricultural problems in Fiji. A research problem is formulated to study the allocative, technical and energetic efficiency of crop production on Fijian and Indian smallholder farms in the Sigatoka Valley and to determine how agricultural production is affected by race, diet, regions, soils and land tenure. The research methodology and the farm management survey are outlined.

Chandra, S. 1977. Productive efficiency of Fijian and Indian farming systems in semi-subsistence agriculture: Part 2 Description of the farming systems and partial productivity results. *Fiji Agricultural Journal*, 39(2), 57–70.

The following characteristics of Fijian and Indian farms are described: farm sizes and cropping intensities, capital items and current expenditure patterns, family composition and population densities, cropping and labour use seasonality, crop consumption and marketing. The partial productivity analysis demonstrated that the gross outputs, gross margins and cash sales on the Indian farms were nearly twice those on the Fijian farms. On the Fijian farms the gross output per hectare and per man hour decreased with increasing farm size, whereas on Indian farms these measures increased with increasing farm size.

Chandra, S. and de Boer, A. J. 1977. Measuring the economic productivity of soil water in crop production systems. *Fiji Agricultural Journal*, 39(1), 25–31.

A production function model developed to measure the productivity of available soil moisture during dry periods (when potential evapotranspiration exceeds precipitation) was tested using data derived from smallholder farms in the Sigatoka Valley. Productivity estimates were also made of other inputs such as land, labour, capital and current expenses. Only partial success was obtained with the soil water component of this model. This is attributed to data limitations imposed on the specification of this variable. Suggestions are made for further refinement of the model for other types of farm productivity analysis.

Chandra, S. and de Boer, A. J. 1977. Productive efficiency of Fijian and Indian farming systems in semi-subsistence agriculture: Part 3 Production function models and statistical estimation procedures. *Fiji Agricultural Journal*, 39(2), 71–86.

General forms of production functions are reviewed and the properties and limitations of the various types of production functions are discussed. A class of production functions is chosen for use in this study. Statistical problems associated with these functions are discussed, followed by a literature review of studies using these functions. The production function models used in this study of productive efficiency of Fijian and Indian farming systems are summarised. Finally the estimation procedures employed in quantifying the dependent, independent and dummy variables in the production models are described.

Chandra, S. and de Boer, A. J. 1977. The allocative efficiency of Fijian root crop producers. *Proceedings of the Fourth Symposium of the International Society for Tropical Root Crops, Cali, Colombia, 1–7 August 1976*, pp. 221–226.

It was found that the most efficient root crop producers are those farming the light-textured soils in the lower Sigatoka Valley, and the most important production factors are labour and capital. Recommendations are made on the optimum levels of resource use under various conditions of limited capital and fixed availability of land or labour.

Government of Fiji, Bureau of Statistics 1977. *Report of Household Income and Expenditure Study*. Government Printer, Suva.

Summary details are provided that relate to income and expenditure patterns of rural households in Fiji.

Chandra, S. 1978. Productive efficiency of Fijian and Indian farming systems in semi-subsistence agriculture: Part 7 Summary and conclusions. *Fiji Agricultural Journal*, 40(1), 51–57.

In this final part of a series of papers, the whole study is reviewed and a summary of conclusions is presented. Suggestions are outlined for future research and the future of the Sigatoka Valley is discussed.

Chandra, S. 1978. The production, marketing and consumption of root crops in Fiji. In: Fisk, E. K. ed., *The Adaptation of Traditional Agriculture: Socioeconomic Problems of Urbanization*. Monograph No. 11, Development Studies Centre, Australian National University, Canberra, pp. 303–323.

A description is given of the typical semi-subsistence smallholding in Fiji. The crop production and consumption systems are explained on the basis of research work carried out by the author in the Sigatoka Valley. The marketing system for products of these smallholdings is described in terms of structure, produce and participants. The chapter concludes with a brief analysis of the dilemma created by urbanisation accompanied by increasing malnutrition.

Chandra, S. and de Boer, A. J. 1978. Productive efficiency of Fijian and Indian farming systems in semi-subsistence agriculture: Part 4 Resource allocation. *Fiji Agricultural Journal*, 40(1), 1–17.

Results are presented of regression analyses of production functions with dummy variables for small and large Fijian and Indian farms. Marginal value products were estimated for all factors. The method of analysis to determine the optimal allocation of resources by farmers is described. Policies based on the results are developed for farm readjustments.

Chandra, S. and de Boer, A. J. 1978. Productive efficiency of Fijian and Indian farming systems in semi-subsistence agriculture: Part 5 Frontier production function analysis and results. *Fiji Agricultural Journal*, 40(1), 19–36.

The concept of technical efficiency is explained and studies on the methods of measurement are reviewed. A linear programming procedure is described, which was used to derive the levels of technical efficiency on Fijian and Indian farms. This is followed by a discussion on the differences in technical efficiency ratings between years and races, and between villages and settlements. The results of the linear programming analysis are used to derive optimum farm plans and optimal crop mixes on these farms. Agricultural policies for farm development programs are then discussed.

Chandra, S. and de Boer, A. J. 1978. Productive efficiency of Fijian and Indian farming systems in semi-subsistence agriculture. Part 6 Energetic efficiency analysis and results. *Fiji Agricultural Journal*, 40(1), 37–50.

The theoretical bases for efficiency ratio and energy purchasing power are discussed followed by a review of the energetics of crop production in the Sigatoka Valley of Fiji. The food crop dietary preferences of Fijians and Indians are utilised to define a minimum subsistence bundle for each race. Semi-subsistence farming models are discussed and the concept of subsistence affluence outlined, A subsistence cash production model for Fijian and Indian farms is then developed, based on the energetics concept. This model is used for the test of utility maximisation between the two ethnic groups. The test established that the two groups have significantly different utility functions. Finally, some implications are drawn of using energetics in agricultural development policy formulation.

Chandra, S., de Boer, A. J. and Basha, M. J. 1978. A model for production and consumption for Fijian and Indian farms in Sigatoka valley. *Fiji Agricultural Journal*, 40(2), 71-80.

A description is given of a linear programming model used to integrate production and consumption modules of a sample of Fijian and Indian semi-subsistence households in the Sigatoka Valley. The model was only partly successful because of deficiencies in the data base. Improvements in data are argued to be necessary to enable realistic model results to point the way to more efficient allocation of production and consumption activities for agricultural development.

De Boer, A. J. and Chandra, S. 1978. A model of crop selection in semi-subsistence agriculture and an application to mixed agriculture in Fiji. *American Journal of Agricultural Economics*, 60(3), 436–444.

Models of fully subsistence agriculture are modified to allow a two-goods analysis of cash crop and staple crop production. A further extension allows comparisons between two groups of farmers—Indians and Fijians—possessing different production functions for their respective staple crops. Production possibility curves are constructed for each group of farmers and an empirical test is formulated. Empirical results confirmed the hypothesised behavioural relationships which would give rise to the observed differences in resource allocation and resource productivity between Indian and Fijian farmers operating within a similar agricultural environment.

Fiji Sugar Board 1978. Annual Report for 1978 Season. Lautoka, 16 pp.

As required by the Fiji Sugar Industry Ordinance Act 1961, this is a report submitted on the operation of the Sugar Board and Sugar Advisory Council during the 1978 cane harvesting and crushing season. Information is included on cane production, cane harvesting and crushing, on the marketing of sugar and molasses, and on other matters concerning the sugar industry (e.g. cane prices), and there is a brief section on future prospects. Appendices contain accountants' reports and accounts for the year ended 31 December 1977. This report is included as an example of the contents of the annual reports.

International Sugar Organization 1978. The World Sugar Economy, Structure and Policies: National Sugar Economies and Policies No. 3—Australia, Fiji, New Zealand. International Sugar Organization, London, 40 pp.

In the coverage of the sugar industry in Fiji, it is reported that the sugar industry contributes about one-sixth of the gross domestic product and accounts for more than one-quarter of total employment. Nine-tenths of the sugar produced is exported and the commodity accounts for more than two-thirds by value of all exports.

Nayacakalou, R. R. 1978. Tradition and Change in the Fijian Village. South Pacific Social Sciences Association, Suva, 164 pp.

The tasks carried out in this book are to define traditional Fijian social structure in the villages studied on Viti Levu (Draubuta, Lomawai and Nakorosule), determine whether new circumstances had caused cultural change, and proffer alternative courses of action made possible by the new circumstances. Fieldwork was carried out in 1954. Separate chapters are presented on the three villages, and there are chapters on the traditional Fijian village economy and the factors causing change. In the final chapter on choice and compromise, the author considers the scope for choice in the traditional organisation, the impact on choice of the introduction of money, economic growth and social change, and the need for compromise in a situation of change.

Rutz, H. J. 1978. Ceremonial exchange and economic development in village Fiji. *Economic Development and Cultural Change*, 26(4), 777–805

The author analyses the ceremonial exchange system in Fiji by addressing questions about the 'economic functions of ceremonial systems and the conditions of agricultural growth'. He concludes that ceremonial

exchange 'is intrinsically neither inhibitory nor facilitative of economic development'. It is argued that ceremonial exchange that inhibits development could be explained by the need to provide welfare services that otherwise are inadequately provided by the government.

Sharma, A. P. 1978. Studies on the mechanised harvesting of cassava in Fiji. *Fiji Agricultural Journal*, 40(1), 59–61.

Cassava is argued to be shifting from a peasant crop to a commercial plantation crop in Fiji. Larger scale production with minimum input cost is more practicable when supported by suitable mechanical equipment. Some of the results of studies on the mechanised digging of cassava roots are reported. Field tests were carried out at Koronivia on farmers' fields to find a more suitable machine than existing ones for use as a cassava digger, to reduce cultivation cost and increase net profit per unit of investment. Results indicated that a medium horsepower tractor attached to a single bottom mouldboard plough can harvest 0.4 ha of crop in 6 hours with minimum acceptable (1.44 per cent) tuber damage.

Amerasinghe, A. R. B. 1979. Sugar cane crop insurance. Commonwealth Secretariat South Pacific Regional Insurance Adviser and Commissioner of Insurance, Suva, 30 pp.

The paper lists the nature of the hazards involved in crop production, the scope and limitations of commercial and state insurance schemes and the options available. It focuses on Fiji. Tables illustrate sugar production, sugarcane yields and prices, sugar proceeds (1968–1978) as well as statistics on sugarcane crop losses and average yields (1966–1978).

Chandra, S. 1979. Crop production statistics for Sigatoka Valley, Fiji. *Fiji Agricultural Journal*, 41(1), 21–30.

Crop production statistics are presented for 13 Fijian villages and Indian settlements in the Sigatoka Valley. Data are given for each village or settlement on cropped and total area, mean plot size, yield, labour use, value of crop output, variable costs and gross margins per hectare, man-day and farm. The results are discussed in terms of crop diversity, labour requirements and gross margins analysis of the staple and commercial crops.

Chandra, S. 1979. Root crops in Fiji: Part 1 Production, marketing and consumption patterns. *Fiji Agricultural Journal*, 41(2), 73–85.

The author describes the system of root crops production including use of land, labour and capital on semi-subsistence farms and offers suggestions to improve the system. The contributions by farmers, middlemen and the National Marketing Authority in the marketing structure are assessed. The consumption patterns for root crops are described and the implications for future food supply are reviewed.

Government of Fiji, Bureau of Statistics 1979–current. *Current Economic Statistics*. Government Printer, Suva.

Contains statistics on agricultural production and prices.

1980–1989

Chandra, R. ed., 1980. *Food Distribution Systems in the South Pacific: Report on a Conference*, Suva, 13–17 December 1978. Development Studies Centre, Australian National University, Canberra.

This edited collection reports the results of two years of investigations into the food distribution systems in Fiji, New Hebrides (now Vanuatu) and Tonga. The seminar report emphasises the role of indigenous and non-indigenous people in food distribution; the role of government; satisfaction of food preferences using local and overseas sources; and the role of the intermediaries in food distribution.

Chandra, S. 1980. The productivity of the sugar cane farms in the Sigatoka Valley, Fiji. *Fiji Agricultural Journal*, 42(1), 35–39.

Sugar, the principal economic enterprise in Fiji, is produced by some 19 000 smallholders, covering 80 000 ha, and producing some 500 000 tons of sugar in the dry zones of the two main islands. Exports account for 70 per cent of foreign exchange earnings. The farm production systems are outlined and the levels of land, labour, capital and cash utilisation are discussed. The productivity levels, based on partial productivity measures for the Fijian and Indian farmers, are discussed.

Knapman, B. and Walter, M. A. H. B. 1980. The way of the land and the path of money: the generation of economic inequality in Eastern Fiji. *Journal of Developing Areas*, 14(2), 201–222.

The authors argue that the traditional basis of social inequality has been eroded over time and replaced by a new basis of economic inequality. The latter reflects 'differential access to resources within a cash-dominated society'. They report on the processes of change in the Eastern islands of Fiji, focusing on monetisation, population growth and coconut cash cropping, and analyse the pattern of economic differentiation that follows.

Rothfield, R. and Kumar, B. 1980. Report on the Census of Agriculture 1978. Parliamentary Paper No. 28, 1980, Parliament of Fiji, 114 pp.

A broad array of tables is provided on farm numbers and sizes, employment, planted areas and yields in the agricultural sector in Fiji, with considerable detail by agricultural activity, province and division, and ethnic group. Details are also provided on livestock and poultry numbers. Data collection procedures are outlined, including their organisation, scope of the census and program of data collection, sector classification and sample design, data processing and program of verification. A note is included to explain classification by land tenure, land occupancy, race and agricultural activity.

Ward, R. G. 1980. Agricultural options for the Pacific Islands. In: Shand, R. T. ed., *The Island States of the Pacific and Indian Oceans: Anatomy of Development*. Monograph No. 23, Development Studies Centre, Australian National University, Canberra.

The author outlines the options for developing agriculture in the South Pacific, which are derived from the ADB agricultural survey undertaken in 1979.

Ward, R. G. 1980. Plus ça change ... plantations, tenants, proletarians or peasants in Fiji. In: Jennings, J. N. and Linge, G. J. R. ed. *Of Time and Place*. Australian National University Press, Canberra.

There are sharp divisions in the landscape of rural settlement in Fiji on ethnic, social, tenurial and economic bases. The study reported in this paper focuses on the sugarcane areas in Western Division where activities and life on the estates are described. An account is given of the history of the relationships between CSR and workers on estates and European planters. Progress was rapid in subdivision and leasing in the early part of the 20th century, leading to a new landscape of small tenant

farms and individual homesteads which ensued from labour problems in the 1920s. But the labour problems were not responsible for a sharp break in settlement patterns. These patterns were more a direct derivative of the earlier estate pattern, and activities still remained under the close control of CSR from which producers held tenancies.

World Bank 1980. Fiji: Selected Development Issues. Washington, D.C., 95 pp.

About one-third of this report is devoted to agricultural development. The structure of the agricultural sector is described as background for discussing three issues. They are the development of the sugar industry and prospects for alternative export crops, commercialisation of subsistence agriculture, and rural regional development. In the latter case, the Eastern islands are used as a case study.

Chandra, S. 1982. Economics of vegetable production in Fiji. *Alafua Agricultural Bulletin*, 7(3), 52–59.

In this paper, the vegetable production system in Fiji is described in terms of production areas, yields and farm husbandry. A gross margin analysis of the main vegetables is carried out, and the marketing structure is outlined. The inputs of agricultural research and extension in vegetable development are evaluated. Finally, some agricultural policy implications are considered.

Evans, D. B. 1982. The Seaqaqa Sugar Cane Development Project: A study of farmer commitment with some implications for the selection of settlers. *Fiji Agricultural Journal*, 44(1), 1–8.

A sample of sugarcane farms was selected and divided into groups according to a number of socioeconomic characteristics. Analysis was undertaken which suggested that official criteria for selection settlers were, in general, well-conceived.

Evans, D. B. 1982. Plantations and the plantation mode of production. In: May, R. J. and Nelson, H. ed. *Melanesia Beyond Diversity*, Vol. 2. Research School of Pacific Studies, Australian National University, Canberra.

The author briefly describes plantations and the plantation mode of production, with Fiji used as an example for sugar. Economic behaviour is analysed under the plantation mode of production, with a specific focus

on group decision making and its implications for this mode. It is difficult to draw firm conclusions about the desirability of such a production mode: understanding of group decision making is crucial.

Prasad, C. and Fleming, E. M. 1982. Supply response of irrigated rice producers in Fiji. *Fiji Agricultural Journal*, 44(2), 53–60.

The price elasticity of supply of irrigated rice producers in the Lakena irrigation scheme in Fiji was estimated. Data were used for the period from 1978 to 1981. Producers were found to be price-responsive, to an extent similar to that reported in studies of rice farmers in other tropical countries.

Ellis, F. 1983. A Study of Employment and Earnings in Cane Harvesting in Fiji. Discussion Paper No. 148, School of Development Studies, University of East Anglia, Norwich.

The aim of the study was to describe the employment situation in cane harvesting in Fiji, and the evolving pattern of labour use and income distribution. Details are provided on the size of the harvesting labour force and its trend, the importance of cane harvesting in wage employment in Fiji, trends in wage rates and cash earnings of hired cane cutters. Policy matters are raised that reflect on the future organisation of cane harvesting.

Fleming, E. M. and Piggott, R. R. 1983. Analysis of trade instability in the South Pacific region. Paper presented at the 15th Pacific Science Congress, Dunedin, February.

Sources of instability in export earnings from South Pacific countries, including Fiji, are outlined and measured.

Matthews, I. 1983. Export Market for Pawpaw and Mangoes by Air Cargo to Japan, with Reference to Canada, Australia and New Zealand. Report Prepared for the Native Land Corporation, Suva.

Estimates are provided of prices and transport and marketing costs of mangoes and papaya into the Canadian, Australian and New Zealand markets. Prospects of success are assessed.

Brookfield, H. C. 1985. An historical and prospective analysis of the coconut districts. In: Brookfield, H. C., Ellis, F. and Ward, R. G. ed. *Land, Cane and Coconuts: Papers on the Rural Economy of Fiji*. Australian National University, Canberra, pp. 111–248.

The history and structure of the ailing coconut industry are analysed. Attention is given to the merits of a number of new initiatives that had been undertaken.

Ellis, F. 1985. Employment and incomes in the Fiji sugar economy. In: Brookfield, H. C., Ellis, F. and Ward, R. G. ed. *Land, Cane and Coconuts: Papers on the Rural Economy of Fiji*. Australian National University, Canberra, pp. 65–110.

This paper covers the nature of employment and incomes in the Fiji sugar industry, with special reference to the growers and cane cutters.

Fairbairn, T. I. J. 1985. *Pacific Island Economies: Studies from the South Pacific*. Institute of Pacific Studies, University of the South Pacific, Suva, 442 pp.

Discussions of Pacific Island economies are wide-ranging. However, there is some material specific to Fiji, notably a tax incentives case study, and some observations on agriculture in a chapter on current developments that have relevance to Fiji.

Fleming, E. M. and Piggott, R. R. 1985. Analysis of export earnings instability in the South Pacific region. *Singapore Economic Review*, 30(1), 14–33.

Sources of export earnings instability in South Pacific countries, including Fiji, are decomposed into price, quantity and price–quantity interaction terms.

Forsyth, D. J. C. 1985. *Mechanisation of Sugar Harvesting in Fiji*. Technical Report No. WEP 2–22, Tr. No. 4, World Employment Programme, International Labour Office, Geneva, 44 pp.

The study was conducted to ascertain what was by far the most serious technology policy issue facing Fiji: the choice of technology in sugarcane harvesting. The government of Fiji opposed the use of mechanical harvesters and enforced this policy by forbidding their importation. The problem arose because of a combination of heavy concentration of resources in a single industry, sugar, with a technology characterised by severe limitations of the number of alternatives and by a wide gap in

labour intensity between the current manual harvesting and the nearest alternative (whole-stick mechanical harvesters). Any change is considered likely to involve a very sharp shift in capital:labour ratios in the industry with consequent large-scale dislocation as resources are reallocated on a massive scale. The author develops detailed cost comparisons between the different technologies to isolate strands of economic and social arguments for and against mechanisation.

Sivan, P. 1985. Economic evaluation of taro production systems in Fiji. *Fiji Agricultural Journal*, 47(1/2), 7–12.

The profitability of different ways of incorporating taro in smallholder farming systems is assessed. The paper points up the opportunities for using taro in an economic manner as an intercrop.

Sofer, M. 1985. Yaqona and the peripheral economy. *Pacific Viewpoint*, 26(2), 415–436.

Kava (yaqona) is becoming an increasingly important cash crop besides its prominent role in all rituals and ceremonial events as well as social gatherings for native Fijian communities in peripheral areas. Three less developed regions as represented by Kadavu Island are increasing their engagement in cultivation and commercialisation of kava. This is shown through the cultivation patterns of crops, distribution of income sources and spatial pattern of yaqona flows centred on the Suva market. The main reasons for this area specialisation are thought to be the suitability of the physical conditions, agrotechnical advantages, and the nature of the core-periphery structure of Fiji's economy.

Ward, R. G. 1985. Land, land use and land availability. In: Brookfield, H. C., Ellis, F. and Ward, R. G. ed. *Land, Cane and Coconuts: Papers on the Rural Economy of Fiji*. Australian National University, Canberra, pp. 15–64.

World Bank 1985. *Fiji: Adjustment and Selected Development Issues*. Washington, D.C., 117 pp.

The primary production sector is analysed for the period 1979–83, and its future prospects are assessed. Commodity profiles are included for sugar, root crops and vegetables, export tree crops and export fruit crops. A chapter is devoted to rural development programs and the alleviation of regional income disparities.

Fleming, E. M. 1986. Agricultural market development in the South Pacific. Ph. D. thesis, University of New England, Armidale.

Analyses are made of a number of dimensions of agricultural markets in selected South Pacific countries, and the implications for agricultural market development are discussed.

Fleming, E. M. 1986. A study of agricultural market development in the South Pacific region: structure, conduct and performance. South Pacific Smallholder Project Occasional Paper 3, South Pacific Smallholder Project, University of New England, Armidale, 50 pp.

A structure–conduct–performance framework is used to study the development of agricultural markets in South Pacific countries.

Fleming, E. M. and Hardaker, J. B. 1986. Agricultural supply response in the South Pacific. *Pacific Economic Bulletin*, 1(1), 25–26.

The empirical evidence is reviewed on short-run and long-run estimates of price elasticities of supply for agricultural products in South Pacific countries, including Fiji.

Fleming, E. M. and Hardaker, J. B. 1986. Analysis of Agricultural Marketing Performance in Five South Pacific Countries. Occasional Paper 6, South Pacific Smallholder Project, University of New England, Armidale.

The performance is assessed of agricultural marketing systems in selected South Pacific countries, including Fiji, in terms of the value of exports relative to the value of food imports.

Hardaker, J. B. and Fleming, E. M. 1986. Rural development and social change. Paper presented at the Conference on Australia and the Pacific Islands, June, 1986. Academy for the Social Sciences in Australia, Canberra.

This paper focuses on the way that social factors interact with economic factors in influencing the nature and rate of rural development in the South Pacific.

Hardaker, J. B., Fleming, E. M. and Delforce, J. C. 1986. Prospects for Smallholder Development in the South Pacific: Background to a Research Project. Occasional Paper 1, South Pacific Smallholder Project, University of New England, Armidale.

An outline is presented of a project to study smallholder agricultural development in the South Pacific.

Piggott, R. R., Fleming, E. M. and Kunert, A. C. 1986. The debate on causes of export earnings instability: further conceptual issues with evidence from South Pacific economies. Paper presented at the 30th Annual Conference of the Australian Agricultural Economics Society, Canberra, February.

For a number of South Pacific countries, including Fiji, sources of export earnings instability are decomposed by major commodities and, for each commodity, into supply, demand and supply–demand interaction effects.

Sharma, P. 1986. Pricing policy in Fijian agriculture. *Review*, 13:34–39.

Brookfield, H. C. 1987. Export or perish: commercial agriculture in Fiji. In: Taylor, M. J. ed., *Fiji: Future Imperfect?*, Allen and Unwin, Sydney, pp. 46–57.

The author explains how early development in Fiji was based on the export of primary products, especially sugar, to meet the demands of the expanding metropolitan economies. Commercial agriculture based on the plantation system is described for the late colonial period. Sugar and coconuts are the focus of discussion. Major events in commercial agriculture in the early period of independence are recounted. Government initiatives included a subsidy on internal sea freight of copra, land development schemes, intervention in the marketing system, establishment of a national disaster organisation and support for the diversification of export crops. The growth of the kava industry, on the other hand, is described as a private initiative neither requiring nor receiving government assistance. Declines in world prices in the early 1980s hit commercial agriculture hard, and the response by the government is recounted. It is concluded that the relative prosperity of Fiji was largely built on primary production for export, and will only continue if prosperity in the export sector is sustained.

Cameron, J. 1987. A note on the history of the sugar sector in Fiji: ‘peasantisation’ under capitalism. *Journal of Peasant Studies*, 14(3), 211–219.

The author reviews the history of the sugar sector in Fiji from 1874 when Fiji became a formal British Colony, dividing it into periods: the early period, 1875–1916; crisis and confusion, 1916–1926; resolution through ‘peasantisation’, 1926–1939; and ‘a brittle continuity’, 1939–1970. After political independence in 1970 and nationalisation of the Fiji operations of the Colonial Sugar Refining Company of Australia (CSR) in 1973, the Fiji government accepted the small farm sugarcane system as an economic and political reality and expanded the area under sugarcane on that basis. Questions of mechanisation, ethnic mix, economic equity and institutional

arrangements for the whole industry are addressed in the framework of a typical 10-acre family farm. The paper concludes that the system created in the 1920s was convenient for a fully capitalist enterprise in the light of some peculiar local circumstances, and that in the 1980s that system acquired a strength in economic, political and social terms that still appear unchallengeable, despite vastly changed local circumstances. Physical and economic flexibility, financial accountability, local economic multiplier effects and producer participation are all at high levels.

Fleming, E. M., Hardaker, J. B. and Jones, S. C. 1987. Agricultural development in the South Pacific: Background Paper, UNESCO-SPEC High Level Regional Meeting on Policy and Management of Science and Technology for Development in the South Pacific Region, Apia, March.

The agricultural sectors and their development processes are described for South Pacific countries.

Government of Fiji, Bureau of Statistics. 1987. Census of Fiji, 1986. Government Printer, Suva.

Comprehensive summaries are presented in tabular format on a range of activities and characteristics, including agricultural production.

Kanbur, M. G. 1987. Forecasts and actuals of Fiji sugar cane output: a bird's eye view. *Economic Bulletin for Asia and the Pacific*, 38(1-2), 73-76.

The accuracy of an axonometric evaluation of sugarcane forecasts from the Fiji Sugar Corporation was assessed for the years 1965-1986. Results indicated that these forecasts, although better than those derived from naive models, were underestimates. It was recognised that most reported data contain measurement errors, usually in the condition of the crop, made by sugarcane farmers and FSC officers.

Knapman, B. 1987. Fiji's Economic History, 1874-1939: Studies of Capitalist Colonial Development. Pacific Monograph 15, National Centre for Development Studies, Canberra, 153 pp.

The spread, functioning and impact of capitalism in Fiji from 1874 to 1939 are examined through six case studies. Two of these case studies are on the sugar industry. In Chapter 2, the dominant influence of CSR on capitalist export growth is the topic of analysis. In Chapter 4, the demise of the white sugar planter is dealt with in which it shown that the 'white capitalist grip on the colonial economy was emphatically a corporate one'.

Parkinson, S. V. 1987. A study of the effects of economic development on food consumption and nutrition in a Fijian village, 1952–1982. In: Rae, C. and Green, S. ed. *Nutrition in the Tropics*. Menzies School of Public Health, Darwin.

Plange, N. 1987. *The Crisis in Partnership: Labour Unions, Associations and Management in the Fiji Sugar Corporation, 1973–1985*. School of Social and Economic Development Working Paper No. 7, University of the South Pacific, Suva, 56 pp.

The Fiji sugar industry is described, with particular emphasis on the role of the Fiji Sugar Corporation. A feature of the work of the Corporation that is dealt with in this paper is the resolution of disputes. A number of conflicts arose in the period 1973–85 that are analysed. The conclusion is reached that the bargaining strength of growers was enhanced by the new Sugar Industry Bill, with implications for the unions in the Fiji Sugar Corporation.

Sofer, M. 1987. Progress through transformation—a Fijian village. *Pacific Viewpoint*, 28(1), 1–19.

The issue of transformation of a subsistence village into one comprising market-oriented farmers is the issue considered in this paper, with institutional change in the village of particular interest. The transformation process in villages in Fiji is described specifically in relation to Narata village in the Sigatoka Valley. A comparison is drawn between current demographic characteristics, land distribution, agricultural activities and income pattern and those prevailing in the late 1950s, described in an earlier study in the village by Belshaw. Three conclusions are drawn: (1) greater flexibility and security occurred in the land tenure system, with greater individual mobility; (2) farmers in the village increased agricultural production and achieved higher incomes by adapting to a situation of no paternalistic support and weaker institutional assistance; and (3) the village mode of production was successfully modified to enable farmers to commercialise their activities.

Ward, R. G. 1987. Native Fijian villages: a questionable future? In: Taylor, M. J. ed., *Fiji: Future Imperfect?*, Allen and Unwin, Sydney, pp. 33–45.

The importance of the village as a symbol of Fijian society and polity is assessed in a present-day context. Its future importance is considered in the light of commercialisation in an increasingly monetised economy,

specialisation, and changes in land and labour use. Among the implications of these changes for villages are a growing number of Fijians without access to land and increasing wealth disparities within villages.

Chung, M. 1988. The impact of a road. In: Overton, J. ed., *Rural Fiji*. Institute of Pacific Studies, Suva, pp. 97–122.

The question is posed whether new roads contribute to rural development. It is explored by studying the initial and longer-term impacts of the Wainimala-Monasavu road in Fiji. Commercialisation was observed with greater access to markets. Changes occurred in market destination of produce and marketing arrangements, and there was a small increase in the quantity of goods transported. But little change ensued in production methods. The local population became more mobile and gained improved access to rural public services such as education and health. However, while there was a notable improvement in education services, little change occurred in the provision of health services because of complicating factors. The overall impact on rural development is adjudged not to be evidently beneficial in the longer term: development requires more than just a road.

Ellis, F. 1988. Small farm sugar production in Fiji: employment and distribution aspects. *IDS Bulletin*, 19(2), 47–53.

The sugar industry in Fiji shows that export crop production can satisfy equity criteria without sacrificing efficiency, growth or rising real incomes. This beneficial outcome results from a small farm structure maintained by government leasing of land, employment intensity linked to the prohibition of mechanical cane harvesting technology and a high grower share in sales revenue, assured by the high degree of grower participation in policy-making institutions. It is concluded that while Fiji is a special case, it may provide lessons for other countries.

Hardaker, J. B. and Fleming, E. M. 1988. Agricultural research problems in small developing countries: case studies from the South Pacific island nations. *Agricultural Economics*, 3:279–92.

The special difficulties in introducing new technologies in South Pacific agriculture are described. Greater reliance on more sharply focused adaptive work is recommended, as is the need to develop a more parsimonious research paradigm involving a broadening of the range of people who contribute to the research process.

Mangal, J. 1988. The marketing of yaqona. In: Overton, J. ed., Rural Fiji. Institute of Pacific Studies, Suva, pp. 59–70.

The role of yaqona in the economy of Fiji is described, and details are given on marketing channels. These channels include the Fiji Co-operative Association Ltd, producer-vendors, non-producer vendors, retailers and household sellers. It is concluded that yaqona is a well-established indigenous crop with increasing demand that yields good returns to producers.

Overton, J. 1988. The study of rural Fiji. In: Overton, J. ed., Rural Fiji. Institute of Pacific Studies, Suva, pp. 1–11.

The author commences this edited collection of papers on rural Fiji by giving details of studies of tradition and rural society, and outlining the material covered in succeeding chapters.

Plange, N. 1988. Shedding the emperor's clothes: from Colonial Sugar Refining to Fiji Sugar Corporation—the take-over and consolidation 1973–1976. *Journal of Pacific Studies*, 14:112–130.

By focusing on the early years of operation of the Fiji Sugar Corporation, it is shown that the conduct of industrial relations changed with the new management. Background information is provided on the takeover of sugar operations by the newly formed Fiji Sugar Corporation and the plans for departure by Colonial Sugar Refining. Then, the takeover and subsequent changes are analysed, and it is explained how industrial problems were resolved. The first industrial crisis was caused by a general workers' strike in 1973. This event, and its prompt negotiation and settlement, is reported to show the flexible response taken by the new management. Cane growers' demands for an increase in the minimum cane price are also covered, along with an account of the variation in the Denning award that occurred in 1975. There are also sections on cane contracts and cane production, rehabilitation of sugar mills, and the Fiji Sugar Corporation in the international market. The paper concludes with an appraisal that, by the end of 1976, the corporation had matured and consolidated itself.

Tukai, M. 1988. In: Overton, J. ed., Rural Fiji. Institute of Pacific Studies, Suva, pp. 13–18.

The modernisation of society in Cautata, on the southeast coast of Viti Levu, is analysed. Emphasis is placed on economic linkages forged or strengthened by improved bus services.

Ali, R. A. and Narayan, J. P. 1989. The Fiji sugar industry: a brief history and overview of its structure and operation. *Pacific Economic Bulletin*, 4(2), 13–21.

Sugar, the principal export of Fiji since the 1880s, had maintained its dominant position despite efforts to diversify the economy. The numerous problems and challenges that beset the industry are discussed, including labour shortages in its early stage, production and price fluctuations and, in 1987, political difficulties. A chronology is presented of the establishment of the mills in various localities. Other issues covered include the sugar industry structure, smallholder system of farming, the sugarcane contract, ethnic farming, milling, transport, storage and markets including future prospects.

Brookfield, H. C. 1989. The human context of sustainable smallholder development in the Pacific. In: *Proceedings of Soil Management and Smallholder Development in the Pacific Islands*. Proceedings No. 8, International Board for Soil Research and Management, Bangkok, pp. 189–203.

Leunissen, J. 1989. Co-operatives in Fiji: a review and analysis. *Journal of Rural Cooperation*, 17(1), 3–20.

The author discusses the status of rural cooperatives in Fiji, using the rice cooperative as a case study. Special focus is placed on the relationship between the social and economic aspects of cooperative associations. The role of the government in the operation and performance of cooperatives is discussed. For widespread and close involvement of people in a cooperative, it is essential that the decision to form a cooperative comes from the participants themselves rather than an outside agency.

Low, J. 1989. An analysis of the marketing of fresh tropical fruits from the South Pacific islands in New Zealand. In: *Proceedings of the Regional Technical Meeting of Tropical Fruit Production in the South Pacific*. Apia, Western Samoa, Institute for Research, Extension and Training in Agriculture, Alafua, pp. 69–94.

An economic analysis is undertaken of the export marketing of fresh tropical fruits from South Pacific countries, including Fiji, to New Zealand. Fiji has one of the longest histories of trying to export fresh fruit to Pacific rim countries. Some of the difficulties faced by exporters are discussed.

Since the article was written, significant advances have been made by the government of Fiji in establishing quarantine protocols for fresh fruit with the New Zealand government.

McGregor, A. and Eaton, C. 1989. Developing a Viable Horticulture Export Sector in the Pacific Islands. Food and Agriculture Organization of the United Nations, Rome, 25 pp.

Focusing on a small number of niche export crops, including ginger and papaya in Fiji, some guidelines are presented on how to develop a viable horticultural export sector in Pacific countries. Particular attention is paid to the need to develop the export market in an orderly fashion. The roles of the private sector and the government are assessed in this endeavour.

Menz, K. M. and Fleming, E. M. 1989. Economic prospects for vanilla in the South Pacific. ACIAR Technical Reports 11, Australian Centre for International Agricultural Research, Canberra, 14 pp.

The vanilla industry in the South Pacific is discussed in terms of its production, processing and market characteristics. The future direction of the world market is considered and factors affecting the world market are outlined.

Menz, K. M. and Fleming, E. M. 1989. Vanilla in the South Pacific. Pacific Economic Bulletin, 4(1), 26-30.

This paper describes the main properties of vanilla and analyses the development of niche export markets in South Pacific countries such as Fiji, Vanuatu and Tonga. Production and consumption estimates are provided, together with price movements for vanilla.

National Marketing Authority of Fiji 1989. Fiji. In: Marketing Farm Products in Asia and the Pacific. pp. 217–230.

This paper describes the role of government in marketing developments in Fiji. Fiji's comparative advantage is seen to lie in the production and export of high-value, usually specialised, products. The programs outlined for tropical fruits, processed ginger, root crops and horticultural products are justified largely on the basis of comparative advantage. While the economic principle is sound, successful implementation is far from assured given Fiji's poor record in the export of fresh products. Future production will be based on smallholders who may have significant advantages in terms of employment and income distribution. However, heavy demands will be placed on organisational and marketing

infrastructure. A scheme proposed for nucleus estate production, marketing and servicing units aims to encourage smallholders to improve quality in order for their production to be combined with that of large estates for export and processing.

Prasad, L. 1989. Fiji's efforts in market promotion of fruits in Australia, Japan and Canada. *Alafua Agricultural Bulletin*, 14(1/2), 41–43.

The paper describes the efforts of the High Commission and Consulate-General in Australia, Embassy in Japan, Consulate-General in Los Angeles and the Fiji Trade and Investment Board in Fiji to promote exports, and stimulate and facilitate economic development. In 1986, papaya, pineapple, mango, guava, ivi, custard apple, jackfruit, kavika, star-apple and passionfruit were exported by air-freight in varying quantities to Australia, Japan and Canada.

1990–present

Eaton, C. S. 1990. Prospects of the private sector's participation in the development of smallholder agriculture in Fiji and Vanuatu. *Pacific Islands Development Program*, East-West Center, Honolulu.

The major constraints facing small-scale agriculture are identified and a model is presented for directing smallholder cultivators who are emerging from a semi-subsistence base to one oriented to the cash economy. Various potential private sector projects are described. Private management services, national planning objectives and governmental regulatory controls and policies are all crucial determinants in increasing private sector participation in smallholder agriculture.

Government of Fiji, Bureau of Statistics 1990. *Household Economic Survey 1989–90*. Government Printer, Suva.

Summary details are provided that relate income and expenditure patterns of rural households in Fiji during 1989–90.

Naidu, R. and Puttaswamaiah, K. 1990. Sugar production and rural development: a case study of Fiji. In: *Poverty and Rural Development: Planners, Peasants and Poverty*. Intermediate Technology Publications, London, pp. 236–263.

The chapter examines the contribution of the sugar industry to rural development in Fiji. With background information on population and employment, the industry is analysed with regard to sugarcane plantations, the sugar industry and its targets, inflation, income

distribution, government incentives for cane farmers and the spread effect of income generated by sugar. Sugar must remain a major export earner to balance imports and improve the ratio of rural to urban income.

Plange, N. 1990. *Rendezvous with the Cane Growers: The Restructuring of the Fiji Sugar Industry 1980–84*. School of Social and Economic Development Working Paper No. 17, University of the South Pacific, Suva, 59 pp.

The Denning award occurred in 1975 and is viewed as the point of departure for the major restructuring of the Fiji sugar industry that took place in the early 1980s. Early initiatives to restructure are described along with the search for a new framework for the sugar industry. The competing claims of the workers, growers, millers, researchers and the Fiji Sugar Corporation are analysed. It is explained how these divergent interests were resolved from mid-1981 onwards. The new Sugar Industry Act came into being in 1984. Details are given of the Act and its implications for a restructured industry.

Vinning, G. 1990. *Marketing Perspectives on a Potential Pacific Spice Industry*. ACIAR Technical Reports 15, Australian Centre for International Agricultural Research, Canberra, 60 pp.

Chapters cover: the definition of spices; global production and trade; spices in South Pacific countries; marketing prospects for various spices; case studies in the Pacific; commercialisation of spices in the Pacific; marketing issues; the Australian spice market; and prospects for spices in the Pacific.

Achary, S. S. 1991. *The lifeworld of National Marketing Authority in the Fijian socio-political economy: A critical analysis within the Hegel-Habermas model*. M. A. thesis, University of the South Pacific, Suva.

The author analyses the steering mechanisms influencing the operations of the National Marketing Authority. Of particular relevance is the subversion of the functions of both the National Marketing Authority and Ministry of Primary Industries by particular communities, notably producers in the Sigatoka Valley.

Asian Development Bank 1991. *Fiji Agricultural Pricing and Marketing Study*. Asian Development Bank, Manila.

Government of Fiji, Bureau of Statistics 1991. *Statistical Report on the Household Economic Activity Study, 1989-1990*. Government Printer, Suva.

The report comprises 26 tables providing information by sex, ethnic group and spatial division on the distribution of population, income and expenses by sector of origin and capital formation during 1989-90.

Economic Planning and Statistics Division 1992-present. *Market News*. Ministry of Agriculture, Fisheries, Forests and ALTA, Suva.

Market News is a quarterly market information newsletter on commodities, prices (domestic and overseas) and other relevant news in brief.

Otanez, G., Narayan, D. and Tubuna, S. 1992. *Fiji National Agricultural Census 1991*. Agricultural Planning and Statistics Division, Ministry of Primary Industries and Co-operatives, Suva.

The third agricultural census was conducted for the agricultural sector by the Ministry of Primary Industries and Co-operatives with technical assistance from UNDP/FAO. It contains a brief introduction and background of Fiji, an outline of the census program, the new area sampling frame method used, analysis of the census results, tables of raw census data and questionnaires used in data collection.

Asian Productivity Organization 1993. *Improvement of Agricultural Statistics in Asia and the Pacific*. Tokyo, 342 pp.

Good-quality statistics are argued to be necessary for the development of agriculture and the rural economy. To address the need for better agricultural data in APO countries, a meeting was held from 26 November to 6 December 1992 in Tokyo on how to improve the supply of agricultural statistics in member countries. The papers and proceedings of the meeting are documented in this publication, and include a Fiji country report.

Chand, P. and Rae, A. N. 1993. *New food and agribusiness market opportunities: some recent developments from the Forum Island countries*. In: *Pacific Rim Agriculture: Opportunities, Competitiveness and Reforms*.

Proceedings and Papers of the Fifth Workshop of the Agricultural, Trade and Development Task Force of the PECC, Hawaii, 14–16 May 1992, pp. 33–54.

The paper discusses how policy makers and private investors in the Forum Island Countries are now increasingly exploring opportunities for new food and agribusiness development. The Forum Island countries, comprising 13 independent and self-governing Pacific Island countries, traditionally relied on agriculture as the mainstay of their economies. Horticulture is seen as one of the areas where great untapped potential exists. The paper also briefly discusses horticultural export performance of Forum Island Countries. It puts forward a case for their special and different treatment in the emerging trade environment, given their unique problems faced in securing higher levels of income, employment and standards of living.

Asian Productivity Organization 1994. Oilseed Production and Marketing in Asia and the Pacific: Report of an APO Symposium, 11–18 December 1991, New Delhi. Tokyo.

Results of a survey for enhancing the contribution of oil crops to the economy are discussed. Regional analyses and 11 country papers, including one from Fiji, are covered.

Economic Planning and Statistics Division 1994. Farm Management Manual. Updated edition (1994), Ministry of Agriculture, Fisheries, Forests and ALTA, Suva.

This is the latest version of a longstanding manual on farm management in Fiji. It contains technical budgets, with information pertaining to all technical and husbandry data, and financial budgets, with information on financial, marketing and commodity analyses. Appendices contain information that helps users in decision making.

Fiji Association of Women Graduates 1994. Women market vendors in Fiji. Fiji Association of Women Graduates, Suva.

A survey was undertaken of women selling produce in markets in Fiji. This report on its results provides interesting information on their activities, and the important role they play in fresh produce marketing in Fiji.

South Pacific Commission/German Biological Control Project and the Ministry of Agriculture, Fisheries and Forests 1994. Seminar/Workshop on Rapid Rural Appraisal (RRA), Knowledge Attitude Practice (KAP)—Survey and Agricultural Economics, Nadi, Fiji, April 11–16, 1994. South Pacific Commission/German Technical Cooperation Agency, Suva, 76 pp.

Chand, H. and Field, S. P. 1995. Data Requirements for Economic Analysis. SCEP Technical Report No. 7, Soil and Crop Evaluation Project, Suva.

The purpose of this report is to develop a better understanding of the real costs farmers pay and the real returns they receive for their produce so that economic analysis could be undertaken. Its authors examine ways to collect information in order to undertake economic analysis through the number of options available to the research and extension officers.

Economic Insights 1995. The Economy of Fiji: Supporting Private Investment. International Development Issues No. 40, AusAID, Canberra, 109 pp.

The publication is a review of the economy of Fiji, potential opportunities and the role of the government. Some emphasis is given to the opportunities for the production and processing of foodstuffs for the domestic market and for export.

Grynberg, R. 1995. Bananas and sugar—the Lomé waiver and the Fiji sugar industry. *Journal of South Pacific Agriculture*, 2(1), 41–47.

Prognostications are made about the likely effects of the successful conclusion of the Uruguay round of GATT negotiations. The author focuses on the implications for special preferential access to the European Union for sugar and bananas from Fiji.

Grynberg, R. 1995. The Impact of the Sugar Protocol of the Lomé Convention on the Fiji Economy. Economics Division Working Paper No. 95–8, Research School of Pacific and Asian Studies, Australian National University, 56 pp.

The Sugar Protocol of the Lomé Convention must come to an end, the author predicts, because the European Union has no need for ACP sugar. An absence of potential economic growth in the sugar and garment industries sector means that the Fiji economy is in need of major adjustment. The effects of the Lomé convention on farm size, productivity and land use are discussed in detail, and a brief examination is made of the

environmental effects. Some actions are considered for economic reform open to the government to adjust rationally to a more efficient industrial structure.

McGregor, A. 1995. A marketing plan for pineapple and other tropical fruit for Fiji, with particular emphasis on the Seaqaqa Pineapple Micro-Project. Report prepared for the European Union, Suva.

Ministry of Agriculture, Fisheries, Forests and ALTA, Fiji 1995. Deregulation of the Primary Industry Sector. Management Information System Report. Suva.

The Ministry of Agriculture, Fisheries, Forests implemented a management information system to improve management procedures within the Ministry and enable it to respond more quickly to the needs of its clients. This report outlines procedures that were instituted.

South Pacific Forum Secretariat 1995-present. Trade Forum. South Pacific Forum Secretariat, Suva.

The Forum Secretariat publishes newsletters with a focus on trade and investment in South Pacific countries. They are produced by the Network for the Trade and Investment Division, South Pacific Forum Secretariat, Suva, Fiji in conjunction with its South Pacific Trade Commission office in Sydney and Auckland and the Pacific Islands Centre, Tokyo, Japan.

Woodward, K. 1995. Rice Sector Study. Ministry of Finance, Suva.

This study of the rice industry in Fiji was undertaken at a crucial stage in the history of the industry. Market liberalisation policies adopted by the government of Fiji had exposed the industry to greater competitive forces from imports. The study focuses on how the industry could best respond to the new challenges it faced by improving its performance. The future of irrigated rice production was considered to be grim.

World Bank 1995. Fiji: Restoring Growth in a Changing Global Environment. Country Operations Division, East Asia, Washington, D.C.

Suggestions are made on how the role of export-oriented agricultural activities could contribute to economic growth in Fiji in a climate of economic liberalisation.

Economic Planning and Statistics Division 1996. Agricultural Statistics (Part One) 1990–1994. Ministry of Agriculture, Fisheries, Forests and ALTA, Suva.

This statistical publication contains basic agricultural and related data from sources within and outside the Ministry. Data from three previous agricultural census and trade reports from the Bureau of Statistics cover a wide range of agricultural information to be regularly updated.

Field, S. P., Kumar, N. and Prasad, M. 1996. A Review of the SCEP Socio-Economic and Agronomic Program 1993–1995. SCEP Technical Report No. 10, Soil and Crop Evaluation Project, Suva.

The report contains a review of five socioeconomic surveys in various parts of Fiji and 16 agronomic trials on various research stations in Fiji.

Fleming, E. M. 1996. Research Options for High-Value Agricultural Exports in South Pacific Island Nations, Research Report 10, International Service for National Agricultural Research, The Hague, 206 pp.

The history and prospects of high-value exports are analysed for ten South Pacific countries, including Fiji. The report highlights the special problems faced by small countries in carrying out agricultural research to promote agricultural export development. Prospects for sustained export success are influenced by a variety of factors that are specified in the report.

Singh, J. 1996. A survey of market vendors in a rural township: could more schooling assist rural market vendors? *Journal of Pacific Studies*, 19:159–172.

The author investigated the effects of attainment of basic schooling on income earnings of market vendors in Labasa. A statistically significant association is reported.

Anon. 1997. The kava phenomenon. *Trade Forum* 3(3), May/June 1997.

A symposium in Hawaii was told that in 1996 sales of kava capsules in USA hit a record US\$14 million with about 350 000 annual prescriptions. It is estimated that about 1.3 million people in Europe are currently using kava capsules (Laitan 100, Kavain, Neuronika and Antares 120). Demand is growing in Europe. Satisfying European demands would require between 1000 and 1400 tons of kava a year. This equates to 6000 tons to 7000 tons of green Pacific kava. Add USA and other parts of the world and the

demand would be around 9000 tons to 10000 tons of green Pacific kava a year. The data indicate the potential of kava in the global market, especially from the herbal and pharmaceutical industries.

Ministry of Agriculture, Fisheries, Forests and ALTA, Fiji. 1997. *Fiji Islands: Harvesting the Potential of the Agriculture Sector*. Suva.

A description is given of the agricultural sector in the Fijian economy for use as an investment guide. Sections are included on the government's agricultural investment policy, investment priority areas, investment approval process, finance, doing business in Fiji, land and the environment, taxation, government and trade contacts, overseas missions of the Fijian government and air cargo rates

Reddy, M. and Yanagida, F. F. 1998. Fiji's sugar industry at the crossroads. *Pacific Economic Bulletin*, 13(1), 72–88.

The authors present an analysis of what they consider to be the two major threats facing the sugar industry in Fiji. They are the loss of the relatively high-priced market in the countries of the European Union and the expiry of land leases on which 73 per cent of sugarcane is currently grown. The need to raise productivity is stressed, and major changes in the industry will be needed for this to be achieved. No change is considered to be effective without a longlasting solution to the land tenure problem.

AGRICULTURAL EXTENSION, EDUCATION, INFORMATION AND RESEARCH TECHNIQUES

1930–1939

Parham, B. E. V. 1937 Agricultural demonstration stations. *Fiji Agricultural Journal*, 8(3), 30–32.

The trend by indigenous Fijians to individualism and independence of effort had brought progress and problems associated with land tenure, exemption from communal services and maintenance of a household apart from the village. Challenges existed in efficient land use, soil conservation and the substitution of permanent land occupation for the 'wasteful' methods of shifting cultivation, its 'accompanying evils' of dissipated energy and soil erosion, and difficulties in transport and marketing. Demonstration stations and agricultural sub-stations were viewed as a useful means of overcoming these problems and meeting

challenges. The author describes these stations with a specific description of the Nanduna Demonstration Station on the Waidina river. He claimed success for them during the two years of their operation in terms of improved cultivation methods.

Jack, H. W. 1939. Progress notes on the General Experiment Station, Sigatoka. *Fiji Agricultural Journal*, 10(3), 76–78.

An account is given of the progress made in developing a research station in the Sigatoka Valley, following a recommendation in the Stockdale report. An impressive range of both annual and perennial crops had already been planted.

Jack, H. W. 1943. Chemical services in Fiji. *Fiji Agricultural Journal*, 14(1), 33–35.

The Department of Agriculture provided services to farmers using its chemical laboratory. Details are given of the services provided and staffing of the laboratory.

1940–1949

Jack, H. W. 1941. Agricultural education of Fijians. *Fiji Agricultural Journal*, 12(2), 32–35.

Various facilities had been constructed for training young Fijians in agriculture by this time. Details are provided on those facilities operated by the Department of Agriculture and provincial training, with a strong practical emphasis.

Parham, B. E. V. 1946. Agricultural training schemes. *Fiji Agricultural Journal*, 17(4), 112.

Brief details are provided on the agricultural training schemes available to Fijian farmers, offered by the Department of Agriculture and provincial institutions. The onset of war had heightened the need to increase local food production and training schemes were viewed as an important contributor to this aim in the early post-war years. A feature of the schemes at this time was the strong practical orientation given to them.

1950–1959

Lamont, N. 1952. Koronivia: The Principal Agricultural Station of Fiji. *Fiji Agricultural Journal*, 23(3/4), 108–118.

The paper begins with an account of the special nature of tropical problems. This is followed by the history of Koronivia and its development in terms of fencing, drainage, dairy construction, accumulation of dairy stock, piggery and poultry constructions, and rice improvement program. A special section is included on crop rotation studies undertaken at the station. A brief coverage is made of other crop improvement work carried out, including that on tree crops and grasslands.

Mason, R. R. 1953. Agronomical investigations, 1953: progress notes from the agricultural stations. *Fiji Agricultural Journal*, 24(3/4), 66–67.

The investigations on which reports are made include the status of research into rice production at Koronivia and Sigatoka. Rice varieties, planting methods and fertiliser application are covered. Other crops being researched include bananas and sugarcane. There are brief notes on rotations and machinery use.

Mason, R. R. 1953. Koronivia Agricultural Station. *South Pacific Commission Quarterly Bulletin*, 3(4), 22.

The Koronivia Agricultural Station is described and details are provided of its development. There are sections on livestock and crop investigations undertaken.

Hartley, R. L. 1955. Young farmers' clubs of Fiji. *South Pacific Commission Quarterly Bulletin*, 5(2), 25–27.

The young farmers' clubs movement developed in Fiji from 1950. Details are provided of a model program.

Parham, B. E. V. 1955. Notes on agricultural research. *Fiji Agricultural Journal*, 26(1), 26–27.

Various research projects had been undertaken with assistance from Colonial Development and Welfare research funds. These are described along with research work undertaken by the Department of Agriculture.

Payne, W. J. A. 1955. Sigatoka Agricultural Station. South Pacific Commission Quarterly Bulletin, 5(2), 8–10.

A brief account is given of the development of Sigatoka Research Station from 1927. Details are provided on soils and climate. The farming system being developed is described and information is provided on plantings of arable crops, pasture and fodder crops, tree crops and the nursery.

Hartley, R. L. 1958. The Koronivia Farm Institute. Bulletin No. 33, Fiji Department of Agriculture, Suva, 34 pp.

The Koronivia Farm Institute was opened in 1954. The author describes the two-year course in general and tropical agriculture that was offered at the Institute, located at the principal agricultural research station at Koronivia.

1960–1969

Hackett, E. J. F. 1961. Student-farmer scheme launched in Fiji. South Pacific Commission Quarterly Bulletin, 11(3), 25, 68.

A new three-year course was introduced at Navuso Agricultural School for student-farmers. Some illustrations of the school are included.

Department of Agriculture, Fiji 1965. The Fiji Farmer, 1(1), 1–16.

The Fiji Farmer was a new publication to fill the gap left by the withdrawal of the Fiji Agricultural Journal in 1962. Its aim was as a supplement to extension services to provide articles of general interest to farmers in Fiji. More scientific papers were to be published by the Department in the form of occasional papers.

1970–1979

Nalo, C. 1974. Facing the future: Fiji's rural youth leaders learn new skills. South Pacific Commission Quarterly Bulletin, 24(1), 37–39.

The rising tide of unrest among rural youth is the source of concern dealt with in this article. Rural youth leaders are seen as a way to combat this troublesome trend. It is argued that there is a need to develop among young people a sense of active involvement and voice in the decisions made in rural communities.

Vernon, A. J. 1974. A bibliography of agriculture in Fiji: Part 1. Fiji Agricultural Journal, 36:33–42

The bibliography provides major sources of information about agriculture in Fiji from 1800 to 1905. Bibliographic details are given of all the relevant serials published in Fiji. The list includes: the Royal Fiji Gazette, the Blue Book, the Journal of the Legislative Council, Annual Reports of the Department of Agriculture, bulletins published by the Department of Agriculture, Fiji Planters Journal, the Transactions and Proceedings of the Fiji Society, and various journals issued by the Department of Agriculture such as the Fiji Agricultural Journal.

1980–1989

Pacific Information Centre 1981-present. South Pacific Bibliography. University of the South Pacific, Suva.

This bibliography superseded the Pacific Collection Accession Lists of the University of the South Pacific Library Vols 1–8, 1975–1982.

Coolen, P. and Beal, G. 1984. Information and Knowledge Exchange among Agricultural Research, Dissemination and Producer Systems in Selected South Pacific Island Nations: Fiji. Institute of Culture and Communication, East-West Center, Honolulu.

The main topic for discussion in this monograph is the transfer of information on agricultural research in Fiji to the users of research results. Background information is provided on agriculture in Fiji, the Ministry of Agriculture and Forests and its goals, and roles of extension and dissemination of information. Constraints to the flow of agricultural information are identified and key issues are discussed. Conclusions and recommendations are drawn on marketing, linkages and misperceptions between and within systems, needs and problem identification, technical information, systems operation and maintenance, job and role descriptions, subject matter specialists, support coordination, monitoring, planning for extension manpower, and interaction with alternative dissemination systems.

James, K. 1985. An account of agricultural education in Fiji 1865–1925. Suva.

International Service for National Agricultural Research 1988. The Planning and Management of Agricultural Research in the South Pacific: Report of a Workshop, 5–16 October 1988. Institute for Research, Extension and Training in Agriculture, Alafua, CABI, 91 pp.

The workshop was attended by 35 directors of agriculture and agricultural research managers from 11 countries (including Fiji) in the South Pacific. Staff members of the Institute for Research, Extension and Training in Agriculture (IRETA) and the School of Agriculture from the University of the South Pacific (USP) also participated. The workshop provided an introduction for senior policy makers and practising research managers to key concepts and tools for strengthening the planning and management of agricultural research in the context of the South Pacific. It was designed to be an intensive learning experience based on a mixture of formal lectures, management case studies and exercises and small working group discussions. This report contains the papers and summaries of the main presentations made at the workshop. A wide range of topics are covered, from strategic planning and project design to human resource management issues, such as motivation and leadership. Some of the main papers were: working to strengthen national agricultural research systems (H. Elliott); resource commitments to agricultural research in the South Pacific, preliminary findings (L. Fernando); the scope for improved management in the South Pacific (E. Solofa); the future role of agricultural research in the South Pacific (R.G. Ward); research planning and management in Fiji (P. Sivan); planning and managing regional research activities, the IRETA experience (L. Fernando); a strategy for improving extension services in a South Pacific country, some lessons for agricultural research (T. F. Wendt); information management for agricultural research in small-scale agriculture at the University of the West Indies (L. A. Wilson and R. Singh); the future role of agricultural research in the South Pacific: whither IRETA? (D. Osbourne); what is good research management? (L. Fernando); and designing agricultural research projects for external assistance (N. Amerasinghe).

Overton, J. 1988 The adoption of rice by village Fijians. In: Overton, J. ed., Rural Fiji. Institute of Pacific Studies, Suva, pp. 147–164.

This chapter deals with the impact of green revolution technologies in rice production in Fiji. Fijian farmers are studied according to whether they are individual non-village farmers, village farmers or members of village group farms. Problems and prospects for the adoption of high-yielding rice varieties are discussed. It is pointed out that Fiji is unlike many countries that have adopted a green revolution approach in rural development in that rice is non-indigenous and a staple for only one-half the population. Nevertheless, it is observed that there are early and tentative signs of successful adoption.

Walton, P. 1989. Information needs for crop protection in the Pacific region. In: Harris, K. M. and Scott, P. R. ed. Crop Protection Information: An International Perspective. Proceedings of an International Crop Protection Conference Information Workshop held at CAB International, Wallingford, U.K.

The abundance of crop protection information available for the Pacific islands is discussed. Access to a Pacific plant protection information system (PPPIS) within the Plant Protection Service of the South Pacific Commission enables new computer technology to manage integrated databases of plants of the region, pests, control procedures (e.g. biological, resistant varieties, pesticides), quarantine regulations, legislation and literature. The ppPIS will make such information readily accessible and integrate its activities with an agricultural information network already established and operated by trained staff.

1990–present

Currie, W. J. 1993. A study to strengthen research/extension/information linkages for the support of agriculture in the South Pacific. *Journal of South Pacific Agriculture*, 2(2), 1–3.

A study was conducted to identify the preferred methods of agricultural information flow in the countries of the South Pacific region and understand the constraints on that flow. The links were studied between agricultural research and other agricultural services and the link between these and information sources. This study included 6 South Pacific nations: Cook Islands, Kiribati, Fiji, Solomon Islands, Tonga and Vanuatu. The

objective of the project was to develop proposals to improve information dissemination, alleviate constraints where possible and assess the effect on existing systems working in the region.

Kern, R. 1993. Communication failures in systems for generating and transfer of agriculture technology in the South Pacific. *Journal of South Pacific Agriculture*, 2(1), 21–24.

Activities include participating in review teams in Papua New Guinea, Solomon Islands, Fiji and Western Samoa for the International Service for National Agricultural Research, and six subsequent research and consultative activities in those countries plus Tonga. The paper is based on seminars conducted with scientists in the Fiji Association of Agriculture and the East-West Center, updated to include additional observations in 1991 and 1992.

Ola-Roberts, N. 1994. Interim and final reports on the documentation of materials in the South Pacific Commission Agriculture Library in Suva, Fiji (Crop Protection in the South Pacific; RAS/86/037), for the periods November 1992 to December 1993 and January to August 1994. South Pacific Commission, Suva, 22 pp.

This publication contains an update on materials collected and catalogued on the library maintained by the South Pacific Commission in Suva.

South Pacific Commission/German Biological Control Project and the Ministry of Agriculture, Fisheries and Forests 1994. Seminar/Workshop on Rapid Rural Appraisal (RRA), Knowledge Attitude Practice (KAP)—Survey and Agricultural Economics Nadi, Fiji, April 11–16, 1994. South Pacific Commission/German Technical Cooperation Agency, Suva, 76 pp.

This report on the seminar/workshop on rapid rural appraisal contains little new in terms of the methodology of rapid rural appraisal. However, it is of some interest because of its specific application to meeting the information needs of researchers working on biological control.

Standing Committee on Agricultural Information Networking in the Pacific 1994. Third seminar on agricultural information networking in the Pacific and PAIS workshop, Apia: resource materials. South Pacific Commission, Noumea.

Dowling, A. J. and, Kumar, D. 1995. Structure and Procedures of the Research Division, and its Relationship with other Divisions within MAFFA. SCEP Technical Report No. 8, Soil and Crop Evaluation Project, Suva.

This report outlines agricultural research policy and gives an overview of activities, research stations, and finance and budgeting of the research division of MAFF. Staffing is discussed in terms of organisation (established and unestablished), career opportunities, duties and responsibilities, staff deployment, gender and ethnic balance, and qualifications. Reporting is discussed in terms of annual work plans, research reports and MAFF annual reports, the transfer of results and recommendations, and reporting as a means of appraising staff performance. Technical and specialist service activities are described and assessed. Finally, the institution is assessed in respect of meeting the objectives of SCEP.

Hart, P. B. S., Giltrap, D. and Leslie, D. M. 1995. Systems for transferring agricultural information and predicting plant performance and suitability in Pacific Island agro-ecological zones. *Journal of South Pacific Agriculture*, 2(1), 5–15.

A description is given of the analogue and matching systems used to transfer agricultural information and predict plant suitability and performance in agroecological zones of Pacific island countries, including zones found in Fiji.

Morton, J. R. 1995. How to lay out, maintain and record a randomized block trial. PRAP Leaflet No. 1, Pacific Regional Agricultural Programme, Suva.

Morton, J. R. 1995. Basic handling and preparation of data for analysis. PRAP Leaflet No. 2, Pacific Regional Agricultural Programme, Suva.

Morton, J. R. 1995. The analysis of variance. PRAP Leaflet No. 3, Pacific Regional Agricultural Programme, Suva.

Nagatalevu, M. M. and Foraete, H. 1995. Experiences with Participatory Rural Appraisal in Fiji. Paper presented at the National Workshop on 'Participatory Methods', PRAP Project 11, Soil and Crop Evaluation Project/International Board for Soil Research and Management, Suva.

Rogers, S. 1995. Planning for On-Farm Research: Report and Papers from the First Annual Meeting of Cooperators, Apia, Western Samoa, 4–10 April 1995, PRAP Report No. 1, Pacific Regional Agricultural Programme, Suva.

Dowling, A. J., Singh, J. M. and Puran, K. 1996. SCEP: Annual Research Plan 1996. SCEP Technical Report No. 17, Soil and Crop Evaluation Project, Suva.

The research plan for 1996 is outlined and a schedule of activities is presented. Details are provided on 10 on-farm and 12 off-farm activities involving people from the research and extension divisions of MAFF. In addition, seven specialist activities are outlined.

Kronen, M. 1996. A primer on participatory methods based on papers presented at the Fiji National Workshop on Participation, Koronivia, Fiji, 13–14 September 1995, PRAP Report No. 2, Pacific Regional Agricultural Programme, Suva.

The focus is on creating awareness among staff of the Ministry of Agriculture, Fisheries, Forests and ALTA and related institutions about participatory methods and to explain how these methods can best be used to promote agricultural development. Examples from Tonga and Western Samoa are also included. Another major chapter presents background information on methodological approaches and their application in the context of Fiji.

Kronen, M. 1996. Logical framework training kit [multimedia], PRAP Project No. 11, Pacific Regional Agricultural Programme, Suva.

Kronen, M. 1996. Participatory learning and action (PLA): the first steps towards change—training extension workers and farmers in the South Pacific [VHS/PAL]. Pacific Regional Agricultural Programme, Suva.

This is a training video on PLA with accompanying notes, for use by researchers, extension workers and farmers in the South Pacific. It concentrates on the methodological approach of PLA, which is described in the context of the planning process. A checklist is provided for planning and preparing field surveys, and a six-step procedure is outlined. The composition of an action plan is spelt out.

Morton, J. R. 1996. On the use and misuse of zero controls: a note on trial design. PRAP Leaflet No. 8, Pacific Regional Agricultural Programme, Suva.

Morton, J. R. 1996. The misuse of multiple range tests. PRAP Leaflet No. 9, Pacific Regional Agricultural Programme, Suva.

Taukei, P. 1996. New crop development in Fiji: a case study on development of the traditional crop dalo or taro (*Colocasia esculenta*) as a potential 'new crop' for export markets. In: RIRDC New Crops Proceedings 1996. RIRDC Research Paper No. 97/21, First Australian New Crops Conference, Vol. 1.

The importance of taro within the subsistence component of Fijian farming systems is well known. A recent development, however, as been its rise in importance as an export cash crop. The history of its export development is outlined in this paper.

Walton, P. 1996. Directory of Agricultural Information Resource Centres in the Pacific 1996. Pacific Regional Agricultural Programme, Suva.

This directory reflects a major attempt to compile details on the sources of agricultural information in South Pacific countries, including Fiji. It covers 120 institutions from 20 countries in the Pacific region. These institutions are publishers, libraries, information centres and individual projects.

Walton, P. 1996. Guidelines for the Distribution of Agricultural Publications in the Pacific. PRAP Working Paper No. 96-4, Pacific Regional Agricultural Programme, Suva.

There are numerous institutions in the South Pacific that distribute and receive agricultural publications (publishers, libraries, information centres and individual projects). This set of guidelines is designed to assist them in distributing material more effectively to their clients.

Walton, P. 1996. National SDI Management Workshop, Keravat, East New Britain, Papua New Guinea, 28 October-1 November 1996, Pacific Regional Agricultural Programme, Suva.

Findings are presented of a workshop on the selective dissemination of information and designing a strategy to unlock available information resources to a wide audience. Details are provided on methods of search and retrieval from CD-ROM information bases (e.g. current contents on diskette).

Bachmann, L., Macedru, A., Kaiyanuayanu, I., Singh, S. B. and Naerecoko, E. 1997. The Use of Rapid Rural Appraisal (RRA): Test of RRA as a Survey Tool at the Example of Fiji's Central Division—Field and Methodological Findings, Fiji, July 1995. PRAP Working Paper 97-1, Pacific Regional Agricultural Programme, Suva.

The authors report on a training exercise in rapid rural appraisal in the Central Division led by a team of four MAFF staff and an expatriate trainer. The aim of the exercise was to find suitable means of conducting rapid rural appraisals in Fiji. Details are provided on the training exercise and information gleaned from it. The appraisal covered labour availability, farm classification and suitability of selection criteria, farm management, cropping and livestock activities, income and expenditure, and marketing.

Bachmann, L., Macedru, A., Kaiyanuayanu, I., Singh, S. B. and Naerecoko, E. 1997. Towards a Better Understanding of the Farming System: The Use of RRA as a Survey Tool at the Example of Fiji's Central Division—Field and Methodological Findings, Fiji, October 1995. PRAP Working Paper 97-2, Pacific Regional Agricultural Programme, Suva.

The training exercise to find suitable means of conducting appraisals in Fiji, reported above, provided useful experiences in applying the method that are recounted in this paper. Methodology is outlined and a number of research topics are covered. They include labour availability, crop activities and rotations, land tenure, fallow systems, farming practices, yield perceptions, sustainability of cropping activities, profitability of enterprises, marketing and adoption of improved technologies. Some recommendations are made, including the need to improve the farm management handbook and apply RRA measures.

Fairbairn-Dunlop, P. 1997. Pacific women's triple agricultural role: food security, informal trade and cash cropping. *Journal of South Pacific Agriculture*, 4(1/2), 139-144.

The author outlines the roles of agricultural research and extension and women's contributions in agriculture in South Pacific countries. She argues that the provision of micro credit services is insufficient, and that farming systems research needs to be tailored better to meet the research needs for women's activities in the informal sector.

Kronen, M. 1997. Participatory methods. Pacific Regional Agricultural Programme, PRAP Leaflet No. 11, Pacific Regional Agricultural Programme, Suva.

Kumar, J. 1997. Status of crop research in Fiji. *Journal of South Pacific Agriculture*, 4(1/2), 74–77.

Current crop research in Fiji is outlined, with specific details of research in the production of coconut, ginger, kava, taro, tropical fruits and vegetables. Work being undertaken in farming systems research and support services is outlined.

Morton, J. R. 1997. Analysing harvests of tree crops. PRAP Leaflet No. 10, Pacific Regional Agricultural Programme, Suva.

Morton, J. R. 1997. Some statistical designs and their uses. PRAP Leaflet No. 12, Pacific Regional Agricultural Programme, Suva.

Pacific Regional Agricultural Programme 1997. The use of rapid rural appraisal (RRA). PRAP Working Paper No. 97–1, Pacific Regional Agricultural Programme, Suva.

This report gives details of a comprehensive training exercise in RRA methodology as a survey tool for MAFF Central Division staff in July, 1995. Field and methodological findings are presented.

AGRICULTURAL PRODUCTION PRACTICES AND FARMING SYSTEMS

IRRIGATION AND WATER MANAGEMENT

1940–1949

Parham, W. L. 1942. Water-control methods for smallholders. *Fiji Agricultural Journal*, 13(1), 20–22.

Work had been carried out on demonstration farms of methods for smallholders to control water for rice production in Fiji. Results of this work are reported.

Vasey, C. R. and Bharat, S. 1946. Irrigation. *Fiji Agricultural Journal*, 17(2), 32.

An interesting example of rice irrigation at Votualalai in the province of Nadroga and Navosa is described.

1950–1959

Cassidy, N. G. and Singh, S. A. 1955. The importance of flooding of rice. *Fiji Agricultural Journal*, 26(1), 6–10.

Experimental evidence is presented to demonstrate the importance of flooding rice. The practicality of using natural rainfall to do this is assessed.

Whitehead, C. E. 1957. Flood mitigation and control. *Fiji Agricultural Journal*, 28(1/2), 19–22.

The flood catastrophe in western and north-western Viti Levu and Vanua Levu in 1956 is argued to be a grim reminder of the need for flood mitigation and control. The extent of animal losses is assessed and the case is put for a long-term plan of operation covering upstream and downstream engineering, land treatment and agricultural practices.

1980–1989

Spriggs, M. J. T. 1980. Taro irrigation in Oceania: a call for more research. *South Pacific Bulletin*, 30:15–18.

The author observes the dearth of existing knowledge and current practices in irrigating taro, despite its importance in ancient farming systems. Few people now realise how widespread the irrigation of taro was in the recent past, or still was at the time of writing. Some areas for further research are suggested to redevelop the practice. While the focus is on New Caledonia and Vanuatu, there are some references to Fiji.

Watling, J. 1984. Irrigated terrace cultivation of dalo at Nawaikama, Gau, Domodomo, *Fiji Museum Quarterly*, 2:21.

An account is given of examples of the irrigation of taro at three locations in Fiji.

1990–present

Asian Productivity Organization 1995. Agricultural water management technology in Asia and the Pacific: Report of an APO Seminar, 12–16 July 1994, Colombo, Sri Lanka. Asian Productivity Organization, Tokyo.

A summary is made of the conference findings, 5 resource papers and 12 country papers. The resource papers are: (1) status of irrigation management in Asia and the Pacific; (2) current developments in applying water management technologies; (3) investments in irrigation; (4) operation and maintenance of irrigation facilities; and (5) water users' associations: issues and prospects. The country papers relate to agricultural water management technology in China, Fiji, India, Indonesia, Iran, South Korea, Malaysia, Nepal, Philippines and Sri Lanka.

Prakash, K. 1995. Irrigation project doubles vegetable yields, IRETA's South Pacific News, September 1995.

The Sigatoka Valley Rural Development Project, which cost \$10 million and was half-sponsored by the Asian Development Bank, ended in 1993. An area of 309 ha, or 20 per cent of the total cultivated land in the valley, was irrigated and grown with vegetables. Yields increased together with an increase in quality; also, irrigation allowed off-season production.

CULTURAL PRACTICES AND FARMING SYSTEMS

1930–1939

Parham, W. L. 1937. The Fijians as agriculturalists. *Fiji Agricultural Journal*, 8(3), 15–17.

This is an interesting assessment of the Fijians as agriculturalists. Their skills and weaknesses are outlined in the context of the rapidly improving communications system in Viti Levu. With new desires and burdens for the farmer, the Department of Agriculture identified a role for agricultural instruction in the homes. The author observes that 'the most spectacular evidence of Fijian skill is to be seen in the many and extensive terraces in some of the hill districts'. He felt that 'the Fijian is an expert gardener with a thorough inherited knowledge of the needs of every crop customarily grown'. He opines that an 'extraordinary point about the Fijian in agriculture is that it is the one activity in which he is and was an individualist'. Much of the reputation for laziness is ascribed to 'ignorance of his

habits whereas left to himself, the native can undoubtedly fend for himself. The author is convinced of the ability of Fijian farmers to apply themselves to learn so long as there is something worth learning.

Jack, H. W. 1938. Progress in field agriculture among Fijians. *Fiji Agricultural Journal*, 9(4), 3–6.

Details are provided on the agricultural activities and output of so-called 'exempted men'. The author observes that, for various reasons, the Fijian farmer fails to appreciate the value of regular rotation cropping and adopt inexpensive methods of soil conservation. This occurs when his farming energies become more restricted to smaller areas than those to which he is habitually accustomed.

Jack, H. W. 1939. Local food production. *Fiji Agricultural Journal*, 10(3), 65–68.

This article deals with government efforts to raise food production for the war effort. It is based on the premise that war has provided a greater need for food self-sufficiency by relying on local foods.

1940–1949

Harwood, L. W. 1940. Fijian independent farmers in the province of Cakaudrove. *Fiji Agricultural Journal*, 11(1), 9–11.

A description is provided of a group of independent farmers in Cakaudrove. Details are given on the land they farm and the foods they produce. The crops grown are mainly the staples of taro and yams, with little cassava produced. Kava is the only cash crop of any value. It is concluded that 'what they have done, with limited supervision and advice, is astounding when one considers the many difficulties which confront them'.

Vasey, C. R. 1946. Budding. *Fiji Agricultural Journal*, 17(3), 84.

An elementary description is given of the budding of fruit trees, and the different forms it can take.

1950–1959

Harwood, L. W. 1950. Observations on indigenous systems of agriculture. *Fiji Agricultural Journal*, 21(1/2), 3–8.

This paper was prompted by a claim that polycultural systems were preferable to monocultural systems. These two types of systems are summarised in the context of traditional agricultural practices in Fiji and other tropical countries. It is concluded that polycultural systems work satisfactorily in areas with little population pressure. However, they are unsuitable to areas that are closely settled or which require more intensive production methods.

Payne, W. J. A. 1950. Introduction to the problem of efficient land utilisation. *Fiji Agricultural Journal*, 21(3), 3–4.

The author expresses the opinion that the efficiency of arable farming in Fiji is debatable. He argues that pasture grass is the pivotal crop.

Dorrity, J. T. and Nield, J. 1954. Crop areas for period 1950–52. *Fiji Agricultural Journal*, 25(3/4), 60.

Brief statistics are provided on the production of major crops in Fiji during the period, 1950–52. A table is presented with crop areas, yields, estimated values paid to growers and export volumes by crop.

Harman, L. 1954. Fijian agriculture: Cakaudrove, 1953. *Fiji Agricultural Journal*, 25(3/4), 57–58.

Summaries are presented of statistics that were collected by field staff on areas planted to crops by district in Cakaudrove in 1953.

Mercer, A. D. 1954. Fijian agriculture—Western Division. *Fiji Agricultural Journal*, 25(3/4), 58.

Summaries are presented of statistics that were collected by field staff on areas planted to crops by district in Western Division in 1953.

Mercer, A. D. 1954. Crop rotation in the dry zone of Viti Levu. *Fiji Agricultural Journal*, 25(3/4), 59.

The author reports on the rotation needs for sugar and rice land in the dry zone. He observes that declining yields are forcing farmers to adopt improved farming practices.

Barrau, J. 1958. Subsistence agriculture in Melanesia. Bulletin 219, B. P. Bishop Museum, Honolulu.

Surridge, H. R., O'Connor, B. A., Morwood, R. B. and Gregory, G. B. 1958. Gardening in Fiji. Government Printer, Suva, 47 pp.

This publication is the product of knowledge gained by Department of Agriculture staff in advising on gardening practices in Fiji over the previous two decades. It contains updated material presented in many articles in the Fiji Agricultural Journal during this period.

Parham, J. W., Whitehead, C. E. and Twyford, I. T. 1959. Watershed and rangeland management trials on the Ba closed area. Fiji Agricultural Journal, 29(1), 43–47.

The authors report on the results of an experimental program to halt erosion and degradation of the Ba closed area in an economic manner. They conclude that rehabilitation is unlikely to be easy and it would probably take a long time to find an economic way to do it. It was thought important to develop forms of land use to prevent degradation of other areas.

1960–1969

Barrau, J. 1960. The selection, domestication, and cultivation of food plants in tropical Oceania in the pre-European era. In: Symposium on the Impact of Man on Humid Tropics Vegetation. UNESCO, Bangkok.

1970–1979

Reddy, K. M. 1975. Agricultural Systems in the Lautika District, Suva. School of Social and Economic Development, University of the South Pacific, Suva, 218 pp.

Brookfield, H. C. 1977. Constraints to agrarian change. In: Winslow, J. H. ed., The Melanesian Environment. Australian National University Press, Canberra, pp. 133–145.

Evidence in Fiji is presented that suggests that farmers are capable of responding to incentive. It is argued that the low-technology high labour structure of much of Melanesian industry should be re-examined as it imposes harsh working conditions and is often unrewarding for the individual. There is a need to study traditional practices and 'native agricultural wisdom' carefully before knowledge of them is completely lost.

Chandra, S. 1977. Minimum tillage practices: possible applications in Fiji agriculture. *Fiji Agricultural Journal*, 39(1), 39–45.

The paper reviews the merits of minimum tillage methods in the development of sorghum, legume and other crops in the dry zone of Vanua Levu.

Thaman, R. R. 1977. Urban gardening in Papua New Guinea and Fiji. In: Winslow, J. H. ed., *The Melanesian Environment*. Australian National University Press, Canberra, pp. 146–168.

The author describes the nature of urban gardening based on root crops in Fiji and Papua New Guinea in this chapter. The importance of urban gardening in Melanesian countries is stressed and its extent in Suva and Port Moresby is described for 1974–75. The wide range of outputs from urban gardening is detailed, from subsistence to commercial products. The implications of urban gardening are discussed from instrumental, territorial, sentimental, symbolic and nutritional orientations. Findings are related to the importance of data on urban gardening activities as inputs for planning decisions. Suggestions are made on the information needs and possible policy decisions that could increase urban gardening output.

Chandra, S. 1978. Monoculture, mixed cropping and rotations: implications for Fiji agriculture. *Fiji Agricultural Journal*, 40(2), 63–70.

The paper contains an analysis of the effects of three farming systems on crop yield and quality, incidence of pests, diseases and weeds and nutrient uptake, soil structure and soil erosion. Trial results indicate that legume yields were lower than in monoculture, but the intercropping system gave better gross returns.

Vunakece, A. D. 1978. Fiji's Farm Mechanisation Project's successful harvest. *South Pacific Commission Quarterly Bulletin*, 28(3), 19–20.

The Farm Mechanisation Project commenced in 1976 in Fiji, and it is the author's contention that it was very successful, particularly with sorghum. He gives an account of the introduction of a combine harvester on Nutumaliva farm in Bua.

Chandra, S. 1979. Monoculture, mixed cropping and rotations: implications for Fiji agriculture. *Fiji Agricultural Journal*, 41(1), 31–36.

Results of a technical efficiency analysis are used to find a negative relationship between the age of the farm manager and technical efficiency level. This result is reported to be consistent with results reported elsewhere in agriculture. The importance of management in farming is then discussed.

Chandra, S. and Sharma, A. P. 1979. Current status of agricultural mechanisation in Fiji. *Agricultural Mechanisation in Asia*, 10(3), 28–32.

The production efficiencies of various crops in manual, animal and tractor-powered systems are compared. Research and development activities in the Agricultural Engineering Section of the Fiji Department of Agriculture include the design of new hand hoes, an animal-drawn ridger, furrower, light mouldboard plough, paddy drill, groundnut harvester, electric-powered paddy, pulse or sorghum winnower and a tractor-drawn cassava harvester.

1980–1989

Chandra, S. 1980. Low technology agriculture and development in Fiji. *Alafua Agricultural Bulletin*, 5(2), 11–17.

Three farming systems—manual, animal-based and tractor—are outlined. It is concluded that the level of agricultural mechanisation in Fiji will remain low because the smallholder agricultural system does not permit capital-intensive investment. The most appropriate production technology, which lies in a combination of all three systems, is already being practised on sugarcane and some vegetable farms.

Yen, D. E. 1980. Pacific production systems. In: Ward, R. G. and Proctor, A. ed. *South Pacific Agriculture: Choices and Constraints*. Australian National University Press, Canberra, pp. 197–234.

This book chapter on South Pacific food systems begins with a description of the main indigenous foods, their uses, adaptation and distribution in the South Pacific, including Fiji. Food crops are discussed in the context of national self-reliance, particularly in respect of import substitution and food export prospects. Aspects of agricultural intensification are then discussed, notably the intensification of smallholder production and post-harvest activities, and the chapter concludes with a review of the key

research requirements: genetic backgrounds of indigenous and exotic species; plant pathology and post-harvest studies; agronomic research; and economic research.

Hunt, T. 1981, Early horticulture in Fiji. *Journal of the Polynesian Society*, 90(2), 259–266.

Using archaeological evidence from Sigatoka and Yanuca (an island off the coast of southwest Viti Levu), the author concludes that ‘it is reasonable to argue that horticulture—as an integral part of a portable economy—formed a necessary adaptive basis for Oceanic colonisation’.

Sefanaia, S., Chandra, S. and Etherington, D. M. 1982. A review of recent research on intercropping under coconuts. *Fiji Agricultural Journal*, 44(1), 31–36.

The principles of intercropping are outlined and different intercropping systems described. Specific examples are cited of coconut yields with or without a cocoa intercrop. Intercropping coconuts and cocoa results in a lower temperature and lower variation in relative humidity under the crops. The shading and reduced air temperature cause a considerable reduction in the rate of evapotranspiration. Suggested intercrops for coconuts in Fiji are cocoa, root crops, cinnamon, vanilla, kava, pepper, cloves, nutmeg, cardamom and ginger. It is concluded that intercropping may be a useful long-term farming strategy.

Chandra, S. 1984. Agricultural mechanisation in Fiji. *Agricultural Mechanisation in Asia, Africa and Latin America*, 15(1), 47–50.

Information is provided on farm area and farm population (1978), farm size distribution, farm type, productivity, tractors and mounted implements, draught animals and animal-drawn implements, means of transport and miscellaneous machinery such as rice mills, water pumps, sprayers and mowers.

Chandra, S. and Sharma, A. P. 1984. Mechanised cultivation of taro (*Colocasia esculenta*) in Fiji. *Agricultural Mechanisation in Asia, Africa and Latin America*, 15(2), 41–43.

The paper compares a tractor-based production system with an animal-based system. It was found that the operational costs of production were much lower in the tractor-based system. Much higher

gross margins per hectare and per man-day could be expected in the tractor-based system. Overall, it is concluded that considerable mechanisation possibilities exist for taro cultivation in Fiji.

Thaman, R. R. 1984. Urban agriculture and home gardening in Fiji: a direct road to development and independence. *Transactions & Proceedings Fiji Society*, 14:1.

This is yet another article by this author advocating a more prominent role to urban gardening as an effective way of improving self-reliance in food production.

De Haen, H. 1988. Protection of agriculture land resources in Fiji through interaction of agriculture and forestry. Technical Report No. 10, Fiji-German Forestry Project, Fiji Forestry Department, Suva.

A review is made of the possibilities and considerations for better integrating agricultural and forestry activities, thereby making more efficient long-term use of land resources in Fiji.

Ali, I. 1988. The dissociation of crop and livestock production on sugarcane farms. In: Overton, J. ed., *Rural Fiji*. Institute of Pacific Studies, Suva, pp. 165–177.

Integrated crop-livestock systems in Fiji are described, with emphasis on the system in Yaladro in Ba province, Viti Levu. The effects are examined of a reduction in livestock production on smallholder cane farms, with potentially deleterious impacts on diets. It is concluded that attempts should be made to reincorporate symbiotic crop-livestock production systems on sugarcane farms.

Thaman, R. R. 1988. Fijian agroforestry: trees, people and sustainable polycultural development. In: Overton, J. ed., *Rural Fiji*. Institute of Pacific Studies, Suva, pp. 31–58.

They key issue discussed in this thought-provoking chapter is agro-deforestation. The nature of traditional agroforestry in Pacific islands is discussed, in recognition that trees are seen as symbols of ecological and cultural stability. A useful table is included on the ecological and cultural functions and uses of various trees in agroforestry systems in the region. Case study material on Fiji is presented for Namosi and Mataiasau in the interior wet zone of Viti Levu. Polycultural agroforestry is argued to be a

basis for innovation and stability. There is a useful appendix on important tree and tree-like species of agroforestry systems of Namosi and Mataiasau villages.

1990–present

Rogers, S. 1992. The potential for alley cropping as a sustainable land use in the volcanic islands of the South Pacific. *Journal of South Pacific Agriculture*, 1(1), 3–10.

The author assesses threats to the sustainability of food supply from traditional shifting cultivation on the high volcanic islands in the South Pacific. He considers that the development of sustainable crop production systems for small farmers should be given a high research priority. A description is provided of the biophysical and socioeconomic conditions in the region. This is used as the basis for considering the relevance to farming systems of alley cropping. A review is made of data on alley cropping experiments in Africa and Asia to assess the relevance of the technique to South Pacific farming systems.

Limalevu, L., Tubucake, S. and Willatt, S. T. 1993. Management of sloping lands for ginger and other crops in Waibau, Fiji. IBSRAM Pacificland Annual Review Meeting, Suva, Fiji, 15–17 November 1992, International Board for Soil Research and Management, pp. 49–76.

Yen, D. E. 1993. The origins of subsistence agriculture in Oceania and the potentials for future tropical food crops. *Economic Botany*, 47(1), 3–14.

A three-tiered crop structure of indigenous agricultural systems was derived by the author, and is described in this paper. It comprises (1) independent early domestication of endemic species in the New Guinea region, (2) introduction of species from Southeast Asia, and (3) the advent of American crop plants. The temporal sequence was for 10 000 years in the first stage and 6000 years in the second stage. The relevance of intellectual property rights on current and future crop introductions is discussed in the final section of the paper.

Agricultural Development in the American Pacific 1994. Pacific Islands Farm Manual. College of Tropical Agricultural and Human Resources, University of Hawaii, Manoa.

The manual contains a collection of 75 extension leaflets with information on taro varieties, taro pests and diseases, tropical perennial vegetables, cover crops and farm trees. The results of various on-farm research trials

conducted on the use of cover crops for weed control and taro intercropping are also included. The manual features a sustainable farming strategy of using nitrogen-fixing trees for organic fertiliser, cover crops to attract beneficial insects and control weeds, and integrating new crops on the farm.

Rogers, S. 1994. Alley cropping and agroforestry in the South Pacific. In: Proceedings of the Second Annual Meeting of the Pacificland Network. Network Document No. 10, International Board for Soil Research and Management, Bangkok.

These proceedings contain a set of papers that highlight the substantial roles that alley cropping and agroforestry can play in meeting threats from traditional shifting cultivation to the sustainability of food supply in South Pacific countries. Ways are discussed of developing sustainable crop production systems for small farmers.

Manu, V. T. and Halavatau, S. 1995. Agroforestry in the food production systems in the South Pacific. In: Lefroy, R. D. B., Blair, G. J. and Craswell, E. T. ed. Soil Organic Matter Management for Sustainable Agriculture: A Workshop Held in Ubon, Thailand, 24–26 August 1994. ACIAR Proceedings No. 56, Australian Centre for International Agricultural Research, Canberra, pp. 63–68.

The two main types of agroforestry practices in the region are described, namely shifting cultivation and perennial tree crop-based agroforestry (mainly with coconut and breadfruit). The main producing sector is the smallholder with a traditional system of integrated cultivation of annual root crops and perennial fruit and tree crops. This system is diversified and provides an insurance against climatic risk and the isolation of these remote island countries. Results are presented of experiments with hedgerow alley cropping giving depressed yields of root crops in comparison with non-hedgerow control.

Rogers, S. and Thorpe, P. ed. 1995. Pacific Regional Agricultural Programme. Project 1: Farming Systems in Lowlands—Planning for On-Farm Research: Reports and Papers from the First Annual Meeting of Cooperators, Apia, Western Samoa, 4–10 April 1995, 82 pp.

This report is on the first meeting organised by the Pacific Regional Agricultural Programme on the second phase of Project 1. It was attended by 26 participants from seven countries. The theme was planning for on-farm research which allowed participants to share farming experiences

in farming systems research and development in the region, compare and contrast problems and opportunities, and discuss planning methods for on-farm research.

Fuller, R. J. 1996. Solar Drying in the Pacific. Forum Secretariat, Suva, 42 pp.

This is a review of different solar drying systems, components and the designs for commercial producers of dried agricultural and marine products in the Pacific region.

Pacific Regional Agricultural Programme 1996. Core Data Set for Farming Systems Research in the South Pacific. PRAP Project No. 1, Pacific Regional Agricultural Programme, Suva.

Rogers, S. and Iosefa, T. 1996. Building on Indigenous Knowledge and Practice: A Participatory Approach to the Development of Adaptable Agroforestry for Conservation Farming. PRAP Working Paper 96-1, Pacific Regional Agricultural Programme, Suva.

Rogers, S. and Thorpe, P. ed. 1996. Agroforestry Research and Practices in the Pacific: Reports and Papers Presented at the Second Annual Meeting of Collaborators, Port Vila, Vanuatu, 22-24 April 1996. PRAP Report No. 3, Pacific Regional Agricultural Programme, Suva.

This report contains 27 papers and country reports on the status and practice of agroforestry research and technology in the South Pacific.

Pacific Regional Agricultural Programme 1997. Agricultural Rural Development: Towards a Better Understanding of Farming Systems. PRAP Working Paper 97-2, Project 11, Pacific Regional Agricultural Programme, Suva.

The working paper reports on the use of RRA as a survey tool for the Central Division of MAFF. The report has two main sections. The first section describes the RRA methodology for data collection in the context of agricultural development. A simple series of steps demonstrate how to plan, implement and analyse RRA. The second section deals with the actual field findings.

SOIL MANAGEMENT, SOIL CONSERVATION AND PLANT NUTRITION

1930–1939

Blackie, W. J. 1935. Soil investigations—Part I Observations and methods. *Fiji Agricultural Journal*, 8(1), 12–16.

Attempts had been made to classify soils. The methods were commonly used in laboratories, and their usefulness is assessed in this context.

Blackie, W. J. 1935. Soil investigations—the sandy loams of the Central Agricultural Station. *Fiji Agricultural Journal*, 8(1), 17.

The author reports on a soil profile examined on the Central Agricultural Station. Chemical findings were found to correlate well with results of field trials.

Blackie, W. J. 1936. Lime as a soil ameliorant. *Fiji Agricultural Journal*, 8(2), 5–7.

The beneficial effects of lime on Fijian soils are outlined. They include its effect on tilth and bacterial action, liberation of plant food materials, and effect on toxic substances and plant diseases. Some experimental work is reported on the use of lime, with promising results.

Blackie, W. J. 1937. The lime requirement of Fijian soils. *Fiji Agricultural Journal*, 8(3), 33–36.

Results are provided on surveys of soils in Tailevu, Navua, Koro and parts of Vanua Levu using three laboratory methods. The purpose of the surveys was to determine the acid status of the soils and their lime requirements.

Blackie, W. J. 1937. Soil notes, Koro and Lau. *Fiji Agricultural Journal*, 8(3), 43–44.

Several soil samples were taken on visits to Koro and Lau, and observations were made on the chemical and mechanical analyses undertaken.

Jack, H. W. 1937. Soil erosion. *Fiji Agricultural Journal*, 8(4), 4–7.

This is a report on the extent of soil erosion in Fiji, and production methods that cause it. Fiji had been fortunate in experiencing little loss of vegetation and soil erosion to date. But there is evidence of enough damage to warrant caution and education to develop sound farming systems.

Donald, D. A. and Silas, R. J. 1939. Soil erosion. *Fiji Agricultural Journal*, 10(1), 5–8.

The causes and effects of soil erosion in Fiji are outlined. The causes are observed to be principally from water. Four measures to control soil erosion are outlined, and quite a deal of space is given to terracing, contour strip cultivation, and banks and ridges on sloping land.

Harvey, C. 1939. Some methods of composting suitable for small-holdings. *Fiji Agricultural Journal*, 10(2), 33–34.

It is observed that most smallholders have not fully recognised the benefits of organic manure. Prescriptions are given to overcome the lack of use of organic material in composting, based on an agricultural leaflet from Ceylon (Sri Lanka).

1940–1949

Blackie, W. J. and Biggs, A. I. 1942. Observations on soil methods, Part 2. *Fiji Agricultural Journal*, 13(3), 83–93.

The authors record observations on recent methods to determine phosphorus and potassium. They give a description of techniques using hydrochloric acid extracts of tropical soils.

Blackie, W. J. 1944. The sugar-cane soils of Rewa. *Fiji Agricultural Journal*, 15(1), 4–7.

Approximately 11 000 acres was planted to sugarcane on the alluvial flats of the Rewa river valley. The average chemical composition are given for 29 alluvial soils together with estimates of yields and drainage. The need for lime was stressed.

Blackie, W. J. 1944. Soil investigations, Part 4: The soils of the General Experiment Station, Sigatoka. *Fiji Agricultural Journal*, 15(2), 33–36.

A description is given of the General Experiment Station at Sigatoka and its climate. Field notes are provided with a detailed soil map. On the basis of laboratory observations with detailed mechanical analyses, it is concluded that Sigatoka alluvials are heavier than Rewa alluvials.

Department of Agriculture, Fiji 1944. The prevention of soil erosion: a note for schoolteachers. Government Printer, Suva.

Jack, H. W. 1944. Soil conservation. *Fiji Agricultural Journal*, 15(2), 37–39.

The role attributed to demonstrations on soil conservation is outlined. Explanations are given of the main causes of soil erosion in Fiji.

Harvey, C. and Blackie, W. J. 1945. Soil investigations, Part 5: A note on the soils of Nadala, Colo North. *Fiji Agricultural Journal*, 16(4), 93–97.

Details are provided on the locality and its climate and topography. The results of soil samples are presented, accompanied by some general remarks. An assessment is made of the agricultural potential of the locality.

Surridge, H. R. 1945. How to make a compost heap or manure from garden rubbish. *Fiji Agricultural Journal*, 16(1), 6–7.

The author describes how to make and take care of a heap of compost or manure, and stresses its advantages and value to Fijian farmers. There is a section on the use of straw as an input.

Blackie, W. J. 1947. Soils of Fiji. *Fiji Agricultural Journal*, 18(1), 2–7.

An overview is given of the different soil types in Fiji.

Blackie, W. J. and French-Mullen, M. D. 1947. Soil investigations, Fiji—Part 6 Observations on certain soil types at Toga, Rewa. *Fiji Agricultural Journal*, 18(1), 20–24.

A description is given of the area and its agricultural history and general field information. A soil survey that was carried out is described and laboratory data are presented. Sections are included on drainage and irrigation, and rice yields. An assessment is made of the potential for land development.

Mercer, A. D. 1948. Improving soil fertility by indirect nitrogenous manuring. *Fiji Agricultural Journal*, 19(3/4), 69–71.

Results of experiments on improving soil fertility by indirect nitrogenous manuring conducted outside Fiji are discussed in terms of their applicability to Fiji.

Whitehead, C. E. 1949. A soil conservation project in Nadroga-Navosa. *Fiji Agricultural Journal*, 20(1), 9–14.

The author reports on extension work to convert farmers to contour layout and crop rotation. Details are given on this project in terms of its design and layout, contour and dam construction, and their costs. It was considered successful in that many farmers in the district applied for assistance with a similar layout of their farms.

Nandan, S. 1949. Soil conservation on peasant farms. *Fiji Agricultural Journal*, 20(2), 35.

Peasant farmers had largely ignored contour ploughing. In this note, it is speculated that these farmers had not been given full information about its value. A report is given on a contouring project in the Nadi district, and its costs and benefits.

1950–1959

Cassidy, N. G. 1952. The fertiliser value of Lau (Ogeadriki) phosphate. *Fiji Agricultural Journal*, 23(1), 24–25.

The author describes the Lau phosphate fertiliser deposit that had been estimated to contain from 80 000 to 200 000 tons of fertiliser. He opined that a process was needed to treat the phosphatic material to make it less insoluble or else it could not be used in Fijian agriculture. Three processes were listed that might usefully be trialled.

Cassidy, N. G. 1952. The potash status of coconuts on Viti Levu. *Fiji Agricultural Journal*, 23(1), 25–26.

Forty nuts from 15 palms on Viti Levu were collected and analysed. Tests showed little evidence of phosphate deficiency.

Cassidy, N. G. 1952. A reconnaissance survey of liming materials on Viti Levu. *Fiji Agricultural Journal*, 23(1), 27.

Sigatoka limestone was concluded to be the most promising among those covered in the survey.

Harwood, L. W. and Cassidy, N. G. 1952. Response to lime in Viti Levu. *Fiji Agricultural Journal*, 23(1), 28.

Results of trials indicated responsiveness to lime in a range of situations. It is recommended that further trials be undertaken of ground limestone.

Cassidy, N. G. and Pahalad, S. D. 1953. The maintenance of soil fertility in Fiji. *Fiji Agricultural Journal*, 24(3/4), 82–83.

Results are presented on investigations into subsistence cropping by Fijians in the wet zone, and the effects of cropping on the maintenance of soil fertility.

Cassidy, N. G. 1954. The use of lime on Fiji soils. *Fiji Agricultural Journal*, 25(1), 27–29.

Information is provided on the time taken by coral sand to react completely with the soil, and the lime requirements for soils in Fiji.

Fox, J. P. and Twyford, I. T. 1954. The soils of the Navua plains and their chemical status. *Fiji Agricultural Journal*, 25(1), 30–37.

A reconnaissance survey was undertaken on the Navua plains in 1953. Results of this survey are reported here. Descriptions are provided on the plains area and its soils. A section is allotted to the laboratory investigations that covers the methods used, observations and interpretation of results. Prospects are assessed for agricultural development on the plains.

Miles, N. S. 1954. Sawdust and straw. *Fiji Agricultural Journal*, 25(3/4), 63–64.

Sawdust and straw are considered as a cheap alternative to artificial fertilisers, given that they are cheap and in plentiful supply. Methods for their use are outlined.

Parham, B. E. V. 1954. Two examples of land use in Fiji: soil conservation on a Fijian farm. *Fiji Agricultural Journal*, 25 (3/4), 109–112.

The author reports on terraces used mainly for taro cultivation in Navakasiga, Moala and Kadava that were still maintained. Notes are also presented on soil erosion in a Chinese market garden as typical of many instances occurring throughout Fiji.

South Pacific Commission 1954. Land conservation in Fiji. South Pacific Commission Quarterly Bulletin, 4(2), 17.

The Fiji Land Conservation Board is described and its functions are outlined.

Whitehead, C. E. 1954. Soil erosion and conservation in Fiji. Fiji Agricultural Journal, 25(1), 38–42.

Separate descriptions are given of soils in the wet zone and dry zone, concentrating on hilly areas. Cultural practices that lead to erosion are noted, and details are provided of activities undertaken by the Department of Agriculture to reduce soil erosion.

Cassidy, N. G. 1955. Bat guano as fertiliser. Fiji Agricultural Journal, 26(1), 19.

Brief details are provided on the nitrogen and phosphoric contents of bat guano according to original moisture and place of origin.

Twyford, I. T. 1955. An introduction to the soil survey of Fiji. Fiji Agricultural Journal, 26(1), 20–26.

A three-year survey of the soils of Fiji is reviewed. Suggestions are given for its uses and an assessment is made of progress to date.

Whitehead, C. E. 1955. Soil erosion and its control in Fiji. Bulletin No. 28, Fiji Department of Agriculture, Suva.

This bulletin consolidates earlier publications by the author on soil erosion and conservation. Descriptions are provided of soils in Fiji, especially those in the erosion-prone parts of the country. The cultural practices that encourage erosion are discussed, and details are provided of erosion-control measures instigated by the Department of Agriculture.

Cassidy, N. G. 1956. A response of rice to Lau (Ogeadriki) phosphate. Fiji Agricultural Journal, 27(3/4), 65–66.

Rice was found to respond to Lau (Ogeadriki) phosphate under flooded conditions but the use of superphosphate was found to be more economic.

Cassidy, N. G. 1956. Experiments with rice on padi soils. *Fiji Agricultural Journal*, 27(3/4), 66–69.

Greenhouse trials showed consistently large response to phosphate while response to nitrogen was of a much lower order. Field trials showed good response to controlled flooding plus the use of superphosphate. Difficulties were experienced in getting rice to stand up to the increased weight of ear heads.

Twyford, I. T. 1957. The alluvial soils of the 'wet' zone. *Fiji Agricultural Journal*, 28(1/2), 5–13.

The deltaic alluvial series of soils found in the wet zone are described. A survey of the flats at Koronivia Agricultural Station showed their alluvial sequence, which is presented with a description of sequence members. The vegetation in this area is also described. The author draws a distinction between the freely and poorly drained soils. There is a note on buried topsoils.

Wright, A. C. S. and Twyford, I. T. 1957. Soil development, shifting cultivation and permanent agriculture in the humid tropics. *Fiji Agricultural Journal*, 28(3/4), 56–61.

A comprehensive coverage is given of the topics of soil development, shifting cultivation and permanent agriculture in the humid tropics, and their relevance to agricultural development in Fiji. The authors spell out in detail the steps needed to develop farming systems on the basis of permanent land use. They argue that legislative improvements concerning land ownership are needed for significant productivity improvements to occur.

Whitehead, C. E. 1959. Important land conservation measures become effective in 1960. *Fiji Agricultural Journal*, 29(4), 137.

Two conservation orders are discussed that were introduced in 1960: the prohibition of use of sledges in specified areas; and growing of sugarcane in drills or furrows running across the slope or at right angles to the fall of the land. The orders were made by the Land Conservation Board under section 7 of the Land Conservation and Improvement Ordinance.

1960–1969

Cassidy, N. G. 1960. The salinity of the Sigatoka river at the Agricultural Station, Nacocolevu. *Fiji Agricultural Journal*, 30(1), 39.

Twyford, I. T. and Wright, A. C. S. 1965. *The Soil Resources of the Fiji Islands*, Vol. 1. Government Printer, Suva, 570 pp.

A background is provided to the environment and landscape in Fiji by region, climate and plant cover in the first two chapters. In Chapter 3, a description is given of soils and their origins, fertility and classification for land use. Chapter 4 covers land use in the present and historical context. Four periods are delineated: prehistoric, 1800–1874, 1875–1905 and from 1906 to the present. Details are provided of the land use potential of the soils and local factors delaying optimal land use patterns. Soil resources and land use on individual islands or island groups are the subject of Chapter 5.

Twyford, I. T. and Wright, A. C. S. 1965. *The Soil Resources of the Fiji Islands*, Vol. 2. Government Printer, Suva.

This second volume contains soil maps of the island groups.

1970–1979

Adams, M. E. 1970. The Rewa peat bog and related clay horizons. *Fiji Agricultural Journal*, 32(1), 3–8.

The Rewa peat bog is described, and prospects of reclamation for agricultural purposes are assessed.

Chandra, S. 1970. Clay mineralogy of some Fijian soils. *Fiji Agricultural Journal*, 32(1), 9–10.

Infrared analysis was carried out on 18 samples of soils commonly found in Fiji, and the results of the analysis are presented in this paper. It is suggested that a constitutional soil classification based on the nature and amounts of soil constituents is possible.

Posnett, N. W. and Reilly, P. M. 1973. *Fiji: Land Resource Bibliography* No. 4. Land Resources Division, Suva, 138 pp.

This bibliography was compiled in conjunction with a land resource project and contains references under the following subject headings: general agriculture (132), animal science, botany, climatology (25), crop

science of specific crops (305), cultural studies, economics, forestry, geoscience, land tenure, maps, miscellaneous, natural resources, population, soil science and water resources.

Richmond, T. de A., Williams, J. M. and Datt, U. 1975. Influence of drainage on pH, sulphate content and mechanical strength of a potential acid sulphate soil in Fiji. *Tropical Agriculture*, 52(4), 325–334.

The study reports that decreases in pH and increases in sulphates develop rapidly when the degree of pore space saturation falls below 0.95 which, in this soil, was associated with a matrix potential of around –60 cm of water. Estimates of bearing capacity indicate that this soil could support mechanical equipment associated with agricultural operations at matrix potentials between –50 and –80 cm of water. However, management of this soil to minimise oxidation would restrict the soil-water regime to matrix potentials greater than –60 cm of water.

Leslie, D. M. and Blakemore, L. C. 1978. Properties and classification of the soils from Lakeba, Lau Group, Fiji. *Bulletin of the Royal Society of New Zealand*, 17:165–190.

Soil units mapped in previous surveys of Lakeba island, Fiji, were re-examined and classified using chemical, mineralogical and physical properties to key the soils to a family category in soil taxonomy.

Latham, M. 1979. Land resource potential. In: Brookfield, H. C. ed., *Lakeba: Environmental Change, Population Dynamics and Resource Use*, UNESCO/UNFPA Population and Environment Project in the Eastern Islands of Fiji. *Island Reports 5*, Australian National University for UNESCO, Canberra, pp. 111–126.

Three parameters are used to estimate land capability, namely edaphic (concerned with the soil and availability of water and nutrients), morphodynamic (concerned with erosion and flooding) and technical (concerned with land management). The information derived from this estimation was used to evaluate the landscape of Lakeba.

1980–1989

Morrison, R. J. 1981. Factors Determining the Extent of Soil Erosion in Fiji. Environmental Studies Report No. 7, Institute of Natural Resources, University of the South Pacific, Suva, 18 pp.

Asghar, M. 1982. Report on the Regional Forum in Soil Taxonomy, Suva, Fiji, 2–13 November 1981, University of the South Pacific, Alafua.

Morrison, R. J. 1982. A benchmark soils project for the South Pacific—the potential and possible constraints. In: Morrison, R. J. and Leslie, D. M. ed. Proceedings of the South Pacific Regional Forum on Soil Taxonomy. Suva, 2–13 November 1981, pp. 275–288.

Morrison, R. J. and Leslie, D. M. 1982. Bibliography of soils information from the South Pacific region. In: Morrison, R. J. and Leslie, D. M. ed. Proceedings of the South Pacific Regional Forum on Soil Taxonomy. Suva, 2–13 November 1981, pp. 383–445.

Information is listed as follows: general (22 references.), Cook islands (17 references), Fiji (156 references), French Polynesia (9 references), Micronesia (19 references), New Caledonia (16 references), Niue (9 references), Papua New Guinea (43 references), Solomon Islands (147 references), Tonga (13 references), Vanuatu (12 references) Western Samoa (51 references) and others (11 references)

Partridge, I. J. 1982. The efficacy of biosuper and rock phosphate on forage legumes on hill soils in Fiji. *Fiji Agricultural Journal*, 44(1), 27–30.

Results of trials on *Macroptilium atropurpureum*, *Stylosanthes guianensis* and *Desmodium heterophyllum* sown in natural grassland revealed that both biosuper and rock phosphate give higher annual total herbage and legume dry matter yield. It was concluded that biosuper could be an effective substitute for imported superphosphate on nigrescent soils.

Seru, V. B. 1982. The Fiji soil classification, crop evaluation and management program (1980–1985). In: Morrison, R. J. and Leslie, D. M. ed. Proceedings of the South Pacific Regional Forum on Soil Taxonomy. Suva, 2–13 November 1981, pp. 289–300.

Singh, N. K. 1982. Phosphate retention by some Fijian soils in relation to surface properties. M. Sc. thesis, University of the South Pacific, Suva.

Syna, B. P. and Duve, R. N. 1982. An evaluation of fertiliser requirements for Lisbon lemon grown in a ferruginous latosol soil. *Fiji Agricultural Journal*, 44(1), 9–16.

A factorial trial was conducted on 3-year-old Eureka Lisbon lemon trees at Seaqaqa research station to assess their fertiliser requirements. Results are presented that show levels of soil and leaf nutrients bear no relationship to lemon yield.

Silva, J. A., Gregg, P., Haydock, K. P., Leslie, D. M., Widdowson, J. P. and Wood, I. M. 1984. A Proposal for Fiji Soil and Crop Evaluation Project (Fiji SCEP). Scientific Report No. 65, New Zealand Soil Bureau, DSIR, Wellington, 124 pp.

This report details recommendations of a panel established to develop a soil and crop evaluation program, using information developed from the reclassification of the soils of Fiji, in particular those of the nine research stations of the Ministry of Agriculture and Fisheries. These research stations were to be benchmark locations for the selected soil series and the data obtained would be utilised in the transfer of agrotechnology within Fiji as well as internationally. The project entails the establishment of fertiliser experiments to determine the nutrient requirements of crops grown on soil series selected on the basis of their agricultural importance and their area distribution. The data obtained from these experiments will be used to formulate management practices for crops on the soil series studied which can be transferred to other areas of the same soil series throughout Fiji.

Leslie, D. M. 1985. Soils taxonomic unit descriptions for Koronivia Agricultural Research Station, Viti Levu, Fiji. Soil Taxonomic Unit Descriptions No. 4, New Zealand Soil Bureau, DSIR, Wellington.

Bell, R. W. 1986. Nutrient deficiencies in four acid soils from southeast Viti Levu. *Fiji Agricultural Journal*, 50(1), 7–14.

This paper contains a report on a study of the response of maize to N, P, K, Ca, Mg and S using an omission design pot experiment. Omission of Ca depressed maize shoot dry weight on all except one soil but plants exhibited symptoms resembling P deficiency, suggesting Ca treatment was alleviating aluminium toxicity.

Masilaca, A. S., Prasad, R. A. and Morrison, R. J. 1986. The impact of sugarcane cultivation on three oxisols from Vanua Levu, Fiji. *Tropical Agriculture*, 63:325–330.

The impact of sugarcane cultivation on three oxisols at Seaqaqa, Vanua Levu, Fiji, was studied over a period of six years (1978–1983). All three sites had been under native vegetation prior to the development of the sugarcane project. Topsoil properties including pH, organic C, CEC, 15 bar water retention, bulk density, phosphate retention and exchangeable (Ca + Mg) were monitored approximately annually during the period of the study. Most of the observed changes could be related to the decline in organic matter and associated ion exchange properties, together with increased bulk density. Subsoil samples (30–40 cm and 70–80 cm) were analysed at the beginning and end of the study period. Virtually no changes occurred in the 70–80 cm samples. Samples showed an increase in organic C and CEC at all sites, probably caused in part by ripping and rotavating during the initial land preparation. Changes at the level site were more highly correlated internally than at the two sloping sites, indicating that the effects of erosion (both adding and removing material) may have influenced some of the topsoil properties at the latter sites.

Yee, W. S., Wallens, P. J., Gangaiya, P. and Morrison, R. J. 1986. The effect of liming on some chemical properties and maize production on a highly weathered Fiji soil. *Tropical Agriculture*, 63:319–324.

The authors studied the impact of liming on maize production (with and without added fertiliser) and on the chemical properties of a *Typic Palehumult* from the wet zone of southwest Viti Levu. A field trial involving lime, N, P and K fertilisers and poultry manure indicated that the addition of lime alone had a marked effect on maize production, with yields being more than doubled. The addition of fertilisers in the absence of lime also produced a significant yield increase and poultry manure was shown to be an effective alternative or additive to commercial fertilisers. A low initial soil Mg concentration led to problems with plants on unlimed plots and was also reflected in low Mg concentrations in the tissue analysis. The effect of lime could be related to changes in saturation percentage, exchangeable Mn and the change in the ion exchange and surface charge properties. Although pH values of the soils could not be determined (all < pH 3.5), the net negative surface charge increased with liming. The cation retention sites thus created were dominated by Ca. The critical Al saturation percentage for marked yield reductions in maize production would appear to be greater than 30 per cent.

Clarke, W. C. and Morrison, R. J. 1987. Land mismanagement and the development imperative in Fiji. In: Blaikie, P. and Brookfield, H. C. ed. *Land Degradation and Society*. Methuen, London, pp. 176–185.

The expansion and degradation of land in Fiji are outlined, and institutional and structural factors are identified as contributors to degradation. It is observed that an adaptive land management policy had been implemented from the 1930s until independence that had slowed down but not eliminated land degradation. This management policy went into decline after independence along with 'conservation consciousness'. It is concluded that the political dimension is crucial to the introduction of effective land conservation measures, but had not been very supportive to date. Conditions at the time of writing had hopefully become more conducive to a reintroduction of adaptive land management and ecological consciousness.

Eyles, G. O. 1987. *Soil Erosion in the South Pacific*. Environmental Studies Report, Institute of Natural Resources, University of the South Pacific, Suva/Soil Conservation Centre, Ministry of Works and Development, Palmerston North, 49 pp.

Nelson, D. 1987. *Land conservation in the Rewa and Ba: Watershed Management Study*. Food and Agriculture Organization Report to the Fiji Ministry of Primary Industries, Suva.

Laffan, M. D. 1988. *Soils of Legalega Agricultural Research Station, Viti Levu, Fiji*. NZ Soil Survey Report 77, NZ Soil Bureau, DSIR, Lower Hutt.

Laffan, M. D. 1988. *Soils of Seaqaqa Agricultural Research Station, Vanua Levu, Fiji*. NZ Soil Survey Report 79, NZ Soil Bureau, DSIR, Lower Hutt.

Liedtke, H. 1988. *Soil erosion on fields of indigenous Fijians in the area of Suva (Fiji)*. Fiji-German Forestry Project Report, Suva (mimeograph), 51 pp.

Craswell, E. T. 1989. *The role of fertilisers in smallholder agriculture*. In: *Soil Management and Smallholder Development in the Pacific Islands*. IBSRAM Proceedings No. 8, International Board for Soil Research and Management, Bangkok, pp. 99–109.

Dahl, A. L. 1989. *The challenge of sustainable development in the South Pacific*. Paper presented at the 4th South Pacific Conference on Nature Conservation and Protected Areas, 4–12 September, Port Vila.

Liedtke, H. 1989. Soil erosion and soil removal in Fiji. *Applied Geography Development*, 33:68–92.

The soils and climate of Fiji are reviewed. Soil losses of 16–18t/ha during the rainy season are reported. Factors influencing the erosion of agricultural soils are evaluated and some conservation measures recommended.

Miura, S. Tomioki, E. and Chand, K. 1989. Soil classification and fertiliser recommendation for Nausori area. Ministry of Primary Industries and Japanese International Centre for Agriculture, Suva.

Thistlewaite, R., Leslie, D. M., Osbourne, D., Patel, N. P., Sivan, P. and Wood, I. M. 1989. A Review of the Fiji Soil and Crop Evaluation Project (Fiji SCEP). Joint review by the Australian International Development Assistance Bureau and New Zealand Ministry of Foreign Affairs. SCEP Technical Report No. 2, Suva.

Background material is provided on the activities of SCEP during 1986–87, its goals and accomplishments. Operational constraints are outlined, covering finance, staffing, technical equipment and material, support services, and institutional and socioeconomic factors. Consideration is given to SCEP's options, and recommendations are made for a revised SCEP.

Weeraratna, C. S. and Morrison, R. J. 1989. Fertilizer situation in the South Pacific. *Alafua Agricultural Bulletin*, 14(3), 31–40.

The total annual consumption of inorganic fertilisers in the 22 island countries of the South Pacific was estimated at around 25 000 tons. For the 15 years prior to writing, the amount of inorganic plant nutrients applied per hectare per year was much lower than the average for developing countries, except in Fiji, Papua New Guinea and New Caledonia. This is despite the fact that crops grown in this region respond positively to fertiliser application. The low rate of consumption is attributed to a number of factors. Recommendations are made for fertiliser research and management for increased crop production.

Willatt, S. T. and Tranggono, R. 1989. Optimising tillage for wetland rice. In: Hoffman, D., Nari, J. and Petheram, R. J. ed. *Draught Animals in Rural Development: Proceedings of an International Symposium*, Cipana, Indonesia, 3–7 July 1989. ACIAR Proceedings Series No. 27, Australian Centre for International Agricultural Research, Canberra, pp. 272–279.

Discussion focuses on the classification of paddy soil in accordance to the physical and mechanical characters of soils and rice yields. A rating system for cultivation of rice soils is presented relating to clay content, cation exchange capacity, soil permeability, endurance to traffic and days available for seed bed preparation. The information derived can be used to predict cultivation requirements and in the development of cultivation systems for wetland and dryland soils.

1990–present

Buresova, N. V. and McGregor, A. 1990. The economics of soil conservation: the case study of the Fiji ginger industry. In: Ziemart, R. R., O’Loughlin, C. L. and Hamilton, L. S. ed. *Research Needs and Applications to Reduce Erosion and Sedimentation in Tropical Steeplands*. IAHS Publication No. 192, pp. 247–255.

Severe land degradation now threatens the production base of the ginger industry in Fiji. Despite the financial benefits from adopting simple soil conservation measures, farmers have shown little interest in investing in them. A combination of measures involving legislation, fiscal incentives and information dissemination is proposed to rectify the situation.

Morrison, R. J. and Clarke, W. C. 1990. Soil erosion in Fiji—problems and perspectives. *Journal of Erosion Control Engineering Society (Japan)*, 43(2), 54–59.

Morrison, R. J., Clarke, W. C., Buresova, N. V. and Limalevu, L. 1990. Soil erosion in Fiji. In: Ziemart, R. R., O’Loughlin, C. L. and Hamilton, L. S. ed. *Research Needs and Applications to Reduce Erosion and Sedimentation in Tropical Steeplands*. Publication No. 192, IAHS, pp. 14–23.

The steepland topography and highly erosive rainfall contribute to high natural rates of erosion in Fiji. Over the past 30 to 50 years, agricultural production on sloping land and increased logging in rainforests has caused appreciable erosion that has led to land degradation, decreased productivity, sedimentation in rivers with a subsequent increase in flooding, and damage to the coastal ecosystem by transported sediments. Legislation

for land use and conservation has not been widely applied. The land tenure system, increasing demands for cash income, and a lack of strong political commitment to conservation has allowed the perpetuation of soil erosion and sedimentation problems.

Naidu, R., Singh, U., Prasad, G., Bain, D. C. and Morrison, R. J. 1990. Evaluation of Fiji phosphate rocks: chemical and mineralogical properties of samples from the Lau group. *Fertiliser Research*, 23(2), 181–190.

The chemical and mineralogical properties of two major types of phosphate rock deposits identified in the Lau group, eastern Fiji, were investigated before and after acidulation and calcination. X-ray diffraction showed the presence of Ca and Al rich phases of phosphate minerals. Of the two types of phosphate rock, the apatite rich oolitic material released 8 to 10 times more extractable P than phosphatic clays following acidulation. Calcination of the phosphatic clays at high temperatures caused a small but significant increase in extractable P but the effect was less distinct than that of acidulation.

Rijkse, W. C. 1990. Soils of Sigatoka Agricultural Research Station, Viti Levu, Fiji. New Zealand Soil Survey Report 81, New Zealand Soil Bureau, DSIR, Lower Hutt.

World Bank 1990. *Vetiver Grass: The Hedge Against Erosion*. Third edition, World Bank, Washington, D.C., 88 pp.

Vetiver grass (*Vetiveria zizanioides*) is used as a hedge on contours to prevent soil erosion and conserve water. It is inexpensive, durable and adaptable over a range of climates. It has been successfully employed in Fiji, India and Nigeria and is being adopted by other countries. This cost-effective technology can replace expensive and high-maintenance conservation systems based on contoured bunds and terraces.

Curtin, D., Naidu, R. and Syers, J. K. 1991. Chemical and mineralogical characteristics of some strongly weathered Fijian soils: fertility implications. *Geoderma*, 48(3/4), 363–372.

Chemical and mineralogical properties of six soils representing areas of Fiji with potential for agricultural development were investigated with a view to identifying possible fertility constraints. The soils were all highly weathered, strongly acidic with clay mineral assemblages of hydrous oxides (gibbsite/geothite) and kaolinite. The chemical and mineralogical characteristics are described.

Fertiliser Advisory, Development and Information Network for Asia and the Pacific (FADINAP) 1991. Supply, Marketing, Distribution and Use of Fertiliser in the Pacific Subregion. United Nations, New York.

Descriptions are given of the fertiliser industry in six Pacific countries: Cook Islands, Fiji, Samoa, Solomon Islands, Tonga and Vanuatu. Information is published about soil types and their uses in these countries. Constraints to the development of the fertiliser sector are discussed, such as continued practice of poor agricultural/farming systems, farmers' reluctance to use fertilisers, paucity of information and poor extension services, and the unavailability of the right type of fertilisers in the right place, the right quantity and at the right time. Finally, the report draws a number of conclusions and recommends action to increase food production through the promotion of fertiliser use on a sound basis, giving due consideration to the environmental implications.

Haynes, R. J. and Naidu, R. 1991. Effects of lime additions on the availability of phosphorus and sulphur in some temperate and tropical acid soils. In: Wright, R. J., Baligar, V. C. and Murrmann, R. P. ed. Plant Soil Interactions at Low pH: Proceedings of the 2nd International Symposium on Plant Soil Interactions at Low pH, 24–29 June 1990, Beckley, West Virginia. Also *Developments in Plant and Soil Sciences*, 45:267–274.

The effects of liming on the availability of phosphorus and sulphur in acid soils in New Zealand and Fiji were investigated. Liming affected phosphate adsorption in different soils in different ways. Liming did not greatly affect phosphate adsorption and extractability. The main effect was to alleviate aluminium toxicity to allow plants to make use of available soil phosphate. Liming and phosphate application reduces sulphate adsorption capacity of all soils and reduces the soil's ability to retain sulphate against leaching. It also resulted in net mineralisation of soil organic sulfur and accumulation of sulphate in the soil.

Leslie, D. M. and Hunter, G. 1991. Soil and Crop Evaluation Project (SCEP) Design Appraisal, April 1991. Report prepared for Fiji Ministry of Primary Industries, Australian International Development Assistance Bureau and New Zealand Ministry of External Relations and Trade, Suva.

Naidu, R., Haynes, R. J., Gawandar, J. S., Morrison, R. J. and Fitzpatrick, R. W. 1991. Chemical and mineralogical properties and soil solution composition of acid soils from the South Pacific islands. In: Wright, R. J., Baligar, V. C. and Murrmann, R. P. ed. *Plant soil interactions at low pH*.

Proceedings of the 2nd International Symposium on Plant Soil Interactions at Low pH. 24–29 June 1990, Developments in Plant and Soil Sciences, 45:43–53.

The chemical and mineralogical properties of a range of soils representing area with potential for agricultural development in Fiji, New Caledonia, Vanuatu, Solomon Islands and Western Samoa are investigated to identify soil fertility constraints.

Naidu, R. and Syers, J. K. 1992. Influence of sugarcane mill mud, lime and phosphorus on soil chemical properties and the growth of *Leucaena leucocephala* in an oxisol from Fiji. *Bioresource Technology*, 41(1), 65–70.

This paper investigates the effects of lime-containing sugarcane millmud (filter cake), and lime and phosphorus added separately or in combination, on soil chemical properties and growth of the tropical legume, *Leucaena leucophala*, in an oxisol in Fiji.

International Board for Soil Research and Management 1993. The Management of Sloping Lands in the Pacific Islands. IBSRAM Network Document No. 7 (Pacifcland), International Board for Soil Research and Management, Bangkok.

Limalevu, L. and Willatt, S. T. 1993. Management of sloping lands for ginger and other crops in Waibau, Fiji. In: Pushparajah, P. ed., The Management of Sloping Lands in the South Pacific Islands. IBSRAM Network Document No. 7, International Board for Soil Research and Management, Bangkok, pp. 49–76.

Willatt, S. T. 1993. Soil and water conservation strategies in the Southwest Pacific. In: Baum, E., Wolff, P. and Zobisch, M. A. ed. Acceptance of Soil and Water Conservation Strategies and Technologies: Topics in Applied Resource Management in the Tropics, Vol. 3. Witzebhausen, pp. 193–212.

Erosion is problematic in the Southwest Pacific, with increased land pressure and clearing of tropical rain forests. The soil taxonomy classes occurring in the region are listed. Factors affecting erosion are discussed and a modified rating system to determine soil suitability to minimum tillage is described. The rating system was applied to a site in Fiji. Water conservation strategies are also discussed.

Daly, B. K. and Wainiqolo, J. L. 1994. *Methods of Analysis for Agricultural Samples: Soil, Plant Animal Feed and Water*. Fiji Agricultural Chemistry Laboratory, Koronivia Research Station, Ministry of Agriculture, Fisheries and Forests, Suva.

Howlett, D. J. B. 1994. A Review of the IBSRAM Pacificland Network and the Challenges for Sustainable Land Management in the South Pacific. In: *International Workshop on Conservation Farming for Sloping Uplands in South East Asia: Challenges, Opportunities and Prospects*. International Board for Soil Research and Management, Manila, 19 pp.

International Board for Soil Research and Management 1994. *Proceedings of the Second Annual Meeting of the Pacificland Network*, Network Document No. 10, International Board for Soil Research and Management, Bangkok.

Soil and Crop Evaluation Project 1994. *Fiji Soil and Evaluation Project, Project Implementation Document, Final Management Report No. 4*, Suva.

Willatt, S. T., Suka, S. Q. and Limalevu, L. 1995. Water infiltration and implications for soil erosion: a case study at Waibau, Viti Levu, Fiji. *South Pacific Journal of Natural Science*, 14.

Howlett, D. J. B. 1995. Sustainable smallholder agriculture and the role of fertilisers in Fiji and the South Pacific. *Fiji Agricultural Journal*, 51(2), 59–72.

The paper reviews the changes and challenges to the achievement of sustainable smallholder agriculture farming systems in the South Pacific, and the potential role of fertilisers in these systems. The IBSRAM Pacificland network is addressing this challenge through the establishment of six research sites in Fiji, Papua New Guinea, Vanuatu and Western Samoa. These trials compare soil erosion, surface runoff changes and soil fertility and agronomic data from a range of management practices including the minimum use of fertilisers.

Lincoln, A. 1995. *Bibliography of Soil Fertility and Soil Management in Pacific Island Countries*. Information Document No. 60, South Pacific Commission, Noumea, 212 pp.

A comprehensive bibliography is provided for Pacific island countries that is a compilation of papers and monographs reporting studies of soil fertility and soil management.

Daly, B. K., Wainiqolo, J. L., Chand, K. and Hart, P. B. S. 1996. The use of microbial biomass carbon for monitoring organic matter dynamics under cropping and agroforestry in two Fiji soils. *Fiji Agricultural Journal*, 52(1), 35–41.

Studies on a soil from an agroforestry trial, which involved the return of hedgerow pruning to the soil, showed that C_{mic} levels increased in two of the three samples by 57 and 74 per cent compared with the control plot after three years. In contrast, C_{org} levels showed no increase, thus demonstrating the sensitivity of the C_{mic} technique in detecting changes. This technique could have wide application in monitoring land degradation and restoration under various management systems.

Dowling, A. J., Chandra, H. and Wood, I. M. 1996. Potential for utilising organic materials as fertilisers and soil conditioners in Fiji. SCEP Technical Report No. 11, Soil and Crop Evaluation Project, Suva.

The objectives of this report were to examine the current use of inorganic fertilisers in Fiji and assess the potential of the use of natural organic local materials to replace or supplement inorganic fertilisers. It contains four chapters of separate parts multi-authored by various scientists. Issues covered include: current usage of inorganic fertilisers and the sources and quantities of organic materials produced in Fiji; sampling and analysis of organic materials with potential for use of fertiliser or soil conditioners; economic and marketing considerations in the utilisation of organic materials as fertiliser or soil conditioners; and conclusions on the potential for using organic materials in agricultural production in Fiji, and recommendations for future research and development.

Dowling, A. J., Kumar, D., Puran, K. and Wood, I. M. 1996. Evaluation of SCEP Trials 1986 to 1993. SCEP Technical Report No. 9, Soil and Crop Evaluation Project, Suva.

This report summarises the first phase of the Soil and Crop Evaluation Project (SCEP) which commenced in April 1986 and operated until 1992. In many of the trials, which consisted of 39 factorial and 14 nutrient rate trials, significant yield responses obtained were too small to be of practical value and the results were inconclusive. However, the notable results were that: Mo deficiency occurs in Nadi soils; estimates of N requirements were near the maximum yield of potato on Sigatoka soils at 100 kg to 140 kg N/ha and for maize 70 kg/ha to 100 kg/ha; and estimates of N and P requirements for near maximum yield of lowland rice on Soso soils at 40 kg/ha to 80 kg/ha for N and 20 kg/ha for P.

CROP INTRODUCTION, DISTRIBUTION AND DESCRIPTION

Before 1900

Seemann, B. 1862. *Viti: An Account of a Government Mission to the Vitian or Fijian Islands in the Years 1860–61*. Macmillan, London.

Seemann, B. 1865–1873. *Flora Vitiensis: A Description of the Plants of the Viti or Fiji Islands with an Account of Their History, Uses and Properties*. L. Reeve & Co., London, 453 pp.

Thurston, J. B. 1886. *Catalogue of Trees, Shrubs and Foliage Plants at Thornbury, Suva and St Heliers*. Taveuni, Suva, 18 pp.

1900–1919

Wright, C. H. 1918. A list of Fijian plant names. Bulletin No. 9, Fiji Department of Agriculture: 1–10.

1920–1929

Wright, C. H. 1920. A list of Fijian plant names—errata and addenda. *Agriculture Circular Fiji*, 1(4), 59–60.

Copeland, E. B. 1929. *Ferns of Fiji*. Bulletin 59, B. P. Bishop Museum, Honolulu, 105 pp.

1930–1939

Gillespie, J. W. 1930. New plants from Fiji I. Bulletin 74, B. P. Bishop Museum, Honolulu, 99 pp.

Gillespie, J. W. 1931. New plants from Fiji II. Bulletin 83, B. P. Bishop Museum, Honolulu, 72 pp.

Gillespie, J. W. 1932. New plants from Fiji III. Bulletin 91, B. P. Bishop Museum, Honolulu, 81 pp.

Parham, H. B. R. 1933. *Native and Classical Names of a Few Fiji Ferns*. Department of Agriculture, Suva, 2 pp.

Parham, H. B. R. 1935. Names of a Few Fijian Plants and their Botanical Equivalents. Department of Agriculture, Suva, 13 pp.

Smith, A. C. 1935. Botanical exploration of the Fiji islands. *Tropical Woods*, 41:1–5.

Smith, A. C. 1935. Plant collecting in Fiji. *Proceedings of the Linnean Society*, 148:5–7.

Smith, A. C. 1936. Fijian plant studies. Bulletin 141, B. P. Bishop Museum, Honolulu, pp. 166.

Parham, B. E. V. 1937. Poisonous plants of Fiji. *Fiji Agricultural Journal*, 8(4), 25–26.

Little formal knowledge existed of poisonous plants and their uses in indigenous toxicology or medicine. Descriptions are given of a couple of plants known to be poisonous.

Parham, H. B. R. 1937. Valuable plants of Fiji. *Pacific Islands Monthly*, 7:41–42, 49–51.

Surridge, H. R. 1937. Trees ornamental and useful. *Fiji Agricultural Journal*, 8(4), 15–18.

Twenty-four trees of ornamental and economic use are described of which 15 are indigenous and 9 introduced. It is observed that little planting had been done for ornamental purposes.

Fosberg, F. R. 1938. Notes on the plants of the Pacific islands I. *Bulletin of the Torrey Botany Club*, 65:607–614.

The author records information on the species of the genera, *Gouania* (Rhamnaceae), *Diaspyros* (Ebenaceae) and *Randia* (Rubiaceae) found in the Pacific Islands. Some references are made to material collected from Fiji, mainly on Viti Levu.

Harwood, L. W. 1938. Native food crops of Fiji. *Fiji Agricultural Journal*, 9(4), 6–7.

This is a sequel to an article on native food crops in the previous edition of the journal, containing a piece on sweet potato that was inadvertently omitted. The indigenous methods of propagating and cultivating sweet potato are described. It is suggested that more attention be given to growing European vegetables, soya beans and cowpeas, and Fijian green vegetables such as bele, ota and moca.

Parham, B. E. V. 1938. New banana varieties for Fiji. *Fiji Agricultural Journal*, 9(2), 12–14.

Trials were conducted for four imported varieties of banana, three of which belong to the Cavendish group. The fourth variety is a hybrid, I.C.2, which is a cross between Gros Michel and a wild seeded banana, *Musa acuminata*. The desirability of their introduction into Fiji was assessed and brief notes are provided on experiences with their introduction.

Parham, W. L. 1938. The wild tamarind (*Leucaena glauca* Benth.). *Fiji Agricultural Journal*, 9(1), 18.

The wild tamarind grows with a minimum of human intervention, and promises to ameliorate soil erosion problems and maintain soil fertility in the dry zone.

Parham, W. L. 1938. Two useful trees. *Fiji Agricultural Journal*, 9(2), 23–24.

A description is provided of the avocado tree, with some recommendations on its propagation, maintenance and handling of its fruit. The annatto is in demand for colouring butter and cheese. Details are given of germination, maintenance and harvesting procedures.

Copeland, E. B. 1939. New or interesting ferns from Micronesia, Fiji and Samoa. *Occasional Paper 15*, B. P. Bishop Museum, Honolulu.

Parham, B. E. V. 1939. Fijian plants and their story. *Transactions Fiji Society of Science & Industry*, 1(1), 18–25.

Parham, B. E. V. 1939. List of plants introduced to Fiji by R. B. Howard and W. I. Wallace. *Fiji Agricultural Journal*, 10(4), 112–116.

Considerable detail is provided on 46 plants that were introduced to Fiji by R. B. Howard and W. I. Wallace.

1940–1949

Blackie, W. J. and Johns, R. 1940. Observations on citrus introductions at Nasinu. *Fiji Agricultural Journal*, 11(3), 30.

The introduction to this article contains a brief history and details of the various introductions of citrus, followed by an outline of soil and climatic conditions at Nasinu. Field observations are reported on grapefruit and oranges, with tree descriptions, yields, fruit descriptions, incidence of pests and diseases (especially collar rot) and fruit quality. Estimates are provided of vitamin C values for the different fruits.

Fosberg, F. R. 1940. Notes on plants of the Pacific islands II. Bulletin Torrey Botany Club, 67:417–425.

This is the second in an irregular series describing plant species found in the Pacific Islands, including Fiji.

Anon. 1941. Plant and seed list, Nasinu Agricultural Station. Fiji Agricultural Journal, 12(2), 56–58.

Harvey, C. 1941. Plant and seed introductions 1939–40. Fiji Agricultural Journal, 12(4), 114–115.

Reports are given on the introductions of oil palm, tung oil, cowpeas, sorghum, soya bean, tomato, ramie, cotton, lima beans, bamboo, flax and sunflower, plus details on other introductions on which no report could be made at the time.

Parham, B. E. V. 1941. Minor food plants of the Fijian and Indian. Transactions & Proceedings Fiji Society of Science & Industry, 1(3), 12–18.

Parham, B. E. V. 1941. Fijian ferns and fern allies. Transactions & Proceedings Fiji Society Science & Industry, 1(3), 19–25.

Parham, B. E. V. 1942. Fijian Plant Names. Fiji Department Agriculture, Suva, 83 pp.

Parham, B. E. V. 1942. Some useful plants of the Fiji Islands. Fiji Agricultural Journal, 13(2), 39–47.

The article covers in detail (1) roots and tubers (the four main root crops and some minor ones), (2) leafy green vegetables, and (3) native and introduced fruits. Tables are provided of food values of items in each group.

Parham, B. E. V. 1942. Some useful plants on the Fiji Islands: Part II. Fiji Agricultural Journal, 13(3), 69–75.

The useful plants covered in this paper include some timber products, first aid plants, poisonous plants and cover plants.

Parham, B. E. V. 1942. Observations on some plants received for identification. Fiji Agricultural Journal, 13(2), 50–52.

Descriptions are given of the giant sensitive plant, muraina grass, wood apple and fenugreek plants found in Fiji.

Parham, H. B. R. 1943. Fiji native plants with their medicinal and other uses. Polynesian Society Memoirs, Vol. 16, 160 pp.

Smith, A. C. 1943. Studies of the Pacific island plants II: Notes on the Pacific species of Piper. Journal Arnold Arboretum, 24:347–361.

Smith, A. C. 1943. Studies on Pacific island plants III: New and noteworthy flowering plants from Fiji. Bulletin Torrey Botany Club, 70:533–549.

Parham, B. E. V. 1944. Plant introduction 1933–1943. Fiji Agricultural Journal, 15(4), 94–104.

The work of the Department of Agriculture in plant introduction and acclimatisation of plants is detailed. Plants are classified into 7 medicinal drugs, 3 insecticides, 9 fibre plants, 6 fodder plants, 5 grasses, 3 field crops, 15 fruits, 24 trees and 6 ornamental plants.

Anon. 1945. Plant distribution list. Fiji Agricultural Journal, 16(1), 17–21.

Smith, A. C. 1945. Studies of Pacific island plants IV: Notes on Fijian flowering plants. Journal Arnold Arboretum, 26:97–110.

Parham, B. E. V. 1946. Notes from Central Agricultural Station Naduruloulou. Fiji Agricultural Journal, 17(1), 20–21.

Parham, B. E. V. 1946. Botanical notes. Fiji Agricultural Journal, 17(1), 22–25.

Some local plants of interest are described in terms of laboratory records. There is a list of grasses and legumes that have been successfully introduced in Fiji.

Smith, A. C. 1946. Studies of Pacific island plants V: New and noteworthy flowering plants from Fiji. Journal Arnold Arboretum, 27:319–322.

Parham, B. E. V. 1947. Botany notes. Fiji Agricultural Journal, 18(2), 56–57.

Prickly pear had been declared a noxious weed in 1945. Infestations had been sighted near Ba and Tavua, and action had been taken in reporting and control of outbreaks.

Parham, B. E. V. 1947. Economic botany notes. Fiji Agricultural Journal, 18(3), 77–79.

The notes cover recent plant introductions and citrus rootstocks.

Parham, J. W. 1948. The Botanical Gardens, Suva. *Fiji Agricultural Journal*, 19(3/4), 88–105.

This paper is in three parts. In the first part, notes are presented on the early historical associations between 1820 and 1882. In the second part, the focus is on the subsequent development of the Botanical Gardens in Suva between 1882 and 1918. In the final part, a description is given of the collection of trees and shrubs. Useful sections are included on palms and other economically useful trees in agriculture, and weeds and grasses.

Copeland, E. B. 1949. Further notes on the ferns of Fiji. *Journal Arnold Arboretum*, 30:433–442.

Parham, B. E. V. 1949. List of grasses recorded in Fiji: 1860–1948. *Fiji Agricultural Journal*, 20(1), 15–20.

Parham, B. E. V. 1949. List of introduced leguminous plants recorded in Fiji. *Fiji Agricultural Journal*, 20(1), 21–25.

Around 120 entries are given of introduced leguminous plants recorded in Fiji.

Parham, B. E. V. 1949. Plant introduction, 1949. *Fiji Agricultural Journal*, 20(1), 26.

A progress report is given on recent plant introductions in Fiji.

1950–1959

Perry, L. M. 1950. Notes on some Myrtaceae of Fiji. *Journal Arnold Arboretum*, 31:350–371.

Smith, A. C. 1950. Studies of Pacific island plants VI: New and noteworthy flowering plants from Fiji. *Journal Arnold Arboretum*, 31:137–171.

Smith, A. C. 1950. Studies of Pacific island plants VII: Further notes on Fijian flowering plants. *Journal Arnold Arboretum*, 31:288–319.

Parham, B. E. V. 1951. Plant introduction—1950. *Fiji Agricultural Journal*, 22(1), 20–21.

Efforts to improve plant introduction at Nasinu are described. Details are provided on fodder and pasture plants, root crops (33 varieties of yams, 2 varieties of sweet potato, 3 aroids, 2 arrowroot, 2 ginger and 1 turmeric), pulses and grains, 16 varieties of vegetables, fibre plants, cocoa, various fruits and nuts, and a dwarf coconut variety.

Parham, B. E. V. 1951. Plant Introduction List No. 1 (1950). Fiji Department Agriculture, 17 pp.

Smith, A. C. 1951. The vegetation and flora of Fiji. *Science Monthly*, 73:3–15.

Smith, A. C. 1951. Studies of Pacific island plants IX: Notes on the Rutaceae of Fiji, Samoa, and Tonga. *Journal Arnold Arboretum*, 32:226–255.

Smith, A. C. 1952. Studies of Pacific island plants X: The Meliaceae of Fiji, Samoa and Tonga. *Contributions U.S. National Herbarium*, 30(4), 469–522.

Smith, A. C. 1952. Studies of Pacific Island Plants XI: Further notes on Fijian flowering plants. *Journal Arnold Arboretum*, 33:91–118.

Parham, B. E. V. 1953. Plant introduction and quarantine station, Fiji. *Fiji Agricultural Journal*, 24(1/2), 18–29.

A description is given of the plant introduction and quarantine station at Naduruloulou, with details of recent introductions and activities of special interest.

Parham, H. B. R. 1953. Some rare or little known plants collected in Fiji. *Transactions & Proceedings Fiji Society of Science & Industry*, 2(2), 68–75.

Lists and descriptions are given for orchid species of particular interest, and details are provided of some rare shrubs and trees.

Keleny, G. P. 1954. Plant introduction in the Pacific. *South Pacific Commission Quarterly Bulletin*, 4(2), 11–13.

The author compares the work of plant introduction stations in Fiji, Papua New Guinea and Australia. He advocates closer collaboration in the import, testing and distribution of plant material.

Parham, B. E. V. 1954. Fiji plant introduction station. *South Pacific Commission Quarterly Bulletin*, 4(1), 25–26.

There is a description of the plant introduction and quarantine station at Naduruloulou, with particular attention to introductions and activities of special interest in 1953.

Anon. 1955. Botanical investigations in Fiji. *Fiji Agricultural Journal*, 26(3), 95–97.

Parham, B. E. V. 1955. Plant Introduction List No. 4, 1954. Department of Agriculture, Suva, 20 pp.

Parham, J. W. 1955. The collection of plant specimens. *Fiji Agricultural Journal*, 26(1), 9–13.

The botany laboratory received more than 1000 specimens for identification during 1954. Many were of poor quality. Advice is given on how to collect and prepare specimens for identification.

Smith, A. C. 1955. Botanical studies in Fiji. *Smithsonian Report for 1954*, pp. 305–315.

Walker, C. 1955. Trees: useful and ornamental. *Fiji Agricultural Journal*, 26(1), 14–15.

Details are provided on a large number of trees and shrubs that were supplied during 1953.

Parham, B. E. V. 1956. Plant Introduction List No. 5, 1955. Fiji Department of Agriculture, Suva.

Parham, J. W. 1956. The Grasses of Fiji. *Bulletin No. 30*, Fiji Department of Agriculture, 166 pp.

Barrau, J. 1958. Plant introduction at Naduruloulou. *South Pacific Commission Quarterly Bulletin*, 8(4), 46–47.

A brief review, with illustrations, is given of plant introduction activities over the previous year.

Parham, J. W. 1959. Plant Introduction List No. 6, 1956–1958. Fiji Department of Agriculture, Suva, 17 pp.

Parham, J. W. 1959. The Suva Botanical Gardens. *Fiji Agricultural Journal*, 29(1), 31–34.

This paper updates an earlier journal article on the gardens, with a comprehensive listing of species.

1960–1969

Parham, J. W. 1960. Plant Introduction List No. 7, 1959. Fiji Department of Agriculture, Suva, 8 pp.

Parham, J. W. 1961. Plant Introduction List No. 8, 1960, Fiji Department of Agriculture, Suva, 8pp.

Parham, J. W. 1962. Plant Introduction List No. 9, 1961. Fiji Department of Agriculture, Suva, 10 pp.

Parham, J. W. 1963. Plant Introduction List No. 10, 1962. Fiji Department of Agriculture, Suva, 9 pp.

Parham, J. W. 1964. Plant Introduction List No. 11, 1963. Fiji Department of Agriculture, Suva, 8 pp.

Parham, J. W. 1964. Plants of the Fiji Islands. Government Printer, Suva, 353 pp.

The plant checklist provides a brief description of families and species, and notes on occurrences and uses. Cross-referencing is made to a comprehensive bibliography, maps, and general and historical notes of flora.

Parham, J. W. 1965. Plant Introduction List No. 12. Fiji Department of Agriculture, Suva, 15 pp.

Parham, J. W. 1966. Plant Introduction List No. 13. Fiji Department of Agriculture, Suva, 8 pp.

Parham, J. W. 1967. Plant Introduction List No. 14. Fiji Department of Agriculture, Suva, 8 pp.

Smith, A. C. 1967. Studies of Pacific island plants XVIII: New and noteworthy plants from Fiji. Contributions U.S. National Herbarium, 37(3), 69–106.

Stone, B. C. 1967. Notes on the plant genus *Pandanus* in Fiji, Tonga, the New Hebrides and Niue. Proceedings Biological Society Washington, 80:47–59.

Parham, J. W. 1968. Plant Introduction List No. 15. Fiji Department of Agriculture, Suva, 8 pp.

Geesink, R. 1969. An account of the genus *Portulaca* in Indo-Australia and the Pacific (Portulacaceae). Blumea, 17:275–301.

This paper comprises five main sections and a detailed key to the species that contains some illustrations. In the first section, a brief historical review is given of earlier treatment of the genus *Portulaca*. It is followed by morphological observations and a discussion of the wide distribution of several species, mainly due to man, transportation and cultivation. In the fourth section, a discussion ensues on the sub-division of the species. Finally, some notes are made on typification in which it is acknowledged

that some types proved to be untraceable. It is estimated that the entire genus comprises no more than 15 good species, mainly in the Old World. Some references are made to types found in Fiji.

Parham, J. W. 1969. Plant Introduction List No. 16. Fiji Department of Agriculture, Suva, 13 pp.

Parham, J. W. 1969. The Fiji Herbarium: a brief history of its establishment and some suggestions for its future. Paper presented to Fiji Society, 12 August 1969, Suva.

1970–1979

Anon. 1971. Plant resources of the Pacific countries, their recognition, collection and conservation. *Plant Introduction Review Australia*, 8(2), 17–27.

Reports are given of the prevailing situation with regard to the recognition, collection and conservation of valuable indigenous plant resources in Indonesia, the Philippines, Taiwan, Japan, Korea, New Caledonia, New Guinea, Hawaii, Fiji, Solomon Islands, South America and USSR.

Parham, J. W. 1972. *Plants of the Fiji Islands*. Revised edition, Government Printer, Suva, 462 pp.

This revised and expanded edition of a book originally published in 1964 provides a list with brief information on the ferns and fern allies (*Pteridophytes*), *Gymnospermae* and the flowering plants (*Angiospermae*). It includes endemic, indigenous and naturalised plants that had been recorded and established to date in the Fiji islands. A total of 104 plants are covered. There is a good index of scientific and native names together with an extensive botanical bibliography (852 references) and several coloured illustrations. There are also lists of nature reserves, forest reserves, and agricultural and forestry research stations, with a note on the Fiji Herbarium.

St John, H. 1975. Revision of the genus *Pandanus* Stickman Part 38: *Pandanus* in Fiji (first group except section *Pandanus*). Pacific Science, 29(1), 55–77.

Four sections of the genus, *Pandanus*, are present in the flora of Fiji. Most have small drupes without aerenchyma as fruits and are not buoyant. This means they were not ocean-distributed. They are comprehensively described and illustrated in this paper.

St John, H. 1976. Revision of the genus *Pandanus* Stickman Part 40: The Fijian species of the section *Pandanus*. Pacific Science, 30(3), 249–315.

In addition to the four non-buoyant sections of the genus, *Pandanus*, described above, with small drupes without aerenchyma, there are other species with compound ovaries, forming phalanges with aerenchyma, that are buoyant and regularly dispersed by sea. They are classified, described and illustrated in this paper.

Wright, C. H. 1978. A List of Fijian Plant Names. Government Printer, Suva.

Smith, A. C. 1979. *Flora Vitiensis Nova: A New Flora of Fiji (Spermatophytes Only)*, Vol. 1. Pacific Tropical Botanical Garden, Lawai, Kauai, Hawaii.

1980–1989

Baines, G. B. K. 1980. Mangrove resource management in a Pacific island nation: Fiji. Paper presented at the Asian Symposium on Mangrove Environment, Kuala Lumpur.

Singh, A. 1980. Medicinal Plants in Fiji and Other South Pacific Islands, Parts I & II. School of Natural Resources, University of the South Pacific, Suva.

Smith, A. C. 1981. *Flora Vitiensis Nova: A New Flora of Fiji (Spermatophytes Only)*, Vol. 2. Pacific Tropical Botanical Garden, Lawai, Kauai, Hawaii. 818 pp.

This is the second volume of a four-volume set containing taxonomic treatments of 73 families of the dicotyledons.

Smith, A. C. 1985. *Flora Vitiensis Nova: A New Flora of Fiji (Spermatophytes Only)*, Vol. 3. Pacific Tropical Botanical Garden, Lawai, Kauai, Hawaii.

Ash, J. 1987. Demography, dispersal and production of *Pandanus tectorius* (Pandanaeae) in Fiji. *Australian Journal of Botany*, 35(3), 313–330.

Populations of *P. tectorius* were examined at coastal and peat swamp sites. Rates of leaf production (10–90/yr), stem and branch growth (2–80cm/yr) were determined and used in conjunction with observations of the number and spacing of leaf scars and peduncle scars to estimate plant age. A semi-prostrate juvenile phase of 4,5–9 years is followed by erect trunk growth for about 5–12 years, followed by a flowering phase lasting 40 years or more. Male plants form about 30 branches and flower annually, while female plants form about 16 branches and flower biennially. Each fruit forms about 76 phalanges and each phalange contains up to 8 embryos. Dispersal of phalanges by the fruit bat *Pteropus tonganus*, water, man and crabs or rats was recorded. In swamp sites occasional fires kill many small to medium-sized plants, while cyclone damage kills large plants at all sites. There are slightly more female than male plants. The allocation of biomass to reproduction is estimated to be about 34 per cent in females and 15 per cent in males at 60 years.

Smith, A. C. 1988. *Flora Vitiensis Nova: A New Flora of Fiji (Spermatophytes Only)*, Vol. 4. Pacific Tropical Botanical Garden, Lawai, Kauai, Hawaii.

Palmer, J. 1989. Lesser-Known Crop Plants of the South Pacific: An Annotated Bibliography. Report No. 133, Crop Research Division, DSIR, Lower Hutt, 134 pp.

This bibliography provides common names, synonyms, basic botanical details and information sources on crop species (including edible fungi) present but little utilised in the area extending from New Zealand to Papua New Guinea and east to Tahiti. Only crops used for food, medicine or textiles are included.

1990–present

Pillai, G. 1990. *Mangroves of Fiji*. University of the South Pacific, Suva, 31 pp.

Smith, A. C. 1991. *Flora Vitiensis Nova: a new flora of Fiji (Spermatophytes only)*, Volume 5: *Angiospermae*. Pacific Tropical Botanical Garden, Lawai, Hawaii.

This volume covers taxonomic treatments of 14 families of the subclass, Lamiidae, including Solanaceae, Convolvulaceae, Gesneriaceae, Asteridae and the Orchidaceae.

Cambie, R. C. and Ash, J. 1994. *Fijian Medicinal Plants*. CSIRO, Brisbane.

The book opens with a description of the origins and dispersal of medicinal plants in Fiji, their place in the supernatural world and medicinal properties. Sections then follow on ferns and their allies, and flowering plants split into monocotyledons and dicotyledons. Indexes are presented on scientific and Fijian and local names of plants. Each plant is described by family names, botanical notes, medicinal uses and chemistry.

De Wilde, W. J. J. O. 1994. Taxonomic review of *Myristica* (Myristicaceae) in the Pacific. *Blumea*, 38(2), 394–406.

A new account is presented of the genus *Myristica* in the Pacific area. There are 16 species and 8 infraspecific taxa that are locally endemic. Three species, one subspecies and two forms are described as new, and five new subspecific combinations are proposed.

Watkins, A. J. 1995. A biogeographic database for seed plants of Fiji: A preliminary communication. *South Pacific Journal of Natural Science*, 14:75–96.

Data from *Flora Vitiensis Nova* and other sources are used for developing a relational database of Fijian seed plants where information is stored according to location rather than taxonomic detail. Fifty-eight per cent of species recorded are native and 63 per cent of these are endemic to Fiji.

Department of Forestry, MAFF and the Fiji-German Forestry Project (GTZ) 1996. *A Guide to Some Indigenous Fijian Trees*. Department of Forestry, Ministry of Agriculture, Fisheries and Forests, Suva, 238 pp.

A botanical guide is given for the identification of some indigenous trees in Fiji based on a project to manage indigenous Fijian trees. Part of the project is on the National Forest Management Pilot Project in Nakavu village, Namosi Province, in southeast Vitu Levu carried out jointly by the Fiji German Forestry (GTZ) and the Department of Forestry from 1990 to 1993. Information is provided on tree description, distribution, local Fijian names and uses with coloured plates.

INSECT PESTS, PLANT DISEASES AND WEEDS

WEEDS

1900–1919

Knowles, C. H. 1907. Miscellaneous Notes: *Mikania scandens* from Fiji. Kew Bulletin Miscellaneous Information, 1907(7), 306.

The author wrote a letter to the Royal Gardens, Kew, advising that he had sent specimens of the weed, *Mikania scandens*. He advised that this weed was a major problem in Fiji as in other tropical countries.

1920–1929

Anon. 1925. Water hyacinth. Agriculture Circular Fiji, 5(2), 6–7.

Anon. 1925. Noxious weeds (*Acacia farnesiana*). Agriculture Circular Fiji, 5(2), 7.

Kermack, J. 1928. Action taken in regard to control of noxious weeds. Fiji Agricultural Journal, 1(2), 9–10.

The author outlined steps taken to control *Clidemia hirta*, *Solanum torvum* and *Lantana camara* in Fiji through biological control.

Barnes, A. C. 1929. Noxious weeds. Fiji Agricultural Journal, 2(2), 95–97.

A brief survey is given of major noxious weeds in Fiji and their methods of control.

1930–1939

Barnes, A. C. 1930. Noxious weeds and their control in Fiji. Fiji Agricultural Journal, 3(3), 112–121.

Steps taken in biological control of *Clidemia hirta* are described, along with the distribution of the introduced thrips. Details are provided on the slow progress in the spread of thrips.

Lever, R. J. A. W. 1931. Notes on coconut pests and noxious weeds in Fiji. Fiji Agricultural Journal, 4(2), 77–80.

The author presents findings of a tour of Taveuni, and explains how to investigate the results of liberations of *Apanteles tirathabae* against the spike- or spathe-borer (*Tirathaba trichogramma*) and the leaf-miner

(*Promecotheca reichei*). Apparent failure of the liberations contrasts with successful liberations around Suva. It was concluded that the chief controlling factor had been rainfall and not the insect parasites.

Simmonds, H. W. 1931. Noxious weeds and their control in Fiji. Fiji Agricultural Journal, 4(1), 29–31.

A brief description is given of noxious weeds in Fiji. The paper focuses on blue rat tail and *Clidemia hirta*, and the distribution of colonies of 20,000 thrips in March 1930 as a parasite to the latter. The belief was expressed that there were strict limits to biological control.

Simmonds, H. W. 1932. Noxious weeds and their control in Fiji: biological control of *Clidemia hirta*. Fiji Agricultural Journal, 5(1), 18–20.

Steps taken in biological control of *Clidemia hirta* are described, along with the distribution of the introduced thrips. Details are provided on the slow progress in the spread of thrips from March to December 1931.

Simmonds, H. W. 1932. Progress report. Fiji Agricultural Journal, 5(1), 21–22.

Details are given of the control measures introduced for *Lantana crocca* and *Clidemia hirta* in a number of locations.

Simmonds, H. W. 1932. Weeds in relation to agriculture. Fiji Agricultural Journal, 5(2), 58–62.

Major weeds that influence agricultural production in Fiji are summarised. Details are given on their origin and means of control.

Simmonds, H. W. 1933. Biological control of *Clidemia hirta*. Fiji Agricultural Journal, 6(2), 32–3.

This is a report on a visit to Tailevu district to observe progress on the introduction of the thrips, *Liothrips urichi*, which was recently introduced to control this noxious weed.

Paine, R. W. 1934. The control of Koster's curse (*Clidemia hirta*) on Taveuni. Fiji Agricultural Journal, 7(1), 10–20.

The study focused on the impact of 'the curse' in coconut plantations on Taveuni. History of its introduction and spread is recounted for the period prior to 1920, and a detailed account is given of observations made during 1933–36. The status is assessed at the time of writing, and comments are made about further control measures.

Simmonds, H. W. 1934. Biological control of noxious weeds, with special reference to the plants *Clidemia hirta* ('the curse') and *Stachytarpheta Jamaicensis* (blue rat tail). Fiji Agricultural Journal, 7(1).

The spread of *Clidemia hirta* is described, along with the introduction from Trinidad of the thrips. Its method of attack is also described, and details are given of surveys undertaken in 1934. The author explains how biological control can take place through both prevention and destruction, expressing confidence about its success. He described other major weeds in Fiji, with special reference to blue rat tail which tends to be more of a problem on grazing than cultivated land.

Simmonds, H. W. 1937. The biological control of the weed *Clidemia hirta* commonly known in Fiji as 'the curse'. Fiji Agricultural Journal, 8(3), 37–39.

The author recounts the history of the introduction of the weed between 1880 and 1886, and spells out efforts at biological control.

Parham, B. E. V. 1938. The history and distribution of *Solanum torvum* Swartz in Fiji with notes on the possibility of its control. Fiji Agricultural Journal, 9(3), 2–5.

Solanum torvum Swartz is a serious pest of pastures in Fiji. Details are provided on its distribution and action taken to control it between 1926 and 1937. Five methods are outlined, and recommendations for control are made.

Parham, B. E. V. 1938. Notes on weeds in Fiji—I. Fiji Agricultural Journal, 9(3), 12.

This short note is on *Piper aduncum* Linn. There is a description of the weed, and details of its origin and distribution.

Simmonds, H. W. 1938. The biological control of the weed *Clidemia hirta* commonly known in Fiji as the curse. Tropical Agriculture, 15:173–174.

The author recounts the history of the introduction of the weed, and spells out efforts at biological control.

Parham, B. E. V. 1939. Notes on weeds in Fiji—II *Lythrum hyssopifolium* Linn. Fiji Agricultural Journal, 10(1), 21.

The weed, *Lythrum hyssopifolium* Linn., had been recorded at a number of sites in Viti Levu, and sent for identification. It is described, and details are provided on its habitat.

1940–1949

Parham, B. E. V. 1940. The control of weeds. *Fiji Agricultural Journal*, 11(2), 51–52.

Parham, B. E. V. 1940. Notes on weeds in Fiji—III. *Fiji Agricultural Journal*, 11(3), 83–84.

Notes are provided on hibiscus burr which had spread rapidly in some locations in Fiji. A descriptions is given together with suggestions for control measures.

Parham, B. E. V. 1940. Notes on weeds in Fiji—IV. *Fiji Agricultural Journal*, 11(4), 101–103.

A description is given of nut grass and details are provided on its distribution in Fiji where it had earned the status of a serious weed. Some control measures obtained from Australia are outlined.

Parham, B. E. V. 1942. Weeds in Fiji—IV. *Fiji Agricultural Journal*, 13(1), 53–54.

Reports are provided on the mint weed (*Hyptis pectinata*) and the false tobacco (*Elephantopus mollis*).

Greenwood, W. 1943. The adventive and weed flora of the leeward coasts of Fiji. *Proceedings of the Linnean Society*, 154(2), 92–106.

Greenwood, W. 1944. Supplementary notes on the adventive and weed flora of the leeward coasts of Fiji. *Journal Arnold Arboretum*, 25:397–405.

Parham, B. E. V. 1945. Weed control in relation to pasture management. *Fiji Agricultural Journal*, 16(2), 33–40.

Estimates are provided of areas devoted to grazing and principal pastures. There are sections on pastures versus weeds and the grazing animal in relation to weeds. Recommendations are given on the best pasture plants, grazing management and how to control the main pasture weeds.

Greenwood, W. 1949. Notes on some Fijian weeds and introduced plants. *Journal Arnold Arboretum*, 30:75–84.

1950–1959

Parham, B. E. V. 1951. Tobacco weed in Vanua Levu. *Fiji Agricultural Journal*, 22(1), 2.

Tobacco weed is described and its distribution on Vanua Levu is given. Prospects for introducing control measures are briefly discussed.

Mune, T. L. 1953. Declared noxious weed: giant sensitive, *Mimosa invisa*. *Fiji Agricultural Journal*, 24(1/2), 53–54.

Parham, B. E. V. 1953. Recent advances in local weed control. *Transactions & Proceedings of the Fiji Society Science & Industry*, 3(3), 160–165.

An outline is given of the major weed problems and history of weeds in Fiji. Recent control methods are mentioned with information on selective weed killers.

Parham, B. E. V. 1953. The naturalised flora of Fiji with special reference to grasses, legumes and weeds. *Proceedings 7th Pacific Science Congress*, 5:221–253.

Mune, T. L. and Parham, J. W. 1954. Tobacco weed—Tavako ni Veikau (*Elephantopus mollis* H. B. K.). *Fiji Agricultural Journal*, 25(1), 21–22.

This brief note provides a botanical description of tobacco weed, a noxious weed in Fiji. Suggestions are made for its control.

Mune, T. L. and Parham, J. W. 1954. Mint weed—Timoci ni Vavalagi (*Hyptis pectinata* (L.) Poit.). *Fiji Agricultural Journal*, 25(3/4), 80–81.

Mint weed is observed to cover a large area of Fiji, and had been declared a noxious weed. A botanical description is given, and suggestions are made for its control.

Mune, T. L. and Parham, J. W. 1954. Water hyacinth—Bekabekairaga (*Eichhornia crassipes* Solms.). *Fiji Agricultural Journal*, 25(3/4), 82–83.

Water hyacinth had been declared a noxious weed. A botanical description is given, and suggestions are made for its control.

Mune, T. L. and Parham, J. W. 1955. Johnson grass—*Sorghum halepense* (L.) Pers.: a declared noxious weed. *Fiji Agricultural Journal*, 26(1), 30–31.

A botanical description is given of Johnson grass and details are provided on its distribution in Fiji. Recommended control measures are presented.

Mune, T. L. and Parham, J. W. 1955. Prickly solanum—kausoni—*Solanum torvum* Swartz: a declared noxious weed. Fiji Agricultural Journal, 26(3), 86–87.

Mune, T. L. and Parham, J. W. 1956. Guava and its control in Fiji. Fiji Agricultural Journal, 27(3/4), 103–108.

A botanical description of guava is given, and its significance as a weed is discussed. Both physical and chemical control measures are presented.

Parham, J. W. 1956. Navua sedge. Fiji Agricultural Journal, 27(3/4), 94–95.

A botanic description of Navua sedge is presented, and details are given on its distribution in Fiji. A warning is given about the dangers of spreading seeds.

Parham, J. W., Mune, T. L. and O'Connor, B. A. 1956. Lantana and its control in Fiji. Fiji Agricultural Journal, 27(1/2), 28–32.

The significance of lantana is highlighted in terms of its status as the most widespread and troublesome weed in Fiji. A botanical description is provided of the weed. Several attempts at biological control are recounted, and prospects for success are described as moderately good. Direct control is assessed as expensive and needing good coverage.

Mune, T. L. and Parham, J. W. 1957. Ellington curse and its control in Fiji. Fiji Agricultural Journal, 28(1/2), 24–25.

A botanical description is given of Ellington curse, and its distribution and significance in Fiji are discussed. It is assessed as a vigorous and widespread plant. Chemical control measures are recommended.

Mune, T. L. and Parham, J. W. 1957. Muraina grass and its control in Fiji. Fiji Agricultural Journal, 28(3/4), 54–55.

The note contains a botanical description, distribution of the weed, and its assessment as a major weed of rice fields. Control is recommended through the prevention of seeding and other physical means such as ploughing and discing.

Mune, T. L. and Parham, J. W. 1957. Declared Noxious Weeds of Fiji and their Control. Bulletin No. 31, Fiji Department of Agriculture, Suva, 73 pp.

Notes are provided on 15 species with botanical description, distribution and illustrations, methods of control—cultural, chemical and biological. A separate appendix is provided on Navua sedge.

Mune, T. L. 1959. Navua sedge (*Cyperus melanospermus* (Nees) Valck. Suring.), a common pasture weed. Fiji Agricultural Journal, 29(1), 23–25.

This is yet another description of this common weed and its distribution in Fiji. Precautions are given to prevent its spread. While it is considered difficult to kill, some suggestions are given for its containment through chemical and physical control measures.

Parham, J. W. 1959. Weeds of Fiji. Bulletin No. 35, Fiji Department of Agriculture, Suva, 196 pp.

A list is provided on recorded weeds, along with a key. Each entry contains a description and its distribution. A glossary of terms is included.

Parham, J. W. 1959. A new weed recorded. Fiji Agricultural Journal, 29(1), 35.

A new weed, *Elephantopus spicatus*, had been discovered at Yalobi on Waya island in the Yasawa group that was closely related to tobacco weed but had not been recorded. A brief description is given.

Parham, J. W. 1959. Botany notes: Navua sedge, Batiki blue grass. Fiji Agricultural Journal, 29(4), 153.

Revised determinations are made for Navua sedge and Batiki blue grass to give their correct botanical names.

1960–1969

Mune, T. L. 1960. The chemical control of weeds in rice fields. Fiji Agricultural Journal, 30(1), 33–34.

The growth stages of rice are described, and details are provided on the types of weeds that infest the crop at each stage. Recommendations are given on when, what and how to spray.

Parham, J. W. 1960. The germination of Batiki blue grass seed. Fiji Agricultural Journal, 30(2), 71–77.

Results are reported for trials of germination of Batiki blue grass seed.

Mune, T. L. and Parham, J. W. 1967. Declared Noxious Weeds of Fiji and their Control. Bulletin No. 48, Fiji Department of Agriculture, Suva, 87 pp.

This is a revised version of Bulletin No. 31, originally published in 1957.

1970–1979

Patel, N. P. 1971. Rice weed control research in Fiji. Proceedings of the Asian Pacific Weed Science Society, No. 3, 10 pp.

The author reviews the efficacy of four chemicals—propanil, 2,4,5-T, 2,4-D and MCPA. The review is carried out in comparison with hand weeding, conventional ploughing and harrowing in control of various weed species and rice yield increases.

Department of Agriculture, Fiji 1973. Weed control in Fiji. Research Division, Fiji Department of Agriculture, Suva.

Partridge, I. J. 1973. Chemical control of guava. Fiji Agricultural Journal, 35(2), 101–102.

In trials at the Sigatoka Research Station in November 1970, guava (*Psidium guajava*), 2 m high in range pasture was sprayed with dicamba. The recommended treatment for guava control based on these results is dicamba at 1 lb/acre plus 2,4-D amine at 2 lb/acre plus a wetting agent.

Robinson, J. B. D. and Singh, J. M. 1973. Effects and economics of weed control in bananas. Fiji Agricultural Journal, 35(2), 85–88.

One dalapon spray application at 6.24 g/litre and 11 paraquat sprays at 3 g/litre to mixed weed growth in bananas were much more effective than hand-slashing in controlling all weeds except *Merremia peltata*. Weed control did not increase the plant and first ratoon crop yields over the unweeded treatment but advanced the time of cropping. Hence, yields were greater over a 30-month period with economic advantages.

Karan, B. 1975. Studies of Navua sedge (*Cyperus aromaticus*), Part I: Review of the problem and study of morphology, seed output and germination. Fiji Agricultural Journal, 37(2), 53–58.

A detailed study of this most noxious weed in Fiji covers morphology, seed output and germination. Details are given of estimates of 251 seeds per shoot and of the proportion likely to germinate.

Karan, B. 1976. Studies of Navua sedge (*Cyperus aromaticus*), Part II: control studies. Fiji Agricultural Journal, 38(2), 61–72.

In the past, no single chemical or cultural treatment controlled *C. aromaticus* satisfactorily. MSMA or MSMA + 2,4-D required repeated applications to give lasting control, as did paraquat. However, glyphosate and cyperquat, each at 2 to 4 kg/ha gave excellent control in recent trials.

Complete kill of both aerial and underground parts was achieved with both compounds. Cyperquat destroyed the weed selectively in pasture but, after spraying with glyphosate, the pastures needed to be resown. Even clumps and very heavy infestations of *C. aromaticus* were destroyed in this way. Mechanical clipping was ineffective.

Mandal, R. C. 1977. Effect of newer herbicides on weeds in dry and wetland rice in Fiji. Program and Abstracts of Papers, Weed Science Conference and Workshop in India, Paper No. 21, 13 pp.

Due to the high cost of manual labour in Fiji, the traditional method of mechanical weeding has been replaced by herbicides that have proved comparatively more efficient. In dryland drilled rice, pre-emergence application of butachlor at 3.6 kg/ha controlled all annual grasses, sedges and broad-leaved weeds throughout the crop period. In upland rice dominated by sensitive weed (*Mimosa pudica*), post-emergence application of propanil plus oxadiazon controlled all weeds. In the case of broadcast and transplanted wetland rice, thiobencarb granular was found to be very effective for the control of all common weeds except *Salvinia*, whereas C-288 (piperophos 40 per cent + dimethametryn 10 per cent) post-emergence controlled all weeds including *Salvinia*.

Lambert, M. H. 1979. Practical Training in Weed Control in the South Pacific. Proceedings of the 6th Asian-Pacific Weed Science Society Conference, Vol. 2. Jakarta, 1977, pp. 673–678.

Weed control is difficult in the Pacific Islands due essentially to climatic conditions, the wide variety of crops, lack of information and the difficulty of setting up suitably located demonstration fields where the results can be discussed with farmers, stock breeders and technicians. Fortunately, all agricultural colleges and practical agricultural schools in the Pacific area include weed science and weed control in their curricula. Agronomic research stations, often situated very close to the agricultural schools, carried out applied research and field trials in cooperation with lecturers and students. There is, however, a gap between agronomic researchers and agricultural extension workers who are working in close contact with farmers. The South Pacific Commission periodically organised practical training courses on weeds and weed control with the help of consultants and members of the Asian Pacific Weed Science Society. These courses are intended for agriculturalists, agricultural extension officers and farmers. The emphasis is on practical work in the field. The main objective is to familiarise participants with a number of generally accepted basic principles of weed control on small farms.

Lambert, M., Yau, R., Merrick, J. and Karan, B. 1979. Weed Control Trials on Taro (*Colocasia esculenta* L. Schott) in the South Pacific. Proceedings of the 6th Asian-Pacific Weed Science Society Conference Vol. 2. Jakarta, 1977, pp. 357–363.

In the Pacific Island territories, taro (*Colocasia esculenta*) is usually grown in rotation or intercropped with other crops. Often it is planted in areas cleared from bush in a bush fallow system. Generally, little use is made of fertilisers in traditional plantings but organic debris from bush fallow, mulch and green manure of weeds and debris are used to increase the nutrient supply to plants. Within the region, hand weeding following traditional methods is still the established practice, weeding on at least three occasions being common. Herbicides are in use or under investigation in several countries.

Partridge, I. 1979. The guava threat in Fiji. South Pacific Commission Quarterly Bulletin, 29(2), 28–30.

The wild guava (*Psidium guayava*) had become a major woody weed in Fiji, especially in pastures. It is described in this article, and measures of control are suggested and discussed. It is concluded that biological control would be the most satisfactory solution but there is little prospect of finding suitable pathogens or pests.

Sundaresan, A. and Reddy, N. 1979. *Salvinia molesta* (Mitchell)—a serious water weed in Fiji. Fiji Agricultural Journal, 41(2), 103–107.

S. molesta, an introduced weed species, was spreading rapidly along all waterways and rice fields in Fiji. Chemical and biological control methods have been taken but no one method is adequate. It is suggested that integrated control using manual, chemical and biological methods could be most effective.

1980–1989

Black, I. D. 1984. Chemical Weed Control in Fiji: A Handbook for Extension Workers and Farmers. Bulletin, Ministry of Primary Industries, Suva.

Crop losses from weed competition are outlined, and details are given of choices of methods for control and steps for correct application of herbicides. Recommendations are made for weed control in non-crop situations, weeds in crops, and weeds in sugarcane. Herbicide recommendations are also given for minimum tillage and no-tillage crop production. A certain amount of technical information is provided.

Black, I. D. 1984. Navua sedge in pastures in Fiji. *Australian Weeds*, 3(1), 16–19.

The paper discusses the status of Navua sedge (*Cyperus aromaticus*), the worst weed in Fiji, in terms of area covered and loss of productivity to the dairy industry. A paragraph is included on biological control. Identification, worldwide distribution, morphology and anatomy, reproduction and persistence of the species are described. Chemical and mechanical control methods, including mowing, rolling pasture or ploughing, are not effective in the long term. *Setaria splendida* is argued to be the most effective biological agent for long-term control.

Singh, R. S., Prasad, R. S. and Solly, R. K. 1982. The status of *Neochetina eichhorniae* Warner (*Coleoptera*: Curculionidae) as a biocontrol agent for water hyacinth, *Eichhornia crassipes* (mart) Solms (Fam: Pontederiaceae) in Fiji. In: Report of the Regional Workshop on Biological Control of Water Hyacinth, 3–5 May 1982, Bangalore. Commonwealth Science Council, London, pp. 35–38.

Neochetina eichhorniae Warner, introduced into Fiji for the biocontrol of water hyacinth, was not effective in causing dieback of the weed because of the low damage caused by the adults and larvae, although it became well established. Reasons for this are elaborated.

Black, I. D. 1983. Herbicide evaluation in water yams (*Dioscorea alata* Linn.). *Fiji Agricultural Journal*, 45(1), 1–6.

Some pre- and post-emergent herbicides were evaluated for weed control in staked water yam cv. *Vurai Balavu*. All herbicides treatments except glyphosate were well tolerated by the crop and effective weed control increased crop yields by an average of 36 per cent over two seasons. Diuron and paraquat gave the most reliable weed control, although other products, such as *Cyperus aromaticus*, may be used for problem weeds.

Swarbrick, J. T. 1988. Weeds of the Tropical South Pacific: A Report to the South Pacific Commission. South Pacific Commission, Noumea, 159 pp.

A literature review and survey of some of the major islands of the Southwest Pacific revealed the presence of 520 species of weeds. Eighteen species were deemed to have a significant impact on crop or pasture production in at least one of the countries surveyed. An outline is given of the ecology, biology, distribution and damage of these weeds.

Swarbrick, J. T. 1989. Major Weeds of the Tropical South Pacific. Proceedings of the 12th Asian Pacific Weed Science Society Conference No. 1, pp. 21–30.

This paper is a summary of the literature review and survey of some of the major islands of the Southwest Pacific reported in the preceding reference. The feasibility of different methods of control, including biological control, is assessed and the importance of strict quarantine legislation is stressed.

1990–present

Pillai, A. 1996. Weed control with glyphosate in pigeon pea. *Fiji Agricultural Journal*, 52(1), 43–44.

An experiment was undertaken on a ferruginous latosol soil at Legalega research station to assess the control of weeds using the herbicide, glyphosate. The experiment entailed single and split applications in ratoon crops of pigeon pea. Glyphosate effectively controlled two *Axonopus* species and burr grass (*Cenchrus echinatus*) without affecting the pigeon pea.

INSECT PESTS

1920–1929

Simmonds, H. W. 1928. Entomological records. *Fiji Agricultural Journal*, 1(1), 7.

The author identifies a fruit fly, *Dacus passiflorae*, the bugs, *Germalus pacificus* Kirk and *Coleostichus sordidus*, and several parasites and cotton pests.

Simmonds, H. W. 1928. Some experiments to ascertain the part played by flight in the dispersal of the banana borer *Cosmopolites sordidus* in Fiji. *Fiji Agricultural Journal*, 1(3), 23–7.

A thorough account is given of experiments on four plots to ascertain the part played by flight in the dispersal of the banana borer. The flight of the adult beetles is described. Results of the experiments show that contribution of flight to dispersal is negligible. Another finding was that it was difficult to obtain borer-free suckers by mechanical means.

1930–1939

Simmonds, H. W. 1931. Citrus fruit pests. Fiji Agricultural Journal, 4(2), 61–62.

The author discusses insect disease caused by fruit fly and the fruit-piercing moth. Control was acknowledged to be difficult.

Simmonds, H. W. 1932. A list of insects introduced into Fiji. Fiji Agricultural Journal, 5(1), 5–9.

A list of 45 species of insects is provided of which 18 are known to have established themselves. A table gives details of the insect name, its origin, the country or area of which it is a native, who introduced it, to control what, and whether it is known to have become established. Some specific observations are also recorded.

Simmonds, H. W. 1932. Report on banana borer (*Cosmopolites sordidus*)(investigations, April, 1931. Fiji Agricultural Journal, 5(1), 10–17.

The paper begins with a summary of work undertaken to date on the banana borer. It describes experimental conditions and objectives, and records the number of beetles trapped. Flight is viewed as an important factor in the spread of the borer. Details are given of causes of migration, sex ratio of trapped beetles and the economic value of control.

Paine, R. W. 1934. Observations on rat damage to coconuts on Taveuni. Fiji Agricultural Journal, 7(1), 26–34.

The author observes that the extent of rat damage varied considerably between localities. He analyses rat damage on coconut estates and provides details of the principal ways by which damage is caused. They include: chewing through the inner spathe before it bursts; damage to the fleshy axillary parts of the lateral flowers' branches after the spathe has burst; damage to the female lower buds after the spathe bursts; damage to young fruits; and damage to copra after harvesting. Estimates are made of the damage in each way.

Paine, R. W. 1934. Shot-hole borer in coconuts. Fiji Agricultural Journal, 7(1), 39–41.

Damage on estates had not been previously observed before found on a particular plantation. There was no serious damage but it was thought possible it might occur to avocado trees in the future.

Jack, H. W. 1935. Summary record on entomological work in Fiji. Fiji Agricultural Journal, 8(1), 18–22.

Entomological work since 1905 is detailed, emphasising the major research problems of scale, coconut leaf moth, 'the curse' and the leaf-mining beetle in coconuts.

Simmonds, H. W. 1935. Fruit fly in Fiji. Fiji Agricultural Journal, 8(1), 22–23.

The two most common species of fruit fly are identified as *Chaetodacus passiflorae* Frogg and *Chaetodacus xanthodes*. Their preferences are described. Details are given of the introduction of a parasite for biological control.

Jack, H. W. 1936. The giant toad. Fiji Agricultural Journal, 8(2), 4.

Comments are made on the reports being received about the beneficial actions by the toads as a predator of slugs, beetles and millipedes.

Simmonds, H. W. 1936. Fruit Fly Investigations 1935. Bulletin No. 19, Fiji Department of Agriculture, Suva, 18 pp.

Simmonds, H. W. 1936. Entomological notes. Fiji Agricultural Journal, 8(2), 43.

The notes cover reports from Taveuni on fruit fly parasites, 'the curse' and slugs.

Lever, R. J. A. W. 1937. Hints on collecting and forwarding of insects. Fiji Agricultural Journal, 8(4), 35.

Advice is provided to settlers living away from Suva on sending specimens of insects that damage crops to the Department of Agriculture.

Simmonds, H. W. 1937. Fruit fly. Fiji Agricultural Journal, 8(3), 23.

This is a brief note on progress made in controlling fruit fly. An initially promising parasite had achieved disappointing results.

Lever, R. J. A. W. 1938. The shot-hole beetle borer of avocado pear trees. Fiji Agricultural Journal, 9(1), 20–21.

The shot-hole beetle borer was found in Waitavala in 1938. It is described, and suggestions are made for its control.

Lever, R. J. A. W. 1938. Some insect pests of the Tahitian chestnut. Fiji Agricultural Journal, 9(1), 22–23.

Caterpillars were found in the Tahitian chestnut in late 1938 and early 1939. They are described, and three other parasites are mentioned. A repellent is suggested as a control measure.

Lever, R. J. A. W. 1938. Three moths from coconut flowers. Fiji Agricultural Journal, 9(1), 23.

Tinaeid A, B and C are described.

Lever, R. J. A. W. 1938. Entomological notes. Fiji Agricultural Journal, 9(2), 14–18.

There are reports on two palm beetles from Eastern Samoa, two parasites for controlling fruit fly and timber-boring beetles observed in Fiji, and the export of thrips to Solomon Islands to control *Clidemia hirta*.

Lever, R. J. A. W. 1938. Entomological notes. Fiji Agricultural Journal, 9(3), 19–24.

There are reports on fruit flies and their biological and chemical control, identification of parasites of the ivi nut moth, *Cryptophlebia*, army worms and cut worms and their chemical control, a caterpillar, *Ephestia cautella* Walk., that attacks stored copra, a caterpillar that damages *Pandanus* leaves, and a coconut leaf moth.

Lever, R. J. A. W. 1938. Entomological notes. Fiji Agricultural Journal, 9(4), 12–19.

Notes are provided, among others, on a Javan parasite of the coconut leaf insect, local fruit flies and their parasites, and a useful insecticide powder.

Simmonds, H. W. 1938. Coconut Pests and Diseases. Bulletin No. 20, Fiji Department of Agriculture, Suva.

This publication is a revised version, with additional material, of Bulletin No. 16 of the Fiji Department of Agriculture which was published in 1925. Over 50 major insect pests in the South Pacific region are described, with details of their place of origin and natural enemies. Details are given of control measures.

Lever, R. J. A. W. 1939. Vegetable garden pests and their control. Fiji Agricultural Journal, 10(1), 11–17.

Emphasis is placed on the cut worm and ten other caterpillars, beetles, sucking bugs, fruit flies, ants, mites, land crabs, slugs, millipedes and worms.

Lever, R. J. A. W. 1939. Entomological notes. Fiji Agricultural Journal, 10(1), 17–20.

Notes are provided on the avocado beetle borer and mealy bug, termites, pleurotropis parasite in Tonga and Western Samoa, the diet of the giant toad, and a tiger beetle for the control of the rhinoceros beetle.

Lever, R. J. A. W. 1939. Entomological notes. Fiji Agricultural Journal, 10(2), 35–39.

Notes are provided, among others, on guava leaf-rolling caterpillars, the cabbage butterfly in New Zealand, identification of local parasites of the coconut leaf moth, and the giant toad.

Lever, R. J. A. W. 1939. Entomological notes. Fiji Agricultural Journal, 10(4), 125–126.

There are notes on an observation of a sandfly attacking a caterpillar near Suva, the lantana bug and the copra mite.

1940–1949

Lever, R. J. A. W. 1940. Entomological notes. Fiji Agricultural Journal, 11(1), 16–19.

Notes are made on the Jassid leaf hopper on cotton, corn-ear worms of maize, and overseas insects that were intercepted at Suva in 1939.

Lever, R. J. A. W. 1940. Entomological notes. Fiji Agricultural Journal, 11(2), 38–42.

Notes are provided on wood-boring beetles, the maize leaf miner, the green vegetable bug, new and introduced insects of economic importance, and insects of taro—notably, the hawkmoth, cutworm, cotton aphid, brownish-blade plant bug and small leaf hopper. At that time, it was recognised that it was important to keep out the *Dynastid* beetle *Papuana* spp. because of its potential to destroy taro crops.

Lever, R. J. A. W. 1940. Entomological notes. Fiji Agricultural Journal, 11(3), 81–83.

Further notes are provided on the green vegetable bug and details are provided on the air transport of insect pests.

Lever, R. J. A. W. 1940. Insect pests of citrus, pineapple, tobacco. Fiji Agricultural Journal, 11(4), 99–101.

Citrus pests had been well researched. A description is given of two fruit flies, *Chaetodacus (Strumeta) passiflorae* Frogg. and *Notodacus xanthodes* Broun, as the worst pests of citrus. Other major pests are also described. Certain important pests that had been either not recorded or unidentified are listed, especially the black aphid, *Alphis citricidus* Kirk. Local pests of pineapple are less comprehensively dealt with, but some are listed. The chief damage to tobacco comes from the cut worm, *Heliothis armigera* (Hbn.), and *Agrotis ypsilon* Rott. The stem borer no longer appeared to be a major pest, and few beetle pests had been reported.

Lever, R. J. A. W. 1941. Entomological notes. Fiji Agricultural Journal, 12(2), 45–50.

The notes contain material on egg parasites of the green vegetable bug, a beetle pest of pulses; introduced beneficial insects, and caterpillars that are pests of rice, sorghum and sugar.

Lever, R. J. A. W. 1941. Entomological notes. Fiji Agricultural Journal, 12(1), 19–22.

Notes are presented on (1) the spotted ladybird of potato, (2) gall insects of the kavika tree (*Eugenia*), (3) identifications of insects, (4) fig and cocoa moths in Melanesia and Polynesia, and (5) a leaf mining beetle, *Promecotheca*.

Lever, R. J. A. W. 1941. Entomological notes. Fiji Agricultural Journal, 12(3), 77–79.

This paper contains notes on (1) identification of a rare fruit fly, (2) a leaf rolling caterpillar of tea, (3) a caspid bug of brinjal, and (4) shot-hole beetle borers.

Lever, R. J. A. W. 1941. Entomological notes. Fiji Agricultural Journal, 12(4), 117–120.

Notes are presented on (1) *Othreis*, a fruit-piercing moth, (2) insects in relation to the Pacific air services, and (3) the small coconut weevil, *Diocalandra*, in Oceania.

Lever, R. J. A. W. 1942. Division of Entomology Annual Report for 1941. Fiji Agricultural Journal, 13(1), 23–24.

The report covers the green vegetable bug, quarantine, beneficial insects, miscellaneous pests, coconut insects and general issues.

Lever, R. J. A. W. 1942. Entomological notes. Fiji Agricultural Journal, 13(1), 25.

Contains notes on the tamarind beetle in the dry zone and the green vegetable bug and its parasite.

Lever, R. J. A. W. 1942. Entomological notes. Fiji Agricultural Journal, 13(2), 48–49.

Notes are presented on the pumpkin beetle, new host records of a termite and the rice leafhopper.

Lever, R. J. A. W. 1942. Entomological notes. Fiji Agricultural Journal, 13(3), 81–82.

Contains notes on spread of the green vegetable bug, *Nezara*, and beetle borers in stored derris.

Lever, R. J. A. W. 1942. Pests of the vegetable garden and their control. Fiji Agricultural Journal, 13(4), 109–115.

Sections are allocated to cut worms, other caterpillars, beetles, sucking bugs, flies, ants, mites, land crabs, slugs and worms. Some general notes are added on control recommendations and guidelines are given on collecting and packing insect specimens.

Lever, R. J. A. W. 1943. The cut worm *Prodenia litura* Fabr. Fiji Agricultural Journal, 14(1), 11–13.

A description is given of the cut worm in Fiji, along with its life history and distribution. Early and recent records are used to describe its effects on plants in Fiji and methods for biological control.

Lever, R. J. A. W. 1943. Entomological notes. Fiji Agricultural Journal, 14(1), 14–18.

Contains notes on shot-hole beetle borers of seeds and roots, the cabbage white butterfly, recovery of the fruit fly parasite, *Mellitobia indicum*, *Ceromasia* fly of the cane beetle borer, insect pests of spices, flowers and fruits, additional records of insect pests and control of vegetable garden insect pests.

Lever, R. J. A. W. 1943. Entomological notes. Fiji Agricultural Journal, 14(2), 40–44.

Notes are provided on *Diocalandra* and related weevils in Polynesia and scale insects from Fiji intercepted in USA and Hawaii.

Lever, R. J. A. W. 1943. Entomological notes. Fiji Agricultural Journal, 14(3), 79–82.

Contains notes on spread of the cabbage white butterfly, the diamond back moth of cabbage and turnip, and beetle borers of twigs, roots, seeds and corms.

Lever, R. J. A. W. 1943. Entomological services in Fiji. Fiji Agricultural Journal, 14(4), 92–97.

The entomological services in Fiji commenced in 1906. A history is given of activities undertaken from that date until the time of writing.

Lever, R. J. A. W. 1943. Entomological notes. Fiji Agricultural Journal, 14(4), 101–103.

Contains notes on common mosquitoes, insects from cave deposits and supplies of *Chaulmoogra* seeds for planting to extract oil from fruit.

Lever, R. J. A. W. 1944. Entomological notes. Fiji Agricultural Journal, 15(1), 14–19.

Among other items, the notes deal with injuries to lettuce by thrips, records of a new host for fruit flies, new species of *Brontispa* beetles in Solomon Islands and the coconut stick insect.

Lever, R. J. A. W. 1944. Entomological notes. Fiji Agricultural Journal, 15(2), 45–50.

Discussion centres on fruit flies and their parasites, cut worms and their parasites, and banana beetles.

Lever, R. J. A. W. 1944. Entomological notes. Fiji Agricultural Journal, 15(3), 76–80.

The green vegetable bug, its food plants and egg parasite are discussed and a recent revision is reported of scientific names of some local insects and plants.

Lever, R. J. A. W. 1945. Entomological notes. Fiji Agricultural Journal, 16(1), 8–11.

The author reviews food preferences of some beetles for stored products, the larger cabbage moth, *Crociodolomia binotalis* Zell., fruit fly parasites and host plants, and the predaceous plant bug, *Cyrtorhinus*, in Fiji.

Lever, R. J. A. W. 1945. An annotated checklist of the mealy bugs and scale insects of Fiji. Fiji Agricultural Journal, 16(2), 41–43.

This checklist of mealy bugs and scale insects covers 3 *Coccids*, 10 *Dactylopiinae*, 10 *Coccinas* and 28 *Diaspinae*.

Lever, R. J. A. W. 1945. Entomological notes. Fiji Agricultural Journal, 16(4), 98–102.

Contains notes on (1) the pineapple beetle borer and its original food plant, (2) ants decomposing bat guano from caves, (3) further notes on the *Aedes*, or tiger mosquitoes, (4) the human and dog fleas in the Pacific, and 5) the Indian rose beetle, *Adoretus versutus* Har.

Lever, R. J. A. W. 1946. Entomological notes. Fiji Agricultural Journal, 17(1), 9–13.

Contains notes on (1) some mites from Fiji, (2) 666 versus DDT, (3) an introduced beetle borer from Australia, (4) a new type of damage by the coconut spathe borer, *Acritocera neglegens*, (5) the rice leaf roller, *Marsmia venialis*, (6) additions and corrections to insect pest records, (7) new insect pest records from Tonga and Samoa, and (8) further experiments with DDT.

Lever, R. J. A. W. 1946. The aphids or green flies of Fiji. Fiji Agricultural Journal, 17(3), 81.

Twelve aphids or green flies known to be present in Fiji are listed. Details are also provided on the economic plants that they attack.

O'Connor, B. A. 1949. The banana scab moth, *Nacoleia octasema* Meyr., and its control. Fiji Agricultural Journal, 20(2), 84–86.

Details are presented on the life history of the banana scab moth and its habits. Control measures are suggested.

O'Connor, B. A. 1949. Scale insects of Fiji. Fiji Agricultural Journal, 20(2), 88.

A list is presented of scale insects reported in Fiji.

1950–1959

Simmonds, H. W. 1951. Premature nutfall on Taveuni. Fiji Agricultural Journal, 21(1), 22–24.

The symptoms and insect causes of premature nutfall in coconut plantations on Taveuni are described. Notes are also included on bud rot and the effects of weeds. Remedies for premature nutfall are considered to be too difficult to implement.

O'Connor, B. A. 1952. The rice leaf hopper, *Sogata furcifera* Kolophon, Kircaldy and 'rice yellows'. Fiji Agricultural Journal, 23(3/4), 77–78.

This is a report on investigations through experiments into 'rice yellows' over three seasons. Information is recorded but it is admitted that there may be gaps in knowledge. The report also contains a description of rice-growing methods and natural control of insect pests.

Singh, S. R. 1952. Notes on the life history of the coconut leaf moth, *Agonoxena argaula* Meyr. Fiji Agricultural Journal, 23(3/4), 106–107.

A description is provided of the moth, its eggs, and its larval, pre-pupal and pupal stages.

Simmonds, H. W. 1953. *Oryctes rhinoceros*. Fiji Agricultural Journal, 24(3/4), 89–91.

The rhinoceros beetle (*Oryctes rhinoceros*) had been observed in coconut plantations in Fiji prior to 1953, and was fairly well established by that year. But it was felt that certain factors would tend to inhibit its increase or check its spread. These factors are outlined. In order to combat the pest, a committee was formed under the chairmanship of the Director of Agriculture. Its terms of reference are presented and descriptions are given of predatory agencies and suitable breeding places.

O'Connor, B. A., Pillai, J. S. and Singh, S. R. 1954. Notes on the coconut stick insect, *Graeffea croani* le Guillou. Fiji Agricultural Journal, 25(3/4), 89–92.

Periodic severe injury had been caused to coconut palms by the coconut stick insect in Fiji. However, the extent of damage had tended not to be too great. Descriptions are given of the insect and the way in which it damages palms. Two methods of chemical control had been used in field experiments, but they produced disappointing results. Recent advances are reported in biological control measures that were thought at the time to offer promise.

Parham, B. E. V. 1954. Birds as pests in Fiji. Fiji Agricultural Journal, 25(1), 9–14.

The author lists the birds that had been reported as pests of crops in Fiji, with common and scientific names provided along with the distribution of the birds. There is a special section on the European starling. Assessments are made of the damage these birds cause to crops such as bananas, plantains and root crops. Control measures are suggested.

South Pacific Commission 1954. Rhinoceros beetle outbreak in Fiji: eradication campaign under way. South Pacific Commission Quarterly Bulletin, 3(2), 14–15.

Brief details are presented on the early days of the campaign to eradicate the rhinoceros beetle.

O'Connor, B. A. 1957. Entomological notes. Fiji Agricultural Journal, 28(3/4), 79–82.

Notes are presented on the small coconut leaf moth, parasites of caterpillar pests, biological control of lantana, and biological control of the banana scab moth.

O'Connor, B. A. 1959. Insect pests of cocoa. Fiji Agricultural Journal, 29(2/3), 92–95.

The main insect pests of cocoa are listed and described. The paper covers pests found both on the trees and in stored beans.

1960–1969

Singh, S. R. 1960. The Hawaiian beet web worm (*Hymenia recurvalis* F.), a serious pest of Indian spinach (*Amaranthus viridis* Linn.). Fiji Agricultural Journal, 30(1), 35–38.

This is a rare paper in dealing with research into leafy green vegetables. The Hawaiian beet web worm is a serious pest of this introduced spinach in Fiji. Details are provided of the geographic distribution, host range and life history of the pest. The nature of the injury it causes to the spinach is described. Brief notes are provided on its natural enemies and means of chemical control.

Honckley, A. D. 1963. Trophic Records of some Insects, Mites and Ticks in Fiji. Bulletin No. 45, Fiji Department of Agriculture, Suva, 116 pp.

1970–1979

Singh, S. R. 1973. Common Agricultural Pests of Fiji and their Control. Bulletin, Fiji Department of Agriculture, Suva.

An outline is given of pest control measures. Pests are discussed for two cereal crops, five fruit crops, two pasture crops, six root crops, three tree crops, nine vegetables, including two leafy green vegetables, tobacco and voivoi.

Stapley, J. H. 1973. Insect pests of coconuts in the Pacific region. Outlook-on-Agriculture, 7(5), 211–217.

The insect pests of coconut in the Pacific region and attempts at their control are reviewed. Control of *Oryctes rhinoceros* had been achieved by the use of a chemical attractant, ethyl chrysanthemumate, and infection by the virus, *Rhabdionvirus oryctes*. Premature nutfall caused by *Amblypelta cocophaga* had been reduced by replacing the ground-nesting ant, *Pheidole megacephala*, with the tree-nesting ant, *Oecophylla smaragdina*. Soursop trees are argued to be good sources to establish *O. smaragdina* in plantations where they are scarce. The biological control of the coconut leaf beetle, *Brontispa longissima*, by the parasite, *Tetrastichus brontispae*, is recommended except on young palms where it can be controlled chemically.

Bedford, G. O. 1976. Rhinoceros beetle. Paper presented to Coconut Industry Workshop in Fiji 1972. Cocomunity, APCC-QS-16, pp. 13–17.

Oryctes rhinoceros was found to damage up to 70–90 per cent of coconut palms on some islands in Micronesia. Destruction of breeding sites, such as decaying palm stems and compost heaps, gave some control and biological control with parasites and predators had been successful. A virus that kills grubs in 7–22 days was discovered in 1963 and was successfully released by spreading virus-inoculated sawdust and placing split pieces of coconut stem on it. The beetles crawled under the stem, became infected and spread the disease to other areas. Virus-infected grubs could be added to the sawdust to keep the inoculum level high. Traps using the attractant, ethyl chrysanthumate, are also described.

Singh, S. R. 1976. Other insect pests of coconuts. Paper presented to the Coconut Industry Workshop in Fiji 1972. Cocomunity, APCC-QS-16, pp. 18–24.

The Levuana moth (*Levuana iridescens*) was reduced in coconut palms in Fiji through control with *Bessa remota*. The coconut leaf miner (*Prometheca reichei*) had been a serious pest in the Lua Islands but was now controlled by *Pediobius parvulus*, introduced from Java in 1953. The coconut scale insect (*Aspidiotus destructor*) was a severe pest in Fiji but was controlled by the ladybird (*Cryptognatha nodiceps*), introduced from Trinidad in 1928. The coconut spike moth (*Coleoneura trichogramma*) caused only minor damage and was probably controlled by parasites introduced from Java in 1931 and 1934. The coconut spathe borer (*Acritocera negligens*) and the coconut leaf moth (*Agonoxena arguala*) were of only minor importance. Details are presented on parasites and predators of the stick insect (*Graeffea crouani*), and control by stem injection of Bidrin (diclrotophos) and Azodrin (monocrotophos) at 5 ml a.i./palm.

Greenwood, W. 1977. The food plants or hosts of some Fijian insects: V. Proceedings of the Linnean Society, 101(4), 237–241.

This paper in a series on Fijian insects contains a list, arranged under families in insect orders, of numerous records of insect species and their food plants, many of which are of economic importance. In the case of parasitic *Hymenoptera* and *Diptera*, the hosts, including insect pests, are named.

Stride, G. 1977. Coconut palm rhinoceros beetle. Advisory Leaflet No. 4, South Pacific Commission, Noumea, 4 pp.

Information is presented on the distribution in the South Pacific region of *Oryctes rhinoceros* (L.), the damage it causes to coconut, and its biology and control. A simple method for the assessment of the degree of damage is suggested. Measures to prevent the introduction of the beetle into hitherto uninfested areas are briefly discussed.

Drew, R. A. I. 1978. Taxonomy. In: Drew, R. A. I., Hooper, G. H. and Bateman, M. A. ed. Economic Fruit Flies of the Southern Pacific Region. Watson, Ferguson, Brisbane, pp. 1–94.

Stout, O. O. 1978. Plant Quarantine Treatment Manual for Island Countries of the South Pacific. South Pacific Bureau for Economic Cooperation, Suva.

Anon. 1979. New records, Fiji—coffee. Quarterly Newsletter, FAO Plant Protection Committee for the South East Asia and Pacific Region, 22(2–3), 4.

Hypothenemus hampei was observed boring into coffee beans and stems of arabica coffee plants on Viti Levu and Taveuni, Fiji. Also, *H. pulverulentus* and *Xylosandrus compactus* were found on coffee in Taveuni.

Ministry of Agriculture and Fisheries, Fiji 1979. Annual Report for the Year 1977. Parliamentary Paper No. 1 of 1979, Suva.

Entomological notes reported include: control of *Nilaparvata lugens* and *Susumia exigua* on rice using acephate; the release of *Neochetina eichhorniae* for the biological control of water hyacinth; use of *Paulina acuminata* and *Samea multiplicalis* against *Salvinia* weeds; studies of baculovirus on rhinoceros beetle; biology of *Graeffea crouanii* on coconut; and studies on fruit-piercing moth damage on tree crops.

Stride, G. 1979. Summary of Agricultural Pests and Diseases in the South Pacific, Suva.

1980–1989

Department of Agriculture, Fiji, 1980. Annual Research Report 1974 and 1975, Suva, 141 pp.

Entomological notes are found on pages 53–57 for 1974 and pages 123–128 for 1975. They include: chemical control of *Ophiomyia phaseoli* on soya bean; *Maruca testulalis* on pigeon pea, and *Nilaparvata lugens* and *Susumia exigua* on rice. There are also notes on: the biological control of

rhinoceros beetle and *Graeffea crouanii* on coconut; the biological control of *Lantana camara* and the *Salvinia molesta*; and incidence and control of arthropod pests on soybean, rice and sorghum.

Firman, I. D. 1982. Plant Protection News. South Pacific Commission Information Circular No. 90, Suva, 8 pp.

There are reports on: damage to sorghum in New Caledonia by *Contarinia sorghicola*; the discovery of the polyphagous pest, *Alerodiscus dispersus*, in American Samoa and Guam; the re-establishment of the melon pest, *Dacus cucurbitae*, on Rota in the Marianas; confirmation of reports of *Aonidiella aurantii* on citrus and another plant in Fiji; the discovery of *Procytiphora mangiferae* (*Dasineura mangiferae*) on mango; and the continuing problem of *Sternochetus mangiferae* on mango in Guam.

Kumar, K. 1983. Rearing greasy cutworm *Agrotis ipsilon* (Hufnagel) in the laboratory. Fiji Agricultural Journal, 45(1), 43–44.

Methods are described for rearing the greasy cutworm in the laboratory in Fiji, continuously for one year, using leaves of Chinese cabbage supplemented with sliced carrot to prevent cannibalism. The method was providing 1000 larvae per week.

Mitchell, W. C. and Maddison, P. A. 1983. Pests of taro. In: Wang, J. K. ed., Taro. University of Hawaii Press, Honolulu, pp. 180–235.

A detailed coverage is given of pests that damage taro leaves, those that damage the petioles of taro and those that damage the corms and roots of taro, with table listings. Details are given of other studies in the Pacific islands. Means of biocontrol and chemical control are discussed.

Gutierrez, J. and Schicha, E. 1984. Phytoseidae and Tetranychoida in Fiji and other South Pacific islands (Acari). International Journal of Entomology, 26(4), 386–388.

Twelve species of Tetranychoida and seven of Phytoseidae were found in Fiji, Wallace and Futuna, Cook Islands and French Polynesia during trips from 1976 to 1981. A checklist of economic crops is given—including coconut, taro, cassava, passionfruit, aubergine, breadfruit and papaya—with the mites identified, their locality and collection dates.

Singh, S. R. 1984. Fiji taro beetle. Quarterly Newsletter, FAO Asia and Pacific Plant Protection Commission, 27(1–3), 6.

The author reports that the taro beetle (*Papuana huebneri*) was detected for the first time in Fiji on 28 June 1984 in Veisari, near Suva. Measures were being taken to eradicate the pest.

Ministry of Primary Industries, Fiji 1985. Taro Beetle. Parliamentary Paper No. 62, 84 pp.

An eradication program for the taro beetle was launched in September 1984 and all known and suspect host plants were uprooted and treated with diazinon or lindane. Over 18 000 beetles were collected and destroyed. In view of the heavy infestation and the discovery of a fern as a preferred food plant, the eradication program was abandoned.

Macfarlane, B. 1987. What's in a name? Fiji taro beetle re-identified. Information Circular, South Pacific Commission, No. 104, Suva, p. 1.

The taro beetle in Fiji was reported to be *Papuana uninodis* and not *P. huebneri* as originally identified. This new information means that the source of the original introduction into Fiji was probably not from Kiribati as *P. uninodis* does not occur there. It is thought that the beetle was introduced into Fiji in taro corms from Papua New Guinea or Solomon Islands.

Autar, M. L. and Singh, J. M. 1988. Biology of the taro beetle (*Papuana uninodis* Prell) infesting taro (*Colocasia esculenta*) in Fiji. Fiji Agricultural Journal, 50(1), 15–21.

The taro beetle is described and details are given of its life history. It was observed for a period of two years under laboratory conditions; a description is given of the observation method. Estimates are provided of the three larval instars based on head capsule size. The study revealed that the life cycle of the beetle is completed within 22 to 25 weeks.

Bateman, M. A. 1988. A Report on the Tropical Fruit Flies of the South Pacific Region. UNDP/SPC Project for Crop Protection in the South Pacific. RAS/86/037. Suva, 33 pp.

Williams, D. J. and Watson, G. W. 1988. The Scale Insects of the Tropical South Pacific Region: Part 1 The Armoured Scales (Diaspididae). CAB International Institute of Entomology, Wallingford, 289 pp.

Williams, D. J. and Watson, G. W. 1988. The Scale Insects of the Tropical South Pacific Region: Part 2 The Mealy Bugs (Psuedococcidae). CAB International Institute of Entomology, Wallingford, 262 pp.

Drew, R. A. I. 1989. The tropical fruit flies (Diptera; Tephritidae; Dacinae) of the Australian and Oceania regions. *Memoirs of the Queensland Museum*, 26:1–521.

1990–present

Williams, D. J. and Watson, G. W. 1990. The scale insects of the tropical South Pacific region: Part 3 The soft scales (Coccidae) and other families. CAB International Institute of Entomology, Wallingford, 267 pp.

Paine, R. W. 1994. *Recollections of a Pacific entomologist 1925–1966*. ACIAR Monograph No. 27, Australian Centre for International Agricultural Research, Canberra, 120 pp.

An insight is provided into the historic setting in which the entomological work by R. W. Paine took place, together with biological information. One of his many successes was the classical eradication of the *Leuvana* moth attacking the coconut palm.

Kumar, J. Kaitetara, T. and Kashyap, D. M. 1996. Kumala: pests and diseases. In: 1995 Annual Research Report. Department of Agriculture, Suva, pp. 37–38.

This section of the annual research report comprises a brief description of the sweet potato and the major pests and diseases currently afflicting the crop.

Tamanikaiyaroi, R. 1997. Cane weevil borer (*Rhabdoscelus obscurus* Boisd.) damage on Mana in western Viti Levu. *Journal of South Pacific Agriculture*, 4(1/2), 49–54.

The author carried out an extensive survey of damage by the cane weevil borer on Mana in western Viti Levu. Results show the following average percentage damage: stalks, 6.5 per cent; stalk length, 1.1 per cent; stalk weight, 1.0 per cent; and stalk internodes, 1.5 per cent. Damage was found on 58.6 per cent of farms surveyed. A selection of resistant varieties was recommended.

PLANT DISEASES

1930–1939

Parham, B. E. V. 1934. Tomato wilt observations—Part 2 Notes on wilts of tomato. *Fiji Agricultural Journal*, 7:23–25.

The existence of bacterial wilt was confirmed with details of symptoms and general appearance. A motile bacteria was identified as the cause. The author concluded that control possibilities are slight, because the pathogen is capable of living in a virulent state in the soil, but he suggested ways to help: sterilisation and disinfection of the seed bed; crop rotation; use of resistant varieties; and plant sanitation.

Parham, B. E. V. 1934. Report on banana disease investigations, 1933. *Fiji Agricultural Journal*, 7(1), 42–48.

This report on the status of banana diseases in Fiji focuses in particular on banana 'leaf-spot' disease. Many views prevailed at the time about its causes, and research work in the Department of Agriculture concentrated on field experiments at Navuso Experimental Station for direct control of leaf-splitting organisms and indirect control of the disease. Results were incomplete at the time of writing. The incidence and impact of the disease are described in this paper, and brief details were given of the relation of the weevil borer to leaf-spot. Factors contributing to incidence include soil deficiency, location, cultivation methods, drainage, and packing station conditions and procedures. Results of field experiments to date were detailed along with some preliminary laboratory and special investigations. Recommendations were made on the elimination of sources of infection, selection of planting material, search for and propagation of more resistant varieties and strains, and crop rotation and elimination of ratoons.

Simmonds, H. W. and Parham, B. E. V. 1934. Tomato wilt observations—Part 1. *Fiji Agricultural Journal*, 7:21–23.

The impact of wilt is described. It had proven very virulent although some signs were noted of natural resistance. Three series of observations were made. Control had been achieved to some extent by increasing the acidity of the soil.

Parham, B. E. V. 1935. Wilt disease of 'yangona'. Fiji Agricultural Journal, 8(1), 2–8.

The author expresses concern at the losses to wilt disease over the past two to three years as more farmers grow kava as a cash crop that yields good returns within four to five years. He describes the plant and its varieties, suitable growing conditions, methods of cultivation, and the economics of production and marketing. He also mentions that the crop was traditionally grown exclusively for ceremonial purposes in small plots or around houses. Surveys were undertaken and a report is presented on the number of holdings and areas planted in surveyed areas. Proportions of killed or damaged plants are specified, and observations are made on the nature of the disease, its cause and control measures.

Simmonds, H. W. 1935. Tomato wilt. Fiji Agricultural Journal, 8(1), 31.

A very brief note is given on a simple treatment for tomato wilt.

Parham, B. E. V. 1936. Banana disease Investigations. In: Annual Report for 1935. Fiji Department of Agriculture, Suva, pp. 28–31.

Parham, B. E. V. 1937. Citrus diseases in Fiji. Fiji Agricultural Journal, 8(4), 22–24.

Details are provided of citrus exports in 1937. It is observed that Fiji had been fortunate in the lack of diseases in citrus. Five major disease problems are outlined: mottle leaf; collar rot or foot rot; bark-crack; sooty mould; and citrus scab.

Lever, R. J. A. W. 1938. Thread blight of coconut. Fiji Agricultural Journal, 9(2), 26.

The purpose of this note is to show that thread blight in coconut is much more widespread in the Pacific than hitherto assumed.

Jack, H. W. 1939. Non-fruiting of apparently healthy trees. Fiji Agricultural Journal, 10(2), 41–42.

The author speculates that an excess of nitrogen might be causing the non-fruiting of certain apparently healthy trees and palms. He mentions three well-known remedies.

1940–1949

Parham, B. E. V. 1947. Economic botany notes 3: diseases of taro. *Fiji Agricultural Journal*, 18(3), 80.

The diseases of taro prevalent in Fiji are described and possible control measures are discussed.

1950–1959

Harvey, C. 1951. Canker disease of citrus. *Fiji Agricultural Journal*, 22(1), 30–31.

Canker disease of citrus was regarded very seriously in many countries, and had been discovered in Fiji. The symptoms on leaves, fruit, twigs and branches are described. Some rough tests and prevention measures are suggested.

Morwood, R. B. 1954. Citrus canker. *Fiji Agricultural Journal*, 25(1), 15–16.

Oranges, grapefruit and other citrus trees in Fiji had been affected by citrus canker. Distribution of the disease is outlined. Symptoms are presented together with details on varietal susceptibility. Some control measures are suggested.

Morwood, R. B. 1956. Notes on plant diseases listed for Fiji. *Fiji Agricultural Journal*, 27(3/4), 83–86.

These notes were prepared as a supplement to a publication on plant diseases in Fiji. They cover diseases in bananas, beans, breadfruit, cabbage, cocoa, carrots, cassava, citrus, coconuts, coffee, cotton, cowpea, cucurbits, eggplant, gerbera, grenadilla, lettuce, maize, mango, papaya, peanuts, pineapples, potatoes, rice, rubber, sugar, sweet potato, taro, tea, tobacco, tomatoes and yams.

Harwood, L. W. 1959. Diseases of cocoa. *Fiji Agricultural Journal*, 29(2/3), 96–98.

The author focuses on four main diseases of cocoa: black pod; pod rot; root diseases; and pink disease. He also lists some other dangerous diseases that had not yet been recorded in Fiji.

1960–1969

Leach, R. 1964. A new form of banana leaf spot in Fiji: black leaf streak. *World Crops*, 16(4), 60–64.

Banana leaf streak was first described in Fiji in 1913 and was subsequently known throughout the world as Sigatoka disease. The symptoms are described along with the fungus that causes the disease. This fungus is morphologically similar in many respects to *Mycosphaerella musicola* which causes Sigatoka disease but differs in the spores produced. Three types of control are discussed: spraying, removal of trash and the introduction of disease-resistant banana varieties.

Rhodes, P. L. 1964. A new banana disease in Fiji. *Commonwealth Phytopathological News*, 10:38–41.

Morwood, R. B. 1965. Notes on plant disease listed in Fiji. *Fiji Agricultural Journal*, 27:51–54.

Known plant diseases in Fiji are listed from public records by crop type. References are provided for published sources.

Zaiger, D. and Zentmeyer, G. A. 1966. A new lethal disease of breadfruit in the Pacific islands. *Plant Disease Reporter*, 50:892–896.

Trujillo, E. E. 1967. Diseases of the genus *Colocasia* in the Pacific area and their control. In: Tai, E. A., Charles, W. B., Iton, E. F., Haynes, P. H. and Leslie, K. A. ed. *Proceedings of an International Symposium on Tropical Root Crops Vol. 2*. University of the West Indies, Port of Spain, pp. 13–14.

1970–1979

Department of Agriculture, Fiji 1970. Annual Report for 1969—Cocoa. Suva, 37 pp.

The Trinitario clone S1070 showed moderate resistance to *Phytophthora palmivora*.

Meredith, D. S. and Firman, I. D. 1970. Banana leaf spot diseases in Fiji. *Tropical Agriculture*, 47:127–30.

The authors give a background to banana leaf spot diseases in Fiji and describe their symptoms. They make a comparison of collections with those in Hawaii, Taiwan and the Philippines, and discuss the proposition that there had been a longer period of incidence than generally recognised because of the confusion with Sigatoka disease.

Department of Agriculture, Fiji 1971. Report for the Year 1970—Plant Nematology. Parliamentary Paper No. 25 of 1971, Suva, 7 pp.

Planting material of ginger, treated in water for 10 minutes at 122°F for control of nematodes, grew and yielded satisfactorily.

Department of Agriculture, Fiji 1971. Report for the Year 1970—Diseases of Cacao, Banana, Sugarcane and Tomato. Parliamentary Paper No. 25, Suva, 34 pp.

Of 26 cocoa clones tested for susceptibility to *Phytophthora palmivora*, an Amelonado clone was most resistant. A collection of banana varieties was assessed for susceptibility to black leaf streak (*Mycosphaerella* sp.). Some varieties of the vudi group and some diploid wild types showed less susceptibility than commercial varieties. Malayan leaf spot caused by *Haplobasidium musae* became epidemic in October and November causing rapid loss of leaf in oil-sprayed bananas. The standard spray treatment for black leaf streak of oil/maneb/water gave significantly higher yields than oil/water or maneb/water. However, Malayan leaf spot is more serious in the cool season if plants are sprayed with oil. Several lines of sugarcane derived from the variety, Pindar, by tissue culture showed more resistance to Fiji virus than Pindar. Another study showed a slight correlation between the number of leaf stomata and resistance to *Sclerospora sacchari*. Of several tomato varieties tested, the local 2ASS showed tolerance of *Pseudomonas solanacearum*.

Graham, K. M. 1971. Plant Diseases of Fiji. Overseas Research Publication 17, Ministry of Overseas Development, London, 215 pp.

Trujillo, E. E. 1971. The breadfruit diseases of the Pacific basin. Information Document 27, South Pacific Commission, Noumea.

Firman, I. D. 1972. A List of Fungi and Plant Parasitic Bacteria, Viruses and Nematodes in Fiji. Phytopathological Papers No. 15, Commonwealth Mycological Institute, 36 pp.

This list of fungi and plant parasitic bacteria, viruses and nematodes contains 32 plants with the nematodes found on them in Fiji and, conversely, a list of 21 nematodes and the plants on which they were found. *Meloidogyne* spp. are commonest, being recorded on 20 host plants, and *Musa sapientum* had the greatest number of different nematode genera. Host lists of fungi (3–16), bacteria (17–18) and viruses

(19–22) are given by botanical names of hosts. There are also lists of fungi, bacteria and nematodes, and common names of hosts with their botanical equivalents.

Firman, I. D. 1972. Susceptibility of banana cultivars to fungus leaf diseases in Fiji. *Tropical Agriculture*, 49(3), 189–196.

Results are reported of studies on the reaction of 41 banana cultivars to black leaf streak (*Mycosphaerella* sp.), black cross spot (*Phyllachora musicola*) and rust (*Uromyces musae*). Cultivars of AA, AAA, AAAA, AAB and ABB genetic constitution were represented. The commercial triploids were very susceptible to black leaf streak whereas some of the diploids and some local cooking bananas were only moderately susceptible. None of the cvs showed marked resistance to black leaf streak, and results were generally similar to those reported from Hawaii. Only cvs containing the B genome were susceptible to black cross spot. Rust was particularly prevalent on some of the diploids but was not a serious disease problem.

Meister, D. W. 1973. Differential reaction of citrus species to diseases and pests at Koronivia. *Fiji Agricultural Journal*, 35(2), 75–78.

Reports are made on the response of different citrus species and varieties to anthracnose, citrus canker scab and vein corking. The latter was observed for the first time in Fiji on two mandarin orange varieties and bark cracking of unknown cause appeared on Lisbon lemon, Persian seedless lime and two orange varieties. Virus disease indexing showed that all trees had tristeza, and Lisbon lemon had exocortis.

Stover, R. H. 1974. Effect of measured levels of Sigatoka disease of bananas on fruit quality and leaf senescence. *Tropical Agriculture*, 51(4), 531–542.

Experimental work showed that, on termination of control measures for Sigatoka disease of bananas, four to eight months were required for premature ripening to appear. The length of time depends on the amount of spotting present at the time spraying was stopped and the time of year.

Butler, L. and Vilsoni, F. 1975. Potential hosts of burrowing nematode in Fiji. *Fiji Agricultural Journal*, 31(1), 38–39.

A list of potential and known hosts of *Rhadinopholus similis* is provided. *R. similis* was found on ginger rhizomes and tubers of *Dioscorea alata*. In both cases, transmission was mainly through planting infested materials.

Firman, I. D. 1975. *Phytophthora* and *Pythium* species and the diseases caused by them in the area of the South Pacific Commission. Fiji Agricultural Journal, 37:1–8.

The survey reported in this paper covered America Samoa, Cook Islands, Fiji, French Polynesia, New Caledonia, New Hebrides, Norfolk Island, Papua New Guinea, Solomon Islands, Trust Territory of the Pacific Islands and Western Samoa. There is discussion of 10 named *Phytophthora* species (*P. capsici*, *P. cinnamomi*, *P. citrophthora*, *P. colocasiae*, *P. drechsleri*, *P. infestans*, *P. jatrophae*, *P. nicotianae* var. *nicotianae*, *P. nicotinae* var. *parasitica*, *P. palmivora*) and 11 identified *Pythium* species (*P. aphanidermatum*, *P. arrhenomanes*, *P. butleri*, *P. debaryanum*, *P. gracile*, *P. irregulare*, *P. middletoni*, *P. myriotylum*, *P. spinosum*, *P. splendens*, *P. vexans*) together with several unidentified species of both genera and the diseases caused on the crops and soil. A reference list is given for each of the 132 reports. In Fiji, the following *Phytophthora* and *Pythium* species and crops attacked include: *Phytophthora cinnamomi*—heart and root rot of pineapple, taro corm rot, passionfruit collar rot, avocado dieback and root rot; *P. nicotianae* var. *parasitica*—similar symptoms as above on passionfruit, pineapple and taro; *P. colocasiae*—reports from Fiji needed confirmation as the disease had not been recently seen; *Pythium gracile*—soft rots of ginger; *Pythium irregulare* and other *Pythium* spp.—corm rots of aroids and roots of kava; *P. splendens*—on roots of kava and, together with *P. vexans*, taro corm rot.

Reddy, D. M. ed., 1975. New Records of Pests and Diseases in South East Asia and Pacific Region November 1973–December 1975. Technical Document No. 101, FAO Plant Protection Committee for the South East Asia and Pacific Region, Bangkok, 5 pp.

New records for nematodes from Fiji comprise *Meloidogyne* spp. on *Amaranthus sessilis*, *Dioscorea nummularia*, *Heliconia* sp., *Phaseolus lathyroides*, *Solanum torvum* and *S. tuberosum*; *Pratylenchus* sp. on *Dioscorea alata*; *Radopholus similis* on *Zingiber officinale* and *D. alata*; and *Xiphinema* sp. on *Saccharum officinarum* and *Sorghum vulgare*.

Firman, I. D. 1976. Banana rust in Fiji and other Pacific Islands. *Fiji Agricultural Journal*, 38(2), 85–86.

An account is given of the taxonomy, incidence and control of *Uredo musae* in the Pacific islands. Although susceptible cultivars are present in all the main groups of bananas grown in this area, the rust is not considered a serious disease problem. Confusion in the identification of *Uredo musae* and *Uromyces musae* is discussed.

Firman, I. D. 1976. Plant diseases in the area of the South Pacific Commission: 3. IMI herbarium specimens of fungi on plant hosts from Fiji. Information Document No. 39, South Pacific Commission, Suva, 3 pp.

Meister, D. W. 1976. An indexing program for the identification of citrus virus diseases in Fiji. *FAO Plant Protection Bulletin*, 24(3), 86–89.

Orange, mandarin, grapefruit, lemon and lime cultivars were indexed for 11 virus and mycoplasma-like diseases. Only Marsh grapefruit was virus-free in all tests. A list is included of the indicator cultivars used, the disease indicated by each and the disease symptoms.

Orton-Williams, K. J. 1976. UNDP/FAO Survey of Agricultural Pests and Diseases, Interim report, March 1976: Part Two Nematology, Entomology. South Pacific Bureau for Economic Cooperation (SPEC), Suva, 79 pp.

In this preliminary note, *Meloidogyne incognita* and possibly *M. arenaria* were found on *Colocasia esculenta* in Niue and Fiji, damage being heaviest in Niue. *M. javanica* was also found on *Piper methysticum* in Fiji.

Berrill, F. W. 1977. Bunchy top disease in bananas. In: Proceedings of a Technical Conference on Banana Production and Marketing, Rarotonga, Cook Islands, May. SPEC (77)16, South Pacific Bureau for Economic Cooperation, pp. 1–16.

Bunchy top is caused by a virus transmitted by the banana aphid, *Pentalomia nigronervosa*. Its history in Australia is described and its economic importance in Fiji is assessed. Symptoms are described in detail and notes are provided on field recognition.

Firman, I. D. 1977. *Mycosphaerella* leaf spots of bananas in the South Pacific. In: Proceedings of a Technical Conference on Banana Production and Marketing, Rarotonga, Cook Islands, May. SPEC (77)16, South Pacific Bureau for Economic Cooperation, pp. 151–163.

The author gives the names of leaf spot diseases, the fungi causing them, and their distribution in the South Pacific. Practical implications are drawn from their presence and details are furnished for their control based on experiments in Fiji and Western Samoa.

Kirby, M. F. and Kirby, M. E. 1977. Plant parasitic nematodes associated with sugarcane in Fiji. *Fiji Agricultural Journal*, 39(1), 13–24.

During a survey of Fiji sugarcane lands in 1976, 16 genera of plant parasitic nematodes were identified and the percentage occurrence of 14 genera in 390 soil samples from the sector and mill areas was calculated. *Pratylenchus* (82 per cent) and *Helicotylenchus* (79 per cent) were the most common, and were found in all areas. More restricted in distribution were: *Hemicriconemoides* (41 per cent), *Macroposthonia* (28 per cent), *Meloidogyne* (23 per cent), *Rotylenchulus* (21 per cent) and *Tylenchorhynchus* (38 per cent). Relatively rare occurrences were: *Heterodera* (1 per cent), *Hoplolaimus* (8 per cent), *Paralongidorus* (7 per cent), *Paratylenchus* (8 per cent), *Radopholus* (11 per cent), *Trichodorus* (7 per cent) and *Xiphinema* (10 per cent). *Disconcriconemella* and *Scutellonema* were also found. A species list is given and the relative importance of species as pests of sugarcane assessed. *Pratylenchus* and *Tylenchorhynchus* appeared to be the most important pests.

Kirby, M. F., Navuku, A. and Kirby, M. E. 1977. Distribution and control of rice white tip nematodes *Aphelenchoides besseyi* in Fiji. *Fiji Agricultural Journal*, 39(1), 47–50.

Aphelenchoides besseyi was found in all major rice areas on traditional and improved rice varieties and in 18 per cent of 786 seed samples during a survey in Fiji in 1976. Nematode infection resulted in whitened and shredded leaf tips, crinkled or distorted leaves, abnormal leaf greening, distorted floral parts and empty grains. The biology of the nematode, loss assessment and control are detailed.

Vernon, A. J. 1977. Yield of cocoa farms with and without fungicide spray to control black pod disease. *Fiji Agricultural Journal*, 39(2), 111.

The percentage crop loss of cacao caused by black pod disease (*Phytophthora palmivora*) on plots sprayed with Perenox (cuprous oxide) was compared with unsprayed plots. Details are provided of the increased returns associated with disease control, and of actual and potential yields, assessed from trials on four plantings.

Walker, L. A. 1977. A review of the method of control of banana bunchy top disease. SPEC 76(10), South Pacific Bureau for Economic Cooperation, Suva, 52 pp.

Firman, I. D. 1978. Natural incidence of canker on Amelonado and hybrid cocoa in Fiji and results from artificial inoculation with *Phytophthora palmivora*. *Tropical Agriculture*, 55(3), 269–272.

Five-year-old trees of cocoa, cv. Amelonado, and several Amelonado hybrids were examined for natural canker infection by completely stripping the bark. The resistance of Amelonado in Fiji to this phase of the disease syndrome caused by *P. palmivora* was confirmed and 90 per cent of the trees had negligible or no canker. Amongst the hybrids, however, the proportion of susceptible trees varied, and the effects of artificially inoculating the trunks could not have been used to predict the incidence of natural infection. Some hybrid trees with many natural cankers were resistant to artificial inoculation and others with no natural cankers were susceptible.

Kirby, M. F. 1978. Reniform and root knot nematodes on passionfruit in Fiji. *Nematropica*, 8(1), 21–25.

Reniform nematode, *Rotylenchulus reniformis*, was found to be present in 16 of 19 passionfruit (*Passiflora edulis* var. *flavicarpa*) site samples, and in numbers exceeding 36 000 per 200 cm³ of soil. *Meloidogyne* sp. was recovered from only one sample. A significant reduction in vine weights was associated with the presence of this nematode in a glasshouse experiment. Leaves were chlorotic, and infected roots had a uniformly darker appearance when compared with controls. No plant growth reductions were associated with *M. arenaria*, *M. incognita* and *M. javanica*, inoculated separately in a controlled experiment. Root galling occurred in response to all species. However, nematodes failed to develop beyond larval stages, and no evidence of reproduction was seen. It is concluded

that reniform nematodes may be involved in a serious decline disease affecting passionfruit in Fiji. Evidence indicates that passionfruit is not a suitable host for the *Meloidogyne* species tested.

Kirby, M. F., Kirby, M. E., Siddique, M. R. and Loof, P. A. A. 1978. Outbreaks and new records: Fiji. *FAO Plant Protection Bulletin*, 26(2), 63–64.

Forty-five species of plant parasitic nematodes are recorded from Fiji for the first time.

Narain, R. and Krishnamurthi, M. 1978. Population dynamics of nematodes in relation to nematicides and moisture in Fijian soils. *Sugarcane Pathologist Newsletter*, 21: 32–34.

The nematicides, Temik and Furadan, reduced soil populations of nematodes in sugarcane plots during a 6–7 month sampling period in three field trials in Fiji. Temik treatments also improved cane stands.

Van den Berg, E. and Kirby, M. F. 1979. Some spiral nematodes from the Fiji Islands (Hoplolaimidae; Nematoda). *Phytophylactica*, 11(2), 99–109.

Ten species of the genus, *Helicotylenchus*, and one of each of the genera, *Hoplolaimus* and *Scutellonema*, are described and illustrated from Fiji, viz. *Helicotylenchus californicus*, *H. dihystra*, *H. egyptiensis*, *H. indicus*, *H. microcephalus*, *H. multicinctus*, *H. paracanalus*, *H. pseudorobustus*, *H. pteracercus*, *H. retusus*, *Hoplolaimus seinhorsti* and *Scutellonema brachyurum*. A key to the Fijian species of *Helicotylenchus* is also included.

Vilsoni, F. 1979. Persistence of the burrowing nematode of ginger in clean-fallow fields. *Fiji Agricultural Journal*, 41(2), 53–54

An analysis was undertaken of four plots in fields abandoned by ginger farmers because of severe infestations of the burrowing nematode of ginger. The research method used is described, and results are presented that show the persistence of this nematode.

1980–1989

Kirby, M. F., Kirby, M. E., Siddique, M. R. and Loof, P. A. A. 1980. Fiji Nematode Survey Report of 1978. Bulletin No. 64, Ministry of Agriculture, Fisheries and Forests, Suva, 25 pp.

The host associations and distribution of plant parasitic nematodes in Fiji are reported. Twenty-one genera and 44 named species of nematodes are recorded. Distributions are given by island.

Kirby, M. F., Kirby, M. E., Siddique, M. R. and Loof, P. A. A. 1980. Fiji Nematode Survey Report—Extensive Survey. Bulletin No. 68, Ministry of Agriculture, Fisheries and Forests, Suva, 25 pp.

A description is given of the materials and methods used in the nematode survey. Results are presented and discussed.

Orton-Williams, K. J. 1980. Plant Parasitic Nematodes of the South Pacific, Vol. 8. Technical Report, UNDP/FAO/SPEC Survey of Agricultural Pests and Diseases in the South Pacific, Suva, 192 pp.

A survey was conducted of plant parasitic nematodes in Fiji, Kiribati, Niue, Western Samoa and Tonga. This technical report of the survey includes a map of each island, brief review of nematology and agriculture in the island plant host listed under specific and common names, information on the crops and nematode parasites, and alphabetical listing of nematodes under generic names with hosts. A complete list of species and hosts is also presented.

Vilsoni, F. 1980. Peanut rust: occurrence in Fiji. *Fiji Agricultural Journal*, 42(2), 45–46.

The known distribution of peanut rust is outlined and its occurrence for the first time in Fiji in July 1980 is noted. It is suggested that the inoculum is probably airborne and not borne by seed.

Atkey, P. T. and Brunt, A. A. 1981. Virus disease of maize in Fiji. In: 1979 Annual Report of the Glasshouse Crops Research Institute. Littlehampton, pp. 158–159.

The authors report the probable presence of maize mosaic virus on the basis of rhabdovirus particles in the leaves of stunted plants with chlorotic spots and leaves.

Brunt, A. A. and Philips, S. 1981. Plant virus diseases in Fiji. In: 1979 Annual Report of the Glasshouse Crops Research Institute. Littlehampton, pp. 157–158.

Results are presented of a survey of virus and similar diseases of crops in Fiji as a part of a United Nations and FAO survey of pests and diseases in the South Pacific.

Dingley, J. M., Fullerton, R. A. and McKenzie, E. H. C. 1981. Records of fungi, bacteria, algae, and angiosperms pathogenic on plants in Cook Islands, Fiji, Kiribati, Niue, Tonga and Western Samoa. Survey of Agricultural Pests and Diseases Technical Report, Vol. 2. SPEC/UNDP/FAO, Suva, 485 pp.

Firman, I. D. 1981. Plant Protection News. Information Circular No. 88, South Pacific Commission, Suva, 12 pp.

Groundnut rust caused by *Puccinia arachidis* is reported for the first time in Fiji.

Heinlein, M. and Kumar, J. 1982. Interaction of *Meloidogyne incognita* and *Fusarium oxysporum* f. sp. lycopersici on 'Alton' variety tomatoes. Fiji Agricultural Journal, 44(1), 17–20.

Inoculation trials showed this cultivar to be susceptible to the two pathogens, *Meloidogyne incognita* and *Fusarium oxysporum* f. sp. lycopersici. Under normal field conditions the nematode caused significantly greater loss in yield than did the fungus and, when inoculated together, the level of disease was not greater than that when the nematode was present alone. Under water-stressed conditions, there were significantly greater losses when the two pathogens were inoculated together but when each was present alone, decreases in yield were similar to that caused by nematodes alone.

Ooka, J. J. and Trujillo, E. E. 1982. Taro diseases and their control. In: Lambert, M. ed., Taro Cultivation in the South Pacific. Handbook No. 22, South Pacific Commission, Noumea, pp. 52–66.

This chapter is divided into sections on fungal leaf diseases, viral leaf diseases, fungal root and corm diseases, physiological root and corm diseases, nematodes, bacterial diseases of stored corms and non-parasitic problems.

Kumar, J. 1984. New records—Fiji. Quarterly Newsletter, Asia and Pacific Plant Protection Commission, FAO, 27(1–3), 6.

New records in Fiji include *Fusarium oxysporum* on ginger, *Phomopsis* on passionfruit, *Cercopsora carotae* on carrot, *Periconia manihoticola* on cassava, *Phyllosticta cajani* and *Mycovellosiella cajani* var. *indica* on pigeon pea.

Mossop, D. W. 1984. Records of viruses pathogenic on plants in Cook Islands, Fiji, Kiribati, Niue, Tonga and Western Samoa. Technical Report. No. 7, Survey of Agricultural Pests and Diseases, UNDP/FAO–SPEC, Suva, 27 pp.

This list comprises part of the data collected for the UNDP/FAO–SPEC project surveying agricultural pests and diseases in the South Pacific during 1975–79. The records are arranged in three interrelated lists host plants with viruses, common names of host plants and botanical equivalents, and viruses and their host species.

Iqbal, M. and Kumar, J. 1986. Bacterial wilt in Fiji. In: Persley, G. J. ed., Bacterial Wilt Disease in Asia and the South Pacific: Proceedings of an International Workshop held at PCARRD, Los Baños, Philippines, 8–10 October 1985. ACIAR Proceedings No. 13, Australian Centre for International Agricultural Research, Canberra, pp. 25–27.

The authors review the occurrence and distribution of bacterial wilt in Fiji and briefly discuss the effect of environmental factors on the incidence of the disease.

Persley, G. J. ed., 1986. Bacterial Wilt Disease in Asia and the South Pacific: Proceedings of an International Workshop held at PCARRD, Los Baños, Philippines, 8–10 October 1985. ACIAR Proceedings No. 13, Australian Centre for International Agricultural Research, Canberra, 145 pp.

This edited collection consists of papers presented on the current status of knowledge and research in progress in the areas of: (1) distribution and importance of bacterial wilt in Asia and the South Pacific; (2) ecology of the disease and variation in the pathogen; (3) cultural and biological control; and (4) breeding for disease resistance.

Samuel, G. J. and Singh, B. 1986. *Botryosphaeria xanthocephala*, cause of stem canker in pigeon pea. Transactions of the British Mycological Society, 86(2), 295–299.

The disease and its pathogen are newly recorded from Fiji. A genetic link is confirmed between *B. xanthocephala* and its anamorph *Macrophoma cajani* for which the new combination, *Fusicoccum cajani*, is proposed.

Davis, R. I., Ogle, H., Hayward, A. C., Irwin, J. and Kumar, J. 1988. Etiology of stem canker diseases of pigeon pea in Fiji. ACIAR Food Legume Newsletter No. 8, Australian Centre for International Agricultural Research, Canberra, pp. 5–6.

The results of surveys carried out in Fiji during 1987 indicate that *Xantomonas campestris* pv. *cajani* is potentially a serious disease of pigeon peas. The disease had been previously reported from India and Puerto Rico. Genetic resistance existed in material being evaluated in Fiji. Further work remains to determine the etiology of smooth stem canker diseases in Fiji.

Brown, J. F. ed., 1989. Kava and Kava Diseases in the South Pacific. ACIAR Working Paper No. 24, Australian Centre for International Agricultural Research, Canberra, 70 pp.

An overview is given of the diseases of *Piper methysticum* in the region. The most important is a disease of unknown etiology and other less important diseases caused by *Sphaerulina* and *Colletotrichum*. Results of preliminary surveys in Fiji, Tonga, Vanuatu and Western Samoa are presented.

Davis, R. I., Ogle, H., Hayward, A. C., Meekin, J. S., Irwin, J. and Kumar, J. 1989. Aetiology of stem canker diseases of pigeon pea in Fiji. Plant Pathology, 38(3), 440–442.

Xantomonas campestris pv. *cajani* is reported for the first time in Fiji as the cause of potentially serious pustular stem lesions of pigeon pea cultivars. Breeding lines differed in susceptibility.

Pearson, M. 1989. A Survey of Vanilla Viruses in Fiji. South Pacific Commission Plant Protection Service, Suva.

1990–present

Jackson, G. V. H. and McKenzie, E. H. C. 1991. Sweet potato scab. Pest Advisory Leaflet 24, South Pacific Commission, Suva, 4 pp.

The symptoms, spread, effect and methods of control of the disease, sweet potato scab, are described.

Jackson, G. V. H. and Pearson, M. N. 1991. Virus disease of vanilla in Fiji. South Pacific Commission, Suva.

Descriptions are given of the viruses and the disease, and its spread and control.

Pares, R. D. A., Gillings, M. R. A. and Brown, J. F. C. 1992. Cucumber mosaic cucumovirus associated with kava plants showing symptoms of dieback disease in Fiji and Tonga. Australasian Plant Pathology, 21(4), 169–171.

Immuno-electron microscopy, dsRNA analyses, ELISA and transmission to *Nicotiana tabacum* and *N. glutinosa* confirmed that the cucumber mosaic cucumovirus was present in many kava plants affected by dieback in Fiji and Tonga. CMV virus was detected in 44 per cent of the plants showing a range of symptoms.

Pearson, M. N., Jackson, G. V. H., Pone, S. P. and Howitt, R. L. J. 1993. Vanilla viruses in the South Pacific. Plant Pathology, 42(1), 127–131.

The following viruses were detected on *Vanilla fragrans* and *V. tahitensis* in Cook Islands, Fiji, Niue, Tonga and Vanuatu during 1986–90: cymbidium mosaic potyvirus and odontoglossum ringspot tobamovirus in all countries; vanilla necrosis potyvirus in Fiji, Tonga and Vanuatu; and vanilla mosaic potyvirus in Cook Islands, Fiji and Vanuatu. Rhabdovirus-like particles were detected in Fiji and Vanuatu.

Ye, W., Siddique, M. R. and Weimen, Y. 1994. Two new species of *Hemicriconemoides* (Nematoda; Criconeematidae) were found from South Pacific with notes on four other known species. Afro–Asian Journal of Nematology, 4(2), 215–223.

Two new nematode species, *Hemicriconemoides ortonwilliamsi* from coconut in Kiribati and *H. rotundus* from Chinese white cabbage in Western Samoa, are described and illustrated. They are compared with four other species, including *H. cocophilus* from corn in Fiji and sugarcane from PNG. Morphometric data, illustrations and descriptions are used.

Australian Centre for International Agricultural Research 1995. Alomae Disease of Taro. Research Note 15, Canberra.

This research note describes and illustrates the common symptoms associated with alomae disease of taro in Papua New Guinea.

Davis, R. I., Brown, J. F. and Pone, S. P. 1996. Causal relationship between cucumber mosaic cucumovirus and kava dieback in the South Pacific, Plant Disease Reporter, 80(2), 194–198.

Kava (*Piper methysticum*) production in the South Pacific has been hampered by a dieback disease of previously unknown etiology. The development of a mosaic symptom on young leaves and leaf growth distortions frequently precede the dieback. Pathogenicity tests showed that cucumber mosaic cucumovirus (CMV) is either the direct cause of kava dieback or a significant component of a disease complex. Double antibody sandwich-ELISA (DAS-ELISA) showed that CMV is geographically widespread in kava plants with leaf and dieback symptoms throughout the four main kava-producing nations of Fiji, Vanuatu, Tonga and Western Samoa. An isolate of CMV originally obtained from a dieback-affected plant caused similar dieback symptoms in 80 per cent of mechanically inoculated kava plants. Aphid transmission was also demonstrated.

South Pacific Commission 1996. Taro Leaf Blight Seminar Proceedings, Alafua, Western Samoa, 22–26 November 1993. South Pacific Commission, Noumea.

Taro leaf blight has not yet occurred in Fiji, but there is an everpresent danger of its introduction. These seminar proceedings contain summary, reports of five working groups and recommendations on how to deal with the disease, based on experiences with its introduction in Samoa. The working groups dealt with the following issues: cultural control (field sanitation); awareness campaign materials; contingency planning and public awareness; taro germplasm collection; selection and breeding; and fungicides biology.

Tamanikaiyaroi, R. and Johnson, S. 1996. Major sugarcane diseases in Fiji. In: Croft, B. J., Piggitt, C. M., Wallis, E. S. and Hogarth, D. M. ed. Sugarcane Germplasm Conservation and Exchange, Report of an International Workshop, Brisbane, Queensland, Australia, 28–30 June 1995. ACIAR Proceedings No. 67, Australian Centre for International Agricultural Research, Canberra, pp. 51–54.

Thirty diseases of sugarcane have been recorded in Fiji. Smut (*Ustilago scitaminea*) and mosaic (a potyvirus) have not been recorded. Only two diseases are of current economic significance—Fiji disease, caused by a reovirus, and downy mildew, caused by *Peronosclerospora sacchari*. Both can be controlled by resistant varieties combined with intensive roguing. Ratoon stunting disease (*Clavibacter xyli* subsp. *xyli*) may also be a yield-limiting factor. Recommendations are included to mitigate the quarantine risk of introducing new diseases at both the national and international levels.

Kohler, F., Pellegrin, F., Jackson, G. and McKenzie, E. 1997. Diseases of cultivated crops in Pacific Islands countries. South Pacific Commission, Noumea, New Caledonia, pp. 186.

This monograph contains the latest information on the symptoms and control of diseases of cultivated crops in the Pacific island nations, with coloured illustrations.

PLANT PROTECTION

1920–1929

Simmonds, H. W. 1928. Visit to Taveuni by Government entomologist. Fiji Agricultural Journal, 1(3), 21–22.

The author describes the liberation in Taveuni of the imported lantana insect, *Teleonemia lantanae*.

Taylor, T. H. C. 1928. Progress report on the Coccinellidae. Fiji Agricultural Journal, 1(1), 7–10.

Coccinellidae were imported from Trinidad to control *Aspidiotus destructor*. Details are provided on five species introduced and preliminary attempts at breeding. Some colonies were liberated in Wakaya and reports are given on progress in their dispersal. *Coccinellidae nodiceps* is considered the most promising species.

Taylor, T. H. C. 1929. The natural control of the coconut scale. Fiji Agricultural Journal, 2(2), 43–45.

Coccinellid beetles were introduced to all islands in 1928 to control coconut scale. Field visits one year after distribution showed that the introduction had the desired effects. The pest was no longer spreading and had been exterminated in some locations.

1930–1939

Simmonds, H. W. 1931. A method of control for banana borer. Fiji Agricultural Journal, 4(2), 63–64.

The method of attack of the banana borer and its effects are described. Five directions are given to enhance control procedures.

Taylor, T. H. C. 1932. The possibilities of controlling rats on coconut estates in Fiji. Fiji Agricultural Journal, 5(1), 22–25.

A report is made of discussions held in England about the possibilities to control rats on coconut estates in Fiji. The discussions covered biological methods (virus diseases, other natural enemies and the Rodier method), trapping and chemical methods (poisoned baits and fumigation).

Taylor, T. H. C. 1936. The biological control of the coconut leaf-miner (*Promecotheca reichei*, Baly) in Fiji. Fiji Agricultural Journal, 8(2), 17–21.

The author describes the insect and its distribution in Fiji, its habitat and the nature of the damage it causes. Details are also given on the nature and causes of outbreaks, its natural enemies in Fiji, the selection of a parasite for its control, the habits of the parasite, and results from its introduction.

Lever, R. J. A. W. 1937. A preliminary note on larval parasites of the spike moth in Taveuni islands. Fiji Agricultural Journal, 8(4), 34–35.

The author reports on the introduction of four parasites of *Tirathaba furivena* Walk. from Java in the period 1930 to 1933 and identification of five local parasites. Despite their introductions, the moth was not under satisfactory control.

Lever, R. J. A. W. 1937. The giant toad. Fiji Agricultural Journal, 8(4), 36.

Results are provided of a laboratory analysis of an immature female giant toad.

Simmonds, H. W. 1937. Fruit fly tapping experiments. *Fiji Agricultural Journal*, 8(3), 13–14.

Experiments on fruit fly tapping were carried out at Nasinu Research Station using the so-called Queensland lure.

Simmonds, H. W. 1937. The giant toad. *Fiji Agricultural Journal*, 8(3), 45–46.

Details are provided on the release of the giant toad in 1936.

Jack, H. W. 1938. The destruction of rats. *Fiji Agricultural Journal*, 9(2), 2–3.

A brief review is given of the various means of eradicating rats. They cover trapping, poisoning and hunting. The need for regular control is emphasised.

Lever, R. J. A. W. 1938. The giant toad—distribution, diet and development. *Fiji Agricultural Journal*, 9(2), 28.

This is a progress report on the introduction of the giant toad.

Lever, R. J. A. W. 1938. Economic insects in some Pacific islands. *Fiji Agricultural Journal*, 9(4), 11–12.

The article deals with inquiries from various Pacific islands with requests for the introduction of beneficial insects.

1940–1949

Parham, B. E. V. 1940. Banana disease investigations. *Fiji Agricultural Journal*, 11(2), 32.

Experiences are recounted in routine experiments to control banana diseases at the Central Agricultural Station. Reports are presented on experiments in (1) spraying for direct control of leaf diseases, (2) selection for resistance to the bunchy top virus, (3) propagation of varieties with disease resistance, (4) cultivation methods and yields of major commercial types, (5) manurial trials, (6) control of scab-moth blemish, and (7) rotation trials.

Parham, B. E. V. 1940. Plant protection. *Fiji Agricultural Journal*, 11(4), 103.

Details are provided of familiar types of diseases caused by parasitic fungi or bacteria and virus diseases. General principles of plant protection are enunciated, and details are given on the cause and control of wilt diseases.

Parham, B. E. V. 1941. Plant protection II. Fiji Agricultural Journal, 12(4), 103–4.

Methods are described for soil sterilisation using steam, fire, chemicals and seed disinfection applying chemicals.

Parham, B. E. V. 1942. Plant protection. Fiji Agricultural Journal, 13(1), 27–28.

Contains notes on the soft rot of jackfruit (*Rhizopus artocarp*), white rust of *Cruciferae* (*Albugo candida*) and brown rot of citrus (*Phytophthora hibernalis*). Control measures are spelt out.

1950–1959

O'Connor, B. A. 1950. Biological control of insects and plants in Fiji. Fiji Agricultural Journal, 21(1/2), 43.

The history of biological control in Fiji is recounted, and reasons are given to expect a degree of success. Notable campaigns are mentioned.

O'Connor, B. A. 1950. *Trichopoda pennipes* F. in Fiji and the British Solomon Islands. Fiji Agricultural Journal, 21(3), 62.

Trichopoda pennipes F. was introduced in Fiji and Solomon Islands to control the Coreid bug, *Amblypelta cocophaga* China, which had been causing premature nutfall in coconuts. The breeding technique is outlined and its liberation is described.

O'Connor, B. A. 1954. Rhinoceros beetle (*Oryctes rhinoceros*): notes on the control campaign in Fiji. Fiji Agricultural Journal, 25(3/4), 84–88.

Details are provided of the distribution and habits of the rhinoceros beetle and measures for its artificial and biological control. Measures of artificial control discussed are (1) collection and destruction of breeding places, (2) compost traps, (3) treatment of crowns of palms, (4) treatment of sawdust heaps, and (5) quarantine and inspection. Biological control measures discussed are (1) predator beetles, (2) *Scolia oryctophaga*, and (3) *Platymeris rhadamanthus*.

Hoyt, C. P. 1957. Parasites and predators introduced into the Pacific islands for the biological control of insects. South Pacific Commission, Noumea.

O'Connor, B. A. 1957. Rhinoceros beetle campaign in Fiji. South Pacific Commission Quarterly Bulletin, 7(4), 32–35.

The early history of the campaign to control the rhinoceros beetle in Fiji is recounted, commencing with the formation of the Rhinoceros Beetle Eradication Board. Events are traced from the discovery of a female beetle at Suvavou, near Suva, in March 1953. The board was created to administer the funds of the campaign and oversee its general direction. A description is given of the campaign, focusing on eight alternative methods of control.

Simmonds, H. W. 1957. The giant toad (*Bufo marinus*) in Fiji. Fiji Agricultural Journal, 28(3/4), 77–78.

The inquiries that led to the introduction of the giant toad are recounted. Discussion focuses on the food contents of its diet, feeding habits and local enemies.

Rhodes, P. L. 1959. The control of sweet potato weevils. Fiji Agricultural Journal, 29(4), 142–145.

Farmers had planted an increased area to sweet potato. This had made the control of sweet potato weevils a matter of priority given their ability to cause severe damage to tubers. Three trials at Koronivia are described and a set of recommendations are given for control.

Simmonds, H. W. 1959. Interim report on *Scolia ruficornis* in Fiji. South Pacific Commission Quarterly Bulletin, 9(3), 28–30.

The story is recounted of the introduction of a colony of wasps, *Scolia ruficornis*, in Fiji. It was hoped that this larval parasite would provide an effective control of the rhinoceros beetle. Details are provided on some aspects of the biology of the wasp and difficulties faced in establishing the colony.

1960–1969

O'Connor, B. A. 1960. A decade of biological control work in Fiji. Fiji Agricultural Journal, 30(2), 44–54.

The author updates a previous paper in the journal (1950) with details of all introductions of biological control measures during the 1950s. He covers biological control measures for Pentatomid and Coreid bugs, rice

army worms, fruit flies, banana scab moth, rhinoceros beetle, cockroaches, coconut stick insects, small coconut leaf moth, noogoora burr, lantana and tobacco weed.

Rhodes, P. L. 1960. Oil spraying to control banana leaf spot disease. Fiji Agricultural Journal, 30(1), 29–32.

The author describes banana leaf spot disease and means of its control. Trial results lead him to some recommendations on oil spraying that he argues offers a more economic means of controlling the disease than high-volume spraying.

Simmonds, H. W. 1960. Search for a parasite. South Pacific Commission Quarterly Bulletin, 10(2), 47–50.

In 1919, the Fiji Department of Agriculture assigned the author the task of searching for a biological control of a major pest of coconuts, the coconut moth (*Levuana iridescens*). He recounts the ultimately successful search which is a good example of how to search for and find an effective parasite of a major pest.

Simmonds, H. W. 1963. A further note on *Scolia ruficornis* in Fiji. South Pacific Commission Quarterly Bulletin, 13(1), 55–56.

Observations are made and views presented on the behaviour of the wasp, introduced to control the rhinoceros beetle, and factors limiting its abundance in Fiji.

1970–1979

Rao, V. P. 1971. Biological Control of Pests in Fiji. Miscellaneous Publication No. 2, Commonwealth Institute of Biological Control, Port of Spain, 38 pp.

This publication contains a review of biological control work on pests in Fiji over the past 50 years. The review deals mainly with the introduction of parasites and predators against insect pests of plants but includes a short section on the biological control of weeds and another on pests of medical and veterinary importance. There is an index to the scientific names and seven pages of references. This was also published as Bulletin No. 55 of the Fiji Department of Agriculture.

Daniels, J., Husain, A. A. and Hutchinson, P. B. 1972. The control of sugarcane diseases in Fiji. Proceedings of the International Society of Sugar Cane Technologists, 14th Congress 1971, pp. 1007–1014.

Downy mildew (*Sclerospora sacchari*) and Fiji disease are the only diseases that have caused major losses in Fiji sugarcane areas. In recent years they have been reduced to a very low level by the release of resistant cultivars coupled with an intensive system of disease control, described here.

Partridge, I. J. 1973. The control of insects in stored maize. Fiji Agricultural Journal, 35(2), 100–101.

With increased demand for and production of maize, it was posited that protection against insects (especially *Sitophilus oryzae* (L.) in stored grain would become of greater importance in Fiji. Dusting with malathion was tested as an alternative to standard fumigation treatments with methyl bromide or phosphine in an open-ended barn. It is concluded that the effectiveness of malathion declines after about 12 weeks under the conditions of storage in the tests.

Bedford, G. O. 1976. Mass rearing of the coconut palm rhinoceros beetle for release of virus. PANS, 22(1), 5–10.

The method used in Fiji for the mass rearing of *Oryctes rhinoceros* (L.) is described. An average of 135 beetles were produced per week at a cost of approximately F\$0.73 per beetle. Mass rearing from the egg stage was more economic than field collection. The adults were confined on a sterilised medium of cow dung and sawdust, and provided with ripe bananas. The eggs were transferred to plastic boxes containing the same medium, and second and third instars were transferred singly to the same medium in tins.

Bedford, G. O. 1976. Use of a virus against the coconut palm rhinoceros beetle in Fiji. PANS, 22(1), 11–25.

The virus, *Rhabdionvirus oryctes*, was initially released to control rhinoceros beetle by the addition of viral material to artificially constructed breeding sites in Fiji. An improved method consists of releasing virus-infected beetles which act as vector to spread into the natural breeding sites. Results indicate a marked reduction in the amount of beetle damage to palms 12 to 18 months after release and establishment of the virus in the beetle population.

Bedford, G. O. 1977. The use of a virus against the coconut palm rhinoceros beetle in Fiji. *South Pacific Commission Quarterly Bulletin*, 27(1), 19–27.

Oryctes rhinoceros occurs throughout Southeast Asia and on a number of islands of the South Pacific. It reached Fiji in 1953. Its life cycle and the use of *Rhabdionvirus oryctes* (baculovirus) to control it are reviewed. The production of this virus, its propagation and the results obtained are discussed. In some cases, attacks were reduced from 79 per cent to 36 per cent one year after treatment with the virus.

Bedford, G. O. 1977. Virus against coconut rhinoceros beetles in Fiji. *South Pacific Bulletin*, 27(1), 27–34.

The article commences with an outline of the incidence of the rhinoceros beetles, *Oryctes rhinoceros* (L.), in Fiji. Methods are described whereby the beetle was reared in the laboratory, infected with the virus, *Rhabdionvirus oryctes*, and released in the field in Fiji in 1970–74 for the biological control of natural populations of *O. rhinoceros* on coconut. The results are given in terms of infection rates in beetles sampled in the field and changes in the damage to coconuts at various sites in 1970–75. Over wide areas where the virus had become established, the beetle population appears to remain at a low level indefinitely, without the need for further virus releases. A three-way balance exists between the number of breeding sites, the size of the beetle population and the incidence of the virus. However, the beetle is not eliminated because the virus does not penetrate to all breeding sites. There is a discussion about the prospects for controlling the spread of *O. rhinoceros*.

Kirby, M. F. 1977. Control of root knot nematodes in Fiji. *Fiji Agricultural Journal*, 39(2), 87–95.

Symptoms of *Meloidogyne arenaria*, *M. incognita* and *M. javanica* infestations and their biology and ecology in Fiji are described. Control is discussed under the following headings: prevention of spread; land management, cultural practices including fallowing, cover crops, crop rotation, flooding fertilisation; plant resistance; biological control; physical factors; and chemical control. A list is included of *Meloidogyne*-resistant cultivars of vegetables and other crops. A summary is presented of results of glasshouse experiments on the susceptibility of local crops to the 3 *Meloidogyne* species.

Peterson, G. D. Jr. 1977. Research on the Control of the Coconut Palm Rhinoceros Beetle—Fiji, Tonga, Western Samoa: Review of Project Results. Consultant Report AG:DP-RAS-71-291, UNDP/FAO, Rome, 109 pp.

This report is a review of research on *Oryctes rhinoceros* (L.) on coconut in Fiji, Tonga and Western Samoa over the period, 1964 to 1975. It includes: (1) a short history of infestation in the South Pacific since the pest was introduced in 1909; (2) a description of the beetle in all stages of its life history, with notes on its biology and damage incited; (3) control measures such as cultural, chemical control, trapping methods, biological control with arthropod parasites and predators, nematodes, pathogens, especially *Metarrhizium anisopliae* and *Rhabdionvirus oryctes*, and integrated control. Prospects for the future are discussed, and some recommendations made.

Kamath, M. K. 1979. A review of biological control of insects pests and noxious weeds in Fiji (1968–1978). Fiji Agricultural Journal, 41(2), 55–72.

This review is an update of previous reviews published in the journal in 1950 and 1960. It was presented at a workshop held in New Caledonia in 1979. A table is included showing all introductions up to 1978. Of over 40 natural enemies tested as biocontrol agents, only 5 established in the field and gave satisfactory control of target organisms.

1980–1989

Jackson, G. V. H. 1980. Diseases and Pests of Taro. South Pacific Commission, Noumea, 50 pp.

Information is provided on the incidence, distribution, diagnosis and control of pest and diseases of taro. Diseases of taro leaves include: taro leaf blight (not yet identified in Fiji); shot hole (*Phyllosticta* spp.—*P. colocasicola* and *P. colocasiae*); ghost spot (*Cladosporium colocasiae*); alomae and babone viruses; and dasheen mosaic virus. Diseases of roots and corms include: *Pythium splendens*, *P. vexans*, *Phytophthora cinnamomi*, *P. nicotianae* var., *parasitica* major, minor *F. oxysporum*, *S. rolfsii*, nematode *Meloidogyne*, *Hirschmanniella* dry corm rot and hard rot (known locally as guava seed) of unknown etiology. Post-harvest diseases of corms include *Pythium splendens* in Fiji, *Phytophthora colocasiae* in PNG, Solomon Islands and Western Samoa, and *B. theobromae*, *F. solani*, *S. rolfsii* and *Erwinia chrysanthemii* all in Solomon Islands. Pests include the taro beetle (*Papuana* spp.—*P. woodlarkiana*, *P. huebneri*, *P. inermis*), taro plant hopper

(*Tarophagus proserpina*, *Aphis gossypii*), whitefly (*Bemisia tabaci*), taro horn worm (*Hippotion celerio*) and cluster caterpillar (*Spodoptera litura*). A total of 37 references are given.

Kumar, J., Vilsoni, F. and Namibiar, V. 1981. Fungicidal control of kumala (*Ipomoea batatas* (L.) Lam.) scab in Fiji. *Fiji Agricultural Journal*, 43(1), 9–11.

Sweet potato scab was effectively controlled by applications of fentin acetate at 0.9 g a.i./l and yield were increased.

Heinlein, M. and Black, I. D. 1983. The use of fallows, planting techniques and nematicide application for control of *Rotylenchulus reniformis* in pigeon peas. *Fiji Agricultural Journal*, 45(1), 35–42.

Weed, disc and herbicide fallows all greatly reduced population densities of *R. reniformis* in the six-month period between pigeon pea (*Cajanus cajan*) crops, with disc fallows being the most effective in the first four months. No-till planting generally increased plant growth over traditional cultivation-saving methods following all fallow strategies with the week fallow-no-till planting combination being the most successful. Oxamyl at 3.6 kg a.i./ha increased crop growth in all fallow planting combinations. Greenhouse studies indicate that growth of *C. cajan* cv Royes is most severely affected by *R. reniformis* when plants are infected before they are two weeks old. Inoculation of plants after this period did not decrease plant height or dry weight compared with uninoculated controls 80 days after sowing.

Kumar, K. and Lal, S. N. 1983. Studies in the biology, seasonal abundance and host-parasite relationship of fruit sucking moth *Othreis fullonia* (Clerk) in Fiji. *Fiji Agricultural Journal*, 45(2), 71–77.

A description is given of a laboratory technique developed to mass-produce a parasite of the fruit-sucking moth for biological control trials.

Ministry of Agriculture and Fisheries, Fiji 1983. Annual Report for the Year 1980. Fiji Parliamentary Paper No. 22 of 1983, Suva, 40 pp.

Plant protection research (p. 29) briefly covers chemical and biological control of insect pests of coconut, cocoa, rice and water weeds, *Salvinia* and water hyacinth.

Ministry of Agriculture and Fisheries, Fiji 1983. Annual Report for the Year 1981. Fiji Parliamentary Paper No. 26 of 1983, Suva, 62 pp.

There is a brief review of the progress of plant protection investigations (p. 29) into: chemical control of *Nilaparvata lugens* and *Susumia exigua* on rice and of *Plutella xylostella* on cabbage; biological control of rhinoceros beetle in coconut using *Baculovirus oryctes* and controlling ground cover to control the coconut stick insect; and biological control of water weed using *Neochetina eichhornia* and *Paulinia acuminata* against water hyacinth and *Samea multiplicalis* against *Salvinia*.

Fullerton, R. A. and Tracey, G. 1984. Tolerance of *Mycosphaerella fijiensis* to benomyl and carbendazim in the Pacific islands. *Tropical Agriculture*, 61(2), 133–136.

Tolerance of *Mycosphaerella fijiensis* to benomyl and carbendazim was found to be widespread in Western Samoa but not in Tonga or Cook Islands. Recommendations are presented for the control of black leaf streak in bananas in certain South Pacific countries such as Fiji where bananas had been an important export crop. Tests had been conducted to determine the tolerance of *Mycosphaerella fijiensis* to benomyl and carbendazim.

Singh, D. S. and Namibiar, V. 1985. A review of research in the control of *Rotylenchulus reniformis* in pigeon pea in Fiji. *Fiji Agricultural Journal*, 47(1/2), 33–35.

Pigeon pea production in Fiji is outlined, and a review is undertaken of research that suggests there is some scope for using alternatives to chemicals in the control of nematodes. Crop rotation and time of planting after a period of clean fallow are assessed as better alternatives.

Bedford, G. O. 1986. Biological control of the rhinoceros beetle (*Oryctes rhinoceros*) in the South Pacific by baculovirus. *Agriculture Ecosystems and Environment*, 15(2–3), 141–147.

A baculovirus originally discovered in Malaysia attacks both larvae and adult rhinoceros beetle, a serious pest of coconut in the south Pacific. Field trials with the virus began in Fiji in 1979. Establishment was successful at many sites and was followed by a reduction in beetle population. The virus also became established in other areas in the South Pacific with a subsequent reduction in beetle damage to palms 1–1.5 years after establishment.

Waterhouse, D. F. 1987. Biological control in the Pacific islands. Special Symposium, 11th International Congress on Plant Protection, Manila, 5–9 October 1987, 6 pp.

Waterhouse, D. F. and Norris, K. R. 1987. Biological Control: Pacific Prospects. Inkata Press, Melbourne, 454 pp.

Pests of Pacific countries are discussed from the aspect of reducing their impact by the use of classical biological control measures. Many pests are examined and details are given on their distribution biology and pest status. Prospects for successful control are reviewed.

Maddison, P. A. 1989. UNDP/FAO-SPEC Survey of Agriculture: Pests and Diseases in the South Pacific. Technical Report 1, Entomology Division, DSIR, Lower Hutt.

Waterhouse, D. F. and Norris, K. R. 1989. Biological Control: Pacific Prospects—Supplement 1. ACIAR Monograph No. 12, Australian Centre for International Agricultural Research, Canberra.

Six further pests are examined, and their distribution biology, pest status and control are reviewed. Previous attempts at their biological control are surveyed and an appraisal is given of the prospects for successful biological control.

1990–present

Buresova, N. V. and Kumar, J. 1992. Prospects and potentials of integrated pest management in Fiji. In: Ooi, P. A. C., Lim, G. S., Ho, T. H., Manalo, P. L. and Waage, J. K. ed. Integrated Pest Management in the Asia Pacific Region. CAB International, Wallingford, pp. 367–372.

The potential of IPM programs in Fiji was discussed in relation to sugarcane, rice and coconut. This paper was presented at a conference in Kuala Lumpur, Malaysia, on 23–27 September 1991.

South Pacific Commission 1992. Report of the Seventh Regional Technical Meeting on Plant Protection, Suva, 25–28 February 1992. South Pacific Commission, Noumea.

This report on plant protection contains a brief introduction, the meeting agenda, summary of proceedings, recommendations, and lists of working papers and participants.

Waterhouse, D. F. 1993. Biological Control: Pacific Prospects—Supplement 2. ACIAR Monograph No. 20, Australian Centre for International Agricultural Research, Canberra.

Discussion is continued of pests of Pacific countries with the prospect of reducing their impact with classical biological control. Eighteen fruit flies, the breadfruit mealy bug, the coconut termite and two weeds are reviewed, along with summaries of their distribution, biology and pest status. Natural enemies are listed and discussed.

Beaudoin, L., Robert, P., Lal, S. N. and Decazy, B. 1994. Control of a pest, *Adoretus versutus*, using an entomopoxvirus on the islands of Fiji. *Plantations Recherche Developpement*, 1(1), 50–56.

A phytosanitary survey was carried out in 1992–93 in cocoa areas on the two main islands of Fiji in conjunction with the control of *Adoretus versutus*, a serious pest of cocoa in the Pacific. A large percentage of the larvae were seen to be affected by an entomopoxvirus that seemed to be a natural control agent of the pest.

De Taffin, G., Vilsoni, F., Lal, S. N. and Nagatalevu, M. M. 1994. *Crop Protection in Coconut Plantations in Fiji*. Ministry of Agriculture, Forests and Fisheries, Suva, 20 pp.

Allwood, A. J. 1995. Report—Tripartite Review of Regional Project: Enhancement of Production and Export of Fresh Fruits by Controlling Fruit Flies in the South Pacific —short title: Regional Fruit Fly Project (RFFP)). South Pacific Commission, Suva, 29 pp.

South Pacific Commission/German Biological Control Project and the Ministry of Agriculture, Fisheries and Forests. 1995. Integrated pest management of cabbage pests in Fiji. *Agricultural Information Leaflet No. 1*, Suva, 4 pp.

South Pacific Commission. *Plant Protection News*.

This is a publication on plant protection in South Pacific countries that disseminates new information and knowledge about pests and diseases, and plant protection methods.

WEEDICIDES, PESTICIDES AND THEIR APPLICATION TECHNOLOGY

1930–1939

Lever, R. J. A. W. 1938. Derris in Melanesia. *Fiji Agricultural Journal*, 9(2), 25.

This short note refers to the use of derris as an insecticide. It had been observed in Fiji.

1940–1949

Lever, R. J. A. W. 1945. 666 or Gammexane insecticide? *Fiji Agricultural Journal*, 16(4), 103.

At the time, the comparative efficacy of these two chemicals was an issue considered worthy of experiment. This brief paper sets the scene for these experimental trials by considering their relative merits.

Parham, B. E. V. and Suckling, J. J. 1945. Control of noxious weeds in Tailevu and Navua. *Fiji Agricultural Journal*, 16(3), 71–75.

Progress is reported on work to counter the spread of noxious weeds in Tailevu and Navua in the Southern Division. Experimental fieldwork was being undertaken on the direct and indirect control of weeds.

Shepherd, C. Y. 1945. *The Sugar Industry in Fiji*. Colonial Report No. 188, HMSO, London.

Lever, R. J. A. W. 1946. Use of DDT and 666 (Gammexane). *Fiji Agricultural Journal*, 17(3), 62.

A brief report is presented on the results of using these two chemicals in trials.

Parham, B. E. V. 1946. Economic botany—weedicide trials in Viti Levu. *Fiji Agricultural Journal*, 17(3), 71–72.

The author reports on results from the use of two weed killers that had recently become available in Fiji. He lists 22 trials that were under way.

Parham, B. E. V. 1947. Weed control studies in Fiji. *Fiji Agricultural Journal*, 18(2), 35–42.

The author reports on the general status of weeds in Fiji, and methods and materials for their control. Only two weeds (lantana and Koster's curse) had responded to biological control. The limitations of biological

control measures are summarised. Mechanical and chemical control measures are also briefly reviewed. Research projects in progress are outlined and selective weedicides are described. A section of the paper also deals with the eradication of water hyacinth and other aquatic weeds.

O'Connor, B. A. 1949. Insecticides. *Fiji Agricultural Journal*, 20(2), 87–88.

A report is presented on satisfactory results obtained from tests of modern insecticides against local insect pests in Fiji undertaken until the time of writing. Details are given of their formulations.

1950–1959

Mune, T. L. 1954. Tobacco weed control in Vanua Levu. *Fiji Agricultural Journal*, 25(1), 23.

Recommendations are given for the control of tobacco weed, based on mowing with scythes first and then spraying with hormone herbicides.

Mune, T. L. 1954. Notes on weed control in Fiji. *Fiji Agricultural Journal*, 25(1), 42–43.

Experimental trials had been conducted on giant sensitive weed. Notes are presented in this paper on these trials. Also, there are notes on efforts to eradicate tobacco weed, water hyacinth, Ellington curse, mint weed, broom weed, *Solanum torvum* and lantana.

Taylor, G. G. 1955. Survey of some spray application problems in Fiji. *Fiji Agricultural Journal*, 26(1), 38–50.

This paper details in a comprehensive way the difficulties imposed by the environment on spray applications to control pests. While the more conventional constraints such as climate, topography and technical know-how are considered, attention is also paid to sociological and cultural factors, and the economics of application in influencing decisions to use modern spraying methods. A survey was conducted in 1955 to assess current control measures. Particular attention is paid to the spraying of coconuts and bananas, with detailed recommendations also given on spraying for weed control.

O'Connor, B. A. 1957. Notes on the control of *Oryctes rhinoceros* by the use of insecticides. Fiji Agricultural Journal, 28(1/2), 15–18.

The author describes modifications and improvements in methods used in previous experiments to control *Oryctes rhinoceros* by the use of insecticides. Results are presented for trials with a variety of insecticides and formulations.

O'Connor, B. A. 1959. Aerial spraying of coconut palms to control the coconut stick insect (*Graeffea crouani* Le Guill.). Fiji Agricultural Journal, 29(4), 138–141.

This article is an account of the first aerial spraying of coconut palms to control the coconut stick insect. Aerial spraying was attempted because earlier attempts to control the insect had failed for lack of a practicable means of applying insecticide to foliage of very tall palms.

1960–1969

Rhodes, P. L. 1960. A combination of spraying and dusting for banana scab moth control. Fiji Agricultural Journal, 30(1), 23–28.

This is a report on spraying and dusting trials for the control of banana scab moth. Some economic analysis was undertaken, and its results are reported. Detailed recommendations are provided.

1970–1979

Sun, L. T. and Gorman, M. L. 1973. The toxicity to fish of herbicides recommended for weed control in the Rewa. Fiji Agricultural Journal, 35(1), 31–33.

Copper sulphate plus bipyridyl mixture was used effectively for water weed control in the Rewa area, and this prompted tests on the toxicity of one such mixture to fish. It was concluded that, in view of the high toxicity of the copper component, spraying should be carried out only when absolutely necessary and then only small areas should be treated with sufficient time allowed between sprayings to enable the copper salts to be thoroughly flushed out to sea.

Hughes, H. R. 1971. Control of the water weed problem in the Rewa river. *Fiji Agricultural Journal*, 33(2), 67–72.

Hydrilla verticillata is a problem weed of the Rewa River, Fiji. The growth, distribution and seasonal development and control of this and other associated weeds are described.

Patel, N. P. 1971. Review of the weed problems of Fiji and of research on weed control in crops other than rice. *Fiji Agricultural Journal*, 33(2), 47–54.

The history of weed problems in Fiji and noxious weed legislation are discussed together with the results of herbicide trials in maize, sorghum, bananas, taro (*Colocasia* spp.), yams (*Dioscorea* spp.), cassava (*Manihot esculentus*), urd (*Phaseolus* [= *Vigna*] *mungo*) and pastures carried out in Fiji during 1960–70.

Firman, I. D. 1976. *Pesticide Handbook: A Guide to the Safe and Efficient Use of Crop Protection Chemicals Available in the Pacific Islands Served by the South Pacific Commission*. South Pacific Commission, Noumea, 73 pp.

This handbook on the use of pesticides in the South Pacific Islands includes sections on the storage, use and toxicity of pesticides, their hazard categories and toxicity to bees, and a summary of the pesticides available in the region. Lists, indexes, glossaries and abbreviations are provided for the pesticides, organisms (including many arthropod pests with their scientific and common names) and crops referred to in the text and tables.

Reddy, K. 1977. New fungicides for the treatment of sugarcane setts. *Sugarcane-Pathologists' Newsletter*, 19:21–23.

Trials carried out at the research station of the Fiji Sugar Corporation on new fungicides for the treatment of sugarcane setts. They demonstrated that dipping cane setts cv. *Ragnar* in saprol (triforine) and panoctine (guazatine) at 5.0 ml/litre and 6.0 ml/litre enhances germination.

Sharma, A. P. 1977. How to design and develop an experimental plot sprayer. *Appropriate Technology*, 4(3), 16–17.

The design, components, construction and calibration of a sprayer, pushed by one man and powered by an air-cooled petrol engine, are described. The machine is constructed from simple, locally available material but is capable of spraying experimental plots accurately with a single pass.

1980–1989

Kumar, K. and Chapman, R. B. 1983. Evaluation of insecticides for the control of diamondback moth *Plutellaxylostella* (L.). *Fiji Agricultural Journal*, 45(1), 13–16.

A field trial was conducted to study the period of protection against the diamondback moth by a single application of permethrin and fenraterate, methamidophos and carbaryl. Pyrethroids at 50 g and 150 g a.i./ha effectively controlled populations for 26 and 33 days, respectively. Larval densities in plots treated with carbaryl and methamidophos were significantly less than the untreated control for 19 and 33 days, respectively.

Mowbray, D. L. 1988. *Pesticide Use in the South Pacific*. Regional Seas Reports and Studies No. 89, UNEP.

1990–present

Sharma, H. D. and Ahmed, S. 1993. Country report: Fiji. In: *Pest Control in Asia and the Pacific: Report of an APO Seminar*, Tokyo, Japan, 24 September–4 October 1991. Asian Productivity Organization, Tokyo.

Agricultural production, pesticide use and handling, government policy and pest control measures are discussed. Major crops are listed, with characteristic symptoms of damage by pests, and crop losses due to weeds are detailed. Future directions of research and development in pest control are outlined.

Oudinot, O. and Jourdain, D. (compilers) 1994. *Regional Agro-Pesticide Index, Vol. 2, Pacific 1994*. Revised edition, ARSAP/CIRAD/SPC, Suva.

A quick reference guide is provided for researchers, extension workers and practitioners in crop protection and pesticide distribution and use in 20 countries in the South Pacific, including Fiji. It cites official and semi-official government-recommended methods of control and other non-chemical control methods which may complement or provide alternative methods of control. Information is included on 275 active ingredients and more than 2000 commercial products. There is a bibliography that cites general and specific handbooks, manuals and advisory materials relevant to the region.

Morrison, R. J., Harrison, N. and Gangaiya, P. 1996. Organochlorine contaminants in the estuarine and coastal marine environments of the Fiji islands. *Environmental Pollution*, 93(2), 159–167.

Twenty-three sediment and two shellfish samples were analysed for 22 organochlorine pesticides, related residues and polychlorinated biphenyls during 1991-92. While a significant number were detected, the concentrations were generally very low. Relatively higher concentrations were observed near the major ports of Suva and Lautoka. No polychlorinated biphenyls were detected in areas away from major industrial centres.

PLANT TISSUE CULTURE AND BIOTECHNOLOGY

1970–1979

Krishnamurthi, M. and Tlaskal, J. 1974. Fiji disease resistant *Saccharum officinarum* var. *Pindar* sub clones from tissue cultures. *South African Sugar Journal*, 58:5, supplement 11.

A technique used for isolating 38 subclones of the variety Pindar is described. At least two subclones showed shifts in chromosome numbers and four were shown by the Department of Agriculture, Fiji to be resistant to Fiji disease.

1980–1989

Reddy, N. 1988. Genotype environment interactions and yield stability in dryland rice. *Fiji Agricultural Journal*, 50(1), 1–6.

The genetic differences in rice cultivars were identified for dryland production using statistical measures, and the results are presented in this paper. The best-performing cultivars are identified. It was found that stability parameters and growth duration are important for selecting rice varieties for dryland conditions.

1990–present

Jackson, G. V. H. 1990. Pathogen free Pacific taro. *FAO Plant Protection Bulletin*, 38(3), 145–150.

A total of 59 varieties and 8 breeders' lines of taro (*Colocasia esculenta*), 3 varieties of giant taro (*Alocasia macrorrhiza*) and a single tannia (*Xanthosoma sagittifolium*) are available as pathogen-tested tissue cultures or as suckers from indexed plants grown in quarantine. The available

varieties are listed by country. Some varieties have resistance to *Pythium* and *Phytophthora* diseases. Plants are available for distribution to countries served by the South Pacific Commission and other regions of the world.

Ashburner, G. R., Faure, M. G., Franz, P. R., Tomlinson, D. R., Pulo, P., Burch, J. M. and Thompson, W. K. 1994. Coconut embryo culture for remote locations. In: Coconut Improvement in the South Pacific: Proceedings of a Workshop, Taveuni, 10–12 November 1993. Suva, pp. 25–28.

Ashburner, G. R. and Rhode, W. 1994. Coconut germplasm characterization using DNA marker technology. In: Foale, M. A. and Lynch, P. W. ed. Coconut Improvement in the South Pacific: Proceedings of a Workshop Held in Taveuni, Fiji, 10–12 November 1993. ACIAR Proceedings No. 53, Australian Centre for International Agricultural Research, Canberra, pp. 44–46.

Protocols for RAPD and RFLP analyses of coconut germplasm are described and the implications of such techniques for germplasm management and breeding are discussed.

Asian Productivity Organization 1994. Biotechnology applications in agriculture in Asia and the Pacific. Report of an APO Study Meeting, Tokyo, 18–28 January 1994.

This four-part report has many authors. Part 1 is a summary of findings, including brief summaries of subsequent chapters. Part 2 consists of resource papers dealing with overview of recent biotechnological development, biotechnology in agriculture with special reference to India, biotechnology for crop improvement and production in Japan and biotechnology for sustainable agriculture. Part 3 consists of country reports, including one on Fiji, and Part 4 contains a list of participants.

Duhamel, G. 1994. Production and dissemination of improved coconut cultivars: Pacific Regional Agricultural Programme. In: Coconut Improvement in the South Pacific: Proceedings of a Workshop, Taveuni, 10–12 November 1993. Suva, pp. 19–21.

Taylor, M. B. 1994. Endogenous contaminants and tissue culture. PRAP Leaflet No. 4, Pacific Regional Agricultural Programme, Suva.

Taylor, M. B. 1994. The transfer of tissue culture plantlets from the tube to the soil. PRAP Leaflet No. 5, Pacific Regional Agricultural Programme, Suva.

Taylor, M. B. 1994. Tissue culture of taro (*Colocasia esculenta* var. *esculenta*). PRAP Leaflet No. 6, Pacific Regional Agricultural Programme, Suva.

Taylor, M. B. ed., 1996. Intellectual property rights and plant germplasm in the South Pacific region. PRAP Working Paper 96–3, Pacific Regional Agricultural Programme, Suva.

Taylor, M. B. 1996. Plant Tissue Culture and Agriculture in the South Pacific: Papers Presented at Tissue Culture Workshops, Nuku'alofa, Tonga, and Lae and Keravat, Papua New Guinea. PRAP Report No. 4, Pacific Regional Agricultural Programme, Suva.

This collection comprises papers presented at tissue culture workshops held for Department of Agriculture staff at Nuku'alofa, Tonga, and Lae, Keravat, Papua New Guinea in April–May 1996. The papers include: tissue culture and its implication for quarantine; the need for a conservation strategy in the South Pacific; in-vitro collecting; micro-propagation of agricultural crops; management of tissue culture laboratories in the tropics; the possibility of cloning cocoa in vitro; and weaning of tissue culture plants.

South Pacific Commission 1997. Taro Genetic Resources: Conservation and Utilisation, A Draft Project Design Prepared by the South Pacific Commission and the International Plant Genetic Resources Institute in Consultation with Pacific Island Governments, Suva.

The document contains details of the project origin and rationale, a description of the project and its planned implementation. Some of the key design issues discussed are feasibility, sustainability, risks and trade.

Taylor, M. B. and Vermeulen, W. 1997. The use of tissue culture for the rapid multiplication of potato plants within a commercial system. PRAP Leaflet No. 7, Pacific Regional Agricultural Programme, Suva.

Tyagi, A. P. 1997. Investigation of quantitative trait loci (QTLs) in two diverse strains of pigeonpea (*Cajanus cajan*) using RAPD markers. Journal of South Pacific Agriculture, 4(1/2), 92–98.

Randomly amplified polymorphic DNAs (RAPD) markers were used to investigate QTLs in two diverse strains of pigeon pea, their F1 and F2 progeny, in Fiji. The F1 progeny were found to be intermediate between two parents but F2 progeny showed little variation between them. This indicates that the parents are quite diverse morphologically but had little variation at the DNA level.

POST-HARVEST HANDLING, GRADING, PROCESSING AND TECHNOLOGY

1920–1929

Southall, C. L. 1928. Deterioration of copra on storage. *Fiji Agricultural Journal*, 1(3), 29–31.

Experiments are reported on changes in acidity, slow drying, storage and rapid drying in open vatas.

1930–1939

Barnes, A. C. 1931. The grading of Fiji copra. *Fiji Agricultural Journal*, 4(2), 71–77.

The question whether Fiji copra should be graded had long been considered. The paper contains a history of the grading issue and an outline of a grading scheme suggested by the Coconut Planters' Union in 1931. While acknowledging criticism that the small premium for quality would not be worth the additional cost, the author argued that the main gains would come from an increase in quantity produced and marketed for the same amount of raw material. This would be achieved by improving preparation methods.

Southall, C. L. 1931. Deterioration of copra on storage. *Fiji Agricultural Journal*, 4(3), 108–110.

A report is given of experiments to determine loss caused by drying copra in open vatas. It is concluded that copra containing less than 6 per cent moisture does not deteriorate to any great extent when stored in sacks in bulk. It is also concluded that no simple relationship exists between an increase in free fatty acids content and loss of copra.

Barnes, A. C. 1932. The drying of copra: the 'inclined chamber' copra drier. *Fiji Agricultural Journal*, 5(2), 84–91.

Investigations were made of artificial copra drying using the 'inclined chamber' copra drier. Detailed technical and cost information is provided, along with caution about the proper operation of the drier.

Jack, H. W. 1935. Brief notes on small copra driers. *Fiji Agricultural Journal*, 8(1), 8–11.

The author expressed his opinion that his tours of selected areas and examination of copra quality show that local customary methods of copra production 'fall short of perfection'. He explains why, with a view to improving quality through better drying methods in particular.

Flemons, G. F. and Harwood, L. W. 1936. Small copra driers. *Fiji Agricultural Journal*, 8(2), 8–10.

Discussion centres on the early experiences with the introduction of a small copra drier that had already proved effective in Malaya. Climatic and economic differences necessitated modification, notably the construction of a drier with smaller capacity. Technical and financial details are provided on its construction, and recommendations are made for its use.

Harwood, L. W. 1938. Factors influencing the quality of copra in Fiji. *Fiji Agricultural Journal*, 9(2), 5–11.

The author describes the system for classifying copra in London and observes discrimination for quality where Fiji copra has a low ranking. He describes two local grades of copra and the process of grading at Levuka. He considers the method of production could be substantially improved. Defects noted in the system include the local method of preparing copra for drying, insufficient and unsuitable drying facilities, inadequate storage conditions and dependence on sunlight. The activities of marketers of copra are briefly reviewed, and the domestic grading system is described and assessed. Other problem areas that are discussed include damage by birds and domestic animals, overloading, use of second-hand sacks, dirty storage accommodation and harvesting of immature nuts.

Parham, B. E. V. 1938. Recent experiences in cool storage transport of fruit. *Fiji Agricultural Journal*, 9(1), 13–17.

The author discusses the diseases of fruit in cool store under two headings, physiological and secondary, from the growth of fungal and bacterial contaminations originating in the orchard and plantation. Implications are considered for Fiji in terms of pre-storage delays due to the periodic nature of transport, inadequacies in handling and bruising.

Jack, H. W. 1939. Small estate copra drier. *Fiji Agricultural Journal*, 10(3), 109–110.

A brief description is given of a cheap platform drier for small estates. Technical details of construction are included.

1940–1949

Blackie, W. J. 1941. Copra quality and grading methods in Fiji. *Fiji Agricultural Journal*, 12(3), 68–75.

An outline is given of factors influencing copra quality preferred for oil crushing. They include oil content, free fatty acids, caramelised copra, extent of wet and dirty copra, and extent of clean and wholesome meal as a by-product. The grading system in Fiji is compared with those from other countries.

Harvey, C. 1941. Copra grading. *Fiji Agricultural Journal*, 12(3), 86.

Details are given of copra deliveries by grade for 1941, plus marks by grade.

Blackie, W. J. 1944. Summary of recent investigations carried out in the chemical laboratory. *Fiji Agricultural Journal*, 15(1), 19–22.

The author reports on the growing commercial importance of dried derris roots and local Chaulmoogra oil.

1950–1959

Harman, L. 1954. Small copra driers at Rabi. *Fiji Agricultural Journal*, 25(1), 7.

The 'Rabi' type of copra drier was by then widely used, replacing the large hot-air kilns constructed by Lever Brothers. The method of its operation is described.

Nield, J. 1955. The harvesting, handling and packing of bananas for export. *Fiji Agricultural Journal*, 26(1), 33–37.

The author recommends procedures for assessing maturity of export bananas, their harvesting, conveyance to packing stations, removal of fruit from bunches, grading and packing (including advice on the cases used in packing).

Sills, V. E. 1956. Copra drying experiments: 1. The relationship between rate of drying and relative humidity. *Fiji Agricultural Journal*, 27(3/4), 99–101.

These experiments of the relationship between rate of drying and relative humidity found that there was still a lot to learn about the physical behaviour of copra during the process of hot-air drying. The process of case hardening is described, and its effects on increasing the tray load are assessed.

Gregory, G. B., Sills, V. E. and Palmer, J. A. 1957. Copra Driers: Principles of Copra Drying and Practical Applications. Bulletin No. 32, Fiji Department of Agriculture, Suva.

This bulletin comprises three sections. In the first section, some statistics on the industry and principles in copra production are provided. Details of different methods of drying are given in the second section, covering sun-drying, smoke-drying, hot-air drying by natural draught and hot-air drying by forced draught.

Sills, V. E. 1957. Copra drying experiments: 2. Effect of temperature on rate of drying. *Fiji Agricultural Journal*, 28(3/4), 72–76.

Sills, V. E. 1957. The Devo drier. *Fiji Agricultural Journal*, 28(3/4), 68–71.

A description and illustration are given of the Devo copra drier, which was a novel method of hot-air drying of copra at low cost developed on Devo estate.

Sills, V. E. 1957. Copra drying experiments: effect of temperature on rate of drying. *Fiji Agricultural Journal*, 28(3/4), 72–76.

This paper reports on the desirability of two-stage drying to ensure the final product is well-dried and of good colour. It highlights the 'extreme slowness with which moisture diffuses or passes through the tough cellular structure comprising the flesh of the copra'.

Sills, V. E. 1959. Cassava starch. *Fiji Agricultural Journal*, 29(1), 16–18.

The prospects for production of cassava starch in Fiji are assessed in light of a failed attempt by the Fijian Cooperative Marketing Association Ltd at Nausori. The product and processing requirements are presented, along with details on quality determination, yields and uses. It is concluded that there is an export market for the product, but prices would need to increase to make it worthwhile trying to enter this market.

1960–1969

Thompson, P. G. 1966. Development of a small agricultural industry in Fiji. *South Pacific Commission Quarterly Bulletin*, 16(4), 53–55.

Prospects are assessed for the development of cottage industries which are argued to have received little attention in South Pacific countries. The formation of a cooperative society to process broom corn (or broom millet) in Fiji is an example of the cottage industry approach to the development of a new cash crop. The Valley Industry Co-operative Society is described as a vehicle for the planned development.

1970–1979

Sills, V. E. 1970. Copra grading in Fiji. *World Crops*, 22(4), 257–260.

A description accompanied by illustrations is given of the copra grading organisation established in Fiji in 1965 along the lines recommended by Lord Silsoe in his report of the Fiji coconut industry survey. Measures taken to improve copra quality through the operations of this organisation are discussed.

Yen, D. E. 1975. Indigenous food processing in Oceania. In: Arnott, M. L. ed., *Gastronomy: The Anthropology of Food and Food Habits*. World Anthropology Series, Mouton, The Hague, pp. 147–169.

Examples of individualistic control of agricultural production at two social levels are presented from South Pacific countries where elaborations of food are part of the social systems. The origins of food preservation methods in the region are discussed and concluded to be obscure. Reasons for their development are discussed.

Chandra, S. 1979. Handling, storage and processing of root crops in Fiji. In: Plucknett, D. L. ed., *Small Scale Processing and Storage of Tropical Root Crops*. Westview Press, Boulder, pp. 53–63.

Issues are discussed relating to the production, storage and handling of taro and cassava in Fiji.

Plucknett, D. L. ed., 1979. *Small Scale Processing and Storage of Tropical Root Crops*, Westview Press, Boulder, 483 pp.

The book describes small-scale processing and storage of tropical root crops such as yam, taro, sweet potato and cassava, and reports on the proceedings of a workshop held in Honolulu, Hawaii, in June 1978. It comprises 5 sections: (1) synthesis reports of international working

groups on handling, storage, processing techniques of products, and economic analysis of tropical root crop products; (2) processing and storage in selected countries (Fiji, Papua New Guinea, Philippines, Nigeria and China); (3) post-harvest handling and storage; (4) processing techniques and products; and (5) economic analysis.

1980–1989

Singh, A., Singh, S. R., Singh, S. P. and Vuivoavao, J. L. 1980. Quality of copra and its deterioration. *Fiji Agricultural Journal*, 42(2), 27–31.

A copra quality survey conducted around Savusavu, Buca Bay, Natewa Bay and Lakeba in 1973 revealed that improper drying practices resulted in poor quality copra. Copra driers were generally in good condition. The highest free fatty acid development occurred during cutting and drying on the farm and during transport, as was observed at the Suva Wharf due to improper storage conditions. Copra should reach the mill within 45 days to keep the free fatty acid content below 1 per cent. Remedial measures are proposed to improve copra quality.

Tavaiqia, M. 1983. Post-harvest losses in Fiji. *Alafua Agricultural Bulletin*, 8(2), 9–10.

A survey was undertaken of losses in post-harvest activities in Fiji. During the peak season for certain vegetables, an oversupply and lack of storage facilities lead to losses greater than 40 per cent. The author lists and discusses the commodities affected, and the major causes of loss. Constraints she identifies include human and physical factors, and lack of financial and training resources for setting up a post-harvest loss research unit that she suggests is needed to reduce losses.

UNIDO 1983. *Fiji: Agroindustrial Development*. World Bank/UNIDO Cooperative Program Report No. 29, New York, 237 pp.

The report commences with a description of the agroindustrial sector in Fiji, trade policy and existing institutional framework. This is followed by a description of the incentives structure for agroindustrial development and an assessment of the adequacy of incentives. Market distortions influence these incentives, and these are analysed together with potential incentives and disincentives. A study is made of comparative advantage in selected agroindustrial activities. The potentially remunerative agroindustrial opportunities that are assessed cover pineapples, fresh papaya, fresh mangoes, maize, onions and garlic. Ginger is already a crop subject to

considerable processing, and marketing opportunities for processed ginger exports are also explored. The report concludes with a plan of action and proposed initiatives to strengthen institutions.

Parkinson, S. V. 1986. Food processing and storage in the Pacific islands. In: Integrating Nutrition into Agriculture Training in South Pacific. Report on Regional Consultation Meeting and Curriculum Workshop, 7-12 July, WHO/University of the South Pacific, Apia.

Wall, D. 1986. Coconut Processing in the Pacific Islands. Islands/Australia Working Paper No. 86/18, National Centre for Development Studies, Australian National University, Canberra.

This paper contains reports on an examination made of the coconut oil processing plants in Fiji and Western Samoa. It is concluded that both were operating at a financial and economic loss, and were causing a drain on national resources.

Etherington, D. 1988. A policy perspective on coconut processing for the South Pacific countries. *CORD 4(2)*, Asian and Pacific Coconut Community, Jakarta, 40 pp.

Options are discussed for the utilisation of copra by adding value in-country in the South Pacific region rather than the export of copra as a raw material. Of particular interest to the author is the village-level development of milling facilities for use of coconut oil as a fuel substitute through the introduction of appropriate small-scale technology.

1990–present

Aalbersberg, W. G. L. and Parkinson, S. V. 1994. Traditional Pacific food technology. In: Morrison, J., Geraghty, P. and Crowe, L. ed. *Science of Pacific Islands Peoples: Fauna, Flora, Food and Medicine*, Vol. 3. Institute of Pacific Studies, Suva, pp. 1–6.

Sections are included on traditional methods of food technology, preservation in the field, post-harvest activities, drying, starch making, flours and meals, shells and shellfish, fruit and green nuts, cooking food and fermentation.

Lodge, N. 1995. Fiji Food Processing Project. Report to the South Pacific Project Facility, Suva.

FOOD AND HUMAN NUTRITION

Before 1940

Milne, W. 1859. On some of the plants used for food by the Fiji Islanders. *Edinburgh New Philosophy Journal* II, 10:151–153.

Milne, W. 1860. On some of the plants used for food by the Feejee islanders. *Transactions Botanical Society (Edinburgh)*, 6:263–265.

Wright, C. H. 1917. Varieties of food plants and edible fruits in Fiji. *Transactions Fiji Society*:19.

1940–1949

Bharat, S. 1940. 'Satua'—a nutritious Indian dish. *Fiji Agricultural Journal*, 11(4), 96.

Satua is described as a prized dish that is made from rice, maize, peas, gram, urd, mung and beans in Fiji. The method of cooking is explained.

Blackie, W. J. 1940. The vitamin C values of Fiji fruits and vegetables. *Fiji Agricultural Journal*, 11(1), 5–6.

A table is presented that contains 16 fruits and vegetables, showing vitamin C values and the range of values recorded elsewhere. There is also a table showing quantities needed for daily ingestion to meet adult and child minimum quantities. It is concluded that vitamin C deficiency should not exist in Fiji.

Dass, C. M. 1940. Cassava flour. *Fiji Agricultural Journal*, 11(4), 28.

Preliminary trials were carried out mixing cassava flour with wheaten sharps for making chapatis. This note reports on the trials.

Ackland, A. B. 1941. Fresh fruit and vegetable supplies to the New Zealand forces. *Fiji Agricultural Journal*, 12(3), 65–66.

An account is given of the means used to procure adequate food supplies for the New Zealand armed forces. Most of the supplies came from the so-called 'exempted Fijians'.

Dass, C. M. 1941. Cassava flour. *Fiji Agricultural Journal*, 12(1), 28.

A short note is written on utilisation of cassava flour in foodstuffs for Indian cooking. Results found it satisfactory but preference is still for sharps.

Jack, H. W. 1941. Food reserves. *Fiji Agricultural Journal*, 12(3), 63–64.

Concern is expressed about maintaining local food reserves in war-time.

Jack, H. W. 1941. Nutrition in relation to agriculture. *Fiji Agricultural Journal*, 12(4), 105–110.

This paper is an important landmark in the literature on food production and nutrition in Fiji. The author links the settlement schemes for Fijian farmers to their desire for the diversification of food production, sense of self-reliance, and desired for higher living standards. He observes the important use of food as a safeguard against the social and economic effects of fluctuations in income from cash cropping. Some reasons are posited why food production for own family consumption should remain an integral part of the farming system: 'In any system of balanced agriculture, the beneficial effects of the family production of food on general nutrition cannot be too highly stressed, and, hence, such production merits every possible encouragement'. Concern was expressed about the risk of price fluctuations for export cash crops leading to a neglect of food production, with consequent food shortages in times of high export prices. It was also observed that Fiji was poorly served by local market facilities. Good cultural methods were seen as a means of raising food production, but little was said about the role of research and development in food crops which had been neglected. Finally, long-term food security was linked to appropriate soil conservation measures.

Jack, H. W. and Blackie, W. J. 1941. Agriculture and nutrition. *Fiji Agricultural Journal*, 12(1), 3–9.

This article is an early attempt to link agriculture and nutrition by focusing on the importance of balanced food production to enhance nutritional status and the standards of living of both Fijians and Indians. The outbreak of war had focused minds on the importance of these links. Details are given of the steps taken by the Department of Agriculture to enhance food production and some rudimentary diets are prescribed. The paucity of data on the nutritive values of local foods is acknowledged.

Blackie, W. J. 1942. The vitamins. *Fiji Agricultural Journal*, 13(1), 13–20.

A background is given to the discovery and nature and functions of vitamins, along with human requirements. Details are provided of vitamins provided by common foods in Fiji.

Harvey, C. 1942. Food production. *Fiji Agricultural Journal*, 13(1), 4–5.

This is a status report on food availability during war-time. There is a repeat of recommendations to encourage local food production.

Jack, H. W. 1942. Local food production. *Fiji Agricultural Journal*, 13(4), 107–109.

This is another short paper in which farmers are exhorted to increase food production for the war effort. Some methods used by the government to encourage greater production are outlined.

Harvey, C. 1943. Planting of food crops by cane growers. *Fiji Agricultural Journal*, 14(3), 86.

CSR had encouraged tenants and cane contractors to plant food crops for their own use. Details are provided of areas planted by district. It is argued that this initiative had been a valuable contribution to self-sufficiency in Fiji during war-time.

Harvey, C. 1943. Supplies of fresh produce to military forces. *Fiji Agricultural Journal*, 14(3), 85–86.

Details are provided of values of fruit, green vegetables and root crops supplied to military forces and the area from which they were obtained. Around 80 per cent came from Fijian growers. Transport difficulties were identified.

Merrill, E. D. 1943. *Emergency Food Plants and Poisonous Plants of the Islands of the Pacific*. War Department Technical Manual TM 10–420, U. S. Government Printing Office, Washington, D.C.

Miller, C. D., Denning, H. and Bauer, A. 1948–50. Food values of native foods from Pacific islands. In: *Hawaii Agriculture Extension Service Biennial Report*. Honolulu, pp. 106–107.

Buchanan, J. R. C. 1949. *A guide to the Pacific Island dietaries*. South Pacific Health Service Paper, Suva (mimeograph).

1950–1959

Bell, M. and Wills, L. 1952. Report on Pilot Study of Nutrition of Fijians and Indians in Fiji, January to February 1950. Medical Department, Legislative Council Paper CP 2/1952, Suva.

Langley, D. M. 1953. Dietary surveys and growth records in a Fijian village, Naduri, June 1952–January 1953. South Pacific Health Service, Fiji Food and Nutrition Committee, Suva (mimeograph).

This is a record of the first of the decennial dietary surveys undertaken in Naduri village in the Sigatoka Valley. This original survey was associated with an agricultural project, the Naduri Co-operative Farm Project, which is described. It had the objective of identifying any changes in food consumption and nutrition that arose from the project. Data were collected on the demography of the village, food sources and production, frequency with which foods were eaten, cooking methods, diets and nutritional status.

O'Loughlin, C. L. and Holmes, S. 1954. A survey of economic and nutritional conditions in Indian households. South Pacific Health Service Paper, Suva (mimeograph).

Parkinson, S. V. 1954. Tropical foods. Transactions Fiji Society, 5(1), 175.

Peters, F. E. 1954. Analysis of South Pacific foods. SPC Quarterly Bulletin, 4(1), 6.

Langley, D. M. 1955. Nutrition Education in the South Pacific. Proceedings of the Australia/New Zealand Association for the Advancement of Science.

Holmes, S. 1956. Public health nutrition programmes in the Pacific islands. SPC Quarterly Bulletin, 6(2), 13–15.

The main features and activities of public health nutrition programs in Pacific island countries are presented. Details are given on surveys recently undertaken in a number of countries, including Fiji. There is a section on the training of nutrition workers where it is mentioned that a dietitian supervisor had been appointed in Fiji to train indigenous women to manage kitchens in institutions.

Massal, E. and Barrau, J. 1956. Food Plants of the South Sea Islands. Technical Paper No. 94, South Pacific Commission, Noumea, 52 pp.

This paper contains chemical analyses of sago, taro, arrowroot, yams, banana, breadfruit, cassava and sweet potatoes. Most of the data were gleaned from studies by F. E. Peters.

Massal, E. and Barrau, J. 1956. A survey of subsistence problems in the South Pacific. South Pacific Commission Quarterly Bulletin, 6(2), 34–35.

The authors examine the 'widely varying impact of the European on the subsistence agriculture and the food habits of island peoples in different parts of the Pacific'. They consider close cooperation between the agronomist and the nutritionist as essential in selecting from many traditional and introduced subsistence plants in order to achieve a balanced diet.

Massal, E. and Barrau, J. 1956. Some lesser-known Pacific food plants. South Pacific Commission Quarterly Bulletin, 6(2), 17–18.

This is the concluding article of the series on the main subsistence crops in the Pacific. It covers green leaves and shoots, flowers and bulbs. There are occasional references to Fiji.

Massal, E. and Barrau, J. 1956. From subsistence gardening to cash crops. South Pacific Commission Quarterly Bulletin, 6(2), 14–15, 48.

The development of cash cropping in the South Pacific from the early period of European settlement is recounted, with emphasis on the key role it played in development of the regional economy. A couple of references are made to Fiji, and the material is generally relevant to Fijian agricultural development in this period.

McKee, H. S. 1956. Cash crops and imported foods in the South Pacific. South Pacific Commission Quarterly Bulletin, 6(2), 23–26.

An argument is presented why Pacific island countries such as Fiji should not become too dependent on cash crops, Rather, they should retain their subsistence agriculture. The continuing predominance of copra as the major cash crop is observed although it was soon to be displaced in most Pacific island countries. There is a section on the impacts of cash cropping on the subsistence economy. Occasional references are made to Fiji agriculture.

Miller, C. D., Murai, M. and Pen, F. 1956. The use of *Pandanus* as food in Micronesia. *Pacific Science*, 10:3.

McKee, H. S. 1957. Some Food Problems in the Pacific Islands. Technical Paper No. 106, South Pacific Commission, Noumea.

The author describes the important traditional basic foods and agricultural systems, with some references to Fiji. He also lists some supplementary food crops common to South Pacific countries. The effects of European contacts on indigenous agriculture are observed in detail, with special reference to the consequences of the introduction of cash crops. Details are provided on storage of staple foods, mainly root crops. There is a section on leguminous seed crops. Marketing, transport, handling and storage of foods are discussed, pointing to major difficulties in the fresh produce system.

McKee, H. S. 1957. Some useful food plants. *South Pacific Commission Quarterly Bulletin*, 7(3), 51–52.

The author examines the prospects for introducing and expanding production of several leguminous food plants in the Pacific. Surprisingly little reference is made to Fiji given the leading role the country had played in this field.

Peters, F. E. 1957. Chemical Composition of South Pacific Foods: An Annotated Bibliography. Technical Paper No. 100. South Pacific Commission, Noumea, 106 pp.

This annotated bibliography includes a few Fiji references. A list of food composition tables is provided, along with an index of food plants, a glossary of scientific names, and composition of some common foods.

Peters, F. E. 1957. The chemical composition of some South Pacific foods. *Proceedings of the 9th Pacific Science Congress, Thailand*, 15:129.

Barrau, J. 1958. A useful plant growing in Fiji. *South Pacific Commission Quarterly Bulletin*, 8(2), 39.

A description and illustrations are presented of the cluster bean, *Cyamopsis psoralioides*, D. C., found in vegetable gardens on Viti Levu.

Murai, M., Pen, F. and Miller, C. D. 1958. *Some Tropical South Pacific Islands Foods: Description, History, Use, Composition, and Nutritive Value*. University of Hawaii Press, Honolulu, 159 pp.

The book contains information on the nutrient content of a number of preserved foods from Micronesia. Some nutrient data for fresh foods are also included.

Peters, F. E. 1958. *The Chemical Composition of South Pacific Foods*. Technical Paper No. 115, South Pacific Commission, Noumea, 56 pp.

The author describes the methods employed to analyse the chemical composition of foods, and presents results for those foods that are important in South Pacific countries. Discussion focuses on many crops that are important in Fiji, covering root crops, other starchy foods, fruits, nuts, leaves and saps. There is also a section on weaning foods made from coconuts.

1960–1969

Maramba, M. 1962. *Report on Food and Nutrition Situation in the Colony of Fiji*. Expanded Program of Technical Assistance, Report No. 1552, Food and Agriculture Organization of the United Nations, Rome.

This report is based on a survey undertaken from May to September 1960, entailing a study of Suva market. A set of recommendations were arrived at which included the need for further market studies. Import requirements should be assessed in the light of seasonal and regional food production patterns, with care to avoid disincentives to local producers.

Wilkins, R. M. 1963. *Dietary survey in a Fijian Village, Naduri, Nadroga*. South Pacific Health Service Paper, Suva (mimeograph).

This is the second decennial dietary survey of Naduri village. The information provided in the paper corresponds fairly closely to that reported for the first survey, with an update on census figures, anthropometric data, data on annual production and consumption, living conditions and health status, and results of the dietary survey.

Fiji School of Medicine, 1964. Food composition tables for use in the South Pacific. Fiji School of Medicine, Suva, 43 pp.

Wilkins, R. M. 1964. Dietary Survey: Rakiraki. South Pacific Health Service Paper, Suva.

Jansen, A. A. J. and Boubela, S. H. 1968. Nutritional assessment and dietary study in the village of Serea, Viti Levu. WHO Project 5601, Suva (mimeograph).

Wilmott, J. V. 1969. A dietary survey of Indians and Fijians living in the Koronubu settlement area. South Pacific Health Services, Paper, Suva (mimeograph).

1970–1979

Wilmott, J. V. 1971. Food composition trends. Fiji Medical School Journal, 5:10.

Wilmott, J. V. 1971. Value of urban diets. Fiji Medical School Journal, 6:10.

Barrau, J. 1973. The Oceanians and their food plants. In: Smith, C. E. Jr ed., Man and His Foods. University of Alabama Press.

Parkinson, S. V. 1973. Some observations on the cause of malnutrition in Pacific island urban populations. In: Rae, C. and Green, S. ed. Nutrition in the Tropics. Menzies School of Public Health, Darwin.

Parkinson, S. V. 1973. Some observations on the causes of malnutrition in Pacific Island urban communities. In: Harre, J. and C. Knapman ed. Living in Town: Problems and Priorities in Urban Planning in the South Pacific. South Pacific Social Sciences Association, Suva, pp. 69–75.

Standal, B. R., Street, J. M. and Warner, R. M. 1974. Tasty, protein rich, and easy to grow—the new edible ‘Sunset’ hibiscus. Hawaii Farm Science, Second Quarter:2–3.

Information is provided on a new hibiscus in Hawaii with high protein levels that could be suitable for production in countries such as Fiji.

Tikaram, S. 1974. Food consumption trends in Naduri village, 1953–1954. Fiji Medical School Journal, 2:223.

The observations made in this paper are based on data collected about food consumption habits in the village of Naduri in the Sigatoka Valley.

McGee, T. 1975. Food Dependency in the Pacific: A Preliminary Statement. Working Paper No. 2, Development Studies Centre, Australian National University, Canberra.

Lambert, J. N. 1977. Low cost diets for Fijian and Indian families. Fiji National Food and Nutrition Committee, Suva.

For given low levels of household budget, diets are presented that would satisfy family nutrition needs, with an emphasis on the consumption of locally produced foods.

Parkinson, S. V. 1977. A Handbook of South Pacific Nutrition. National Food and Nutrition Committee, 74 pp.

This handbook provides basic technical information on nutrition and is intended for people who are interested in applying the principles of good nutrition through education, medicine or agricultural programs in the South Pacific. Suggested nutrition projects for schools are included.

Prior, I. 1977. Nutritional problems in Pacific islanders. Proceedings of the Nutrition Society of New Zealand, 1:1–44.

Stacy, P. 1977. Pacific Island Cookbook. Pacific Publications, Sydney, 84 pp.

This cookbook consists of recipes using tropical fruits and vegetables grown in the Pacific islands. It includes a tropical fruit and vegetable guide.

Thaman, R. R. 1977. Plant resources of the Suva Municipal Market, Fiji. *Ethnomedizin*, 4(1/2), 23–61.

The names and characteristics, properties and uses are given of plants sold through the Suva market.

Lucas, V. E. 1978. Nutritional status of pre-school children in a rural and urban community in Fiji: Part 1 Nutrition. *Fiji Medical School Journal*, 6(11), 280.

Lucas, V. E. 1978. Nutritional status of pre-school children in a rural and urban community in Fiji: Part 2 Diet. *Fiji Medical School Journal*, 6(12), 374.

National Food and Nutrition Committee. 1978. Boarding school meals survey report. Suva (mimeograph).

Chandra, R. 1979. Food buying behaviour in Suva, Fiji. M.A. thesis, School of Social and Economic Development, University of the South Pacific, Suva.
National Food and Nutrition Committee 1979. Food Balance Studies Report, Ministry of Health, Suva.

Thaman, R. R. 1979. Food scarcity, food dependency and nutritional deterioration in small Pacific Island communities. In: Moran, W., Hosking, P. and Aitken, G. ed. Proceedings of the 10th New Zealand Geography Conference and 49th ANZAAS Congress (Geographical Sciences), Auckland, January. New Zealand Geographical Series No. 10.

This paper is a forerunner of a voluminous set of publications by Thaman on the decline in traditional food supplies and related malnutrition, annotated below. Sections are included on abundance and self-sufficiency, health and nutrition, food scarcity, increasing food dependency and nutrition deterioration. Some Fijian examples are given.

Thaman, R. R. 1979. Food dependency and malnutrition: deterioration of traditional Pacific food systems. In: Utrecht, E., ed., Fiji: Client State of Australasia? Transnational Corporations Research Project, University of Sydney, pp. 67–117.

The author interprets what he sees as a drastic change in food systems in Pacific island countries that is leading to economic, social and ecological disaster. He describes the nature of this problem as a breakdown in traditional cultures, and food, food-production and food-distribution systems. An idyllic picture is painted of the past as a time of abundance and self-sufficiency, with high standards of health and nutrition. Details are provided on traditional diets that are contrasted with the present situation of food scarcity, increasing food dependency and deterioration of nutritional status. Many reasons are proffered for this deterioration: introduction of trade goods; emphasis on cash cropping; monetisation; cash employment and consumerism; following a capitalist development path; urbanisation and migration; mining and industrialisation; immigrant populations; missionary influence; changing social relationships; changing aspirations and value systems; changing tastes; technological change; introduction of inferior food crops and foodstuffs; emphasis on livestock production; western education; foreign aid; and improved transportation networks.

1980–1989

Baxter, M. W. P. 1980. Food in Fiji: the Produce and Processed Foods Distribution Systems. Monograph No. 22, Development Studies Centre, Australian National University, 282 pp.

Foodstuff imports involve all ethnic groups in Fiji and the government policy affecting these areas are basic to this analysis of the food distribution system. The author explains how food consumption habits are the outcome of historical trends and cultural bias as well as economic factors. He concludes that food imports cannot be reduced unless these factors are addressed. The food distribution system has two components—one for fresh produce and one for processed food—which are described in detail. Ways are discussed to increase the efficiency of both components, along with active and equitable racial participation.

Duve, R. N. 1980. Food adulteration trends in Fiji. *Fiji Agricultural Journal*, 42(2), 15–18.

A total of 6727 food and water samples submitted by the Ministry of Health, Fiji were analysed by standards for adulteration with various compounds. Commonly adulterated items include raw milk. No serious problems were detected in several other foods including processed milk and ice cream.

Prasad, J. 1980. Pectin and oil from passion fruit waste. *Fiji Agricultural Journal*, 42:45.

The waste products from the passionfruit (*Passiflora edulis* var. *flavicarpa*) industry, which in time would impose a serious disposal problem, could be utilised profitably by extracting pectin from the rinds and edible oil from the seeds. The fresh rind yielded 2.4 per cent pectin of fair commercial value. The seeds contained 23 per cent oil with chemical and physical parameters very close to that of safflower, soybean and other vegetable oils. At the prevailing level of passionfruit production, yields of 13 000 litres of oil and 4.5 tonnes pectin could have been recovered annually.

Chandra, S. 1981. Food production and consumption on Fijian and Indian farms in the Sigatoka Valley, Fiji. *Fiji Agricultural Journal*, 43(1), 33–42.

Evidence is provided to indicate how micro-level studies of the production and consumption behaviour of ethnic communities in subsistence and semi-subsistence agriculture can provide important data for farm planning and national food policies. There is a need to assess the nutrient supply of various foods. Marked differences were found in dietary

patterns between Indian and Fijian households. Indian households were found to be more efficient than Fijian households in meeting their food needs from the farm and at a lower cost. The Fijians had a high cash expenditure on purchased foods and also purchased more expensive sources of kilojoules and protein. They needed to produce more food on their farms and alter their cropping and livestock mix to obtain better returns for expenditure on food.

Johnson, J. S. 1981. Fiji's growing dependence on food imports. *Fiji Food and Nutrition Newsletter*, 9:7.

Details are provided showing that Fiji had become increasingly dependent on food imports. Unfortunately, these details are not analysed in real values over time or as a proportion of national income, so they lack conviction.

National Food and Nutrition Committee 1981 to present. *Fiji Food and Nutrition Newsletter*.

This quarterly newsletter contains a news update of activities of the National Food and Nutrition Committee and information on nutrition education, health, fisheries and recipes.

Viraj, M. E. 1981. Communications Plan for the Fiji National Food and Nutrition Programme, National Food and Nutrition Committee, Suva.

The nutrition policies of the National Food and Nutrition Committee are described, and recommendations are made for their implementation through an information campaign. A proposed campaign is described.

Johnson, J. S. and Lambert, J. N. 1982. The National Food and Nutritional Survey of Fiji 1982. Fiji/79/004 Field Document No. 6, National Food and Nutrition Committee/UNDP/FAO, Suva.

This major national food and nutrition survey revealed a high incidence of malnutrition in children under five years of age and a tendency to overweight in adults in Fiji. Dietary patterns were studied, and revealed that subsistence agriculture and fishing remain important for the provision of food, particularly for Fijian families. Inadequate knowledge of farming practices and land constraints were found to be the main problems in increasing agricultural output and productivity. A number of recommendations were made based on the findings of the survey.

National Food and Nutrition Committee 1982. National Food and Nutrition Development Programme, Preliminary Food and Nutrition Policy for Fiji—With its Programmes and Projects. Fiji/79/004 Field Document No. 5, National Food and Nutrition Committee/UNDP/FAO, Suva.

Johnson, J. S. 1982. A national food and nutrition policy for Fiji. *Food and Nutrition*, 8(1), 19–26.

This is a major review of the achievements of food and nutrition policy in Fiji, initiated through the National Food and Nutrition Committee. The Committee implemented several programs to increase public cognisance of the importance of improved nutrition, improve food supply and raise nutritional status. FAO/UNDP assisted in conducting some field studies which provided data on anthropometrics, economic characteristics, the health environment, food consumption and food expenditure. A draft food and nutrition policy was prepared in October 1981. Adequate food supply, with a reduced dependence on food imports and improved nutrition of young children were the targets. A modified land use policy is thought to be needed to ensure suitable land is available for domestic food production.

National Food and Nutrition Committee 1982. Meeting Basic Needs: a National Food and Nutrition Policy for Fiji. National Food and Nutrition Committee, Suva.

Following a review of the nutrition situation and food supply in Fiji, a set of policy recommendations are presented that were formulated by the National Food and Nutrition Committee.

Parkinson, S. V. 1982. Nutrition in the South Pacific—past and present. *Journal of Food and Nutrition*, 39(3), 121–125.

The varied past food patterns in South Pacific countries are described as a prelude to assessing the advantages and disadvantages of traditional diets. Particular attention is paid to the role of traditional foods in providing energy, vitamins, minerals and fibre. Changes in dietary patterns are traced to the present, with an account of emerging dietary problems.

Parkinson, S. V. and Lambert, J. N. 1982. *The New Handbook of South Pacific Nutrition*, National Food and Nutrition Committee, Suva.

Sivan, P. 1982. Producing more food crops in the South Pacific: what are the possibilities? In: Thaman, R. R. and Clarke, W. C. ed. *Food and National Development in the South Pacific*. University South Pacific, Suva, pp. 105–118.

Standal, B. R. 1982. Nutritional value of edible aroids Araceae, grown in the South Pacific. In: Lambert, M. ed., *Taro Cultivation in the South Pacific*. Handbook No. 22, South Pacific Commission, Noumea, pp. 123–131.

The author lists the edible aroids found in the South Pacific, and which plant parts are used as food. The ways in which these foods are used and their nutritional value are discussed, followed by a brief section on anti-nutrients present in the crops. The final two sections are on taro and the potential for improving protein content of corms and other food uses.

Taylor, R. 1982. Nutrition, health and human productivity: the dimensions of the problems in the South Pacific. In: Thaman, R. R. and Clarke, W. C. ed. *Food and National Development in the South Pacific*. University South Pacific, Suva, pp. 57–78.

Nutrition deficiency diseases are concluded not to be major problems among adults in South Pacific countries. The only exceptions are for iron-deficiency anaemia, underprivileged people or those in lower socio-economic groups, certain populations in remote areas and during natural disasters

Thaman, R. R. 1982. Deterioration of traditional food systems, increasing malnutrition and food dependency in the Pacific islands. *Journal of Food and Nutrition*, 39(3), 109–121.

The author outlines those factors he considered were responsible for a decline in traditional food supplies and related malnutrition. He acknowledges that solutions to the problem of malnutrition are not easy to implement, but suggests an approach to alleviate it in which a higher value is placed on conserving land resources. Some empirical evidence from Fiji is used in the analysis.

Thaman, R. R. 1982. The foods that came first. *Alafua Agricultural Bulletin*, 7(3), 105–115.

A detailed and comprehensive listing is made of traditional foods in South Pacific island countries. The list included many wild foods the use of which is observed to be in decline. Reasons are given why governments should promote the use of wild foods on economic, technical and social grounds. Some Fijian examples are included.

Thaman, R. R. and Clarke, W. C. ed. 1982. *Food and National Development in the South Pacific*, Ray Parkinson Memorial Lectures, University of the South Pacific, Suva.

This collection of eight papers covers: food and national development; food and nutrition policies; determinants of government planning; nutrition, health and productivity; the role of government in providing adequate food supplies; increasing food production and food processing; possibilities for producing more food crops; improved processing and marketing of foods; and food processing.

Thaman, R. R. and Thomas, P. M. 1982. The cassava invasion: the cultural, nutritional and ecological impact of cassava on Pacific island food systems. In: Bourke, R. M. and Kesavan, V. ed. *Proceedings of the 2nd Papua New Guinea Food Crops Conference*. Department of Primary Industry, Port Moresby, pp. 330–352.

Bolabola, C. 1983. Nutrition survey at Naduri village, Sigatoka—infant feeding practices. Fiji National Food and Nutrition Committee, Suva.

Further details are disclosed on diet and nutrition in Naduri village in the Sigatoka Valley, emanating from the decennial surveys undertaken in the village. The material in this paper focuses on feeding practices used for infants.

Johnson, J. S. 1983. *Assistance to the National Food and Nutrition Development Programme Fiji*. Technical Cooperation Programme, Food and Agriculture Organization of the United Nations, Rome.

The technical cooperation program had been undertaken and completed, and its results and conclusions are presented in this monograph. Recommendations are drawn from the work undertaken for improving the food and nutrition program, and forecasts are made about the likely effects of certain agricultural projects on nutritional status. Among the

recommendations is the need to promote more vigorously the incorporation of nutrition and health considerations in the planning and execution of projects in the program, and to include MAFF in these activities.

Parkinson, S. V. 1983. Some traditional methods of storing staple food crops in the Pacific islands. *Alafua Agricultural Bulletin*, 8(2), 105–109.

An outline is given of some traditional methods commonly used in the past to store staple food crops in Pacific island countries. Use of these methods has substantially declined in recent times.

Parkinson, S. V. and Lambert, J. N. 1983. *The New Handbook of South Pacific Nutrition*. Fourth edition, National Food and Nutrition Committee, Suva, 92 pp.

South Pacific Commission 1983. *Food Composition Tables for Use in the Pacific Islands*. South Pacific Commission, Noumea, 33 pp.

Food tables are provided for 13 food groups. Recommended daily intakes of nutrients are presented.

Chin, B., Gillies, M. E. and Shilton, M. G. 1984. Mineral composition of drinking water and beverages consumed by rural and urban Fijians. *Annual Proceedings of the Nutrition Society of New Zealand*, 9:173.

Connell, J. 1984. *Diets and Dependency: Food and Colonialism in the South Pacific*. Occasional Paper No. 1, Ideas Centre, Australian Freedom from Hunger Campaign, Sydney.

The causes and symptoms of dependency on imported food are described. Food dependency is analysed in economic and nutritional terms. Implications are drawn about the need for more 'self-reliant' agricultural and rural development.

Coyne, T. 1984. The effect of urbanisation and Western diet on the health of Pacific island populations. In: Badcock, J. and Taylor, R. ed. *Technical Paper No. 186*, South Pacific Commission, Noumea.

An historical background of urbanisation in Pacific countries is presented, with an account of the consequences of the introduction of a Western diet and lifestyle leading to chronic diseases. There is also a section on infant and child nutrition. The author treats separately Polynesia, Micronesia and Melanesia, and provides some details from Fiji in his treatment of the latter.

Johnson, J., Bolabola, C. and Pollock, N. 1984. Report on Nutrition Survey: Naduri Village. National Food and Nutrition Committee, Suva.

Further details are provided on diet and nutrition in Naduri village in the Sigatoka Valley, emanating from the fourth decennial survey undertaken in the village.

Parkinson, S. V. 1984. The contribution of aroids in the nutrition of people in the South Pacific. In: Chandra, S. ed., *Edible Aroids*, Clarendon Press, Oxford, pp. 215–224.

The author observes that aroid foods long provided people in Pacific island countries with excellent staple foods, but a marked decline had occurred in their consumption. She outlines the nutritional benefits of these staples, and couples the decline in their consumption with increased health problems. Active measures are considered to be needed to make aroids more easily available to people living under modern conditions.

Parkinson, S. V. 1984. The preservation and preparation of root crops and some other traditional foods in the South Pacific. RAS/83/001 Field Document No.1, FAO and South Pacific Commission. Suva, 31 pp.

Pollock, N. J. 1984. Changing food habits in the Pacific. *Proceedings of the Nutrition Society of New Zealand*, 9.

Bradbury, J. H., Beatty, R. E., Bradshaw, K., Hammer, B., Holloway, W. D., Jealous, W., Lau, J., Nguyen, T. and Singh, U. 1985. Chemistry and nutritive value of tropical root crops in the South Pacific. *Proceedings of the Nutrition Society of Australia*, 10:185–188.

Parkinson, S. V. 1985. *A Taste of the Tropics*. Institute of Pacific Studies, University of the South Pacific, and Fiji National Marketing Authority, Suva, A. Haas, Wellington, 94 pp.

The excellent eating opportunities based on tropical foods commonly found in Pacific island countries are extolled and described.

Pollock, N. J. 1985. The concept of food in a Pacific society: a Fijian example. *Ecology of Food and Nutrition*, 17:195–203.

Food, although a broad term in English, is used in different societies to include different items and exclude others. In Fiji, food is used specifically for starches from root and tree crops. A broader term of 'edibles' is suggested to cover the Fijian concepts. The author begins by presenting the case for using the term, edibles, the various categories of which are

described. They include: meals (real and accompanying food); non-meal (refreshments, teas and buns, raw edibles, feasts, and cigarettes and tobacco); and drinkables (water, tea, sugarcane and boiled greens). An additional dimension to the food/edibles concept is the existence of language structure of a possessive form applicable only to edibles. By highlighting the differences between some dimensions of the English concept, food, and its counterparts in the Fijian concepts, we can be alerted to differences in the concept of food in other societies.

Ringrose, H., Ram, P., Mollard, C., Taylor, R. and Zimmet, P. 1985. Energy intakes and diabetes prevalence of rural and urban Melanesian and Indian populations in Fiji. *Fiji Medical Journal*, 13:250–253.

Some 533 people were surveyed to ascertain energy intakes and the prevalence of diabetes among rural and urban Melanesian and Indian populations in Fiji. Prepared food items and fruits and vegetables were measured, weighed and sampled to ascertain edible portions of foods. The 24-hour recall method was used to obtain dietary intake data. It was found that the incidence of diabetes mellitus differed between Melanesians and Indians in rural and urban areas. The difference was not explained by a comparison of body mass indices or differences in types of carbohydrate foods consumed. Energy intake as a measure of energy utilisation may be an important variable accounting for rural-urban differences in the incidence of diabetes.

Thaman, R. R. and Thomas, P. M. 1985. Cassava and change in Pacific Island food systems. In: Cattle, D. J. and Schwerin, K. H. ed. *Food Energy in Tropical Ecosystems*, Gordon & Breach, New York, Ch. 9.

The displacement of what the authors call 'traditional tuber crops', such as yams and taro, by cassava in food systems in Pacific island countries is commonly seen as a major factor in the breakdown of traditional food systems. This, so the argument goes, leads to increased soil erosion, soil deterioration and inferior nutritional status. But the authors also point out some positive characteristics of cassava. It is an excellent source of dietary fibre, energy and some micronutrients, and one of the highest energy-yielding crops in area and fossil fuel input. It also has an extremely wide environmental tolerance. The favourable and unfavourable characteristics are discussed in detail. It is concluded that cassava could play a major role in reversing the increasing rates of malnutrition and nutrition-related degenerative diseases in Pacific islands if appropriately integrated into food and agricultural systems. It could also help ease

economic crises related to dangerously high levels of dependency in many island groups. Some Fijian examples are given, and the material is particularly relevant to the food situation in Fiji.

Institute for Research, Extension and Training in Agriculture 1986. Regional Consultation Meeting and Curriculum Workshop on 'Integrating Nutrition into Agriculture Training in South Pacific'. University of the South Pacific, Alafua.

The aim of the meeting and workshop was to develop institutional capacity to integrate nutrition into training programs in formal agriculture in South Pacific countries. Specific objectives were to review current problems and issues in food, nutrition and agriculture in relation to current policies and programs, and develop a set of resolutions and recommendations. At the commencement of the program, a review was given of the food and nutrition situation in the South Pacific (M. C. Swaminathan) followed by an outline of agriculture and food policies (M. Nube) and nutrition policy in the region (J. Badcock). Other papers with a focus on the South Pacific region were on: types of nutrition integration into agricultural curricula (D. Osbourne); issues in agricultural education at formal levels (L. Fuata'i); effective communication methodologies to reach decision makers and target beneficiaries of nutrition programs (P. Thomas); key nutrition concepts and their relevance to agricultural education (J. Eusebio); the inter-relationships between agriculture, food, nutrition and health (M. Rigamoto and S. Ochetim); the impact of food availability on nutrition (F. Opio and I. Ali); food and nutrients (J. Bale and E. Peters); food and nutritional requirements (J. Badcock); evaluation of nutritional status (E. Peters); food processing and storage (S. Parkinson and T. Moengangongo); food supply systems (M. Rigamoto and S. Ochetim); food diversification systems (I. Ali and R. Clements); mixed home food gardening and plantations (P. Somers and J. Wilson); food and nutrition programs (M. Nube and B. Sio); nutrition education methodologies (P. Schoffel and J. Badcock); and effective communication on nutrition in agriculture (P. Thomas).

Bradbury, J. H. and Singh, U. 1986. Ascorbic acid and dehydroascorbic acid content of tropical root crops of the South Pacific. *Journal of Food Science*, 51(4), 975–978.

Total vitamin content by HPLC was established for sweet potato (*Ipomoea batatas*), taro (*Colocasia esculenta* L. Schott and *Xanthosoma* spp.), giant taro (*Alocasia macrorrhiza*), giant swamp taro (*Cyrtosperma chamissonis*), yams (*Dioscorea alata* and *Dioscorea esculenta*) and cassava (*Manihot esculenta*). Storage of sweet potato at 25°C and 15°C for 28 days reduced the total vitamin C content by 17 per cent and 15 per cent, respectively. There was no significant decrease at 0°C. Cooling reduced levels of ascorbic acid and dehydroascorbic acid by up to 70 per cent.

Bradbury, J. H. and Singh, U. 1986. Thiamin, riboflavin and nicotonic acid contents of tropical root crops of the South Pacific. *Journal of Food Science*, 51(6), 1563–1564.

The authors determined the thiamin, riboflavin and nicotonic acid contents of sweet potato (*Ipomoea batatas*), taro (*Colocasia esculenta* L. Schott and *Xanthosoma* spp.), giant taro (*Alocasia macrorrhiza*), giant swamp taro (*Cyrtosperma chamissonis*) and yams (*Dioscorea alata* and *Dioscorea esculenta*) for fresh and 40°C dried material obtained from six South Pacific countries, including Fiji. Losses on drying at 40°C for two to three days were 10 per cent to 15 per cent. Sweet potato contained the largest amount of thiamin and, along with taro varieties the largest amount of nicotonic acid. The root crops were found to provide inadequate amounts of thiamin, riboflavin and nicotonic acid. Losses on cooking were about the same for all vitamins and root crops at about 20 per cent on boiling (water retained) or baking, and about 40 per cent on boiling (water discarded).

Pollock, N. J. 1986. Food classification in Fiji, Hawaii and Tahiti. *Ethnology*, 25(2), 107–118.

The main thrust of this paper is to demonstrate that food as an important concept in Fiji, Hawaii and Tahiti had certain characteristics that distinguished it from the English concept of food. The predominance of starchy food, the specificity of meal foods and the structural demarcation of edibles all point to ways in which food and edibles were socially significant in each of the three societies which were marked by an emphasis on starchy foods over other edibles.

South Pacific Commission/Fiji National Food and Nutrition Committee/Fiji School of Medicine 1986. Food Composition Tables for Use in the Pacific Islands. South Pacific Commission, Noumea.

Thaman, R. R. 1986. The role of root crops, bananas and plantains in Pacific Island food security. Contribution to a Document on the Role of Roots, Tubers, Plantains and Bananas in the Pacific Islands, Food and Agricultural Organization of the United Nations, Rome.

National Food and Nutrition Committee 1987. Report of drought stricken areas of the Western Division, Fiji. Suva (mimeograph).

Parkinson, S. V. 1987. A study of the effects of economic development on food consumption and nutrition in a Fijian village. Proceedings of the Menzies Symposium, 7th ANZAAS Congress, Townsville, August.

Pillai, G. and Rao, A. N. 1987. Teaching agriculture and food nutrition in Fiji: food, agriculture and education. Science and Technology Education and Future Human Needs, 6:131–132.

In response to an increasing incidence of malnutrition, the Fiji Cabinet set up the National Food and Nutrition committee (NFNC) in 1976. The Committee had launched a multi-pronged strategy to ameliorate food and nutritional standards. The curriculum unit of the Ministry of Education had produced a variety of courses to achieve its goals, including basic science, modern studies, multicraft agriculture, and agricultural and biological sciences.

Aalbersberg, W. G. L. 1988. Food preservation in the Pacific using acid fermentation. *Journal of Pacific Studies*, 14:59–67.

This paper contains a summary of the practice of pit fermentation of breadfruit, as practised throughout the Pacific. There is a report on investigations of the chemistry of this process, and its biochemical and nutritional parameters which are presented in tabular form. It is concluded that the future of this traditional technology is uncertain.

Aalbersberg, W. G. L., Parkinson, S. V., Lovelace, C. E. A. and Madhoji, K. 1988. Davuke: the traditional Fijian method of pit preservation of staple carbohydrate foods. *Ecology of Food Nutrition*, 21(3), 173–180.

Preservation of staple foods by pit fermentation in Fiji is described, together with some microbiological and nutritive aspects of the process in preserving breadfruit. The fermentation can be done using less labour and materials than used in the traditional method.

Bradbury, J. H. and Holloway, W. D. 1988. Chemistry of Tropical Root Crops: Significance for Nutrition and Agriculture in the Pacific. ACIAR Monograph No. 6, Australian Centre for International Agricultural Research, Canberra, 201 pp.

The authors discuss the chemical and nutritive composition and status of a wide range of Pacific root crops. Data are presented that are the result of collaborative studies by the Australia National University and 17 collaborators from 8 Pacific countries. An overview is given of the production and nutrition of root crops, followed by descriptions of their chemical composition, the effects of cooking and storage, antinutritional factors in root crops, and effects of environmental constraints on yield and composition. There is a comprehensive reference list.

Bradbury, J. H., Bradshaw, K., Jealous, W., Holloway, W. D. and Phimpisane, T. 1988. Effect of cooking on nutrient content of tropical root crops from the South Pacific. *Journal of Science, Food and Agriculture*, 43(4), 333–342.

Changes in nutrient content were measured for sweet potato, taro, yam and cassava as a result of boiling, steaming and baking. Some of the root crops used in the experiments were obtained from Fiji. Changes were similar for all crops except sweet potato, and may be explained loosely in terms of breakdown of nutrients with heat and with solubilisation of water-soluble constituents. The major changes observed were: (1) an approximate doubling of the apparent dietary fibre content due to the formation on cooking of starch resistance to degradation by the enzymes used in the starch assay procedure; (2) a decrease in the content of potassium by up to 20 per cent and smaller decreases of other water-soluble salts; (3) a very large increase in the maltose content of sweet potato on cooking. Dry baking was found to be the best cooking method in general, followed by steaming.

Thaman, R. R. 1988. Consumerism, the media and malnutrition in the Pacific Islands. *Journal of Pacific Studies*, 14:68–96.

Analyses are undertaken of the nutritional implications of changing consumption patterns in terms of nutritional disorders related to non-communicable diseases. Deductions are drawn about the dietary factors responsible: refined carbohydrates and sugars; increased intake of animal fats; decreased intake of dietary fibre; excessive salt intake; decline in the consumption of fresh foods; and reduced breastfeeding. The role played by the media in these trends is discussed, with special attention paid to newspapers.

Thaman, R. R. 1988. Health and nutrition in the Pacific islands: development or underdevelopment? *Geo Journal*, 16(2), 211–227.

This is another paper by the author decrying the adverse effects of modernisation on health and nutrition in Pacific island countries. The arguments and evidence presented had been well rehearsed in many other papers, as had the recommendations for overcoming recent problems brought about by dietary changes.

Thaman, R. R. 1988. Pacific Islands' Health and Nutrition: Trends and Areas for Action. Development and Change Issue Papers (Pacific Islands Conference, Rarotonga, Cook Islands, August 1985. Pacific Islands Development Program, East-West Center, Honolulu.

Parkinson, S. V., Stacy, P. and Mattinson, A. 1989. *Taste of the Tropics*. David Bateman Ltd, Auckland.

This cookbook consists of recipes using tropical fruits and vegetables grown in the Pacific islands. It includes a guide to tropical fruits and vegetables and advice on selection, storage and nutritive value of a comprehensive range of foods. There are coloured plates of cooked Pacific foods. It is an updated version of Stacy's 1977 cookbook.

Lovelace, C. E. A. and Aalbersberg, W. G. L. 1989. Aflatoxin levels in foodstuffs in Fiji and Tonga Islands. *Plant Foods for Human Nutrition*, 39(4), 393–399.

Fungal growth, as occurs in South Pacific countries for parts of the year, is a major problem for food storage in humid environments. Major crops, including edible nuts, copra and root crops, are susceptible to *Aspergillus* growth and therefore potential contamination with aflatoxin. Of groundnut samples analysed for aflatoxin, 50 per cent of those from Fiji

were positive but only 9 per cent from Tonga, reflecting different storage practices. Local copra, cassava and maize samples were contaminated, with only the maize at a serious level; 25 plate food samples from Fiji showed low contamination. When starch foods from the Fijian diet left after cooking were analysed to follow potential aflatoxin development, only sweet potatoes showed some contamination.

South Pacific Commission, 1989 to present. Garden to Kitchen Newsletter.
South Pacific Commission, Suva.

Originally started by UNICEF and SPC, now the editorial responsibility is given to the Community Education Training Centre within the South Pacific Commission, with funds from UNICEF. The Newsletter provides information for promoting home food production, and on what households are doing to ensure sufficiency of good quality foods to meet daily requirements.

1990–present

Aalbersberg, W. 1990. Food composition. In: Jansen, A. A. J., Parkinson, S. V. and Robertson, A. F. S. ed. Food and Nutrition in Fiji, Vol. 1 Food Production, Composition and Intake. Department of Nutrition and Dietetics, Fiji School of Medicine and the Institute of Pacific Studies, University of the South Pacific, Suva, pp. 108–155.

Food analyses carried out on Pacific foods and food crops by different scientists (including work by the author) in various publications are reviewed. Food composition tables of various foods are provided.

Aalbersberg, W. 1990. Food preparation and preservation. In: Jansen, A. A. J., Parkinson, S. V. and Robertson, A. F. S. ed. Food and Nutrition in Fiji, Vol. 1 Food Production, Composition and Intake. Department of Nutrition and Dietetics, Fiji School of Medicine and the Institute of Pacific Studies, University of the South Pacific, Suva, pp. 156–171.

Discussion focuses on the methods of preparation, fermentation and preservation of traditional foods in Fiji and other island countries.

Badcock, J. 1990. The Role of Food and Nutrition Surveillance in National Food and Nutrition Planning in the Pacific. Islands-Australia Working Paper 90/12, National Centre for Development Studies, Australian National University, Canberra, 24 pp.

The relevance is considered of nutrition issues and nutritional surveillance to economic growth and development. The author argues that the successes and failures of various development initiatives have typically been assessed by a variety of indicators expressed as aggregated means that rarely permit monitoring of the direction and pace of development. A more appropriate way of assessing development is to view it as a process leading to the satisfaction of essential human needs and minimising inequalities. Nutritional adequacy means more than enough food for all; it encompasses dietary, environmental and socioeconomic factors. Examples from Asia, Europe and USA are contrasted with nutrition surveillance systems in Fiji, Papua New Guinea, Tuvalu and Vanuatu.

Badcock, J., Toganivalu, V., Goodwillie, D. and Lakau, S. 1990. Developing Community Nutrition Programmes, South Pacific Community Nutrition Training Project, University of the South Pacific, Suva.

The aim of this publication is to provide community workers with methods to develop community nutrition programs and to provide training materials. It comprises four sections. In the first section, a six-step program is given on how to assess, plan and develop a community program. In the second section, people are taught how to identify food and nutrition problems. Examples of how to detect such problems are provided in the third section. The final section contains teaching summaries and materials.

Bale, J. T., Bolabola, C., Parkinson, S. V. and Tuivanuavou, A. S. 1990. Preparation of Pacific Island Foods, South Pacific Community Nutrition Training Project, University of the South Pacific, Suva.

The major foods and drinks in the diets of Pacific island populations are described, and ways of selecting and preparing food are outlined. Simple prescriptions are given for making family meals and storing food.

Cleveland, S. 1990. Sigatoka Valley Survey. National Food and Nutrition Committee, Suva (mimeograph).

This paper reports on the results of a survey of 129 households. Income and anthropometric data were collected, as well as information on the household environment, and dietary customs and beliefs.

Food and Agriculture Organization of the United Nations 1990. *Roots, Tubers, Plantains and Bananas in Human Nutrition*. Food and Agriculture Organization of the United Nations, Rome.

Chapters are included on: the origins and distribution of root and tuber crops, plantains and bananas; their production and consumption; nutritive values; methods of cooking and processing; effects of cooking and processing on nutritive values; toxic substances and antinutritional factors; new frontiers for root and tuber crops; and food security in developing countries. Some references are made to Fiji.

Jansen, A. A. J., Parkinson, S. V. and Robertson, A. F. S. ed. 1990. *Food and Nutrition in Fiji*, Vol. 1 Food Production, Composition and Intake. Department of Nutrition and Dietetics, Fiji School of Medicine and the Institute of Pacific Studies, University of the South Pacific, Suva, 479 pp.

This is an important edited collection that covers the evolution of the food system in Fiji. It includes pieces on historical agricultural perspectives, food composition, preparation, preservation, food intake, feeding of infants and children, aquaculture, chemical composition of marine food resources, fish consumption and food technology.

Malolo, M., Sio, B., Iopa, L., Chand, M. and Ta'aram, T. 1990. *Food and Nutrition*, South Pacific Community Nutrition Training Project, University of the South Pacific, Suva.

This manual contains simple and clearly presented material on food, nutrition and the health of people in South Pacific countries, to promote more informed choices about diets. The links between food intake, diet and health are outlined, with sections on the properties of different foods. There are also sections providing guidelines for teaching about food and its intake.

Parkinson, S. V. 1990. Food intake. In: Jansen, A. A. J., Parkinson, S. V. and Robertson, A. F. S. ed. *Food and Nutrition in Fiji*, Vol. 1 Food Production, Composition and Intake. Department of Nutrition and Dietetics, Fiji School of Medicine and the Institute of Pacific Studies, University of the South Pacific, Suva, pp. 172–330.

The authors of this chapter review 34 studies covering different aspects of food consumption in Fiji between the years 1850 and the mid-1980s. The chapter also provides relevant data from the national food and nutrition survey of 1981.

Parkinson, S. V. 1990. The feeding of infants and young children. In: Jansen, A. A. J., Parkinson, S. V. and Robertson, A. F. S. ed. Food and Nutrition in Fiji, Vol. 1 Food Production, Composition and Intake. Department of Nutrition and Dietetics, Fiji School of Medicine and the Institute of Pacific Studies, University of the South Pacific, Suva, pp. 331–392.

An attempt is made in this chapter to chart the history of feeding infants and young children in Fiji, and the effects of changing practice on nutrition over the past hundred years. Information is presented on the changes that have occurred in succeeding decades.

Parkinson, S. V., Fa'ana, M. B., Suara, Z. Q., Elymore, J. and Dabwido, D. 1990. Storing and Preserving Pacific Island Foods. South Pacific Commission Nutrition Training Project, Extension Services, University of the South Pacific, Suva.

The meaning of food preservation is outlined along with both traditional and modern ways of preserving food for different lengths of time. The main resources needed for food preservation are described. A simple user's guide is given for storing and preserving food in Pacific island countries.

Robertson, A. F. S. 1990. Introduction. In: Jansen, A. A. J., Parkinson, S. V. and Robertson, A. F. S. ed. Food and Nutrition in Fiji, Vol. 1 Food Production, Composition and Intake. Department of Nutrition and Dietetics, Fiji School of Medicine and the Institute of Pacific Studies, University of the South Pacific, Suva, 1–22.

This introductory chapter contains an overview of the geography of Fiji, its political system, population, agriculture, economy and health status.

Sofield, C. 1990. Review of the Present Status of Nutrition and the Role of Women in Agricultural Development in Fiji. Report prepared for the FAO Sector Review and Formulation Mission, 29 September–6 October, Suva.

The author assembles evidence on the present status of nutrition in Fiji, especially in relation to the role of women in food production. She sets out some recommendations to improve the nutritional status of women and their contributions to agricultural development.

Sommers, P., Galloway, R., Nanau, I., Sinapatai, A. and Wat, T. 1990. Family Food Supply, South Pacific Community Nutrition Training Project, University of the South Pacific, Suva.

Sources of food are outlined for a healthy diet in Pacific island countries. The authors begin with the proposition that changing lifestyles and increased cash cropping have altered the ability of families to secure sources of locally produced nutritious foods. The bulk of the book contains prescriptions about how to plan for food needs and grow more foods. Some teaching summaries are provided.

South Pacific Commission 1990-present. Pacific Islands Nutrition (PIN).

PIN is a quarterly newsletter of the South Pacific Commission that deals with issues on nutrition, food and health-related matters in the Pacific island communities.

South Pacific Commission 1990. South Pacific foods leaflets. Suva.

This series of coloured leaflets is devoted to the uses of local food in the South Pacific. Foods covered include taro, papaya, mango, guava, cassava, green leaves, banana, coconut, breadfruit, pineapple, citrus, pumpkin, yam, sweet potato, nuts and seeds, legumes, fish and seafood.

Thaman, R. R. 1990. The evolution of the Fiji food system. In: Jansen, A. A. J., Parkinson, S. V. and Robertson, A. F. S. ed. Food and Nutrition in Fiji. Vol. 1, Department of Nutrition and Dietetics, Fiji School of Medicine and the Institute of Pacific Studies, University of the South Pacific, Suva.

This chapter contains a comprehensive and detailed review of the food system in Fiji. The author traces its evolution from the pre-European era. The early food production system is described and crop details are presented with an indication of their relative importance. Separate sections are provided on staple food crops, tree food crops, spices, stimulants and narcotic plants, wild food plant resources and animal protein resources. Three other food system components are briefly outlined: food exchange networks; times of food shortage; and food processing, preservation and preparation. The chapter concludes with some observations on recent trends in food consumption habits, notably the declining importance of traditional foods, and increasing food dependency. Factors contributing to changing food consumption habits are specified.

Aalbersberg, W. 1991. Cyanide in Fiji cassava. In: Jansen, A. A. J., Parkinson, S. V. and Robertson, A. F. S. ed. Food and Nutrition in Fiji. Vol. 2, Department of Nutrition and Dietetics, Fiji School of Medicine and the Institute of Pacific Studies, University of the South Pacific, Suva, pp. 575–583.

The author provides details on the levels of cyanide in cassava cultivars in Fiji, observing varied estimates, and discusses the health consequences of chronic cyanide ingestion from eating cassava. Details are also provided on the effects of boiling to reduce the cyanide level.

Aalbersberg, W. G. L., Ali, N., Naidu, R. and Sotheeswaram, S. 1991. Alpha-glucosidase activity in four varieties of Fiji sugar cane. *Tropical Science*, 31(4), 417–420.

The levels of alpha glucosidase enzyme activity in four *Saccharum officinarum* varieties were determined. Findings are presented and discussed.

Aalbersberg, W. G. L., Currey, N. and Gubag, K. 1991. Nutrient analysis of tropical spinach leaves (*Hibiscus manihot*) in Fiji and Papua New Guinea. *ASEAN Food Journal*, 6 (4), 159–160.

Data are presented on the nutritive composition of leaves of *Hibiscus manihot* (*Abelmoschus manihot*), a major green leafy vegetable in Pacific diets. Samples obtained from three locations were analysed at three laboratories (one in Fiji and two in Papua New Guinea). Differences in the values obtained are attributed to various factors, including differences in the composite mixture of cultivars analysed at each laboratory and differences in soil and climate conditions across the three source locations.

Aalbersberg, W. G. L. and Limalevu, L. 1991. Cyanide content in fresh and processed Fijian cassava (*Manihot esculenta*) cultivars. *Tropical Science*, 31(3), 249–256.

The levels of cyanide in 28 cassava cultivars were determined and the health consequences of chronic cyanide ingestion from cassava are discussed.

Cameron, J. 1991. Practical Economics of Food and Nutrition Policy in Small, Open Economies: A Case-Study of Four Pacific Societies. Food and Agriculture Organization of the United Nations, Rome.

The case-study countries in question are Tonga, Vanuatu, Solomon Islands and the Federated States of Micronesia. Some basic, yet often overlooked or misunderstood, economic principles are enunciated for the sound development of food and nutrition policies in Pacific island countries through the four case studies.

Chand, M. J. 1991. Nutrition intervention. In: Jansen, A. A. J., Parkinson, S. V. and Robertson, A. F. S. ed. Food and Nutrition in Fiji. Vol. 2, Department of Nutrition and Dietetics, Fiji School of Medicine and the Institute of Pacific Studies, University of the South Pacific, Suva, pp. 359–389.

Infant and maternal nutrition are the focus of study. Its history is given for Fiji with supporting evidence. Intervention measures are discussed in detail, covering nutrition in schools, disaster relief, and food and nutrition projects undertaken by various organisations in Fiji. Nutrition intervention in schools has included school gardens and boarding school meals.

Jansen, A. A. J. 1991. Vitamin deficiencies. In: Jansen, A. A. J., Parkinson, S. V. and Robertson, A. F. S. ed. Food and Nutrition in Fiji. Vol. 2, Department of Nutrition and Dietetics, Fiji School of Medicine and the Institute of Pacific Studies, University of the South Pacific, Suva, pp. 189–221.

This chapter contains sections on the incidence of vitamin A deficiency, beri beri disease, riboflavin deficiency, folate deficiency, pellagra, scurvy and rickets. The links between these diseases and dietary factors are explored. It is noted that dark green vegetables high in vitamin A are available in abundance in Fiji and regularly consumed. It is also observed that cases of people suffering from vitamin B or thiamin deficiency have declined rapidly in recent years.

Jansen, A. A. J. 1991. Mineral deficiencies. In: Jansen, A. A. J., Parkinson, S. V. and Robertson, A. F. S. ed. Food and Nutrition in Fiji. Vol. 2, Department of Nutrition and Dietetics, Fiji School of Medicine and the Institute of Pacific Studies, University of the South Pacific, Suva, pp. 222–293.

Anaemia is the major focus of this chapter, and a detailed coverage is given of its prevalence. It particularly affects Indian women and infants. Symptoms and incidence are described and hookworm is noted as a major causal factor.

Jansen, A. A. J. 1991. Agriculture. In: Jansen, A. A. J., Parkinson, S. V. and Robertson, A. F. S. ed. Food and Nutrition in Fiji. Vol. 2, Department of Nutrition and Dietetics, Fiji School of Medicine and the Institute of Pacific Studies, University of the South Pacific, Suva, pp. 690–717.

A small annotated bibliography is presented on general agriculture in Fiji, with separate sections on individual commodities and commodity groups. Some useful observations are made on root crops.

Jansen, A. A. J. and Aalbersberg, W. G. L. 1991. Traditional medicine. In: Jansen, A. A. J., Parkinson, S. V. and Robertson, A. F. S. ed. Food and Nutrition in Fiji. Vol. 2, Department of Nutrition and Dietetics, Fiji School of Medicine and the Institute of Pacific Studies, University of the South Pacific, Suva, pp. 636–653.

The authors report on the rich pharmacopoeia of Fijian medicinal plants. They list many, along with their uses. A comprehensive table is included that shows family, species, Fijian name and therapeutic medications.

Jansen, A. A. J. and Shrestha, M. 1991. Clinical aspects of protein-energy malnutrition. In: Jansen, A. A. J., Parkinson, S. V. and Robertson, A. F. S. ed. Food and Nutrition in Fiji. Vol. 2, Department of Nutrition and Dietetics, Fiji School of Medicine and the Institute of Pacific Studies, University of the South Pacific, Suva, pp. 69–94.

Malolo, M. ed., 1991. Proceedings of the First Regional Workshop for Nutritionists, Dietitians and Nutrition Educators: Planning, Implementing and Evaluating Nutrition Education Programmes. South Pacific Commission, Noumea.

These proceedings contain a number of papers aimed at improving nutrition education programs in South Pacific countries. Useful country case studies are provided on a variety of issues concerning education and training in nutrition.

Ravuvu, A. 1991. A Fijian cultural perspective on food. In: Jansen, A. A. J., Parkinson, S. V. and Robertson, A. F. S. ed. Food and Nutrition in Fiji. Vol. 2, Department of Nutrition and Dietetics, Fiji School of Medicine and the Institute of Pacific Studies, University of the South Pacific, Suva, pp. 622–635.

The author describes how food and drink are central elements in the lives of Fijians. Beliefs and values relating to food quest are discussed and details are provided on tasks and their allocation in food production. The sharing

of food is an important issue, with gender implications. In discussing food consumption it is noted that social occasions and gender differences are important factors, and timing and attitudes to eating impinge on consumption habits. Details are given of foods for different occasions such as ceremonial and hospitality. Other matters mentioned in relation to food consumption are food preparation and preservation, and food taboos. Observations are made on changes in food habits associated with a reduction in formal arrangements, changing preferences for food types, changes in attitudes to eating, and the erosion of food taboos.

Robertson, A. F. S. 1991. Women, development and nutrition. In: Jansen, A. A. J., Parkinson, S. V. and Robertson, A. F. S. ed. Food and Nutrition in Fiji. Vol. 2, Department of Nutrition and Dietetics, Fiji School of Medicine and the Institute of Pacific Studies, University of the South Pacific, Suva, pp. 668–689.

Little comprehensive documentation has been made of the nutritional status of women in Fiji. While the work done to date, as outlined in this chapter, is limited, it is possible to observe changing nutritional patterns in women and their causes. A section is included on women's involvement in nutrition programs, allied food and health programs, and agricultural and fisheries production.

Robertson, A. F. S. 1991. Institutions concerned with human nutrition. In: Jansen, A. A. J., Parkinson, S. V. and Robertson, A. F. S. ed. Food and Nutrition in Fiji. Vol. 2, Department of Nutrition and Dietetics, Fiji School of Medicine and the Institute of Pacific Studies, University of the South Pacific, Suva, pp. 718–719.

A list is provided of 24 institutions in Fiji that are concerned with human nutrition issues.

Savou, S. F. 1991. National food and nutrition policy. In: Jansen, A. A. J., Parkinson, S. V. and Robertson, A. F. S. ed. Food and Nutrition in Fiji. Vol. 2, Department of Nutrition and Dietetics, Fiji School of Medicine and the Institute of Pacific Studies, University of the South Pacific, Suva, pp. 654–667.

Background information is provided on the history of food and nutrition policy in Fiji and the formation, role and responsibilities of the National Food and Nutrition Committee. Project activities of the Committee are summarised and details are provided on the functions of the Food and

Nutrition Council. An assessment is made of progress towards achieving the policy goals set in the areas of food supplies, infant malnutrition, nutrition education, school feeding, food analysis and research.

Bailey, J. M. 1992. *The Leaves We Eat*. Handbook 31, South Pacific Commission, Noumea.

This handbook covers the nutritional, health-medicinal, taste and cooking effects and ways of using the 22 leafy types of vegetables listed, and their role in the food chain in the South Pacific Islands diets. The vegetables covered are: lettuce, taro, papaya leaf cabbage, night shade (*Solanum nigrum*), winged bean, chayote, jointfir (*Gnetum gnemon*), water spinach (*Ipomea*), pumpkin, Chinese cabbage, drumstick, cassava, kale seedlings (*Brassica oleracea* var. *acephala*), water dropwort (*Oenanthe javanica*), watercress, tropical spinach (*Amaranthus*), sweet potato, taro leaves, fern (*Athyrium esculentum*), edible hibiscus and *Basella*. A total of 35 references are provided.

Parkinson, S., Tunidau, J. and Chand, M. 1992. *A Nutrition Handbook for the South Pacific Islands*. Revised edition, National Food and Nutrition Committee, Suva, 107 pp.

Chapters are presented on the need for food, carbohydrates and fats, proteins, vitamins and minerals, food nutrition and disease, how to stay healthy, and 'the foods we eat'. The original book authored by Parkinson in 1964 was revised by Parkinson and Lambert in 1982.

Pollock, N. J. 1992. *These Roots Remain: Food Habits in Islands of the Central and Eastern Pacific Since Western Contact*, Institute for Polynesian Studies, Laie, Hawaii, 289 pp.

A broad survey is made of 11 main starch foods of Polynesia and Melanesia. The study addresses the question of South Pacific people retaining their cultural and dietary attachment to traditional food sources. An investigation is made of the cultural mechanisms that have allowed certain distinctive features associated with food to remain in the face of many intrusions into those societies.

Opio, F. 1993. Contribution of subsistence diets to farm household nutrient requirements in the Pacific. *Ecology of Food and Nutrition*, 29(4), 285–305.

Increasing problems of malnutrition in the Pacific are believed to be associated with traditional household consumption habits. Around 60 to 70 per cent of most household diets are observed to be derived from

subsistence production. Most of the subsistence food items are rich in one type of nutrient but severely deficient in others. Evidence from Fiji and Western Samoa suggests that most households are dependent on subsistence food production for their survival and subsistence food supplies are inadequate to meet the overall household nutrient requirements. Subsistence diets are particularly deficient in vitamins and low in protein but generally self-sufficient in food energy and iron. The most vulnerable appear to be the low-income subsistence farm households. The contribution of subsistence food supply to farm household nutrient requirements is evaluated in order to formulate a food security policy and increase cash production in the South Pacific.

Dignan, C. A., Burlingame, B. A., Arthur, J. M., Quigley, R. J. and Milligan, G. C. 1994. The Pacific Islands Food Composition Tables, South Pacific Commission, Noumea.

The tables contain a collection of foods and nutrient composition data of 22 nutrients from many different published and unpublished sources for some 800 foods eaten in the Pacific island countries.

Seniloli, S. and Tuivaga, J. 1994. Report of the Fifth Decennial Naduri Nutrition and Health Survey, June 24–July 2, 1994. National Food and Nutrition Committee, Suva.

This report summarises the results of the most recent nutrition survey of Naduri village in the Sigatoka Valley. While the format follows previous reports, there is an increased emphasis on the changes in social organisation and demographic and economic status.

Thaman, R. R. 1994. Ethnobotany of Pacific island coastal plants. In: Morrison, J., Geraghty, P. and Crowe, L. ed. Science of Pacific Islands Peoples: Fauna, Flora, Food and Medicine, Vol. 3. Institute of Pacific Studies, Suva, pp. 147–184.

The nature and ecological and cultural importance of coastal plants, most of which grow wild, are described for the Pacific islands. Details are given of their uses, many of which pertain to Fiji.

UNICEF 1994. Report: Family Food Production and Nutrition Workshop, 21–25 November 1994, Suva.

This is a summary report of workshop activities. The report contains an update on the evaluation of the Pacific Regional Family Food Production and Nutrition Project, resource-sharing and technical issues, a field visit and planning country-specific objectives and activities for the project.

Vatucawaqa, P. 1994. Food Balance Sheet. National Food and Nutrition Committee, Suva.

An updated food balance sheet was constructed for Fiji and is detailed in this publication.

Parkinson, S. V., Stacy, P. and Mattinson, A. 1995. Taste of the Pacific. David Bateman Ltd, Auckland, pp. 112.

The updated version of this cookbook consists of recipes using tropical fruits and vegetables grown in the Pacific islands. It includes a tropical fruit and vegetable guide and advice on selection, storage and nutritive value of a comprehensive range of foods. There are coloured plates of cooked Pacific foods.

Prasad, N. 1995. Family Food Production and Nutrition Project of Fiji: Evaluation Report, National Food and Nutrition Committee, Suva, 50 pp.

The activities of the Family Food Production and Nutrition Project of Fiji since its inception in 1985 are described. The long-term objectives of the project were considered to have been achieved to a reasonable extent but the short-term objectives were not because of a number of constraints that are outlined in the evaluation report. The need for a multisectoral approach based on long-term activities is highlighted. The demonstration gardens at hospitals and health centres are assessed, and it is concluded that they were not adequately integrated into the overall activities of these institutions.

Saito, S. 1995. 1993 National Nutrition Survey: Main Report. National Food and Nutrition Committee, Suva.

This main report of the 1993 national nutrition survey provides information on the current nutritional status of Fiji's population by using selected indicators. Factors known to have an impact on nutritional status are evaluated. Information derived from the survey is argued to be helpful in the formulation of national food and nutrition policies and strategies to improve the nutritional and health status of people in Fiji.

Savou, S., Saito, S. and Murti, R. 1995. 1993 National Nutrition Survey: Executive Summary Report, National Food and Nutrition Committee, Suva.

This is an executive summary of the main report from the publication by Saito in the same year.

Vatucawaqa, P. 1995. 1993 National Nutrition Survey: Subdivisional Findings. National Food and Nutrition Committee, Suva.

For each subdivision, summaries are presented on anthropometric data, food intake and diet, and water supply and sanitation.

English, R. M., Aalbersberg, W. G. L. and Scheelings, P. 1996. Pacific Island Foods, Institute of Applied Science, University of the South Pacific, Suva, 94 pp.

A description is given of 78 local foods, and their nutrient composition is specified. The analytical program was sponsored by the Australian Centre for International Agriculture Research.

National Food and Nutrition Committee 1996. The Fiji Plan of Action. National Food and Nutrition Committee, Suva.

This plan of action begins with a brief introduction on the food and nutrition situation in Fiji. The policy framework for the national plan of action for nutrition is then outlined, and detailed suggestions are given for implementation strategies and personnel requirements for implementation.

Anon. 1997. Fiji: anaemia strikes half the country's pregnant women at risk. Pacific Islands Nutrition, 28:3-5.

The paper reports on the results of a study undertaken by the Department of Health of women and pre-schoolers in Fiji. The results reveal severe shortages of iron in diets and widespread incidence of anaemia. The incidence is particularly high among pregnant women.

English, R. M. 1997. Report to the National Food and Nutrition Committee, Fiji, National Food and Nutrition Committee, Suva.

This report is of major significance for the National Food and Nutrition Committee, which had reached a crossroads in its evolution. The report contains details of activities, findings and recommendations for the future. It was undertaken by a consultant who reviewed the work of the Committee.

United Nations Development Programme/Government of Fiji 1997. Fiji Poverty Report. Suva, 156 pp.

This report is the first of a series of commitments to measure the incidence of poverty in the national context in Fiji. Its authors recommend actions that can be taken to eradicate poverty. It is a joint initiative of UNDP and the Government of Fiji.

Vatucawaqa, P. and Seniloli, S. 1997. Fiji Food Balance Sheet 1992. National Food and Nutrition Committee, Suva.

The document provides a brief overview of the food situation and information on food items consumed in Fiji, sources of supply and their utilisation. It is the first food balance sheet for Fiji and is a valuable resource for food, nutrition and economic studies.

PULSES, LEGUMES AND LEGUMINOUS TREES

1930–1939

Maleli, D. N. 1936. The culture of soya bean. *Fiji Agricultural Journal*, 8(2), 52.

Brief notes are made on the production and harvesting of soya beans.

1940–1949

Dass, C. M. 1940. The production of dhal. *Fiji Agricultural Journal*, 11(4), 92–95.

The term, dhal, is used to cover all pulses grown in Fiji. The author highlights evidence that a variety of pulses can be successfully grown in Fiji, as either cash or food crops and as a source of nitrogen for the soil. He provides descriptions of arhar, urd, mung, cowpea and soya bean, and forecasts good prospects for soya bean production.

Saukuru, T. R. 1944. Cultivation of groundnuts or peanuts (*Arachis hypogea*). *Fiji Agricultural Journal*, 5(3), 83.

The various aspects of peanut cultivation covered for conditions in Fiji are land preparation, seed selection, planting, maintenance and harvesting.

Surridge, H. R. 1947. Peanut cultivation. *Fiji Agricultural Journal*, 18(1), 9–12.

The soil preferences of peanuts are described, and recommendations are made on desired sowing, cultivation and harvesting methods. There are also sections on peanut varieties, rotations that include peanuts, and the main pests of peanuts in Fiji.

1970–1979

Department of Agriculture, Fiji 1973. Report for the Year 1972, Suva.

Mean yields are presented (p. 11) for trials on groundnut cv. Natal Common, Red Spanish, American Bunch and Virginia Runner. They decreased from 1531–1866 lb/ac when sown in mid-February to 624–878 lb when sown in April.

Viner, R. C. and Reddy, S. 1975. Yield potential of some mung bean (*Phaseolus aures*) selections in Fiji. *Fiji Agricultural Journal*, 37(1), 37.

Of seven lines of mung bean from India, Philippines and Fiji, the Philippines lines, MC50-10A and MD15-2, gave the highest yields. Varietal cropping periods ranged from 60 to 84 days, those of the above lines being 62 and 61 days, respectively.

Lambert, M. 1976. Results of 1975–76 soya bean trials in certain South Pacific territories. Information Circular, South Pacific Commission, No. 76, 11pp.

Results of small-scale trials of 15 INTSOY soya bean cultivars are reported. The cultivars tested were unsuitable for Fiji. In New Caledonia, 6 cultivars yielded more than 2.5 tonnes of seed per hectare; in French Polynesia, 12 cultivars yielded more than 2 t/ha and 4 cultivars more than 4 t/ha. In Tonga, cultivar Jupiter gave good yields when sown in January–July. January sowings gave the best results. Sowing in August–September led to failure to flower and negligible yields.

1980–1989

Cowie, A. L., Rayment, G. E. and Chand, V. 1987. Responses of pigeon pea to lime on an oxisol in Fiji. In: Wallis, E. S. and Blyth, D. E. ed. Food Legume Improvement for Asian Farming Systems. ACIAR Proceedings No. 18, Australian Centre for International Agricultural Research, Canberra, pp. 258–259.

Lime at an application rate of 0–4.8 t CaCO₃/ha was incorporated to a depth of 10, 20 or 30 cm in a Talasiga soil (acidic oxisol) in Fiji 3 months prior to sowing pigeon peas cv. Hunt. The initial soil pH was 5.1 with an effective CEC of <30 mmol (p+)/kg and Al saturation of approximately 45 per cent of the effective CEC at the surface, rising to 60 per cent at a depth of 30 cm. An application of 4.8 t CaCO₃/ha increased the soil pH to 5.8 and reduced the Al saturation of the top 20 cm to approximately 5 per cent. Total DM yields at flowering ranged from 318 g/m² in the control to 381 g/m² with 3.2 t CaCO₃/ha. Excessive flower drop during an abnormally prolonged flowering period resulted in widely varied seed yields within each treatment, but vegetative yields at maturity were not affected by lime and exceeded 6t/ha in all treatments. Root systems were normal, with tap root penetration to at least 20 cm and primary lateral roots penetrating to <40cm in all treatments. It was concluded that Hunt was a particularly Al-tolerant cv.

1990–present

Singh, B., Narayan, K. and Kuo, G. C. 1993. Pulse production in dry areas of Fiji. In: Adaptation of Food Crops To Temperature and Water Stress: Proceedings of an International Symposium 13–18 August 1992. Taipei, pp. 473–478.

Promising cultivars of *Cajanus cajan*, *Vigna unguiculata*, *V. radiata*, *V. mungo* and groundnuts were released after screening under rainfed and partially irrigated conditions for two seasons at Legalega Research Station, Fiji. Drought stress reduced vegetative growth in all crops and cultivars tested. Under rainfed conditions, seed yields were reduced by 30–80 per cent and 31–53 per cent in the first and second seasons, respectively, compared with irrigated crops.

Prasad, M., Ulitu, S. and Field, S. P. 1996. Pigeon pea as an export crop for Fiji. In: RIRDC New Crops Proceedings: First Australian New Crops Conference, Vol. 2.

Pigeon pea is described as a crop that farmers understand well and which has traditionally been grown in Fiji. The crop, however, has the potential for new high-value uses in the export market, such as the sale of green pods. Results of research work on new varieties capable of producing green pods are discussed.

VEGETABLES

1920–1929

Howard, R. B. 1925. Sunflowers (Giant Russian). *Agriculture Circular Fiji*, 5(2), 77.

1930–1939

Simmonds, H. W. 1933. Gardening notes. *Fiji Agricultural Journal*, 6(2), 33–34.

Brief notes are presented on slug control, hibiscus leaf curl, planting of lettuce, rock melons, fruit fly and the control of cut worms.

Simmonds, H. W. and Donald, D. A. 1937. Notes on the cultivation of European vegetables in Fiji. *Fiji Agricultural Journal*, 8(4), 28–33.

Procedures are outlined for vegetable gardening to limit the leaching of soils of nutrients and overcome dietetic deficiencies. They include composting, drainage, manuring, liming, and the introduction of planting methods for a wide variety of introduced vegetables and fruits.

SurrIDGE, H. R. 1938. Duruka. *Fiji Agricultural Journal*, 9(1), 24.

This is a very brief article that describes the propagation and use of duruka.

Harvey, C. 1939. Raising vegetables by water-culture. *Fiji Agricultural Journal*, 10(4), 121–123.

A brief description is given of hydroponic production of vegetables. Suggestions are made for containers to use, and nutrient solutions. Some hints are given to ensure successful cultivation.

Surridge, H. R. 1939. Vegetable production, *Fiji Agricultural Journal*, 10(4), 98–102.

These brief cultural notes were aimed at expanding the local production of vegetables in small areas. Crops covered include lettuce, mustard, cress, maize, peas, beans, tomatoes, eggplant, beetroot, carrots, celery, cucumber, Chinese cabbage, kohlrabi, leeks, marrows, pumpkins, squash, spinach, okra, onions, parsley, parsnip, radish, silver beet, shallots, turnips, English cabbage and cauliflowers. Emphasis is placed on the need to maintain soil fertility and drainage.

1940–1949

Simmonds, H. W. 1941. Tomato growing on black soapstone soils. *Fiji Agricultural Journal*, 12(1), 25–26.

A brief account is given of the difficulties faced in growing tomatoes on the black soapstone soils. The account is given as a gardening routine rather than an experiment.

Surridge, H. R. and Parham, B. E. V. 1941. Botanical notes 1: Leafy green vegetables in Fiji. *Fiji Agricultural Journal*, 12(3), 76–77.

This paper contains a list of leafy green vegetables, including indigenous wild ferns and weeds, grown and eaten by Fijians and Indians in the dry and wet zones. It includes the Fijian and Hindustani names besides the botanical names.

Dass, C. M. 1943. The production and storage of vegetable seed. *Fiji Agricultural Journal*, 14(2), 38–40.

Guidelines are presented on when and how to extract and store seed. The effects of age on seeds and their viability are assessed.

Harvey, C. 1943. The production of vegetable seeds. *Fiji Agricultural Journal*, 14(1), 10.

A list is provided of vegetable seeds being produced for distribution in Fiji by the Department of Agriculture.

Harvey, C. 1943. Vegetable seed supply. *Fiji Agricultural Journal*, 14(3), 86.

Details are provided on the current quantities of vegetable seeds being provided for production as part of the war-time effort to boost local food supply.

Parham, B. E. V. 1948. Duruka:an edible flower. Fiji Agricultural Journal, 19(1), 16–17.

This note contains a correction to previously reported incorrect namings and gives details on the distribution of the plant and its susceptibility to virus disease.

1950–1959

Parham, B. E. V. 1953. A useful green vegetable (*Basella alba*). Fiji Agricultural Journal, 24 (3/4), 88.

A brief description is given of this recently introduced vegetable, known as Indian or climbing spinach.

Nandan, S. 1957. Market gardening on the Suva Peninsula. Fiji Agricultural Journal, 28(3/4), 37–39.

A description is given of the edaphic conditions and tenurial arrangements for market gardens on the Suva peninsula. Details are presented on size of holdings, labour use, water supply, use of contouring and fertilisers, and pest and weed control.

1960–1969

Nandan, S. 1960. Market gardening on the Suva Peninsula:A progress report. Fiji Agricultural Journal, 30(1), 14–18.

This article updates an earlier (1957) article in the journal. It is observed that soil erosion continues to be a problem and is leading to changes in the farming pattern through contouring and increased use of fertilisers, insecticides and weed control.

Anon. 1966. French beans and long beans. Fiji Farmer, 2:28–29.

These are notes on when, where and how to plant, grow and fertilise beans, the control of pests and diseases, and estimates of bean yields.

Nandan, S. 1966. Commercial onion production. Fiji Farmer, 2:34–36.

Brief notes are given on soil, land preparation, sowing, transplanting, fertilising, weed, pest and disease control, and harvesting

Thompson, P. G. 1966. Growing tomatoes. Fiji Farmer 2:59–61.

Advice is presented on varieties, cultivation out of season and open-sided greenhouse production.

1970–1979

Department of Agriculture, Fiji 1971. Report for the Year 1970. Suva, 34 pp.

Investigations briefly reported include: a nitrogen fertiliser and spacing trial on Chinese cabbage; cultural and variety trials on tomatoes; variety trials with onions and okra; and agronomic investigations on root crops, fruits, coconut and rice.

Lambert, M. 1971. Market Gardening in the South Pacific. Handbook No 8, South Pacific Commission, Noumea.

In this handbook, the SPC agriculturalist discusses: the value of market gardening; the food value of vegetables; site selection, preparation of land, irrigation, sowing, transplanting, fertilisation, pests and diseases, harvesting, preparation and packing of vegetables; main varieties of vegetables grown in the South Pacific; soil-less vegetable growing; marketing; and some recipes.

Department of Agriculture, Fiji 1972. Report for the Year 1971, Suva.

Investigations briefly reported include the following: variety and fertiliser trials on onions; variety and spacing trials on tomatoes; fertiliser trials on tomatoes; fertiliser trials with cabbages, carrots, Chinese cabbage and lettuces; a spacing trial with ginger; breeding work involving coconut; and varietal trials of maize, potato, forage grasses and vegetables.

Hampton, R. E. 1975. Onion production in Fiji. *Fiji Agricultural Journal*, 37:17–21

Production of onion is thought to have started in Fiji during the period 1962–1965 with the introduction of the Texas Early Grano strain. Yield increases were obtained from the application of 112 kg/ha potassium sulphate and by reducing the between-row distance from 20 cm to 10 cm. Var. Texas Early Grano does not store as well as the lower yielding varieties such as Awahaia and Tropired. Current yield is 45 tons/ac. In 1927, output was 450 tons; in 1939, 760 tons; and in 1955, 1420 tons. In 1970, 72 2740 tons of onions were imported annually, valued at F\$600 000.

Hampton, R. E. 1975. Review of cucumber research 1968–1974. Fiji Agricultural Journal, 37:23–27.

Supermarket was the best variety of cucumber evaluated, followed by Polaris and then Ashley. Fertiliser investigations suggest that N at 90kg/ha and P at 68 kg/ha significantly increased market yield. N increased marketable yield and hastened maturity. Increased planting density from 4400 to 22 200 plants/ha significantly increased yield.

Lambert, M. 1975. Vegetable production in the South Pacific. South Pacific Commission Quarterly Bulletin, 25(3), 24–26.

Current activities in the Special Project on Vegetable Production in the South Pacific operated by the South Pacific Commission included selection of species and varieties, improvement of cultivation techniques, pest and weed control, improvement of harvesting and marketing conditions, and vocational training. A special section is included in the paper on the construction of a cold store at Sigatoka. The future prospects for vegetable production in the South Pacific are assessed.

1980–1989

Dahlgren, K. 1981. Growing Vegetables in Fiji. US Peace Corps, Suva.

A description is given of the environment for vegetable production in Fiji, and how to build and maintain soils. The cultural methods of vegetable production are outlined, covering five general groups of garden crops. They are those susceptible to bacterial wilt, those susceptible to cabbage moths, cucurbits, legumes and other crops. Sections are added on growing vegetables under plastic, and composting and mulching.

Wati, M. 1981. Seed production in coriander (*Coriandrum sativum* Linn.). Fiji Agricultural Journal, 43(2), 69–74.

Coriander seeds were sown on 21 September 1981 and the following parameters recorded: flowering and fruit (74–98 days after sowing), changes in seed fresh and dry weight and moisture content (4–36 days after peak flowering) and seed yield, germination and shattering losses (4–36 days after peak flowering). Peak flowering occurred about 82 days after sowing. Maximum viable seed yield (less than 80 per cent) was attained at 28 days after peak flowering and declined thereafter due to shattering.

Jogia, M. K. 1984. Essential oil composition at different stage of growth in two Fiji *Ocimums*. Fiji Agricultural Journal, 46(2), 9–12.

Ocimum sanctum and *O. basilicum* seeds were sown in May 1984 in rows 20 cm apart. Crops were harvested for oil composition determination in late August (vegetative stage), late December (flowering), mid February (seeding) and late June. Leaves were steam-distilled and the oil fractions determined. The two major components of *O. sanctum* oil were methyl eugenol and caryophyllene. Caryophyllene content (9.8 per cent) was highest at the flowering stage when methyl eugenol (ME) content was the lowest (90 per cent). Conversely, ME was highest (96 per cent) at the seeding stage when caryophyllene was lowest (4 per cent). Linalool, methyl cinnamate and ME were detected in *O. basilicum* oil. Methyl cinnamate was highest (97 per cent) and linalool lowest (2.6 per cent) during the flowering stage. Linalool was highest in mature, June-harvested plants (32.7 per cent).

Ministry of Primary Industries, Fiji 1985. Vegetables. Parliamentary Paper No. 62, 1985, Parliament of Fiji, Suva.

Reports are included on research of vegetables (potato, onion, tomato, pumpkin, garlic variety trials), weed and pest control in cabbage (including the release of *Apanteles plutellae* and *Tetrastichus sokolowski* for the biological control of diamond back moth), and a report that five species of parasites were released for the biological control of the bean pest but none became established.

Asian Productivity Organization 1989. Vegetable production and marketing in Asia and the Pacific. In: The Symposium on Vegetable Production and Marketing Organised by the Asian Productivity Organization (APO), Tokyo, 18–25 October 1988. Tokyo, 497 pp.

The main objective of the symposium was to discuss the results of the regional survey on vegetable production and marketing in 12 APO countries and to consider resource papers on related topics. The following were discussed: the current status of the vegetable industry in APO member countries; major problems and constraints affecting the production and marketing of important vegetable crops; and ways of improving the performance of the industry including areas for further research and development. The three papers from the regional survey covered: trends in vegetable production; agronomic aspects of vegetable production; and economics of vegetable production and marketing problems in large urban areas. Other symposium papers cover: recent

advances in vegetable production technology and vegetable post-harvest technology in Japan; regional vegetable trade and market prospects; and areas for further research and development. Fourteen country reports are presented, including one for Fiji. The country reports deal with the characteristics of vegetable growers, production costs and returns, marketing and prices, government policies concerning vegetable production and marketing, and problems and prospects for the vegetable industry.

Datt, B. and Iqbal, M. 1989. Varietal evaluation of vegetables to suit the market demand in Fiji. Paper presented at a Research and Development Conference on Vegetables, the Market and the Producer, Richmond, Australia, 11–15 July 1988, *Acta Horticulturae*, 247:103–105.

Results are presented of the selection and varietal evaluation of the following vegetables in Fiji: tomato, chillies (*Capsicum annum*), eggplant, cabbage, *Vigna unguiculata*, potato and garlic.

1990–present

Prasad, A. 1995. Seed Production and Marketing in Asia and the Pacific: Report of an APO Seminar, 14–23 September 1993, Jakarta. Asian Productivity Organization, Tokyo, pp. 150–161.

The author describes vegetable production, organisations involved in seed production, quality and distribution, the role of the private sector in and government policy on seed production, the existing vegetable seed program and prospects for increased demand for vegetable seeds.

Prakash, K. 1996. Fiji herbs bound for Europe. IRETA's South Pacific News, March 1996.

Pacific Herbs Ltd, a New Zealand company in Fiji has a factory in Coli-I-Suva which grows, processes and packs frozen herbs for shipment to Europe. Herbs grown include dill, tarragon, rosemary, thyme, oregano, marjoram, sage, chervil and basil. The herbs have stronger flavour as they are grown outdoors, unlike in glasshouses in New Zealand.

RICE AND OTHER CEREALS

1920–1929

Tarby, J. P. 1929. Some aspects of rice culture in Fiji. *Fiji Agricultural Journal*, 2(4).

The author expresses concern about the 'lamentable state of affairs' in rice culture, but also in all other agricultural pursuits except sugar production. Issues covered in the paper are the drainage of rice fields to provide aeration, unsuitability of nitrates in rice production, lack of organic matter, and defects in local rice culture.

1930–1939

Parham, B. E. V. 1939. Rice Variety Trials at Central Agricultural Station, 1936–39. Fiji Department of Agriculture, Suva.

Details are given of the origin and date introduced of varieties of rice that had been tested. Yield trial results are presented. Details are also provided on the distribution of pure-line seed to growers between 1932 and 1938.

1940–1949

Donald, D. A. and Parham, B. E. V. 1940. Cultivation of maize. *Fiji Agricultural Journal*, 11(1), 19–20.

It is reported that maize is grown throughout Fiji on all types of soils, and in both the wet and dry zones. Maize culture notes are provided along with some recommendations for post-harvest activities.

Harvey, C. 1941. Padi varieties, Suva area. *Fiji Agricultural Journal*, 12(4), 113.

Brief notes are presented on the options facing Fijian rice farmers on Viti Levu in their choice of seed for planting, with some discussion of the merits of the varieties.

Ramnath, B. 1941. Planting of rice varieties. *Fiji Agricultural Journal*, 12(2), 55.

A note is provided on the seasons best suited to the planting of different varieties of rice. Observations are made on the periodicity of each variety.

Dass, C. M. 1942. Notes on padi varieties grown in Fiji. *Fiji Agricultural Journal*, 13(3), 94–95.

A program of padi classification was recently introduced at the experiment station in Sigatoka. Sixty samples from different rice-growing districts of Fiji comprised material used for trials and classification. Work had been under way for two seasons. Progress is reviewed in this paper.

Jack, H. W. 1942. Toga rice scheme. *Fiji Agricultural Journal*, 13(4), 106–107.

Some 2000 acres of flat land had been chosen to meet increasing demand for rice. Tenants planted 551 acres during the 1940–41 season, with 230 acres planted to rice in the 1941–42 season. The difficulties faced in this development are recounted.

Parham, W. L. 1942. Errors in padi planting. *Fiji Agricultural Journal*, 13(2), 38.

The errors described are those that are commonly made in weeding, cultivation and maintenance of soil fertility, and in irrigation of rice crops.

Parham, B. E. V. and Ramnath, B. 1942. The production of rice in the Southern Agricultural Division in 1941. *Fiji Agricultural Journal*, 13:11–12.

New rice varieties issued by the Department of Agriculture are detailed. Data are provided on area cultivated with other varieties and a brief reference is made to key pests and diseases.

Bharat, S. 1943. The importance and value of maize for human consumption. *Fiji Agricultural Journal*, 14(2), 37.

The uses of maize are described, with suggestions for domestic use by households in Fiji.

Harvey, C. 1943, Padi plantings in Vanua Levu. *Fiji Agricultural Journal*, 14(4), 100.

Brief notes are provided on plantings of different varieties of rice on Vanua Levu, with an assessment of the merits of these varieties in a vein similar to the notes published two years earlier for Viti Levu.

Dass, C. M. 1944. Maize seed collection. *Fiji Agricultural Journal*, 15(2), 39–42.

The author stipulates that maize seed selection should be done in both the field and barn, and sets down procedures to follow at each stage.

Donald, D. A. 1944. Further notes on rice varieties. *Fiji Agricultural Journal*, 15(2), 43–45.

A list is provided of the popular names and synonyms of rice varieties of interest to local growers. Results are reported from a rice variety trial at the General Experiment Station.

Ffrench-Mullen, M. D. 1945. Rice production in Fiji. *Fiji Agricultural Journal*, 16(3), 63–66.

This report is partly statistical covering the period, 1943–45. Statistics are given on area planted, yields and prices. Annual consumption of rice was estimated at 250 lb per head for the Indian population. Alternative methods of meeting the rice shortfall being considered by the Supply and Production Board are discussed.

Parham, B. E. V. and Suckling, J. J. 1945. Factors affecting rice production with special reference to the Southern Agricultural Division. *Fiji Agricultural Journal*, 16(4), 108–113.

The supply of rice is assessed in the light of climatic and soil factors. Sections are included on soil management, drainage and water control, land tenure, the range of activities of farmers, five main diseases and major pests.

Surridge, H. R. 1946. Clean padi seed for sowing. *Fiji Agricultural Journal*, 17(1), 16.

This is a brief note on the preparation of clean seed for use in sowing in rice cultivation.

Surridge, H. R. 1946. Rice growing, 1945–46 season. *Fiji Agricultural Journal*, 17(1), 16.

A brief update is given on statistics for the rice industry in the 1945–46 season.

Harwood, L. W. and Silas, R. J. 1947. Five years of padi production in the Northern Division. *Fiji Agricultural Journal*, 18(2), 43.

The article begins with details on land tenure and the main rice varieties grown in the Northern Division. The planting program is then outlined for each province in the division. Yield estimates are made, pests and diseases are outlined and marketing arrangements are discussed.

Ffrench-Mullen, M. D. 1948. Rice experiments: fertiliser trials. *Fiji Agricultural Journal*, 19(1), 4–10.

This is the first in a series on experimental work on rice cultivation organised by the Research Committee of the Department of Agriculture. Details are given on the layout of the experiment, the 10 treatments undertaken, site, weather conditions, cultural operations and application of manures and fertilisers. Results are presented and assessed. The impacts of 'leaf yellows' disease and major pests are discussed.

1950–1959

Ramnath, B. 1950. Notes on rice seed bed preparation. *Fiji Agricultural Journal*, 21(3), 62.

Extension information is provided on seed selection, preparation and sowing of the seed bed, and care of rice plants after sowing.

Lamont, N. 1952. Rice improvement programme: report of three years trials 1949–52. *Fiji Agricultural Journal*, 23(3/4), 66–71.

The author describes the rice improvement plan and justifies the need to raise productivity in rice production. The varietal position was renewed, results of variety experiments presented, and recommendations made. Other rice investigations were also reported on mechanisation, fertiliser trials, weed control and hand-planting methods.

Badlu, R. 1954. History of some rice varieties in Fiji. *Fiji Agricultural Journal*, 25(1), 19.

The early years of rice production in Fiji from 1902 are recounted, and details are given on rice varieties introduced.

Mason, R. R. 1954. Some comparisons between rice growing in Malaya and Fiji. *Fiji Agricultural Journal*, 25(1), 4–5.

This paper coincided with growing interest at Koronivia in the mechanisation of rice production. It is mainly focused on comparing different methods of peasant production in the two countries.

Mason, R. R. 1954. Introduced varieties of rice. *Fiji Agricultural Journal*, 25(3/4), 103–107.

Details are provided on yields of four varieties of rice that had been introduced. Information is given on the seed beds sown to numerous varieties in 1953.

Mason, R. R. 1956. Seed rate and row spacing in drilled rice. *Fiji Agricultural Journal*, 27(3/4), 70.

Results of a series of experiments on seed rate and row spacing in drilled rice are described and recommendations on rate and spacing are given.

1970–1979

Department of Agriculture, Fiji 1970. Annual Report for 1969 (Rice Research). Suva, 37 pp.

Crosses were performed between the local Fijian variety BG75 and selected parents from the Philippines, USA, Australia, Malaysia and Surinam. Taichung Native 1 gave good yields in both dryland and wetland conditions.

Patel, N. P. 1970. Rice research in Fiji 1960–1970: Part 1 Background, *Fiji Agricultural Journal*, 33(1), 1–4.

The author traces the history of the rice industry in Fiji, and the changes over time in the research needs of the industry.

Rhodes, P. L. 1970. An assessment of the new rice variety—IR 5. *Fiji Agricultural Journal*, 32(1), 16–17.

A comparative assessment is made between the new high-yielding rice variety from the International Rice Research Institute in the Philippines, IR 5, and the local variety, FK 135. A recommendation is made for double-cropping in Fiji using non-irrigation methods.

Department of Agriculture, Fiji 1971. Report for the Year 1970. Suva.

Rice research reported for the year (pp. 3–5) included a trial of eight introduced rice varieties, sown at monthly intervals throughout the year. Paddy yields were highest (5880 lb/ac) with sowing in August. Satisfactory yields (greater than 3918 lb/ac) were obtained with sowings in every month except from February to May. Satisfactory average yields in the eight months were highest in varieties IR480-5, C-4-63 and IR160-27 (5539-5463 lb/ac).

Muralidharan, V. K. 1971. Rice research in Fiji 1960–70: Part II Varietal studies. *Fiji Agricultural Journal*, 33(2), 57–64.

It is noted that the position with respect to rice variety studies was disappointing until 1968: 10 years of intensive work had failed to provide a general-purpose variety better than a variety that had been introduced 30 years earlier. Results of trials with 132 introductions show that the tall photosensitive variety, BG79(75), and the dwarf weakly photosensitive variety, IR5, performed best.

Brown, F. B. and Laure, M. 1972. Development of Rice Growing in the Rewa River Basin, Fiji. Report No. 4, United Nations Development Program, Suva, 61 pp.

The possibility of mechanised double-cropping of rice in an area of 6900 ha of flat arable land was tested in a pilot irrigation scheme of 100 ha. Yields for four crops averaged 2.6 tons/ha for the main season and 3.5 tons/ha for the off-season. A projected farm budget showed net returns to the farmer of US\$400 per year per ha. A holding of about 2.5 ha can give a satisfactory farm income. An economic appraisal was made of the development scheme. Milling and marketing requirements are discussed, and proposals made for farmers' associations.

Patel, N. P. 1972. Rice research in Fiji 1960–1970: Part 2 Weed control. *Fiji Agricultural Journal*, 34(1), 27–34.

The author discusses the screening of herbicides from 1967–71. For close-spaced dryland rice, propanil applied when weeds are at the two to three leaf stage gives good control of both grass and broad-leaved weeds. MCPA or 2,4-D isopropyl ester (IPE) are recommended for the control of broad-leaved weeds about five to six weeks after sowing, while 2,4-D is preferred against *Ageratum conyzoides* and *Mimosa pudica*. Grass weeds are observed not to be a problem in transplanted wet-land rice and other weeds are not serious, particularly where controlled irrigation is

practised; MCPA and 2,4-D are recommended three to four weeks after transplanting. Grass weeds are a serious problem in wet-land rice sown broadcast on a puddled surface and followed by flooding.

Patel, N. P. 1972. Rice research in Fiji 1960–1970: Part 5 Fertiliser, seed rate, and other studies. *Fiji Agricultural Journal*, 34(2), 71–80.

Sowing and planting recommendations are made for photosensitive varieties under dryland and wetland conditions. Under dryland conditions, an economic response to 50–60 kg N/ha was obtained, but not to P (except on red hill soils) or K. No response to fertiliser was generally obtained under wetland conditions.

Vernon, A. J. 1972. Rice research in Fiji 1960–1970: Part 4 Long term trials. *Fiji Agricultural Journal*, 34(2), 61–70.

Fertiliser, rotation and drainage trials for rice production in Fiji are discussed.

Department of Agriculture, Fiji 1973. Report for the Year 1972 (Rice Research). Suva, pp. 6–7.

In irrigated rive varietal trials in 1971 and 1972, yields of IR-661-1-140-3-2, IR-480-59-2 and IR5 were 5.95 t/ha, 5.6 t/ha and 4.99 t/ha, respectively.

Muralidharan, V. K., Patel, N. P. and Reddy, N. 1974. Dry-land rice field experiments, 1969–1972. *Fiji Agricultural Journal*, 36(1), 13–19.

In trials at three sites, IR5 gave yields 25 per cent higher than BG79(75), the previously grown standard variety for dryland cultivation. Recently introduced C4-63, renamed Saute for use in Fiji, gave yields 23 per cent higher than IR5 and matured earlier. Mahsuri gave yields 20 per cent higher than BG79(75) and is recommended where a traditionally tall variety is preferred. Of the quicker maturing varieties suited to catch cropping, Saraya 3 Month and Matmuria gave the highest yields.

Thompson, P. G. 1974. Rice Growing in Fiji. *Bulletin*, Fiji Department of Agriculture, Suva.

Packages are suggested for dryland, transplanted rainfed and irrigated rice production in Fiji. Harvesting procedures are outlined.

Frim, J. 1975. Identification, preparation and implementation of an agricultural project with special reference to rice mechanization. In: Report of the Expert Consultation Meeting on the Mechanization of Rice Production. International Institute for Tropical Agriculture, Ibadan, pp. 252–255.

The problems and successes of implementing the Rewa Rice Project in Fiji are discussed, where two crops of rice variety, cv. IR480-5, were grown annually under controlled water conditions with mechanised land preparation and threshing.

Sharma, A. P. 1978. Design and development of a paddy winnower. *Agricultural Mechanisation in Asia*, 9(3), 61–62.

A paddy winnower with a fan and screen, driven by a 1 hp electric motor, is described. An output of 350 kg/ha clean paddy was obtained in tests undertaken.

Reddy, N. 1979. Boldgrain—a high yielding rice variety for Fiji. *International Rice Commission Newsletter*, 28(1), 31.

The new rice cultivar, Boldgrain, which is resistant to brown planthopper (*Nilaparvata lugens*), yielded 7.0 t paddy/ha, compared with 2.5 t/ha to 6.9 t/ha from standard cultivars. Under upland rainfed conditions at four sites with direct sowing and transplanting, respectively, it yielded 3.46 t/ha and 4.79 t/ha in the wet season and 4.5 t/ha and 6.25 t/ha in the dry season. At 900 m altitude at Nadarivatu, it yielded 3.14 t/ha. It yielded 0.75 t/ha as a ratoon crop and had a growth period of 125 days.

1980–1989

Iqbal, M. 1981. A review of maize research and production in Fiji. *Fiji Agricultural Journal*, 43(1), 27–32.

The history of the introduction of maize into Fiji and subsequent production experience is reviewed. Eighty per cent of maize was grown in the Western Division. Major diseases of maize are outlined, and prospects for expansion are viewed positively through the use of improved varieties and better management.

Food and Agriculture Organization of the United Nations/Ministry of Agriculture and Fisheries, Fiji 1982. *The rice industry of Fiji: An analysis of the rice industry with recommendations for its improvement*, Suva (mimeograph).

Agricultural Commodity Committee 1985. Maize Profile: A Programme for the Development of the Commercial Maize Industry. Suva.

This profile of the maize industry covers its historical development, industry benchmarks, government involvement, commercial production requirements, yields and costs. Market prospects for the maize industry are outlined, and justification is given for according the industry priority status. The main issues affecting its development are discussed, along with the major development constraints.

Reddy, N. 1985. Varietal evaluation of ratooning ability in flood irrigated rice (*Oryza sativa* L). Fiji Agricultural Journal, 47(1), 1–5.

A varietal evaluation was conducted in two separate experiments. In the first test, 135 varieties were evaluated and in the second, six high-yielding (improved) varieties were evaluated. Yields ranged from 0 to 2.05 t/ha for the ratoon crop. The main crop yield and ratoon crop duration showed a significant positive correlation with ratoon yield. Ratoon crop duration ranged from 20 to 80 days. The highest ratoon yield was obtained in 66 days from cv. Acc. 19815. Plant crop yield was higher than the ratoon yield in all varieties.

Umar, M. 1985. National rice production in Fiji. International Rice Commission Newsletter, 34(1), 22–27.

Information is presented on rice research, consumption, production, imports and development in Fiji.

Reddy, N., Reddy, K. and Singh, J. M. 1987. Breeding of a high yielding rice variety Deepak for problem soils. Fiji Agricultural Journal, 49(1), 1–7.

Deepak was developed from a cross between Lalka Motka, an adapted local variety, and IR661, an IRRI semi-dwarf variety. It is insensitive to photoperiod and tolerant of acid sulphate, peat and saline soils. At 90 cm tall, it matures in 120–130 days with yields up to 9 t/ha.

Harada, J. 1989. Some problems of rice cultivation in Fiji and counter measures to increase production. Report No. 32 of the Tohoku Branch of the Crop Science Society of Japan, pp. 57–60.

The average yield of unhulled rice in Fiji ranged from 1.81 t/ha to 2.37 t/ha in the period 1971–86, and the area increased markedly in the period 1984–86. The many problems and solutions are discussed. The problems

include suitability of sites, adequate land preparation, ploughing techniques, previous crop contamination, suitable water management, fertiliser application and weed control.

Umar, M. 1989. Grow more rice—help ourselves. Rice position paper, National Rice Week 1989, Suva.

Under DP9, rice development was accorded a high priority. This position paper covers the main aspects of rice production in Fiji.

1990–present

Katayama, T. C. 1991. Morphological characters of the cultivated rice grains of Fiji (II). *Memoirs Faculty of Agriculture (Kagoshima University)*, 26:46–63.

Various grain dimensions, area and volume—with and minus the husk—were investigated for 20 rice strains from Fiji. Using the 12 characters in an earlier paper, various cultivar and strain-specific patterns were identified and specific parameters relating to a tripartite classification found. The use of this character in differentiating between cultivars is discussed.

Katayama, T. C. 1991. Morphological characters of the cultivated rice grains of Fiji (III). *Memoirs Faculty of Agriculture (Kagoshima University)*, 27:33–40.

Relationships among 24 grain characters were determined in 20 rice cultivars collected in Fiji in 1982. Using 12 character combinations, significant correlations were found in 123 of the 240 cases. Strain differentiation and character specificities were discussed.

Katayama, T. C. 1991. Morphological characters of the cultivated rice grains in Fiji (IV). *Memoirs Faculty of Agriculture (Kagoshima University)*, 28:1–13.

Data are presented on the length, width and thickness of husked and unhusked grains, their ratios, area, volume and quotients of area and volume, and the correlations between these characters for 20 strains of rice collected in 1982 in Fiji.

Namba, T. 1991. Problems and guidelines in rice cultivation for developing countries. *Technology and Development*, 4:67–87.

Methods and problems of rice cultivation in Egypt, Fiji, Iran and Bangladesh are discussed using data from field experiments and a survey of farmers. Recommendations are listed for yield increase in each country.

Katayama, T. C. 1993. Morphological characters of the cultivated rice grains of Fiji (V). *Memoirs Faculty of Agriculture (Kagoshima University)*, 29:1–12.

Mutual relations in terms of practical values, standard deviations and variation ranges were determined for 24 rice grain characters in 20 genotypes of rice from Fiji.

FRUITS

SEVERAL FRUITS

1970–1979

Department of Agriculture, Fiji 1972. Report for the Year 1971. Suva, 37 pp.

Brief reports are given on a varietal trial in citrus and a fertiliser trial in passionfruit, together with information about agronomic studies on other crops.

1990–present

Manarangi, A. and Chase, R. G. 1992. Agricultural research in the atolls of the mid-Pacific on tree crops other than coconut: a review of agricultural development in the atolls. Invited paper to an International Conference on Developing Agricultural Research Programmes for Atolls, Pacific Harbour, Fiji, November 1990. Technical Centre for Agricultural and Rural Cooperation, Wageningen, pp. 125–129.

Discussion focuses on the cultivation of breadfruits, *Pandanus odoratissimus* (*P. tectorius*), papayas, bananas, citrus, figs and timber crops in the mid-Pacific atolls.

BANANAS

1910–1919

Knowles, C. H. and Jepson, F. P. 1912. The Banana in Fiji. Bulletin No. 4, Fiji Department of Agriculture, Suva.

1930–1939

Blackie, W. J. 1932. Preparation of banana figs. Fiji Agricultural Journal, 5(1), 35–40.

Methods were investigated to prepare banana by-products, especially banana figs by sun-drying. The experimental work is described in terms of selection and preparation of fruit, sun-drying under different conditions, treatment to protect from insect attack and packing methods.

Ackland, A. B. 1937. The banana industry. Fiji Agricultural Journal, 8(3), 24–26.

The author surveys the banana export industry from the commencement of the quota system in 1932, expressing concern about falls in banana prices and their disincentive effect on production. He reported on recent improvements in banana quality that coincided with increases in the proportion of bananas exported from Viti Levu and by indigenous Fijians.

1940–1949

Jack, H. W. 1944. Banana wastage. Fiji Agricultural Journal, 15(3), 84.

Dodds, K. S. 1946. *Musa fehi*, the indigenous banana in Fiji. Nature, 157(3996), 729–730.

The indigenous banana, *Musa fehi*, is described from samples taken in Fiji, and numbers of flowers per hand are reported. Preparations of root-tips showed that the banana has $2x = 20$ chromosomes. There is a brief discussion of the importance of distinguishing between seeded and edible types of *Musa fehi* bananas.

Kable, R. A. 1946. Notes on the Fiji banana industry. Fiji Agricultural Journal, 17(3), 82–83.

Banana producers in Fiji historically faced difficulties in producing export-quality bananas. These difficulties are discussed in this short note. A stage-by-stage description of the export marketing process for bananas is presented.

MacDaniels, L. H. 1947. A study of the 'Fe'i' banana and its distribution with reference to Polynesian migrations. Bulletin 190, B. P. Bishop Museum, Honolulu.

Whitehead, C. E. 1948. Banana culture. Fiji Agricultural Journal, 19(1), 12–14.

Extension-style notes are presented on the selection of banana suckers, planting, pruning, harvesting, pest control and packing for shipment.

1950–1959

Dodds, K. S. 1953. Banana breeding. Transactions & Proceedings Fiji Society Science & Industry, 3(1), 45–46.

The breeding work undertaken on bananas in the West Indies is recounted here in terms of the relevance of the work to Fiji. In particular, reference is made to Gros Michel and Veimama bananas.

Massal, E. and Barrau, J. 1956. Pacific subsistence crop: the banana. SPC Quarterly Bulletin, 6(1), 10–12.

Botanical descriptions are given of the different species and sub-species of bananas, identifying true indigenous species. An account is given of the introduction of Chinese, or Cavendish, bananas into the region. An analysis is made of the chemical composition of important cooking and eating bananas. Some traditional cooking methods are mentioned.

Yelf, J. D., Rhodes, P. L. and Bharat, S. 1957. Banana investigations. Fiji Agricultural Journal, 28(3/4), 33–36.

A progress report is presented on banana investigations at the Principal Agricultural Station and their relevance to the banana industry of Fiji. It was found that most export bananas were grown on the young alluvial and colluvial soils of the interior valleys in the wet zone of Viti Levu. Shifting cultivation was found to be practised with little benefit of modern plantation hygiene. Difficulty of access is highlighted in the report, with much time spent on transport to the packing stations. This is viewed as limiting the expansion of commercial banana production. An outline is given of planned experimental work.

Cassidy, N. G. 1959. A varietal difference in the need of bananas for good drainage. *Fiji Agricultural Journal*, 29(4), 133–136.

The author observed that Cavendish and Lady's Finger banana varieties are much more tolerant of restricted drainage than the Veimama variety. For the latter, the best growing conditions are one metre of unmottled soil above the permanent water table when grown under conditions of heavy rainfall.

McPaul, J. W. 1959. Some aspects of banana cultivation in Fiji: Part 1. *Fiji Agricultural Journal*, 29(4), 117–132.

Key field aspects of banana cultivation are discussed. They include choice of site and soils for planting, planting material, depth and method, spacing, followers, propping, fertiliser application, and pests and diseases and their control.

1960–1969

Cassidy, N. G. 1960. The maintenance of soil fertility in Fiji: 3. Banana growing and the special requirements of the banana plant. *Fiji Agricultural Journal*, 30(2), 55–60.

The problem of maintaining soil fertility in banana plantations is considered in the light of the need for profitable production of bananas for export with their rigorous nutritional requirements. Growing conditions in Fiji are described.

1970–1979

Lambert, M. 1970. Banana production in the South Pacific. Handbook No 5, South Pacific Commission, Noumea.

The handbook covers sites to plant, land preparation, planting materials, method of planting, intercropping and interplanting, management of banana plantations, harvesting and packing, pest and disease control, and economics.

Sills, V. E. 1970. Investigations into the treatment and packing of green bananas for export. *Fiji Agricultural Journal*, 32(2), 37–42.

Investigations into the treatment and packing of green bananas for export are described with a view to improving pre-packing treatment, designing packaging materials to reduce physical damage, and overcoming fungus infection of Veimama bananas as they are shipped.

Department of Agriculture, Fiji 1971. Report for the Year 1970. Suva, 34 pp.

Brief reports are presented on the agronomic investigations of many crops including plant spacing, fertiliser and herbicide trials and the control of black leaf streak (*Mycosphaerella fijiensis*) in banana.

Department of Agriculture, Fiji 1972. Report for the Year 1971. Suva, 37 pp.

Brief reports are presented on the comparison of various types of planting materials, plant spacing and herbicide trials and the control of black leaf streak in banana, together with agronomic studies on other crops.

Robinson, J. B. D. and Singh, J. M. 1974. Effect of spacing on banana yield in Fiji. *Fiji Agricultural Journal*, 36(1), 1–6.

Research work on spacing of banana plants over a period of 34 months shows that increasing density results in increased total and export quality yields. Recommendations on spacing are given.

1980–1989

Fullerton, R. A. 1987. Banana production in selected Pacific Islands. In: Persley, G. J. and de Langhe, E. A. ed. *Banana and Plantain Breeding Strategies: Proceedings of an International Workshop Held at Cairns, Australia, 13–17 October 1986*. ACIAR Proceedings No. 21, Australian Centre for International Agricultural Research, Canberra, pp. 57–62.

The status of banana production is reviewed in five South Pacific countries: Cook Islands; Niue; Tonga; Western Samoa; and Fiji. Fruit quality and market acceptability are assessed and a situation analysis is given for these countries with implications for the future of the industry.

1990–present

Watson, B. J. 1993. Major banana cultivars in Pacific and atoll countries. *Infomusa*, 2(2), 19–20.

Daniels, J. 1995. *Illustrated Guide to the Identification of Banana Varieties in the South Pacific*. ACIAR Monograph No. 33, Australian Centre for International Agricultural Research, Canberra, 43 pp.

The banana varieties of Tonga, Western Samoa and Cook Islands are described, and information is included on varieties found in Fiji. The guide provides keys, descriptions, lists and coloured plates of the banana varieties.

PAPAYA

1980–1989

Agricultural Commodity Committee 1985. Papaya Profile: A Programme for the Development of the Commercial Papaya Industry. Suva.

This profile of the papaya industry covers its historical development, industry benchmarks, government involvement, commercial production requirements, yields and costs. Market prospects for the industry are outlined, and justification is given for according it priority status. The main issues affecting its development are discussed, along with the major development constraints.

PINEAPPLE

1950–1959

Nield, J. 1955. The harvesting, handling and packing of pineapples for export. *Fiji Agricultural Journal*, 26(1), 16–17.

Recommendations are made on procedures for the harvesting, handling and packing of pineapples for export. They are classified according to type of fruit, maturity, handling and packing for consignment.

1960–1969

Hall, J. T. and McPaul, J. W. 1960. Pineapple growing. *Fiji Agricultural Journal*, 30(1), 19–22.

The authors observe that there are no processing facilities for pineapples in Fiji, and a limited export market for fresh fruit. Although the crop grows well, it offers the farmer little economic prospect and therefore should not be recommended using large-scale production methods. Guidance is offered for small-scale production in terms of soil requirements, field management, planting and ratooning, weed control, fertiliser application, flower initiation, fruiting and harvesting. Results of a fertiliser trial at Nasinu are summarised.

1970–1979

Department of Agriculture, Fiji 1971. Report for the Year 1970. Suva, 34 pp.

Breeding work on pineapple is briefly reported, together with agronomic investigations of other crops.

1980–1989

Agricultural Commodity Committee 1985. Pineapple Profile: A Programme for the Development of the Commercial Pineapple Industry. Suva.

This profile of the pineapple industry covers its historical development, industry benchmarks, government involvement, commercial production requirements, yields and costs. Market prospects for the industry are outlined, and justification is given for according it priority status. The main issues affecting its development are discussed, along with the major development constraints.

CITRUS

1910–1919

Anon. 1916. The lime (*Citrus limonum*). Pamphlet 22, Fiji Department of Agriculture, Suva.

1920–1929

Wright, C. H. 1923. The citrus industry in Fiji. Kew Bulletin Miscellaneous Information, 1923(7), 261–264.

Details are provided on the introduction and distribution of oranges and mandarins in Fiji. Attention is paid primarily to fruit quality and the ravages of pests, particularly fruit fly and scale insects. Information is provided on efforts to establish an export industry to New Zealand that had been scuppered at the time of writing by fruit fly problems. A shipment of oranges and mandarins had been sent in 1922, and the mandarins had been accepted as free of fruit fly but the oranges were destroyed because maggots were discovered in them. Later shipments of mandarins were found to be infested by fruit fly and the New Zealand authorities condemned them.

1930–1939

Hooper, B. F. 1932. Citrus cultivation. Fiji Agricultural Journal, 5(2), 66–73.

The early history of citrus production and export to Australia and New Zealand is recounted, covering closure of the market due to the incidence of fruit fly in exports and its reopening in New Zealand. A detailed coverage, with advice, is given of rootstocks, seedbed preparation, nursery site and cultivation, grove establishment, application of fertilisers and manures, diseases and their control, and harvesting.

Surridge, H. R. 1935. Some preliminary observations on *Citrus aurentium* as a citrus stock in Fiji. Fiji Agricultural Journal, 8(1), 32–33.

The aim of the note to add to knowledge of this tree, known as sour orange, for citrus culture which was at this time still in its infancy in Fiji.

1970–1979

Department of Agriculture, Fiji 1971. Report for the Year 1970. Suva, 34 pp.

A citrus rootstock trial is briefly reported together with investigations of other crops.

1980–1989

Syna, B. P. 1983. Citrus: Part 1 History, cultivars, cropping patterns, marketing and future expansion possibilities in Fiji. Fiji Agricultural Journal, 45(1), 17–24.

An historical account is given of citrus cultivation in Fiji, with tabulated data yields (average for years 1966–77 and under improved management for years 1979–81) of the lemon cultivars, Lisbon and Meyer, seedless and West Indian lime, mandarin, grapefruit and the orange cultivars, Valencia and Washington navel. Fruiting patterns of some of the above are graphically presented. Other information is provided on topics such as the fruit-piercing moth and its impact and control.

Syna, B. P. 1983. Citrus: Part 2 Review of research in Fiji (1968–1973). Fiji Agricultural Journal, 45(2), 79–84.

A review is presented of lemon nutrition, rootstocks, pruning of lemons, fruit ripening, storage, and chemical evaluation and research in a commercial orchard at Batiri.

Ministry of Primary Industries, Fiji 1985. Citrus. Parliamentary Paper No. 62 of 1985, Suva, 63 pp.

Results are summarised of varietal, cropping, fertiliser and insect pest control investigations. The tachinid, *Winthemia caledoniae*, was released for the biological control of the noctuid, *Othreis fullonia*. No conclusive results were obtained from the use of mercury vapour and sodium yellow lamps against *O. fullonia*.

BREADFRUIT

1950–1959

Massal, E. and Barrau, J. 1954. Pacific subsistence crops: breadfruit. South Pacific Commission Quarterly Bulletin, 4(4), 24–26.

A botanic description is given of *Artocarpus altilis*, and its origins are explained. Short sections are presented on growing conditions, propagation, nutritive values, and cooking and serving suggestions.

1960–1969

Koroiveibau, D. 1967. Some Fiji breadfruit varieties. Bulletin No. 46, Fiji Department of Agriculture, Suva, 31 pp.

Parker, R. D. 1967. A field and laboratory study of the storage and preservation of breadfruit in the South Pacific islands. M.A. thesis, Public Health, University of Hawaii, Honolulu.

1980–1989

Pollock, H. F. 1984. Breadfruit fermentation practices in Oceania. F. Soc. Océanistes, 15:151.

Wooton, M. and Tumali'i, F. 1984. Breadfruit production utilisation and composition: a review. Food Technology in Australia, 36:464.

Ragone, D. 1988. Breadfruit Varieties in the Pacific Atolls. UNDP/OPS Integrated Atoll Development Project. 45 pp.

The Integrated Atoll Development Project entailed an ethno-botanical description of breadfruit varieties for the major atoll countries in the Pacific. A list of recommended superior varieties from both atoll and high islands is included in this paper from the project.

PASSIONFRUIT

1970–1979

Partridge, I. J. 1972. Fertilising passion fruit in the Sigatoka Valley. Fiji Agricultural Journal, 34(2), 97–99.

In a two-replicate NPK factorial fertiliser trial on yellow passionfruit (*Passiflora edulis* var. *flavicarpa*) on alluvial soils in the Sigatoka Valley, one replicate under good management produced a first-year mean yield of

30.7 t fruit/ha while the other, under poor management, produced 5.8 t/ha. The response to P was negligible. Under good management, the application of 0.1 kg urea plus 0.1 kg potassium sulphate per vine every three months from transplanting gave a yield increase valued at F\$1600/ha for a fertiliser cost of F\$40/ha.

Whittaker, D. E. 1972. Passion fruit: agronomy, processing and marketing. *Tropical Science*, 14(1), 59–77.

Passionfruit is considered to be a profitable crop for developing countries where a subsistence pattern of farming is established. Markets exist for this fruit and could be significantly developed. Farmers need to improve production and quality, and governments need to provide processing facilities and credit. The bulk of passionfruit goes into processing for juice. An important market was built up in Fiji by supplying New Zealand. Production costs are relatively high as are transportation costs. Juice yields are lower than for other fruits. European markets are thought to have the largest growth potential.

Hampton, R. E. and Thompson, P. G. 1974. Passion fruit production in Fiji. *Fiji Agricultural Journal*, 36(2), 23–27.

The yellow passionfruit, first grown commercially in Fiji in 1960, occupied about 70 ha near two processing factories at Sigatoka, for which about 380 t of fruit have been produced annually in recent years. Research had shown that yield could be trebled by hand pollination. This was highly economic and is recommended in this paper; some growers had achieved over 30 t/ha. Well grown, hand-pollinated passionfruit responds well to N but less to K. Collar rot (*Phytophthora cinnamomi*) is observed to be the most serious disease, restricting the life of a planting to 30–35 months. Grafting of plants on the rootstock species, *Passiflora maliformis*, did not reduce the incidence of collar rot.

Naville, R. 1975. The marketing of passion fruit and its juice in Fiji. *Fruits*, 30(1), 65–66.

Passionfruit was being grown in the Sigatoka Valley on small holdings of 600 m² to 1200 m². The crop was processed by two local factories. Most of the fruit was exported as frozen juice or pulp, mainly to Australia. It is noted that fresh fruits rapidly lose their flavour and should be shipped at low temperatures of 5.5 °C to 8.2°C and at R.H. of 80–85 per cent.

Chandra, S. 1976. A review of recent research on the yellow passion fruit. Fiji Agricultural Journal, 38(2), 41–48.

Recent research on the agronomy of *Passiflora edulis* var. *flavicarpa* in the world is reviewed, including plant spacing, trellis height, response to fertilisers, pollination, pollen germination, and pests and diseases. A section is also included on pollinating agents in which six insect species are specifically referred to, and there is a section on pests (especially arthropods). In Fiji, there are no important pests but *Tetranychus marianae* McG. can be a problem in some plantations. It can be controlled with chemical sprays including dimethoate (Rogor), lime sulfur, naled (Dibrom) and dicofol (Kelthane).

Chandra, R. and Prasad, P. 1978. Passionfruit production in the South Pacific, an example from Fiji. Pacific Perspective, 7(1–2), 60–69.

A survey of passionfruit in Fiji exemplifies many of the problems of crop diversification programs in the tropics. It has practical lessons for countries in the South Pacific, either involved in passionfruit production or planning to become involved. The most important of these is the need to carry out adequate preparatory work prior to committing farmers to commercial cultivation of a new crop.

1980–1989

Prasad, P. C. and Chandra, R. 1980. Review of passion fruit research in Fiji. Fiji Agricultural Journal, 42(2), 19–22.

Passionfruit production is reviewed, covering pests (mainly red spider mites), diseases (mainly *Phytophthora nicotianae* var. *parasitica*), collar rot, fertilisation, spacing, pollination, flowering and utilisation of fruit residues such as fruit skin for pectin and seed for oil production.

GUAVA

1970–1979

Smith, R. M. 1975. A possible relationship between chemotype and yield of cultivated guavas. Fiji Agricultural Journal, 37(2), 69.

Chemotypical differences in guava rootstocks may be responsible for the low yield of the scion cultivar, Beaumont, on local wild guava rootstock.

MANGO

1980–1989

Iqbal, M. 1982. Review of mango research and production in Fiji. Fiji Agricultural Journal, 44(1), 21–26.

This review contains an outline of the history of mango cultivation in Fiji. Discussion focuses on aspects of current production, yield patterns, pests, diseases and marketing. A report is presented on preliminary trial results of varieties suitable for commercial production in Fiji. Of over 40 cultivars and local selections evaluated, Haden, Gouveia, White Pirie, Momi K and Mapulehu are recommended for commercial production along with the currently planted cultivars of Fiji, Peach, Jarra, Parrot and Kerosene. Cleft and side-wedge grafts, using an 8 to 12 cm long scion of the same thickness as the rootstock (cv. Fiji), were the most successful vegetative propagation methods. Grafting under 50 per cent shade was successful in 60 to 95 per cent of cases. Grafting in exposed conditions was less successful (from 1 to 69 per cent).

Agricultural Commodity Committee 1985. Mango Profile: A Programme for the Development of the Commercial Mango Industry. Suva.

This profile of the mango industry covers the historical development of the industry, industry benchmarks, government involvement, commercial production requirements, yields and costs. Market prospects are outlined, and justification is given for accorded the industry priority status. The main development issues are discussed, along with development constraints. A program is given for the future development of nucleus estates.

MELONS

1940–1949

Vasey, C. R. 1944. Rock melons at the General Experiment Station. Fiji Agricultural Journal, 15(1), 25–26.

Details are furnished of trials of 'Hales Best' rock melon mildew resistant strain number 45.

NUT CROPS

Before 1920

Anon. 1897. Fiji ivory nuts. *Kew Bulletin Miscellaneous Information*, 122:236–237.

Observations are made about the display of ivory nuts from Fiji at the Colonial and Indian Exhibition in 1886. Some letters are published between the Royal Gardens at Kew and the curator of the botanic station in Suva about the cultivation of the nuts.

1920–1939

Wright, C. H. 1921. Candlenuts and candle oil. *Agriculture Circular, Fiji*, 2 (2), 23–25.

1930–1939

Blackie, W. J. 1936. Candlenut oil. *Fiji Agricultural Journal*, 8(2), 36–39.

Some candlenut exports took place in the 19th century. This report covers recent laboratory analyses of the oil, prices, and experiments to reduce the cost of decortification.

Field, B. L. 1938. Potentiality of the cashew nut industry in Fiji. *Fiji Agricultural Journal*, 9(3), 13–15.

The author expresses confidence that a cashew nut industry could be introduced for enterprising farmers in Fiji, giving reasons why. The tree is described and an account is given of planting and harvesting methods, and the preparation of kernels for eating.

1940–1949

Vasey, C. R. 1946. Candlenuts. *Fiji Agricultural Journal*, 17(3), 85–86.

A mill had been recently established in Suva to extract oil from the fruit of the candlenut tree. This is a report on its establishment.

1950–1959

Leenhouts, P. W. 1955. The genus *Canarium* in the Pacific. Bulletin 216, B. P. Bishop Museum, Honolulu, 53 pp.

1970–1979

Iqbal, M. and Hampton, R. E. 1977. Macadamia nut production in Fiji. Fiji Agricultural Journal, 39(2), 97–103.

The history of the introduction of *M. tetraphylla* and *M. intergrifolia* into Fiji since 1800 is outlined, and lists are included of varieties introduced from Hawaii and Australia. Data are also presented on the mineral composition of leaves of three to four of the introductions from Hawaii and on age at first flowering, yield, habit and hardiness in two to ten introductions. Macadamia has in general performed poorly in Fiji. The diseases and pests of macadamia overseas are discussed, and it is suggested that investigations are required on the effects of pests and diseases on yield in Fiji.

1980–1989

Prasad, J. 1982. Composition of ivi (*Inocarpus fragiferus*). Fiji Agricultural Journal, 44(1), 41–42.

Ivi, or the Tahitian chestnut, a native tree of Fiji, grows wild along the banks of streams. The tree grows up to 20 m and yields a stout, leathery fruit or pod containing one large edible seed (in February–March), which is boiled or roasted before eating. Analysis of the kernel showed that it contained on average 12.12 per cent protein (comparable to wheat flour), 2.6 per cent fat, 69.88 per cent starch, 10.14 per cent non-reducing sugar and 0.49 per cent fibre and fat. It may be suitable for infant foods.

1990–present

Carlos, D. J. and Dawes, S. N. 1990. South Pacific Tropical Nut Cultivation: Status and Outlook. Institute for Research, Extension and Training, University of the South Pacific, Alafua, 194 pp.

Stevens, M. L., Bourke, R. M. and Evans, B. R. ed. 1996. South Pacific Indigenous Nuts. ACIAR Proceedings No. 69, Australian Centre for International Agricultural Research, Canberra, 176 pp.

These are the proceedings of a five-day workshop on South Pacific indigenous nuts held in Port Vila, Vanuatu, from 31 October to 4 November 1994. They contain 22 papers presented on a wide range of

issues associated with the production, processing and marketing primarily of the genera *Canarium*, *Barringtonia*, *Terminalia*, *Inocarpus* and *Pandanus* in Parts 1 to 3, workshop discussion, which is summarised in Part 4 as country priorities for research and development, and a bibliography in Part 5.

McGregor, A. M. and McGregor, I. K. 1997. Establishing a commercial indigenous nut industry in Fiji: opportunities and requirements, Report prepared for the Food and Agriculture Organization of the United Nations, Suva.

The report includes a regional overview of indigenous nuts in the South Pacific and Hawaii. Opportunities and requirements for vutu kana (edible *Barringtonia*) and ivi (*Inocarpus fagifer*) are outlined, together with details on agronomic characteristics, nut characteristics, traditional utilisation, estimation of the resource base, markets and marketing, commercialisation, estimated returns and conservation issues.

BEVERAGES

COCOA

1910–1919

Knowles, C. H. 1916. Cacao. Fiji Department of Agriculture, Pamphlet, 17:1–4.

1930–1939

Jack, H. W. 1936. Cocoa. Fiji Agricultural Journal, 8(2), 45–46.

World cocoa market conditions are described and possibilities for expanding cocoa production in Fiji are considered. A number of difficulties were identified in cultivation and preparation for market which were to come to the fore in later decades. It is reported that efforts were under way to collect pods suitable for establishing a cocoa nursery.

1940–1949

Ffrench-Mullen, M. D. 1944. Summary of a preliminary survey of existing cacao in the Northern district, Fiji. *Fiji Agricultural Journal*, 15(1), 8–13.

Cocoa trees were planted in 14 places, 10 in the wet zone and 4 in the dry zone. Details are furnished on original plantings which were 60 per cent *Criollo* and 40 per cent *Forastero*. Rats were identified as the principal pest. It was difficult to ascertain whether the plantings were economic.

Harvey, C. 1948. Cocoa. *Fiji Agricultural Journal*, 19(2), 38.

The author refers to a report from the United Kingdom that recommended cocoa as an additional crop for Fiji.

1950–1959

Parham, B. E. V. 1952. Cacao in Fiji—review and prospects. *Fiji Agricultural Journal*, 23(2), 14–24.

Attempts to develop cocoa from 1880 had failed because of a lack of interest from growers. Information is provided on local sources for planting material and on recent introductions. Suggestions are made for future research and field programs.

Urquhart, D. H. 1952. Cocoa Growing in the Fiji Islands. Technical Paper No. 36, South Pacific Commission, Noumea, 15 pp.

The author was commissioned by the South Pacific Commission to review cocoa production in Fiji. The soils and climate were considered suitable, and cocoa was thought to fit well into the small-scale farming system. Planting materials should be sourced from Western Samoa. Notes on pests and diseases in cocoa in Fiji and other Pacific islands are given in appendices by W. J. Blackie and B. A. O'Connor.

Parham, B. E. V. 1954. Cacao at Naduruloulou, 1953. *Fiji Agricultural Journal*, 25(1), 24–26.

The article reports on progress that had been made at Naduruloulou in establishing cocoa plants for propagation purposes. Details are given of routine trials and records of performance.

Sills, V. E. 1957. Chocolate flavour and the quality assessment of Fiji cocoas for 1955/56. *Fiji Agricultural Journal*, 28 (3/4), 62–67.

The paper begins with a discussion of the terms flavour and bulk cocoas, and chocolate flavouring. Results are presented of surveys of cocoa quality in Fiji, with detailed quality assessment. It was found that cocoa quality is variable due to variability in planting material. This leads to the recommendation to raise clonal stocks of much improved cocoa in order to improve both quality and yields.

Harwood, L. W. 1959. Fiji harvests first cocoa crop. *South Pacific Commission Quarterly Bulletin*, 9(1), 29–32.

The first crop referred to in the title of this article is from the cocoa trees planted in 1953 and 1954 as part of a campaign by the Fiji Department of Agriculture to diversify the economy through new cash crops. Results showed that conditions were suitable for cocoa and prospects seemed bright for the rapid development of a profitable and large industry.

Harwood, L. W. 1959. The establishment of a cocoa industry in Fiji. *Fiji Agricultural Journal*, 29(2/3), 50–55.

An account is given of the early attempts to establish a cocoa industry in Fiji, from the first introduction of plants in 1880. The foundation for a large industry is considered to have been successfully established, and the next major problems to solve is envisaged (correctly as things turned out) to be the low and variable quality of cocoa.

Harwood, L. W. 1959. Cocoa planting. *Fiji Agricultural Journal*, 29(2/3), 65–75.

Details are provided on the main factors to consider when selecting a planting site for cocoa. Shade and its variation over the life of the tree are pointed out as important factors to consider. Consideration also should be given to wind breaks and rainfall distribution. Attention is given to planting possibilities under mature coconuts. Sections are devoted to planting material (seedlings and root cuttings), liming, holing, planting, method of after-care and pruning.

Harwood, L. W. 1959. Plans for the future. *Fiji Agricultural Journal*, 29(2/3), 107–111.

A positive view is taken of the future prospects of the cocoa industry in Fiji which, in hindsight, proved over-optimistic. At the time of writing, a cocoa research station was being developed. Research priorities are

identified as quality investigations, fertiliser trials and fermentation studies. Roles are identified for the Department of Agriculture in marketing and legislation.

Harwood, L. W. and McPaul, J. W. 1959. The soil requirements of cocoa. Fiji Agricultural Journal, 29(2/3), 62–64.

The importance of soil selection for cocoa is highlighted in this paper. Cocoa is considered to require fertile, deep, freely draining and well-structured soils. There is a need to pay attention to soil depth, structure, root development and soil fertility in planting and cultivation.

McPaul, J. W. 1959. Notes on cocoa nutrition. Fiji Agricultural Journal, 29(2/3), 99–106.

The author stresses the importance of natural conditions for cocoa production, with the key factors being humidity and temperature. He also stresses the need for a continuous supply of leaf mould to keep soils fertile. Various methods are outlined for investigation of soil fertility in Fiji, and some tentative fertiliser recommendations are offered.

Sills, V. E. 1959. The preparation of cocoa. Fiji Agricultural Journal, 29(2/3), 76–90.

The main thrust of this paper is to explain that much remains to be done beyond the successful raising of cocoa trees. Attention is given to quality, grades and other characteristics. The importance of fermentation and drying is stressed, and procedures are outlined. A comprehensive section on preparation methods covers harvesting and fermentation methods, temperatures and duration. A fermentary at Naduruloulou is described. Different drying methods are outlined and compared. Other aspects of quality are dealt with, including shell content, bean size and fermentation defects. The economic value of cocoa is defined in terms of its uses in chocolate, cocoa butter and local cocoa drinks.

Walker, C. 1959. Notes on the botany of cocoa. Fiji Agricultural Journal, 29(2/3), 56–61.

The habit of growth of cocoa is described, with details given on branches, flowers, leaves, fertilisation of flowers, fruit and root system. An outline is given of cocoa varieties, and the present-day meaning of the terms, *Criollo*, *Forastero* and *Trinitario*.

1960–1969

Eden, D. R. A. 1960. The cocoa industry in Fiji. South Pacific Commission Quarterly Bulletin, 10(3), 59–62.

This is a review of the material included in the September 1959 issue of the Fiji Agricultural Journal which was dedicated to cocoa. The focus of the review is on the importance of shade, the botany of cocoa, soil requirements, planting and the preparation of cocoa.

Sills, V. E. 1960. Cocoa bean studies in Fiji. South Pacific Commission Quarterly Bulletin, 10(2), 28–31.

The Fiji Department of Agriculture compiled information on the quality of cocoa produced from early plantings in Fiji. This information is reviewed with some observations made on fermentation problems, and there is a note on future policy.

Walker, C. 1962. Recent introductions and development of cocoa (*Theobroma cacao* L.) within the region of the South Pacific Commission with special reference to Fiji. Proceedings of the 10th Pacific Science Congress Symposium on Tropical Crops Improvement, pp. 22–38.

1970–1979

Department of Agriculture, Fiji 1971. Report for the Year 1970. Suva, 34 pp.

The report contains a brief description of agronomic investigations on a wide range of crops including a shade cum fertiliser trial, pruning trial and rodent control in cocoa. Of 26 clones tested for susceptibility to *Phytophthora palmivora*, an Amelonado clone was the most resistant.

Vernon, A. J. 1971. The estimation of annual yield of experimental plots of cocoa from sample picks. Fiji Agricultural Journal, 33(2), 41–46.

The possibility of estimating annual yields of experimental plots from the records of sample harvests (every other year, or every third or fourth year) was studied by simulating such sampling on four sets of annual yield records of cocoa experiments. The sampling errors (particularly of alternate sampling) were small compared with experimental error. This suggests that, in appropriate circumstances such as extensive fertiliser trials on smallholdings, a substantial reduction in recording costs, or an increase in precision, may be achieved at the expense of a modest increase in replication.

Department of Agriculture, Fiji 1972. Report for the Year 1971. Suva, 37 pp.

The report contains an account of progress of the shade cum fertiliser trial, pruning trial and rodent control in cocoa, together with agronomic studies on other crops.

Sundarum, S. 1972. A comparison of direct seeding with transplanting of cocoa. *Turrialba*, 22(3), 354–357.

Research by the Department of Agriculture in Fiji demonstrated that, at two sites, Amelonado seedlings grown from seed planted in situ were much bigger at one to two years than seedlings of the same age transplanted from the nursery at five months. At a third site, there was no difference between the two types of seedlings.

Sundarum, S. and Hassan, M. 1973. Further notes on the Waimaro cocoa: Part 2 Yield. *Fiji Agricultural Journal*, 35(2), 61–66.

During 1968–72, individual plots at Waimaro, the first Amelonado cocoa planting in Fiji, yielded between 1500 kg/ha and 3700 kg/ha. Large variations in yield and loss to black pod (*Phytophthora palmivora*) within the small area of the trial (1.7 ha) show that the growth of cocoa is highly sensitive to small variations in soil, and the incidence of black pod to variations in microclimate. The average black pod loss (25 per cent) is extremely high in this rainfall zone.

Vernon, A. J. 1973. The first five years' results of the cocoa pruning experiment at Waimaro. *Fiji Agricultural Journal*, 35(1), 1–10.

A pruning trial was begun in 1968 by allowing, on hitherto strictly pruned 10-year-old Amelonado cocoa, (a) continued vertical growth from the first jorquette, (b) some chupon growth on leaning or sickly trees, and (c) complete freedom of chupon growth. A fourth treatment was the continuation of strict chupon removal. Apart from a depression in the yield of the completely unpruned cocoa in 1969, there was never any significant difference between treatment yields; but, by October 1972, the strictly pruned cocoa was the lowest yielding and the completely unpruned appeared to be the best treatment.

Vernon, A. J. and Sundarum, S. 1973. Design and establishment of a cocoa spacing trial at Waidradra. *Fiji Agricultural Journal*, 3(1), 43–50.

Sixteen blocks of a cocoa spacing trial were planted between December 1971 and June 1972. The planting sites in each block were the interception points of 11 radii with 14 concentric arcs, the outermost radii and arcs

being guard rows. The distances between sites on an arc ranged logarithmically from 0.95 m in the innermost non-guard arc to 4.3 m in the outermost. Site preparation, planning and establishment were hampered by high rainfall and a hurricane in October 1972 which caused some damage; but by March 1973, 845 of the plants were growing well.

Williams, J. M. 1973. Rat damage assessment and control in cocoa. Fiji Agricultural Journal, 35(1), 15–25.

Damage by rats occurs in cocoa plantations as the pods turn yellow at maturity so all the pods attacked are lost. Attack rates exceeding 9000 pods/ha had been recorded. Damage can be reduced to low levels by baiting with warfarin-impregnated wheat set in paraffin wax (commercial preparation). Two to three applications of poison per year (depending on plantation size) with the first at the start of harvest season are reported to have provided satisfactory control. The break-even point for control is when damage exceeds 3–4 per cent of total production.

Singh, A., Sundarum, S. and Vernon, A. J. 1974. Fertiliser trials on young cocoa. Fiji Agricultural Journal, 36(1), 7–11.

Response to N, P and K varied considerably and inexplicably between two trial sites, Wainibuka and Cakaudrove. Neither trunk growth nor yields during the 3rd and 4th year responded to P or K. This was attributed to relatively high values of P (72 ppm) and K (0.4 me per cent) and foliage (P 0.22 per cent and K 1.7 per cent dm), but there was small but significant response to N in Cakaudrove where all the cocoa trees were grown under unfertilised coconuts.

Vernon, A. J. 1975. Hybrid cocoa: progress report on trials, seed gardens and extension. Fiji Agricultural Journal, 37(1), 37–38.

Of seven hybrids produced by crossing Amelonado with ICS and Sca clones, Amelonado × ICS39 (Hybrid A) and Amelonado × Sca 12 (Hybrid C) gave the best seedling performance and were subsequently planted in yield trials with Amelonado. Although initial yields of Hybrid A were higher than Amelonado and the former was superior under unfavourable conditions, Hybrid A is reported to be marginally better under favourable conditions. Yields of Hybrid C were higher than Amelonado.

Vernon, A. J. 1976. Location factors in cocoa cultivation in Fiji. *Fiji Agricultural Journal*, 38(1), 33–40.

Hitherto, most cocoa plantings in Fiji had been in the wet and intermediate zones; but some plantings in the dry zones were now coming into bearing. Stem borers and *Adoretus versutus* Har. occasionally caused failure to establish. Damage by *A. versutus* occurred mainly in the dry zone, and was localised and persistent.

Vernon, A. J. 1977. The seasonal pattern of labour requirement of cocoa in Fiji. *Fiji Agricultural Journal*, 39(1), 51–52.

Monthly cocoa pod production figures are recorded together with labour requirements for one hectare of typical cocoa plantation in Cakaudrove in a typical season. Implications are drawn from the results for both planters and smallholders.

Ministry of Agriculture, Fisheries and Forests, Fiji 1978. Successful Cocoa Planting: A Guide to the Small Farmer. Bulletin No. 65, Suva.

Details are provided on where, what area and how to plant cocoa, and its maintenance, black pod control, harvesting and processing.

Ministry of Agriculture, Fisheries and Forests, Fiji 1978. Cocoa as a Plantation Crop. Bulletin No. 66, Suva.

A background description is given of the cocoa tree. Sections are provided on the economics of production in terms of prices, labour use, pod picking and establishment costs. Recommendations are made on where to plant trees, establishment, planting and early maintenance, weeding control of pests and diseases, gap filling and thinning, pruning and harvesting.

1980–1989

Martin, M. P. L. D. and Prasad, G. 1983. Effects of pruning on Amelonado cocoa in Fiji. *Fiji Agricultural Journal*, 45(1), 7–12.

A nine-year pruning trial, from 1974 to 1982, revealed that discretionary pruning where two or three basal chupons were allowed to grow in addition to the main stem gave greater potential and actual yields than heavy pruning, no pruning or continued growth from the first jorquette (branching point). Unpruned trees had the highest incidence of black pod

loos and heavily pruned tree the least. Trees subject to discretionary pruning and unpruned trees were more susceptible to hurricane damage, but recovered earlier and better than the more heavily pruned trees.

Martin, M. P. L. D., Pratap, R. and Prasad, G. 1984. Residual effects of shade species during establishment on the yield of cocoa. *Fiji Agricultural Journal*, 46(1), 17–20.

Cocoa shaded by bananas gave a mean yield (1977–82) of 1494 kg/ha dried beans compared with 1135 kg/ha, 1110 kg/ha and 1066 kg/ha with cassava, taro and *Terminalia ivorensis*, respectively. Results are discussed in relation to better shade, wind protection and weed control from banana.

Ministry of Primary Industries, Fiji 1985. Cocoa. Parliamentary Paper No. 62 of 1985. 62 pp.

Results are summarised for cocoa trials on variety, pruning and spacing and a trial with six insecticides against *Xyleborus fijiensis*. Carbofuran and acephate gave good control.

Martin, M. P. L. D. 1987. Cocoa in Fiji. *Cocoa Growers' Bulletin*, 38:23–27.

At the time of writing, it was reported that there were 4375 ha of mainly Amelonado cocoa of which 1180 were bearing. Production in 1985 was 225 tons, which was a 9 per cent drop from the 246 tons produced in 1984, due to the damaging effects of two cyclones. Climatic and soil conditions, agronomic practices, pest and disease control, processing and marketing, and research and extension work are described.

Martin, M. P. L. D. 1987. Performance of Amelonado and hybrid cocoa in Fiji. *Fiji Agricultural Journal*, 49(1), 17–24.

The performance of the cocoa variety Amelonado and its hybrids with Upper Amazon and Trinitario clones produced in Fiji in the early 1970s were evaluated in trials established in 1971–1973 at several sites. Amelonado recorded the highest mean yield, with an annual yield of 2106 kg/ha during 1979–85 at Wainigata, although it was outyielded by the hybrids at some sites. Amelonado also showed acceptable pod value and bean weight tolerance of black pod (*Phytophthora palmivora*) and adaptability to farmers' fields, justifying its current position as the only recommended variety for Fiji.

COFFEE

1940–1949

Harman, L. 1944. Preparation of coffee at Navala, North Colo. Fiji Agricultural Journal, 15(4), 108–109.

Coffee was first grown as a cash crop before the turn of the century. A description is given of how some local people make coffee for their own consumption.

1950–1959

Harwood, L. W. 1951. Coffee. Fiji Agricultural Journal, 22(1), 31–32.

Brief notes are given on preparing coffee for the market, using pulping for parchment and hulling of cherries.

Parham, B. E. V. 1954. Plant introduction: 1. Coffee. Fiji Agricultural Journal, 25(3/4), 97–98.

Details are given on plots of coffee introduced at Naduruloulou.

Sills, V. E. 1959. Rural industries(3. Coffee. Fiji Agricultural Journal, 29(4), 148–152.

The author reports on the successful rehabilitation of small areas of early plantings of coffee in Viti Levu. He describes the main varieties of coffee planted, cultivation methods, and preparation and curing methods.

TEA

1970–1979

Department of Agriculture, Fiji 1971. Report for the Year 1970. Suva, 34 pp.

Brief reports are given of agronomic investigations on many crops, including a fertiliser trial and rooting media for vegetative propagation of tea.

1980–1989

Fernando, L. H. and Gunasekera, H. M. 1982. A Feasibility Study for the Production of Tea in Fiji. Institute for Research, Extension and Training in Agriculture, University of the South Pacific, Alafua.

The study covers tea imports into Fiji, requirements for the production, processing and packaging of tea, management structure, training, plucking methods, and economic, financial and social aspects of tea production in Fiji. Analyses were undertaken showing that suitable soil and climatic conditions existed in Fiji for tea production. Three locations were considered suitable, and it would be best undertaken by smallholders on units less than two hectares per family. It was recommended that a consultant on tea technology prepare plans for a factory and machinery, followed by the formulation of a project with more detailed estimates of costs and benefits.

KAVA/YAQONA

1920–1929

Despeissis, A. 1925. Kava or yaqona. Agriculture Circular Fiji, 5(2), 64–67.

1950–1959

Frater, A. S. 1958. Medical aspects of yaqona. Transactions & Proceedings Fiji Society, 5(2), 31–39.

1970 to 1979

Lebot, V. and Merlin, M. 1972. Kava: The Pacific Drug. Yale University Press, New Haven, 255 pp.

Duve, R. N. 1976. Highlights of the chemistry and pharmacology of yaqona (*Piper methysticum*). Fiji Agricultural Journal, 38(2), 81–84.

This paper contains a review of the major compounds isolated from kava: yangonin, methysticin, dihydromethysticin, demethoxyyangonin, kawain and dihydrokawain. These compounds have anaesthetic, analgesic, antimycotic, somniferous, anti-convulsive and spasmolytic properties.

1980 to 1989

Duve, R. N. and Prasad, J. 1983. Quality evaluation of yaqona (*Piper methysticum*). Fiji Agricultural Journal, 43(1), 1–8.

A comparative study was conducted on the chemical constituents of 25 samples of powdered dried roots, 35 samples of unpowdered dried roots, 31 samples of dried basal stems and 37 samples of powdered basal stems of kava. Results revealed adulteration of the powdered materials, which had much lower amounts of the seven major 8-pyrone, the principal active constituents. A recommendation is made to formulate minimum standards of powdered kava in terms of its active constituents.

Duve, R. N. and Prasad, J. 1983. Changes in chemical composition of yaqona (*Piper methysticum*) with time. Fiji Agricultural Journal, 45(2), 45–50.

Dried powdered roots and basal stems of yaqona stored in screw-capped bottles at room temperature deteriorate in major active ingredients after 39, 36 and 22 months periods. The constituents of dihydromethysticin, kawain, dihydrokawain, tetrahydroyangonin, yangonin and methysticin deteriorate in varying degrees after 39 months storage of both powdered basal stems and powdered root samples.

Duve, R. N. and Prasad, J. 1983. Efficiency of extraction of constituents in the preparation of yaqona beverage—Part 1 General constituents. Fiji Agricultural Journal, 46(1), 5–9.

The procedure is described for the extraction process and results are reported for an analysis of the extraction of constituents. It is concluded that the constituents depend on whether the beverage was prepared from roots, basal stems or their commercially powdered counterparts.

Duve, R. N. and Prasad, J. 1983. Efficiency of extraction of constituents in the preparation of yaqona beverage—Part 2: Major active constituents. Fiji Agricultural Journal, 46(1), 11–16.

Details are given of the major active constituents of kava beverage. A study of consumer preferences reveals that consumers prefer lighter coloured beverage preparations from basal stems.

Anon. 1988. Kava. Lancet (British Edition), 8605:258–259.

The article deals with the unlimited intake of kava by Aboriginal communities in Arnhem Land, Northern Territory, Australia. Although there is a clear preference for kava over alcohol in these communities as it

does not elicit violent behaviour, it has been shown that users are more likely to suffer ill health, malnutrition with 20 per cent body weight loss and 50 per cent loss of body fat, liver damage and changes in the blood cells. Kava is taken in regulated amounts in Pacific island communities such as Tonga and Fiji.

1990–present

Aalbersberg, W. and Sotheeswaram, S. 1991. Kava. In: Jansen, A. A. J., Parkinson, S. V. and Robertson, A. F. S. ed. *Food and Nutrition in Fiji*, Vol. 2. Department of Nutrition and Dietetics, Fiji School of Medicine and the Institute of Pacific Studies, University of the South Pacific, Suva, pp. 554–574.

Details are provided on the role of kava in the South Pacific, its properties (pharmacology and chemistry) and symptoms of its use.

Singh, Y. N. 1992. Kava: an overview. *Journal of Ethnopharmacology*, 37(1), 13–45.

The following aspects are covered: etymology, geographic distribution of usage in the Pacific islands, botanic origins, legends relating to origins, botanical characteristics, cultivation and varieties, physiological effects of kava drinking, utensils for preparing and serving kava, sociological aspects, medicinal properties, the kava ceremony, chemical constituents and pharmacology.

Lebot, V. 1997. An overview of kava production in the Pacific islands: What we do know and what we don't know. *Journal of South Pacific Agriculture*, 4(1/2), 55–62.

This overview of kava production in Pacific island countries focuses on the potential and constraints in the kava industry. There is a discussion of its origin, and the botany, genetics and active ingredients of the plant, and their effects. Details are also provided on cultivation, harvesting methods, yields, processing, safety and economics of kava production. Suggestions are made for future initiatives in production, extension, processing, research and facilitation of marketing activities. The material is of considerable relevance to the kava industry in Fiji.

SPICES

GENERAL

1980–1989

Vinning, G. S. 1989. Growth, Production and Distribution of Spices. ACIAR Working Paper No. 27, Australian Centre for International Agricultural Research, Canberra.

Details are provided of the production and product characteristics of major, and potentially important, spices grown in the South Pacific. A feature of this working paper is the attention given to marketing issues.

1990–present

Kaiyanuyanu, I. 1995. Spices in Fiji. IRETA's South Pacific News, February, Alafua.

Spices in Fiji are mainly used in food but small quantities are also used by the pharmaceutical and perfume industries. Currently 26 ha are under vanilla, 1 ha each with pepper and cardamom and 400 trees of nutmeg. Vanilla was first introduced in 1881. Annual production of vanilla is in the form of around 900 kg of cured beans. Fiji has exported small quantities to Australia (37 kg in 1990 and 16 kg in 1993). Nutmeg was introduced in 1939 and, in 1993, Fiji exported 18 kg to Australia. Cardamom was first introduced into Fiji in 1939. The crop bears in three years for 10 to 15 years. Fiji exported pepper before 1888.

Ministry of Agriculture, Fisheries and Forests, Fiji 1995. The Spices Sector in Fiji (5 volumes). South Pacific Project Facility of the International Finance Corporation, Suva.

Details are presented on the various spices being grown in Fiji or with potential for commercial production. Prospects for their commercialisation are assessed.

VANILLA

Before 1930

Anon. 1894. Vanilla at Fiji. *Kew Bulletin Miscellaneous Information*, 91:208–211.

A series of letters between the Kew Royal Gardens and the Colonial Office reveal details of steps taken to establish vanilla in Fiji.

1930–1939

Suckling, J. J. 1939. The cultivation and hand-pollination of vanilla. *Fiji Agricultural Journal*, 10(2), 42–43.

The vanilla production cycle is described, and recommendations are made on propagation. Brief notes are given on how to cure and pack pods.

1940–1949

Jack, H. W. 1940. Notes on curing Tahiti vanilla beans. *Fiji Agricultural Journal*, 11(1), 22–23.

Brief and simple notes are provided on procedures for curing vanilla beans.

1980–1989

Agricultural Commodity Committee 1985. *Vanilla Profile: A Programme for the Development of the Commercial Papaya Industry*. Suva.

This profile of the vanilla industry covers its historical development, geographical distribution, production and productivity, industry structure, markets and marketing, government involvement, employment and income distribution. Market prospects for the industry are outlined, along with the major development constraints and a program for future development. Results are presented of a gross margin analysis and cash flow budget.

1990–present

Karavaki, L. 1994. East Kadavu Vanilla Project. Project paper for vanilla industry in Fiji, Ministry of Agriculture, Fisheries and Forests, Suva.

PEPPER

1950–1959

Parham, B. E. V. 1954. Plant introduction: 2. Black pepper. *Fiji Agricultural Journal*, 25(3/4), 99.

Efforts made previously to establish black pepper at Nasinu had been abandoned. A renewed effort was made at Naduruloulou in 1951. Early results suggested that prospects for a black pepper industry were excellent. Limited supplies were available for propagation.

Lefort, E. J. E. 1956. Promising cash crop for Pacific planters. *South Pacific Commission Quarterly Bulletin*, 6(1), 18–20.

The main purpose of this article is to present the advantages of growing pepper as a cash crop in farm diversification programs in countries such as Fiji where growing conditions are favourable. A botanical description is given and ecological requirements of the plant are spelt out. There are sections on cultivation methods, vegetative propagation, maintenance, harvesting and processing of black pepper.

1960–1969

Sills, V. E. 1960. Pepper. *Fiji Agricultural Journal*, 30(2), 61–66.

Pepper had not been of economic importance even though pepper gardens had been successfully established from imported cuttings at the Naduruloulou experiment station. The crop is described and aspects of its production are discussed. Specific issues dealt with are preparation (for both black and white pepper), yields, chemical constituents and quality.

Sills, V. E. 1962. Pepper growing for the smallholder. *South Pacific Commission Quarterly Bulletin*, 12(2), 31–33, 64–65.

A description is given of the cultivation of the pepper vine and how the crop is processed to produce the pepper of commerce. Commercially useful varieties are listed. A brief history is given of pepper in Fiji. Cultivation details specifically cover raising new plantings, preparation, climate and soils. Price relations to yields are discussed along with quality, pungency and flavour.

1980–1989

Vinning, G. and Perinet, M. 1988. Pepper in the South Pacific: current market prospects and research. *Pacific Economic Bulletin* 42:47–52.

The authors describe the development of the pepper industry in the South Pacific, its international and domestic markets and prices, and research work undertaken.

TURMERIC

1930–1939

Silas, R. J. 1938. Turmeric (*Curcuma longa* L.). *Fiji Agricultural Journal*, 9(4), 28–29.

A cursory description is given of turmeric which had been observed to grow wild in the hilly parts of Fiji. Its use by Indians is described.

1980–1989

Prasad, J. and Singh, A. 1980. Processing of turmeric. *Fiji Agricultural Journal*, 42(2), 23.

Turmeric is the underground stem of the rhizome of *Curcuma longa* L., a plant of the ginger family indigenous to Southern Asia. Turmeric contains volatile oil, fixed oil, resins, proteins, pentosans, starch, cellulose, mineral elements and a characteristic colouring matter called curcumin. It is used for colouring foods, oils, fats and waxes. Turmeric oil is orange-yellow in colour and consists of a mixture of an alicyclic sesquiterpene called turmerone and an aromatic ketone which are present in turmeric to an extent of 3–5 per cent. Turmeric is one of the main ingredients of curry powder and blended spice. The authors describe four pre-treatments: steaming; boiling; boiling in five per cent brine; and cutting into halves. They also describe two drying methods for the preparation of turmeric rhizomes for processing. Results showed that steaming for 30 minutes and drying at 60°C for 28 hours gave the best-quality turmeric powder.

SUGARCANE

Before 1950

Lyon, H. L. 1911. Notes on the sugar industry of Fiji. *Hawaiian Plant Record*, 4:318–339.

This is an early description of the sugar industry in Fiji, its structure, production conditions and milling operations.

1950–1959

Anon. 1953. Sugar in Fiji. *Bank of New South Wales Review* No. 15 (reprinted).

A description is given of the early development of the sugar industry in Fiji. The important role of small holdings is highlighted, as are the considerable political and industrial problems in the industry. The outlook for production and marketing is presented.

Colonial Sugar Refining Co. Ltd 1954. The sugar cane industry in Fiji. *Tropical Agriculture*, 31:272–280.

Sugar production had been undertaken on small-sized farms leased to Indians by Colonial Sugar Refining Company Limited (now the Fiji Sugar Corporation). Information is provided on the climate, locality, area, farming systems, soils, fertilisers, cultural methods, varieties, diseases, harvesting, transport of canes and field organisation.

1960–1969

Daniels, J. 1967. Sugar canes and related plants of the Fiji Islands. *Proceedings of the 12th ISSCT Conference, Puerto Rico, 1965*, 1004–1013.

Price, S. and Daniels, J. 1968. Cytology of South Pacific sugarcane and related grasses with special reference to Fiji. *Journal of Heredity*, 59(2), 141–145.

This paper contains a report and discussion on the chromosome numbers of original sugarcanes and related grasses from Fiji and, to a lesser extent, other Pacific islands. It is found that most *Saccharum officinarum* from Fiji have $2n = 80$ chromosomes but occasional simple aneuploids have $2n = 29$ or 81. Nevertheless, a significant number of clones are atypical in morphology and chromosome numbers.

1970–1979

Department of Agriculture, Fiji 1971. Report for the Year 1970. Suva, 34 pp.

A breeding line, LF63–863, was found to have a high sugar content, give high yields of cane and show resistance to the two main local cane diseases. It was developed using a 'decreased intergeneration interval time' procedure in which the normal ten-year breeding cycle is reduced to three years.

Constantini, O. 1972. The Fijian sugar industry. *Zeitschrift-fur-Wirtschaftsgeographie*, 16(5), 156–159.

The author reported on the status of the Fiji sugar industry at the time of writing. Sugar was mainly exported from Fiji to UK, other Commonwealth countries and Japan. There were four sugar processing plants in Fiji producing 400 000 tons of cane sugar annually.

Department of Agriculture, Fiji 1972. Report for the Year 1971. Suva, 37 pp.

Brief reports are provided on breeding and selection work, herbicide trials and intercropping sugarcane with other crops, together with agronomic studies on other crops.

Stevenson, N. D. and Daniels, J. 1972. Rapid screening methods for sugarcane: 4. A pot method of growing and ripening sugarcane. *Proceedings of the International Society of Sugar Cane Technologists, 14th Congress 1971*, pp. 386–395.

A method is described for rapidly growing large numbers of clones in pots for yield screening and assessing biochemical characters. A trial was carried out at the South Pacific Sugar Mills in Fiji. The degree of correlation for yield and biochemical characters between pot and field-grown cane was similar to that between the early stages of traditional field selection programs.

Brown, A. H. D. and Daniels, J. 1973. Mass selection of commercial hybrid sugarcane populations in Fiji. *Experimental Agriculture*, 9(4), 321–328.

The mass selection reservoir is one way to take a population approach to the breeding of sugarcane. Yield data from four successive plantings of a sugarcane mass selection reservoir showed consistent superiority to a commercial clone. The problem of defining satisfactory selection indices for the reservoir is discussed.

Department of Agriculture, Fiji 1973. Annual Report 1972. Suva, 42 pp.

Three subclones of the variety, Pindar, produced by tissue culture were highly resistant to Fiji virus. They differed slightly in leaf characters from the original Pindar.

Stevenson, N. D., Galuinadi, J. K. and Pederson, D. G. 1974. An evaluation of pot methods for clonal selection in sugarcane. South African Sugar Journal, 58(5), Supplement 11.

This work was carried out at the Agricultural Experimental Station of the Fiji Sugar Corporation. Varietal screening for biochemical and agronomic characteristics using the intensive care trial (ICT), in which growth in the field is restricted to one stalk per plant supported by wires, was as effective as screening in pots placed on a lawn. Correlations between field response and pot or ICT selection were such that when a 60 per cent increase in selection rate and a greater number of characteristics were considered, it was advantageous to use both methods during the early stages of selection.

World Bank 1976. Fiji: Appraisal of the Sugar Development Project. Report No. 986a-FIJ, Washington, D.C.

Krishnamurthi, M. 1977. Conservation of sugar cane germplasm. In: Third International Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania (SABRAO), Plant Breeding Papers 1.1 Genetic resources, pp. 6–9.

Brief information is presented on (1) the geographical origin of *Saccharum spontaneum*, *S. officinarum*, *S. robustum* and *S. edule*; (2) the interrelationships of these species; (3) their conservation as seeds, as living material, by deep freezing and by tissue culture; and (4) the results of hybridisation between *S. saccharum* and *S. spontaneum*.

Huets de Lemps, A. 1978. Sugar cane in Fiji. Cahiers d'Outre Mer, 31(121), 5–47.

The author reports that sugar comprised more than 75 per cent of the total exports of Fiji. Cane growing is concentrated along the leeward coasts where the climate is most suitable. It is grown mainly by Indian farmers on small alluvial plains of fertile soil and, more recently, in the hills. Cane yields are reported to be over 50 tons per ha and sucrose contents about 13.5 per cent. Sugar production decreased from 355 000 tons in

1970 to 268 000 tons in 1975, partly due to excessive rainfall. An output of 400 000 tons was targeted, to be achieved by better drainage, new land development and planting of improved varieties.

May, J. 1979. Fiji: selling a record crop. *World Sugar Journal*, 1(10), 22–24.

Fiji was expected to produce 423 000 tons of sugar in 1979 compared with 346 000 tons in 1978. The Fiji Sugar Marketing Company had plans to sell this large crop under various international agreements to UK, New Zealand, Malaysia, Singapore, USA and Canada. The ISA quota is discussed.

1980–1989

Blume, H. 1980. The sugar industry of Fiji and Hawaii: conformity and diversity of tropical Pacific islands. *Geographische Zeitschrift*, 68(4), 284–304.

The economies in Fiji and Hawaii are maintained to be tied to sugar production. Although physical conditions are similar, cultivation, harvesting and processing differ due to different production structures. In Fiji, production is based on small farms while, in Hawaii, large plantations prevail. In Fiji, production is labour-intensive while in Hawaii it is capital-intensive. A comparison is made between the ecological conditions, historical factors, cultivation and harvesting methods, area under sugarcane cultivation, yields and structural problems since 1970.

Fiji Sugar Corporation 1981. *Sugar in Fiji*. Suva.

1990–present

Yang, S. J. and Chen, J. M. 1991. A review of fertiliser trials carried out by the Fiji Sugar Corporation between 1977 and 1987. *Taiwan Sugar*, 38(4), 19–24.

Nitrogen was found to be most limiting for sugarcane production in Fiji. More than 70 per cent of the experimental trial sites showed a positive response to N at rates ranging from 150 to 250 kg N/ha, with yields increasing by 10 t/ha to 40 t/ha. Only 33 per cent of the sites showed a response to K and there was a response to applied P on some ferruginous latosols where soil P was low.

Yang, S. J. and Wang, C. H. 1993. Performance evaluation of mechanical loading of sugarcane in Fiji: Part 1. *Taiwan Sugar*, 40 (3), 27–29.

A comparison is made of two types of sugarcane loading on flat and sloping land in Fiji: the use of an adapted logging machine and manual loading. Manual loading efficiency on flat land with yields greater than 70 tons/ha was 0.54 tons/man hour compared with 23.9 tons/man hour with the loader. On sloping land with low yields, the loading efficiency of both methods was reduced considerably. Results indicated that mechanical loading could save 35 per cent of harvesting costs and reduce labour requirements.

Yang, S. J. and Wang, C. H. 1993. Performance evaluation of mechanical loading of sugarcane in Fiji: Part 2. *Taiwan Sugar*, 40 (4), 17–23.

The loading and transporting of cane in Fiji were investigated in an economic analysis. Running costs were tabulated for a grab loader and haulage truck. A semi-mechanised harvesting system using manual cutting and mechanical loading with grab loaders was tested and the harvesting cost per ton of cane calculated. The use of grab loaders gave 12 to 35 per cent savings in harvesting costs and 44 to 46 per cent reductions in labour requirements.

Yin, S. A. and Yang, S. J. 1993. Intercropping potato with sugarcane in Western Division of Fiji. *Taiwan Sugar*, 40(1), 14–21.

Sugarcane cv. Ragnar and potatoes cv. Red Pontiac were at Sabeto in pure stands or intercropped with one or two rows between sugarcane rows with either sugarcane fertiliser or sugarcane plus potato fertilisers. Lowest yields of the potato intercrop were obtained with sugarcane fertiliser. Net profit was highest from intercropping with 1:2 sugarcane:potato rows.

James, G. L. 1994. The Fiji sugarcane industry—an agriculturist's viewpoint. *Sugar-Cane*, 4:3–7.

The following information on sugarcane is provided: location, history, meteorological data, pests, diseases and weeds, effect of the environment, area harvested, yield and potential, sugarcane and other crops, planting, fertiliser application, cultivars on different soils, payment system, erosion control, harvesting and harvesting losses, and the future of the industry.

Krishnamurthi, M. 1994. Alternation of conventional with unconventional means of breeding in sugarcane. In: Toward Enhanced and Sustainable Agricultural Productivity in the 2000's: Breeding Research and Biotechnology. Proceedings of the SABRAO 7th International Congress and WSAA Symposium, Academia Sinica, Nankang, Taipei, 16–20 November 1993, Vol. 1 Special Publication. Taichung District Agricultural Improvement Station 1994, No. 35, pp. 285–289.

Saccharum officinarum cv. Korpi was crossed with *Narenga porphyrocoma* and *Erianthus bengalense* (*S. bengalense*) to produce hybrids. Hybrid segregants were derived and propagated in vitro. Pollen fertile progeny on one hybrid were selfed and crossed with commercial sugarcane varieties. The population yielded lower than commercial cultivars but with the same level of sugar and was immune to Fiji disease.

Anon. 1996. The sugar industry in the Fiji islands. *Sugar y Azucar*, 91:11, 27–28, 30–32.

The history of the sugar industry in Fiji is outlined. Organisation of the industry and the role of the Sugar Corporation are discussed together with sugarcane production and the structure, ownership and organisation of the country's sugar mills. Marketing is also covered.

ROOT AND TUBER CROPS

MULTIPLE ROOT/TUBER CROPS

1930–1939

Coster, S. E. M. 1938. Notes on taro, sweet potato and banana growing. *Fiji Agricultural Journal*, 9(4), 24–28.

Simple descriptions are provided of methods for cultivating wetland and dryland taro, and sweet potato. Banana cultivation is dealt with in more detail. There is coverage of choice of land and its preparation, selection and handling of suckers, planting, cultivation, pruning, bearing of fruit, harvesting and handling of bunches.

1950–1959

Parham, B. E. V. 1954. Plant introduction—5. Root crops. *Fiji Agricultural Journal*, 25(3/4), 102.

Details are provided on the harvest of root crops in 1933/34. Crops covered are *Dioscorea alata*, *Dioscorea setiva* (kaile variety), *Amorphallus campanulatus*, ginger and Polynesian arrowroot. Statistics are presented on average weight and range of weights.

1970–1979

Coursey, D. G. and Haynes, P. H. 1970. Root crops and their potential as food in the tropics. *World Crops*, 22(4), 261–265.

The main root crops consumed as food in tropical countries are described, and details are given of their nutritive values and current production. The paper finishes with a section on their biological efficiency as food producers.

Department of Agriculture, Fiji 1971. Report for the Year 1970. Suva, 34 pp.

A brief report is given on the agronomic investigations of many crops including varietal trials on yams, cassava and sweet potato.

Lambert, M. 1971. Agronomic research on tuber crops in the South Pacific. *Tropical Root and Tuber Crops Tomorrow* (University of Hawaii), 2:74–76.

Details are given on trials on tuber crops being carried out in Samoa, Solomon Islands, Fiji, Papua New Guinea, the Trust Territories of the Pacific, Tonga, French Polynesia, New Caledonia and Niue.

Sivan, P. and Vernon, A. J. 1971. Research on cassava, sweet potato and yam in Fiji, 1950–1970. *Fiji Agricultural Journal*, 33:9–14.

This review is based on research work undertaken over three decades on three of the four major root crops in Fiji. The fourth, taro, was reviewed separately. Comparatively little research had been undertaken given the relative importance of these food crops. Trials undertaken covered variety evaluation, planting material, planting rate, staking, cultivation methods and palatability.

Chandra, S. 1974. Root crop production and labour utilisation in the Sigatoka Valley, Fiji. *Tropical Root and Tuber Crops Newsletter*, 7:33–35.

Data are presented on the production and yields of root crops on farms in the Sigatoka Valley, Fiji.

Haynes, P. H. and Sivan, P. 1975. A root crop research and development project in Fiji. *Tropical Root and Tuber Crops Newsletter*, 8: 24–26.

Discussion is focused on an evaluation of indigenous cultivars of taro, uvi (*Dioscorea alata*) and cassava, and research into improved agronomic practices applicable to these crops.

Sivan, P. 1975. Technical Paper on Root Crops. South Pacific Commission, Noumea.

Plucknett, D. L. 1976. Edible aroids. In: Simmonds, N. W. ed., *Evolution of Crop Plants*. Longman, London, pp.10–12.

Haynes, P. H. 1977. Root crop production and use in Fiji. In: Lambert, M. ed., *Regional Meeting on the Production of Root Crops, 24–29 October 1975, Suva, Fiji: Collected Papers*. Technical Paper No. 174, South Pacific Commission, Noumea.

A descriptive account is given of the production of root crops and their utilisation in Fiji.

Haynes, P. H. and Sivan, P. 1977. Towards the development of integrated root crop research and production in Fiji. In: Lambert, M. ed., *Regional Meeting on the Production of Root Crops, 24–29 October 1975, Suva, Fiji: Collected Papers*. Technical Paper No. 174, South Pacific Commission, Noumea, pp. 51–61.

The authors outline root crops research in Fiji since 1973 and diagnose root crop development and production constraints. Root crops resources are evaluated, with specific sections on taro, yam and cassava. A special section is allotted to the productivity and development of taro. The main part of the paper contains an investigation to determine the best agronomic practices with root crops. A section is devoted to the development and extension of systems for commercial production of yams and taro.

Lambert, M. ed., 1977. *Regional Meeting on the Production of Root Crops, 24–29 October 1975, Suva, Fiji: Collected Papers*. Technical Paper No. 174, South Pacific Commission, Noumea, 213 pp.

This publication contains the 35 working papers presented at a regional meeting on the production of root crops in 1975, organised by the South Pacific Commission and held in Suva. Subjects treated include cassava,

yam, taro and sweet potato production and research, root crops in general, urban root crop production, post-harvest technology, use of root crops as animal feed, and root crops development projects.

Plucknett, D. L. 1977. Current outlook for taro and other edible aroids. In: Lambert, M. ed., *Regional Meeting on the Production of Root Crops, 24–29 October 1975, Suva, Fiji: Collected Papers. Technical Paper No. 174*, South Pacific Commission, Noumea, pp. 36–39.

The author describes aroids and their characteristics, and discusses the strengths and weaknesses of the major edible aroids. He suggests that a collaborative effort is needed to exploit these crops.

Thaman, R. R. 1977. Urban root crop production in the Southwest Pacific. In: Lambert, M. ed., *Regional Meeting on the Production of Root Crops, 24–29 October 1975, Suva, Fiji: Collected Papers. Technical Paper No. 174*, South Pacific Commission, Noumea, pp. 73–82.

The nature of root cropping in the South Pacific is described, with some examples from Fiji. The implications of urban root cropping are outlined in terms of instrumental, territorial, sentimental and symbolic orientation. Eleven suggestions are given for improving urban gardening with root crops.

1980–1989

Chandra, S. 1984. Conclusions and recommendations for research and development in the edible aroids. In: Chandra, S. ed., *Edible Aroids*. Clarendon Press, Oxford, pp. 237–242.

This conclusion to the edited collection of papers on edible aroids focuses on the research and development potential for these staple crops in Pacific island countries, and is most relevant to the situation in Fiji. The first area dealt with is agronomy and production systems, and separate sets of observations and recommendations are made on agronomy and production systems. Separate sets are also included for germplasm and breeding in the second section. The third section is on pests and diseases and the fourth on storage, utilisation and marketing where, again, separate sections are included for each component.

Jackson, G. V. H., Ikin, B. and Firman, I D. 1984. Guidelines for the Transfer of Root Crop Germplasm. Field Document No. 6, Food and Agriculture Organization of the United Nations, Rome, 25 pp.

Guidelines are presented on methods of transfer of elite germplasm of *Colocasia* and other edible aroids (cassava, sweet potato and yams) between south Pacific countries without the risks of spreading diseases and pests. General procedures are described along with quarantine implications for the transfer of vegetative planting material, seed, pollen or tissue cultures. Tissue culture germplasm currently available is documented, together with results of evaluations made in the region. Future prospects for surmounting the various problems associated with the transfer of these root crops are assessed.

Thaman, R. R. 1984. Intensification of edible aroid cultivation in the Pacific Islands. In: Chandra, S. ed., *Edible Aroids*. Clarendon Press, Oxford, pp. 102–122.

The focus of discussion in this paper is the development dilemma perceived to be facing people in Pacific island countries of exploitation of scarce resources. It is asserted that this exploitation is causing widespread economic, social, nutritional and environmental deterioration. A case is made for returning to the 'time-tested traditional systems for intensive cultivation of a wide range of taros [that] may at least provide Pacific Islanders with some of the ingredients of a more culturally and environmentally acceptable, as well as more nutritious and non-perishable recipe, for Pacific Island development'.

Breen, J. A. 1985. A Review of Root Crops Development in the Pacific Region. Food and Agriculture Organization of the United Nations and South Pacific Commission, Suva, 74 pp.

An FAO/UNDP project on root crops in the Pacific had been implemented for some years. In this review, activities within the project and the difficulties encountered in implementation are discussed. Regional activities mentioned are: (1) identification of constraints to root crops development; (2) project work in information transfer; (3) transfer and interchange of germplasm; and (4) production objectives for root crops. Country work programs are described, including a section on Fiji. Recommendations are submitted in summary form.

Jackson, G. V. H. and Breen, J. A. 1985. Collecting, Describing and Evaluating Root Crops. RAS/83/001, Field Document 8, FAO/SPC, Suva, Fiji, 95 pp.

Guarino, L. and Jackson, G. V. H. 1986. Describing and Documenting Root Crops in the South Pacific. RAS/83/001, Field Document 8, FAO/SPC, Suva, Fiji, 141 pp.

1990–present

Food and Agriculture Organization of the United Nations 1994. Tropical Root and Tuber Crops: Production, Perspectives and Future Prospects. Food and Agriculture Organization of the United Nations, Rome.

This book is a general text on tropical root and tuber crops that includes some material on their production in Fiji and other South Pacific countries.

Jackson, G. V. H. 1994. Taro and yam resources in the Pacific and Asia. Report for ACIAR and IPGRI. Anutech Pty Ltd, Canberra.

The problems associated with taro and yam production are reviewed and recommendations are made about the establishment of a taro and yam genetic resources network for the Pacific and Asia. Linked with this is the need to set up an active in-vitro gene bank for germplasm conservation and develop research programs on storage methods for these crops.

Brown, M. W. 1995. Quality Standards and Marketing of Selected South Pacific Foods. Institute for Research, Extension and Training for Agriculture, University of the South Pacific, Alafua.

Information is provided to growers and exporters on the specific root crop varieties, quality standards and packaging required by various export markets. The following root crops are covered: cassava, ginger, jicama, taro, tannia, giant taro and yam.

Craswell, E. T., Asher, C. J. and O'Sullivan, J. N. ed. 1995. Mineral Nutrient Disorders of Root Crops in the Pacific: Proceedings of a Workshop, Nuku'alofa, Kingdom of Tonga, 17–20 April 1995. ACIAR Proceedings No. 65, Australian Centre for International Agricultural Research, Canberra, 142 pp.

Twenty-six papers presented at the workshop are included in the proceedings. They cover various aspects of nutrition of various root crops in the Pacific, especially on the nutritional disorders.

Kumar, D., Wainiqolo, J. L., Kumar, N., Field, S. P. and Dowling, A. J. 1995. Mineral nutrition of root and tuber crops in Fiji. *Fiji Agricultural Journal*, 51(2), 53–58.

This paper provides an overview of production systems, soils and their limitations and the current direction of mineral nutrition research on ginger, taro and sweet potato in Fiji. Foliar analyses are provided.

Kumar, D., Wainiqolo, J. L., Kumar, N., Field, S. P. and Dowling, A. J. 1996. Mineral nutrition of root crops in Fiji. In: Craswell, E. T., Asher, C. J. and O'Sullivan, J. N. ed. *Mineral Nutrient Disorders of Root Crops in the Pacific: Proceedings of a Workshop, Nuku'alofa, Kingdom of Tonga, 17–20 April 1995*. ACIAR Proceedings No. 65, Australian Centre for International Agricultural Research, Canberra, pp. 117–121.

An overview is given of production systems, soil limitations and direction of plant nutrition research for ginger, taro and sweet potato in Fiji. Production areas for each crop are identified and foliar analyses are provided.

GINGER

Before 1950

Anon. 1892. Fiji ginger (*Zingiber officinale* Rosc.). *Kew Bulletin Miscellaneous Information*, 64:77–81.

Brief notes are provided on the ginger plant and its uses. Details are also provided on UK imports of fresh and green ginger. Practical difficulties are reported in the preparation of rhizomes for market in Fiji. A series of letters are published with further information on ginger cultivation and its constituents for the purpose of increasing ginger production in Fiji.

1950–1959

Sills, V. E. 1959. Ginger products. *Fiji Agricultural Journal*, 29(1), 13–16.

This is an early article on the emerging ginger industry. Ginger is described with its various uses, sources and trade patterns. Types and constituents of dried and preserved ginger are outlined. Cultivation and curing methods are discussed and the status of the industry is assessed. This makes interesting reading in the light of subsequent development of the industry.

1960–1969

Sills, V. E. Processing and marketing ginger products. *South Pacific Commission Quarterly Bulletin*, 11(3), 58–60.

Sources and types of ginger, cultivation methods, curing methods, uses and trade are covered in this article. An outline is given of the development of ginger production in Fiji. There are also sections on preserved ginger and the constituents of ginger.

1970–1979

Sills, V. E.. 1970. Notes on the preservation of ginger. *Fiji Agricultural Journal*, 32(3), 33–35.

Sun drying is not possible in the ginger growing districts in Fiji; and artificial drying is not considered an financially attractive option. Young tender ginger may be preserved in brine or sulphur dioxide solution. The latter treatment yields an attractive pale lemon-coloured product of mild pungency. The process of syruling ginger is briefly described including a low temperature method that produces marked differences in texture and flavour. Brief notes are given on the preparation of crystallised ginger.

Department of Agriculture, Fiji 1971. Report for the Year 1970. Suva, 34 pp.

Besides briefly reporting on agronomic studies of other crops, the following are briefly discussed for ginger: spacing and fertiliser trials, hot air drying, herbicide trials and the control of nematodes.

Haynes, P. H., Partridge, I. J. and Sivan, P. 1973. Ginger production in Fiji. *Fiji Agricultural Journal*, 35:51–56.

A critical review is undertaken of production practices, marketing and economics of ginger production in Fiji. At the time of writing, ginger accounted for only about 1 per cent of Fiji's export crop earnings, but only

sugar and coconuts earned more. Advanced cultural practices were argued to be in operation, especially with the use of fertilisers, but the substantial use of manual labour made for high costs of production. World prices fluctuated constantly and, whereas efficient farmers did well, the less efficient risked losses in some crop years. *Meloidogyne incognita* caused economic losses, and was controlled by the use of clean seed and a ginger-taro-fallow rotation.

Sivan, P. 1979. Growth, spacing, time of lifting, and production of early harvest ginger in Fiji. *Fiji Agricultural Journal*, 42:37–43.

Ginger rhizomes planted in September germinated after 4–8 weeks. Total fresh weight increased gradually until 16 weeks after planting and then rapidly until 32 weeks due to rapid increases in both shoot and rhizome weights. The optimum time of lifting for early harvest was at 24–26 weeks; later harvesting resulted in an increase in fibre content. Planting density trials ranging from 55 000 to 166 000 plants/ha indicated that the highest total yield and net yield (total yield less weight of seed planted) was obtained at the closest spacing of 60 cm × 10 cm. Average yield per plant, however, was highest with the widest spacing of 60 cm × 30 cm.

1980–1989

Agricultural Commodity Committee 1985. *Ginger Profile: A Programme for the Commercial Development of the Ginger Industry*. Suva.

The profile commences with a brief history of the industry, its geographic distribution and structure. Production conditions and methods, pests and diseases and productivity are described, and details are provided on the processing sector. Fresh ginger export marketing is covered and market prospects are presented for fresh exports, syruped and crystallised ginger, and dried ginger. An evaluation is made of the role of the government in the areas of extension, research, infrastructure and provision of incentives. In the final sections, the priority status of the crop is justified, issues and constraints to development are discussed, and a ginger development program is outlined.

McGregor, A. 1988. *The Fiji Fresh Ginger Industry: A Case Study in Non-Traditional Export Development*. Research Report Series No. 10, Pacific Islands Development Program, East-West Center, Honolulu.

The world ginger economy is described, with attention given to the main types of ginger products. The fresh ginger industry in Fiji is also described, beginning with the agronomic and economic characteristics of the

industry. An account is given of the early development of the industry, characterised by laissez-faire growth. An era of government intervention succeeded it, and an assessment is made of the appropriate mix of public and private participation in the development of this industry. It is a good case study for the development of export-oriented non-traditional agricultural industries in the face of policy failures and constraints. The institutional and legal reforms of 1987 are detailed, and some recommendations are made on the requirements for future success of the industry.

1990–present

Nagatalevu, M. M., Foarete, H. M. and Field, S. P. 1995. Ginger industry in Fiji: a case study. In: Howlett, D., Myers, M. G. and Elliott, C. R. ed. *The Management of Sloping Lands in the South Pacific*. IBSRAM Network Document No. 15, International Board for Soil Research and Management, Bangkok, pp. 79–99.

The authors outline a participatory rapid rural appraisal method they used to identify issues considered important by the ginger farmers in the major growing areas of Lower Waibau, Naisogo, Nakini and Lomaivuna districts of Central Division, Fiji. Production constraints were identified by farmers of both sexes and their objectives for growing ginger prioritised. Socio-economic problems likely to hinder agricultural production were also identified.

Nagatalevu, M., Foarete, H. M. and Field, S. P. 1996. The ginger industry in Fiji: a case study. *Fiji Agricultural Journal*, 52(1), 19–34.

This article is similar to the previous one and covers similar material. Issues were identified that were important to ginger farmers (men and women) in the major growing areas of Lower Waibau, Naisogo, Nakini and Lomaivuna districts of Central Division, Fiji. Production constraints were identified by farmers of both sexes and their objectives for growing ginger were prioritised using rapid rural appraisal methods. Socio-economic problems likely to hinder agricultural production were also identified, and options to address these problems were presented to farmers for their consideration.

TARO/TANNIA/GIANT SWAMP TARO

1930–1939

Parham, B. E. V. and Raiqiso, F. 1939. Dalo (*Colocasia esculenta*). Fiji Agricultural Journal, 10(4), 102–104.

Fairly brief details are given on varieties of taro, their soil requirements, land preparation, spacing, cultivation, harvesting and uses. Some yield estimates are reported. Taro is acknowledged to be 'an excellent and highly nutritious carbohydrate food of fair fat content and contains good quality protein'.

1940–1949

Parham, B. E. V. 1941. Dalo varieties from Rotuma island (*Colocasia esculenta* (L.) Schott). Fiji Agricultural Journal, 12(2), 51–52.

A collection of 52 tops, representing 31 locally named varieties, were brought from Rotuma to Viti Levu in 1939. The tops were planted for observation and compared with local varieties.

1950–1959

Massal, E. and Barrau, J. 1955. Pacific subsistence crops: taros. South Pacific Commission Quarterly Bulletin, 5(2), 17–21.

Description focuses on the two main species grown in the Pacific islands, *Colocasia antiquorum* and *Colocasia esculenta*. Illustrations are included. Mention is also made of other main Araceae with edible tubers that are found in the region: *Alocasia*; *Cyrtosperma*; *Xanthosoma*; and *Amorphallus campanulatus*, Blume. Sections are included on comparative nutritive values and scope for introduction.

1960–1969

Yen, D. E. and Wheeler, J. 1968. Introduction of taro into the Pacific—chromosome numbers. *Ethnology*, 7:250–267.

1970–1979

Sivan, P. 1971. Dalo growing research in the Fiji islands. *Tropical Root and Tuber Crops Tomorrow*, 1: 151–154.

Results are summarised for cultivar, planting date, planting material and methods, spacing, fertiliser and weed control investigations in taro production.

Berwick, J., Biutisuva, F., Ratuvuki, L. V., Kamilo, A. V. and Raghwaiya 1972. Dalo (*Colocasia esculenta*) fertilizer, variety, weed control, spacing and palatability trials. *Fiji Agricultural Journal*, 34(2), 51–57.

In trials, MCPA, propachlor and atrazine (applied as directed sprays to the furrows of taro planted 90 cm apart on ridges in a clay loam soil) were toxic to the crop. Paraquat was not to be recommended.

Berwick, J., Biutisuva, F., Ratuvuki, L. V., Kamilo, A. V. and Raghwaiya 1972. Dalo (*Colocasia esculenta*) fertilizer, variety, weed control, spacing and palatability trials. *Fiji Agricultural Journal*, 34(2), 57–66.

In a fertiliser trial of five varieties, highest yields were found in the long-duration varieties, Tausala-ni-Samoa and Samoa, but the short-term varieties may have been harvested prematurely. Taste and texture of the former group were significantly better than those of the early varieties, and were less affected by nitrogen treatment and storage of corms. There was no variety by nitrogen interaction for corm yield.

Sivan, P., Vernon, A. J. and Prasad, C. 1972. Dalo (taro) spacing trial. *Fiji Agricultural Journal*, 34(1), 15–20.

Details of field trials at Koronivia and Wudrada confirm earlier experimental recommendations of spacing of taro plants. Some evidence is presented that nitrogen deficiencies in the soil cause little or no difference in results between 3 × 3 ft and 2 × 2 ft spacing.

Department of Agriculture, Fiji 1973. Report for the Year 1972: Dalo (Cocoyam) Research. Fiji Department of Agriculture, Suva, p. 13.

In rain-fed trials over three years, cv. Mumu (19 t corms/ha) outyielded all other cultivars. A spacing of 60 cm × 60 cm gave the highest yield of good-sized corms (14.9 t/ha).

Sivan, P. 1973. Effects of spacing in taro (*Colocasia esculenta*). Proceedings of the 3rd Symposium of the International Society for Tropical Root Crops, Ibadan, pp. 377–381.

Sivan, P. 1976. Dry matter accumulation and distribution of three cultivars of taro (*Colocasia esculenta* L. Schott). M. Sc. thesis, University of the South Pacific, Suva.

Sharma, A. P. 1978. Design, development and evaluation of a tractor drawn dalo (*Colocasia esculenta*) planter in Fiji. Fiji Agricultural Journal, 40(2), 101–103.

The paper describes a recently developed tractor-drawn taro planter. The machine required 7.5 man-hours to plant 0.4 ha compared with a minimum of 80 man-hours by the traditional method.

Sivan, P. 1979. Growth and development of taro (*Colocasia esculenta*) under dryland conditions in Fiji. Proceedings of the 5th Symposium of the International Society for Tropical Root Crops.

1980–1989

Sharma, A. P. 1980. Design, development and evaluation of tractor-drawn 'dalo' planter in Fiji. Agricultural Mechanisation in Asia, 11(1), 59–61.

Sivan, P. 1981. Review of taro research and production in Fiji. Fiji Agricultural Journal, 43:59–67.

The paper contains a review of research on taro in the 1970s. Results are presented of trials on cultivars, size and production of planting materials, planting depth and date, spacing, fertilisers, weed control and mechanised production. Also included are present methods and level of production and current research.

Chandra, S. 1982. Taro research and development in Fiji. In: Belen, E. H. and Villanueva, M. ed. 5th International Symposium on Tropical Root and Tuber Crops. Philippine Council for Agriculture and Resources Research, Los Baños, pp. 567–578.

This review of taro research in Fiji includes details of recent accessions to the germplasm collection, varietal trials, growth studies, fertiliser application trials and plant population studies. Data are presented on corm yield and dry matter production, and the effect of spacing and nitrogenous fertiliser on corm size and sucker numbers.

Lambert, M. ed., 1982. Taro Cultivation in the South Pacific. Handbook No. 22, South Pacific Commission, Noumea.

This edited book contains chapters on principal taros grown, cultivation aspects including weed, pest and disease control, nutritional value of edible aroids, some taro recipes and details of taro exports from South Pacific countries. It covers *Colocasia esculenta*, *Xanthosoma*, *Alocasia macrorrhiza*, *Cyrtosperma* and *Amorphallus campanulatus*.

Sivan, P. S. 1982. Growth and development of taro (*Colocasia esculenta*) under dryland conditions in Fiji. In: Belen, E. H. and Villanueva, M. ed. 5th International Symposium on Tropical Root and Tuber Crops. Philippine Council for Agriculture and Resources Research, Los Baños, pp. 637–646.

The accumulation and distribution of dry matter and leaf area development pattern were determined in taro cv. Hawaii, Qawa ni Urau and Tausala ni Samoa grown under dryland conditions in Fiji. Leaf material was sampled at fortnightly intervals, and fresh and dry weights were determined. The growth and development pattern was found to be similar to that of sugarbeet and tannia. Corm development commenced early in growth, and leaves and corm developed synchronously up to maximum canopy at about 20 weeks. Leaf growth and leaf area then declined, while corm growth continued until little leaf area remained.

Thaman, R. R. 1982. Urban taro production in the South Pacific. In: Lambert, M. ed., Taro Cultivation in the South Pacific. Handbook No. 22, South Pacific Commission, Noumea, pp. 103–122.

A description is given of the nature of urban production of taro in the South Pacific and its importance in maintaining the nutritional status of the diet. The chapter concludes with some suggestions to expand this form of production.

Untaman, V. 1982. The cultivation of giant swamp taro. In: Lambert, M. ed., Taro Cultivation in the South Pacific. Handbook No. 22, South Pacific Commission, Noumea, pp. 97–100.

A brief description is provided of the cultivation and use as a food of the giant swamp taro in Yap.

Weightman, B. L. and Moros, I. M. 1982. The cultivation of taro *Xanthosoma* sp. In: Lambert, M. ed., Taro Cultivation in the South Pacific. Handbook No. 22, South Pacific Commission, Noumea, pp. 74–83.

This chapter contains basic information on how to grow *Xanthosoma*, with a South Pacific orientation, rotations in which the crop could be usefully included, and its storage and preparation for eating.

Plucknett, D. L. 1983. Taxonomy of the genus *Colocasia*. In: Wang, J. K. ed., Taro. University of Hawaii Press, Honolulu, pp. 14–19.

The author describes the genus *Colocasia*, botanical varieties, plant types, chromosome numbers and differentiation between cultivars.

Strauss, M. 1983. Anatomy and morphology of taro, *Colocasia esculenta* (L.) Schott. In: Wang, J. K. ed., Taro. University of Hawaii Press, Honolulu, pp. 20–33.

Separate sections are provided on leaves, corms, roots, and flowers, fruits and seeds. There is also a section on cytology in which somatic chromosome numbers are reported, including some from the Pacific islands.

Tang, C. and Sakai, W. 1983. Acridity of taro and related plants. In: Wang, J. K. ed., Taro. University Hawaii Press, Honolulu, pp. 148–163.

The authors discuss the undesirable properties caused by the acidity of the Araceae, in particular taro and related plants, and the limitations placed on their use.

Cable, W. J. 1984. The spread of taro (*Colocasia* spp.) in the Pacific. In: Chandra, S. ed., Edible Aroids. Clarendon Press, Oxford, pp. 28–33.

This chapter contains a brief discussion on how taro was distributed from East India to the Pacific islands. It is concluded that the systematic use of descriptors for taro throughout the region could 'allow the relationships and movements of taro to be better worked out'. Some references are made to taro in Fiji.

Chandra, S. and Sivan, P. 1984. Taro production systems studies in Fiji. In Chandra, S. ed., *Edible Aroids*. Clarendon Press, Oxford, pp. 93–101.

This paper reports on five taro production technologies that were evaluated in a farmer's field in Fiji. Draught animal cultivation and hand planting was found to be the best technology for subsistence farmers. A small tractor system was found inappropriate for Fijian conditions.

Sivan, P. 1984. Effect of some intercrop in taro. Proceedings of the 6th Symposium of the International Society for Tropical Root Crops, Lima, Peru, pp. 103–107.

The effects of cowpeas, long beans, groundnuts, maize, okra and sweet potatoes as intercrops with taro were studied. All the intercrops reduce taro yield to varying degrees. Okra caused the highest taro yield reduction of 40 per cent, while maize, long beans and cowpeas reduced yield by 16, 20 and 23 per cent, respectively. The taro/long bean intercrops gave the highest gross return of 50 per cent above the non-intercropped taro treatment. The other intercrops also increased gross returns, but to a lesser extent.

Sivan, P. 1984. Review of taro research and production in Fiji. In: Chandra, S. ed., *Edible Aroids*. Clarendon Press, Oxford, pp. 52–63.

This review is based on taro research work undertaken during the 1970s. It is observed that very little research on taro had been undertaken before 1969. Trials discussed include variety evaluation, size and production of planting material, depth and time of planting, spacing of plants, fertiliser application, weed control and mechanised production. An outline is given of the taro research program current at the time of writing, including projects on intercropping and the introduction of high-yielding varieties.

Sivan, P. and Tavaiqia, M. B. 1984. First taro variety developed from breeding program released for commercial production in Fiji. *Fiji Agricultural Journal*, 46(1), 1–4.

Colocasia esculenta cv. Samoa Hybrid was developed from open-pollinated seeds of cv. Samoa. It is substantially (about 50 per cent) higher yielding than Samoa under traditional or mechanised systems and produces about twice the number of suckers. It performs equally well on hill and alluvial flatland farms, and has a duration of 10 to 11 months.

Sivan, P., Tavaiqia, M. B., Singh, J. M. and Lagai, I. 1984. Dalo: agronomic studies. 1983 Annual Research Report, Department of Agriculture, Suva, pp. 46–47.

Details of work, status and findings are given of current research projects being undertaken on taro by the Department of Agriculture in Fiji.

Sivan, P. Tavaiqia, M. B. and Lagai, I. 1986. Dalo: agronomic studies. 1985 Annual Research Report, Department of Agriculture, Suva, pp. 33–34.

Details of work, status and findings are given of current research projects being undertaken on taro by the Fiji Department of Agriculture.

1990–present

Rogers, S., Rosecrance, R., Chand, K. and Iosefa, T. 1992. Effects of shade and mulch on growth and accumulation of dry matter of taro (*Colocasia esculenta* (L) Schott). *Journal of South Pacific Agriculture*, 1(3), 1–4.

Wilson, J. E., Sivan, P., Munroe, C., Ofori, F. and Hahn, S. K. ed. 1994. Alafua Sunrise and Samoa Hybrid improve the production of taro (*Colocasia esculenta* (L) Schott) in the Pacific: tropical root crops in a developing economy. In: *Proceedings of the 9th Symposium of the International Society for Tropical Root Crops*, Accra, Ghana, 20–26 October 1991. *Acta Horticultura*, 380:453–461.

Samoa Hybrid, derived from open-pollinated seeds of Fijian cv. Samoa, and Alafua Sunrise, derived from a cross between Samoan cultivars, manua tusitusi mumu (Ce48) and tusitusi (Ce07), were the first two improved cultivars of taro (*Colocasia esculenta*) released from breeding programs based on selecting seedling-derived clones from sexually propagated populations. In trials, Samoa Hybrid yielded 50 per cent more fresh corm weight than traditional cultivars. These cultivars performed equally well in well-drained and poorly drained soils with improved plant vigour and suckering. Alafua Sunrise outyielded the popular local cultivar, Niue, by 13–50 per cent in most trials with the greatest advantage under drought and low soil fertility. Alafua Sunrise had fewer symptoms of dasheen mosaic potyvirus than local cultivars, and produced an adequate number of suckers, with improved plant vigour and rapid early growth. Farmers indicated that the less-preferred, yellow flesh and eating quality of Alafua Sunrise were offset by its impressive vigour and yields. Corms were successfully test-marketed in local and export markets. Samoa

Hybrid and Alafua Sunrise have been multiplied and distributed to farmers in Fiji, Western Samoa and American Samoa, and also supplied as pathogen-free in-vitro plantlets to other countries in the South Pacific.

Nip, W. K. and Vargo, D. 1995. Effect of cultivation and handling practices on the recovery of taro [*Colocasia esculenta* (L.) Schott] flour. *Journal of South Pacific Agriculture*, 2(1), 27–33.

The impetus for this research is the short shelf life of taro, limiting its economic potential. A study was undertaken, with relevance to Fiji, to determine the effects of production site, fertilisers, harvest age, corm storage and corm specific density on taro flour recovery. Results are reported in this paper.

YAMS

1920–1929

Knowles, C. H. and Knight, R. 1920. The kawai. *Agriculture Circular Fiji*, 1(5), 86–87.

1930–1939

Parham, W. L. and Dakui, M. 1938. The yam. *Fiji Agricultural Journal*, 9(3), 12–13.

A terse description is given of the yams growing in Fiji and methods of their cultivation.

1940–1949

Turaga, P. and Yaku, P. 1944. Cultivation of the 'kawai' (*Dioscorea esculenta*). *Fiji Agricultural Journal*, 15(4), 107–8.

The variety of kawai considered to be the best is mocevuta, being sweet-flavoured, large and heavy-yielding. Soils and climate suitable to its cultivation are described and simple instructions are given for planting, cultivation, harvesting and storage.

1950–1959

Malcolm, S. and Barrau, J. 1954. Pacific subsistence crops: yams. South Pacific Commission Quarterly Bulletin, 4(3), 28–31.

A botanic description is made of the yam, and the major types of yams found in the South Pacific are listed. The main species used for human consumption are *Dioscorea esculenta* (Lour.) Burk, *D. alata* L., *D. bulbifera*, L., and *D. hispida*, Dennst. Some sketches are included to help in distinguishing between species. Yield estimates are given for Fiji in comparison with other root crops. Food values and some recipes are also provided, together with an annotated bibliography.

1970–1979

Berwick, J., Chand, D. and Qalibokola, J. 1972. Yam (*Dioscorea alata*) planting rate, staking, variety and palatability trials. Fiji Agricultural Journal, 34(2), 44–49.

The authors note that little had been written about yams, and few studies had been undertaken. In a field trial of four popular, white-fleshed yam varieties, with staking and sett-size treatments, two taniela varieties were susceptible to *Colletotrichum pestis* and gave poor yields, while beka and jamani were little affected. Beka gave the highest yields, up to 21 tons/acre. In palatability trials with ten other varieties, several of the lesser known ones were preferred. Kuro had the best overall rating for taste and texture, but was exceeded in taste by Rewamoni mi.

Martin, F. W. 1974. A collection of yams from the region from India to the South Pacific. Tropical Root and Tuber Crops Newsletter, 7:35–37.

Information is provided on types of edible yams collected in India, Malaysia, Indonesia, Philippines, Papua New Guinea, Fiji and Solomon Islands, and which have been added to the international collection maintained at Mayaguez.

1980–1989

Sivan, P. 1980. Yams. In: Regional Production of Root Crops. South Pacific Commission, Noumea.

Sivan, P. 1980. Evaluation of local yam (*D. alata*) varieties in Fiji. Fiji Agricultural Journal, 42(2), 7–14.

Late and early maturing yam varieties were selected and evaluated for the three rainfall zones in Fiji after preliminary selection for yield, tuber conformation and consumer preference from the national collection. Of the early-maturing varieties (March or early April), vurai is recommended for all zones. Of the late-maturing varieties (May or June), uvi ni Futuna is recommended for all zones while taniela_vulaleka is recommended for the dry and intermediate zones. Other high-yielding, late-maturing varieties (namely, kiev, maruei and beka) may be grown as a second choice in all zones.

CASSAVA

1950–1959

Massal, E. and Barrau, J. 1955. Pacific subsistence crops: cassava. SPC Quarterly Bulletin, 5(4), 15–18.

Sections are presented on the origins and cultivation methods of cassava, its dietary value and common ways of cooking it. A note is also included on several other less widely grown edible tuber-bearing plants with a special section on Polynesian arrowroot.

Mason, R. R. 1956. Cassava varieties in Fiji. Fiji Agricultural Journal, 27(3/4), 88–89.

Sixteen cassava varieties are described. They featured in four variety trials that were conducted. A background to the trials is given, along with information on the introduction of cassava varieties. A key to the identification of varieties is presented, and trial results are reported.

1970–1979

Department of Agriculture, Fiji 1973. Report for the Year 1972: Tapioca (Cassava) Research. Suva, p. 13.

In variety trials during two years at Waidrada, cv. merelesita and navolau gave average tuber yields greater than 45 t/ha compared with 28–31 t/ha for the next highest yielding varieties. Application of 200 kg N/ha gave good increases in tuber yields.

Sivan, P. 1977. Evaluation of local cassava varieties in Fiji. *Fiji Agricultural Journal*, 39(2), 105–109.

Varietal trials from 1973–1976 at Legalega, Sigatoka and Waidradra showed that cv. Beqa and Navolau gave higher total and marketable fresh root yield among 10 selected local cultivars planted in August and September. Yield was considered probably to be limited by root weight rather than root number/plant, but neither was correlated with yield.

Sharma, A. P. 1979. Studies on the mechanised harvesting of cassava in Fiji. *Agricultural Mechanisation in Asia*, 10(2), 39–41.

In field trials, a medium-powered tractor with a single mouldboard plough operated at 3 km/h was found suitable for harvesting cassava that was hand-picked after the tractor passed. The time required for two men to harvest 0.4 ha was six hours, and only 1.44 per cent of the roots were damaged.

Sivan, P. 1979. Post-harvest durability of fresh roots of cassava varieties in Fiji and storage of roots in moist sawdust. *Fiji Agricultural Journal*, 41(3), 95–102.

Tests were undertaken on the post-harvest durability of fresh roots of cassava varieties in Fiji. One variety was found to be resistant to primary deterioration (internal root discolouration) while another was slightly resistant, but all others were susceptible. The storage of roots in moist sawdust in boxes and sacks gave very promising results. About 90 per cent of two susceptible varieties were in acceptable condition after eight weeks of storage. A very susceptible variety gave 80 per cent acceptable roots at four weeks but deteriorated rapidly thereafter. When stored in sacks, 84 per cent of roots of susceptible varieties were acceptable after three weeks but thereafter deteriorated rapidly.

1980–1989

Chandra, S. and Sharma, A. P. 1981. Experiments on cassava production technologies in Fiji. *Agricultural Mechanization in Asia, Africa and Latin America*, 12(1), 19–21.

Traditional and animal production systems were found to be extremely labour-intensive and incurred the highest production cost. The highest gross margin/ha was realised using tractors; however, the use of tractors was inefficient in terms of energy used per unit of food produced.

SWEET POTATO

1930–1939

Dixon, R. 1932. The problem of the sweet potato in Oceania. *American Anthropologist*, 34(1), 40–66.

1950–1959

Massal, E. and Barrau, J. 1955. Pacific subsistence crops: sweet potato. *South Pacific Commission Quarterly Bulletin*, 5(3), 10–13.

The origins of sweet potato and its cultivation method are covered. Its importance as a food in the South Pacific is stressed and nutritive values are presented. Details are provided on extensive selection studies. Finally, some recipes based on sweet potato are given.

Walker, C. 1959. Notes on some kumala (sweet potato) varieties. *Fiji Agricultural Journal*, 29(1), 27–30.

Some sweet potato varieties common in Fiji are described and illustrated.

1970–1979

Yen, D. E. 1974. The sweet potato and Oceania. Bulletin 236, B. P. Bishop Museum, Honolulu.

1990–present

Beetham, P. and Mason, A. 1992. Production of pathogen-tested sweet potato. ACIAR Technical Reports 21, Australian Centre for International Agricultural Research, Canberra, 47 pp.

The authors discuss the techniques and protocol developed at the Institute of Plant Science for disease elimination and pathogen testing of sweet potato plants. They provide a brief outline of the use of micro-propagation for the vegetative multiplication of crops, and steps used in tissue culture multiplication are described in the appendix.

Jackson, G. V. H. 1993. Sweet potato conservation and utilisation in Pacific Island countries. Proceedings of the Asian Sweet Potato Germplasm Network Meeting, Guangzhou, China, 26 February to 2 March 1993, pp. 68–76.

Information is provided on the developments and recent work of the South Pacific Commission in the region in relation to root crop collections, and descriptors and problems associated with their use. Some suggestions are made for improvement. Issues discussed include germplasm conservation and the logistics of its transfer, the roles of the Commission and a UNDP project in crop protection in the South Pacific, indexing procedures and their quarantine implications, and evaluating and monitoring the performance of new introductions.

O'Sullivan, J. N., Asher, C. J., Blamey, F. P. C. and Edwards, D. G. 1993. Mineral nutrient disorders of root crops in the Pacific: preliminary observations on sweet potato (*Ipomoea batatas*). In: Barrow, N. J. ed., Plant Nutrition (From Genetic Engineering to Field Practice. Kluwer Academic Publishers, Dordrecht, pp. 293–297.

POTATO

1940–1949

Harvey, C. 1941. Potato variety trials. Fiji Agricultural Journal, 12(3), 80–81.

A brief account is given of potato variety and planting trials that were conducted by the agricultural officer and staff of the experiment station in Sigatoka over three years.

Whitehead, C. E. 1948. The potato in Fiji. *Fiji Agricultural Journal*, 19(2), 36–38.

Information is presented on time of planting, soils and their preparation, varieties, seed preparation, fertiliser use, planting, cultivation and harvesting of potatoes in Fiji. The major pests are identified as leaf eaters and cut worms. The major diseases discussed in the paper are blue mould and wilt.

Anon. 1949. Potatoes—1948. *Fiji Agricultural Journal*, 20(1), 7.

Brief details are given on the status of potato production in Fiji in 1948.

1980–1989

Iqbal, M. 1982. A review of potato research in Fiji. *Fiji Agricultural Journal*, 44(2), 71–77.

Effects are described of fertiliser application, seed treatment and spacing on potato tuber yield and the results of potato cultivar evaluation studies carried out since 1964. Responses to fertiliser application were varied. Spacing was optimal at 66 cm between rows and 22.5 cm within the rows. The highest tuber yield of 20.8t/ha was obtained with whole seed. Dusting with fungicide is recommended if cut tubers are used. The search for a bacterial wilt-resistant cultivar led to the identification of line, CIP 800–226–BR–69–84, renamed Domoni, being recommended for commercial production then.

Van der Zaag, P., Evin, C., Gorog, G., Malosu, D., Iqbal, M., Reboul, J., Semisi, S. and Taufatofua, P. 1986. The potato in South Pacific developing countries—Part 1. *Agricultural International*, 38(5), 150–152.

The economic role, production levels and agronomic practices of potato cultivation in the South Pacific are described. Ware potato production in 1984 ranged from 11 000 tons in Fiji to 23 tons in Tonga. Highest seed tuber production occurred in New Caledonia (35 tons), French Polynesia (240 tons) and Papua New Guinea (200 tons).

MISCELLANEOUS

1930–1939

Parham, W. L. 1939. Jerusalem artichoke (*Helianthus tuberosus*). Fiji Agricultural Journal, 10(2), 34–35.

The author recounts efforts to grow Jerusalem artichoke (*Helianthus tuberosus*), and concludes that the plant could be grown successfully in Fiji.

1990–present

Pollock, N. J. 1991. Arrowroot. Ethnobotany 2(3/4), 1–10.

COCONUT AND OTHER PALMS

1910–1919

Knowles, C. H. 1916. *Areca catechu* and Piper beetle. Pamphlet 23, Fiji Department of Agriculture, pp. 1–2.

1920–1929

Marechal, H. 1928. Observations and preliminary experiments on the coconut palm with a view to developing improved seed nuts for Fiji. Fiji Agricultural Journal, 1(2), 16–45.

This is a pioneering study in which the author describes the blooming phase of coconut palms in Fiji for male and female flowers, and the production of pollen. He explains how the pollen can be collected and preserved. Self-pollinating, cross-pollination and artificial pollination processes are outlined. Details are given of available varieties of palms and recommendations are made for the selection of superior trees. An account is given of attempts at pollination on Malayan dwarfs around Suva, and on Niu Lekas and Rotuma.

1930–1939

Blackie, W. J. 1931. The improvement of Fiji copra. Fiji Agricultural Journal, 4(3), 111–122.

The impetus for this study was the varied opinions expressed by analysts on the exact nature of reactions of fungi to H. and O.H. ions. The author undertook analyses that revealed that: (1) washing copra with 5 per cent

and 10 per cent solutions of sodium carbonate produced good quality material that markedly resisted mould growth; (2) by washing with 10 per cent sodium carbonate followed by sulphuring, a first grade material was obtained that appeared to resist mould action entirely; and (3) the sulphured carbonated copra had a better appearance than the carbonated copra. The sulphured and carbonated copra also dried well and had the crisp and easily fractured nature of good quality sun-dried copra. While lack of experimental details made it difficult to explain the underlying process, some details are provided to shed some light on the process.

Surridge, H. R. 1931. The improvement of Fiji copra. *Fiji Agricultural Journal*, 4(3), 90–110.

A very detailed account is given of the use of sulphuring to improve the quality of copra, especially smallholder copra. The sulphuring was considered important given the poor quality of much of the smallholder production for which methods are described. Material covers the sulphuring chamber and evaluation of 15 sulphuring experiments. There is also a section on storage of copra on completion of the experiments.

Jack, H. W. 1936. Areca nuts. *Fiji Agricultural Journal*, 8(2), 31–35.

The author reports on the potential use of areca nuts based on a visit he made to Malaya. He describes the necessary production conditions, varieties, grading, uses and curing processes.

Harwood, L. W. 1937. Some aspects of copra improvement. *Fiji Agricultural Journal*, 8(3), 27–29.

The author describes the efforts to interest Fijian producers in a method to improve copra quality. Material concentrates on instruction in the erection and working of small copra driers. A recommendation is given to prohibit trade in green copra. Incentives to improve quality needed to be greater.

Jack, H. W. and Harwood, L. W. 1937. The Fijian copra drier. *Fiji Agricultural Journal*, 8(4), 8–14.

The authors recount the fairly successful efforts to introduce artificial methods of drying copra. They describe the type of drier recently introduced and recommend routines to overcome defects in copra quality.

Silas, R. J. 1937. Coconut oil extraction by peasant farmers. *Fiji Agricultural Journal*, 8(3), 26.

A description is given of the way in which Indian farmers husked and grated coconut meat to extract oil by macerating with hot water. It is observed that the oil was used as a substitute for ghee.

Silas, R. J. 1937. Cultivation of betel leaf in Fiji. *Fiji Agricultural Journal*, 8(4), 49.

The author describes the cultivation of betel nut in Fiji and use of the leaf as a masticatory. Local terms are provided, along with recommendations for successful cultivation.

Jack, H. W. 1939. The present position of the local copra industry. *Fiji Agricultural Journal*, 10(1), 2–5.

It is observed that the copra industry was suffering hardships caused by a depressed world market. Domestic measures are outlined that were considered to be useful in improving this situation. Some estimates are provided of the costs of production and observations are made on the state of plantations. Alternative annual and perennial crops are canvassed.

Jack, H. W. 1939. Copra notes. *Fiji Agricultural Journal*, 10(3), 104–108.

Details are provided on copra prices, oil content and digestibility of coconut oil. The lack of uniformity of Fijian copra is condemned, and it is recommended that an effort is made to discourage the local practice of cutting and selling 'green copra' (described as 'pernicious'). References are made to copra drying and coconut husking.

Parham, B. E. V. 1939. The sago palm—a valuable source of food. *Fiji Agricultural Journal*, 10(1), 21–23.

The sago palm is described, and details are given on its habitat and propagation. Recommendations are provided on planting methods. It is observed that Fijians were at that time ignorant about its value as a food starch. Some details are given on costs to produce sago flour at the Central Agricultural Station in 1938.

1940–1949

Jack, H. W. 1940. The coconut palm. *Transactions Fiji Society of Science & Industry*, 1(2), 27–38.

Jack, H. W. 1942. Coconut notes. *Fiji Agricultural Journal*, 13(2), 56–58.

This note contains details on the coconut husk as a source of fertiliser; coconut recipes; picking versus natural fall in coconut harvesting; copra quality; the potash content of coconut husks and husk ash; the conversion of coconut oil into a solid crystalline mass; and the manufacture of coconut oil from fresh coconut meat.

Blackie, W. J. 1943. The determination of free fatty acids in copra. *Fiji Agricultural Journal*, 14(1), 8–10.

The author covers old ground about the need to raise the quality of copra in Fiji. He describes guidelines for testing copra for free fatty acids and moisture content.

Harvey, C. 1943. Copra notes. *Fiji Agricultural Journal*, 14(3), 87.

This note contains details on copra production by areas and copra grading summary for the second quarter.

1950–1959

Harwood, L. W. 1952. A survey of coconut areas in Fiji as at 31st December, 1950. *Fiji Agricultural Journal*, 23(3/4), 72–76.

Results are presented for a survey of coconut areas in Fiji undertaken in 1946. Estimates are presented of areas under coconut palms by age groups and divisions. Annual replanting estimates are also presented.

Parham, B. E. V. 1953. Hybrid dwarf coconut. *Fiji Agricultural Journal*, 24(3/4), 88.

A brief description is given of the hybrid dwarf coconut in Fiji and its origins.

Massal, E. and Barrau, J. 1955. Pacific subsistence crops: sago. *SPC Quarterly Bulletin*, 5(1), 15–17.

A botanic description is given of *Metroxylon* sago palms and extraction methods for sago starch are outlined. The species found in Fiji is *Metroxylon vitiense*, Benth. and Hook. There is speculation that their use as a food discontinued in early times in countries such as Fiji. Growing conditions are presented along with an analysis of raw sago and sago preparations.

Cassidy, N. G. 1956. The sampling of copra in Fiji in relation to its moisture content. *Fiji Agricultural Journal*, 27(3/4), 96–98.

The author investigated the variability of moisture in copra in Fiji using Toplis-Simpson electric meters. He found a tendency towards either very wet or very dry copra to come to the same equilibrium moisture content when exposed to the atmosphere.

Massal, E. and Barrau, J. 1956. Pacific subsistence crops: the coconut. *South Pacific Commission Quarterly Bulletin*, 6(2), 10–12.

The paper begins with a short review of the origins and distribution of the coconut, and the introduction of *Cocos nucifera* L. in the Pacific islands. Descriptions are provided of food uses and the chemical composition of albumen. The key role of coconuts in the subsistence economy is discussed.

1960–1969

Cassidy, N. G. 1960. Wind damage to coconut palms. *South Pacific Commission Quarterly Bulletin*, 10(1), 37–39.

The author analyses and discusses the temporary and permanent effects of high-velocity winds on coconut palms. Examples are taken from the effects of cyclones on palms in Fiji.

Parham, J. W. 1960. Coconut and Breadfruit Surveys of the South Pacific Region. *Technical Information Bulletin No. 1*, South Pacific Commission, Noumea.

Johnson, W. G. 1963. Something concerning coconuts. *Transactions & Proceedings Fiji Society*, 7:90–103.

McPaul, J. W. 1963. Coconut growing in Fiji. *Bulletin No. 38*, Fiji Department of Agriculture, Suva, 99 pp.

This is a grower's manual that deals comprehensively with all aspects of coconut cultivation in Fiji. The basics of coconut cultivation are provided, with botanic, soils and climatic details. Other areas covered include seed selection and the nursery, field management control, rehabilitation of plantations, new plantings, and control of weeds, pests and diseases.

Silsoe, L. 1963. Report of the Fiji Coconut Industry Survey. Government Printer, Suva, 95 pp.

This is an economic report aimed at improvement of copra quality. It contains information on coconut industries in other Pacific islands and brief advice on copra making and grading.

McPaul, J. W. 1964. Coconut Growing in Fiji: Part II Historical Summaries and Statistics. Bulletin No. 41, Fiji Department of Agriculture, Suva, 39 pp.

Parham, J. W. 1966. Coconut and breadfruit surveys in the South Pacific region. Technical Information Paper 1, South Pacific Commission, Noumea, 70 pp.

Whitehead, R. A. 1966. Sample Survey and Collection of Coconut Germplasm in the Pacific Islands (30 May–5 September 1964). Ministry of Overseas Development, London.

1970–1979

Department of Agriculture, Fiji 1971. Report for the Year 1970. Suva, 34 pp.

Brief reports are given on breeding and selection work on coconut and biological control of rhinoceros beetle.

Williams, J. M. 1971. Assessing the effect of rat damage on coconut yields. Fiji Agricultural Journal, 33(2), 55–56.

Generally, rat damage in coconut plantations had been assessed based on counts of damaged nuts in several parts of the world over the past 40 years. In all cases yield loss was assumed proportional to the number of nuts attacked. It is now suggested that there may be some physiological compensation for rat-induced nut-fall, giving an increase in the production or retention of nuts, or an increase in nut size. A trial was established to simulate rat damage at several intensities.

Department of Agriculture, Fiji 1972. Report for the Year 1971. Suva, 37 pp.

Breeding and varietal trials and control of the rhinoceros beetle are briefly reported together with investigations on other crops.

Leather, R. I. 1972. Coconut research in Fiji. *Fiji Agricultural Journal*, 34(1), 3–10

An outline is presented of the status of coconut industry and coconut research to date in Fiji is reviewed. A number of agronomic studies are reported. Mention is also made of a program to improve seed production and a long-term breeding program.

Sundarum, S. 1975. Coconut varietal improvement: selection and breeding: Part 1 World review. *Fiji Agricultural Journal*, 37(2), 41–46.

The progress made in coconut breeding throughout the world is reviewed. Some of the selection and breeding methods are briefly discussed.

Vernon, A. J., Emose, P. N. and Mudaliar, T. 1975. Coconut varietal selection and breeding: Part 2 Recent work in Fiji. *Fiji Agricultural Journal*, 37(2), 47–52.

From 1970, yields had been recorded of phenotypically selected palms in several large blocks of indigenous coconuts and Malayan Dwarfs in Fiji, to identify potential mother palms. Seed of tall × dwarf types was mass produced and distributed for some years, but this was discontinued because of cost and doubt as to the merit of the hybrids. Variety trials were conducted on one station, but with insufficient replication. Research recording of young commercial plantings of hybrids in comparison with similar plantings of unselected material is proposed in the paper, to determine the merit of the hybrids. The hybridisation process is described.

Satyabalan, K. 1976. Coconut growing in Fiji islands. *Coconut Bulletin*, 7(3), 1–4.

Information is provided on coconut area, production, the contribution of coconuts to the national economy, cultural practices, varieties, pests and diseases and current research.

Vernon, A. J., Emose, P. N. and Mudaliar, T. 1976. Coconut fertiliser yield trials in Fiji 1970–1975. *Fiji Agricultural Journal*, 38(2), 49–59.

A summary is given of results of several trials on the response to N, P and K of young and mature coconut palms. There are usually marked responses to N (as ammonium sulphate) in terms of nut numbers and weight of copra/nut but, in one trial, the latter variable was depressed.

The response to P (as superphosphate) was variable. Mature palms responded only slightly to K (as potassium sulphate), and young palms showed no response despite indications of K deficiency at most sites.

1980–1989

Solly, R. K. and Dass, S. D. 1980. Correlation of moisture content and physical appearance with free fatty acids in graded copra. *Fiji Agricultural Journal*, 43(1), 33–36.

The authors conclude from their correlation analysis that the free fatty acid content of exported coconut oil could be decreased by screening and separating the small copra pieces with high free fatty acid content prior to milling.

Singh, A. and Duve, R. N. 1981. Nutritional status of coconut in Fiji. *Fiji Agricultural Journal*, 43(1), 13–22.

Results are provided for a coconut foliar nutrition survey in 1973, conducted in the main copra-producing areas of Cakaudrove and Taveuni. Widespread deficiencies were observed in N, P, K, Ca and Mn. Nitrogen was found to be most highly correlated with yield. Copra yields ranged from 0.31 t/ha to 1.82 t/ha, with a national average of 0.63 t/ha. Further trials are recommended.

Liyanage, D. V. 1982. Development of small coconut holdings. *Cocomunity Quarterly Supplement*, APCC-QS-41-82, pp. 1–10.

A brief review is made of coconut smallholder development in Fiji, Tonga, Malaysia, Sri Lanka and the Philippines. It covers area, methods of development, planting material and fertiliser usage. A model is proposed for developing small coconut holdings.

Rhoads, J. W. 1982. Sago palm management in Melanesia: an alternative perspective. *Archaeology in Oceania*, 17(1), 20.

A description is given of the biology of the *Metroxylon* palm—its habitat and structure of communities in Papua New Guinea. Management techniques are outlined which could have relevance to Fiji where the use of sago palm in the diet has largely disappeared.

Richolson, J. M. 1982. A review of utilisation possibilities for over-mature coconut palm stems in Fiji. Institute of Plant Science, University of the South Pacific, Suva.

Martin, M. P. L. D. and Mudaliar, T. 1983. Response of coconut to fertiliser application and weed control. *Fiji Agricultural Journal*, 45(2), 51–53.

The authors report on a trial to assess the response of coconut to fertiliser application and weed control. Selected coconut cv. Fiji Tall seedlings, planted at a 9 m × 9 m square spacing in 1966 at Kubuna and Navonu, Vanua Levu, were used to assess the impact of fertiliser treatment and weed control. Average copra yields for 1976–83 with weed control, weed control and fertiliser, and non-weeded/fertilised treatments were 273 kg/ha, 721 kg/ha and 99 kg/ha, respectively.

Martin, M. P. L. D. 1984. Coconut agronomic and breeding research in Fiji. *Fiji Agricultural Journal*, 46(2), 1–7.

Research carried out in Fiji since 1976 is reviewed. A long-term NPK trial on Fiji Tall palms demonstrated that N significantly increased copra yields, but P and K interactions had no effect. Fertiliser and weed control trials in Cakaudrove highlighted the marked copra yield increases that could be achieved by proper fertilisation and weed control. A nutritional survey at Cakaudrove and Taveuni revealed widespread deficiencies of N, P, K, Ca and Mn. Intercropping trials under mature palms showed that rice, maize, taro and cassava are suitable intercrops. Mother palm selection, hybridisation and hybrid evaluations studies are also reviewed, and an assessment is made of constraints and future research needs

Ministry of Primary Industries, Fiji 1985. Coconuts. Parliamentary Paper No. 62 of 1985. 63 pp.

The results of variety, intercropping and rhinoceros beetle control investigations are summarised. Laboratory mass culture of rhinoceros beetle and its virus were maintained and field releases of virus in areas of beetle outbreak were continuing.

Raff, J. 1985. Coconut replanting in the Pacific Islands. In: Persley, G. J. and Ferrar, P. ed. *South Pacific Agriculture: Challenges and Opportunities for ACIAR and its Research Partners*. ACIAR Technical Reports 5, Australian Centre for International Agricultural Research, Canberra, pp. 25–27.

Given a broadly recognised need for replanting coconuts by smallholders in South Pacific countries, the author outlines the sources of improved planting material, tissue culture of coconuts, nursery practices and planting systems.

Foale, M. A. 1987. Coconut Germplasm in the South Pacific Islands. ACIAR Technical Reports 4, Australian Centre for International Agricultural Research, Canberra, 23 pp.

This is a report of survey trips made to Vanuatu, Solomon Islands, Tuvalu, Fiji, Western Samoa, American Samoa and Cook Islands as one of the early activities in the ACIAR Coconut Improvement Project. It contains a brief description of the coconut industry and its improvement in the countries visited. Some data are provided on fruit analysis of the cultivars and their significance.

Foale, M. A. 1988. An Annotated Bibliography on Coconut Research Relevant to the Pacific Islands. ACIAR Working Paper No. 10, Australian Centre for International Agricultural Research, Canberra.

1990–present

Manciot, R. and Sivan, P. 1991. Coconut hybrids for the South Pacific islands. In: Silas, E. G., Aravindakshan, M. and Jose, A. I. ed. Coconut Breeding and Management. Kerala Agricultural University, Vellanikkara.

The results of varietal trials in Vanuatu, Tahiti, PNG, Fiji and other island countries are reported and detailed recommendations are made on the hybrids suitable for various conditions. Hybrids were found to be more precocious and higher yielding than the tall cultivars. Mass selection among local tall types is not recommended because of their low yield potential.

Foale, M. A. 1994. Prospects for future coconut research in the South Pacific: a personal view. In: Foale, M. A. and Lynch, P. W. ed. Coconut Improvement in the South Pacific: Proceedings of a Workshop Held in Taveuni, Fiji, 10–12 November 1993. ACIAR Proceedings No. 53, Australian Centre for International Agricultural Research, Canberra, pp. 74–77.

Discussion centres on factors such as water, nutrients, plant density and germplasm influencing coconut yields, and areas of research related to these factors.

Foale, M. A. and Ashburner, G. R. 1994. Raising coconut productivity in the South Pacific: the Australian connection. In: Foale, M. A. and Lynch, P. W. ed. Coconut Improvement in the South Pacific: Proceedings of a Workshop

Held in Taveuni, Fiji, 10–12 November 1993. ACIAR Proceedings No. 53, Australian Centre for International Agricultural Research, Canberra, pp. 22–24.

The contribution by ACIAR to coconut research in the South Pacific is discussed, especially in terms of aspects of germplasm characterisation and collection, dissemination of information, crop physiology, breeding projects and publications.

Foale, M. A. and Lynch, P. W. ed. 1994. Coconut Improvement in the South Pacific: Proceedings of a Workshop Held in Taveuni, Fiji, 10–12 November 1993. ACIAR Proceedings No. 53, Australian Centre for International Agricultural Research, Canberra, 82 pp.

These proceedings are a collection of 20 papers on coconut research delivered in conjunction with a review of the ACIAR Coconut Improvement Project. Two communiqués were drafted to capture the main findings and opinions of delegates on coconut production and on the problem of viriod-like RNA sequences first observed in coconut in 1987.

MISCELLANEOUS CASH CROPS

1920–1929

Anson, R. R. 1928. Report on the work of the cotton experiment station, Sigatoka, for the season 1927–28. *Fiji Agricultural Journal*, 1(3), 3–11.

Kidney hybrids were introduced and varietal tests were conducted. Results of the tests are reported in some detail.

1930–1939

Parham, W. L. 1936. Tobacco notes. *Fiji Agricultural Journal*, 8(2), 11–13.

A report is made on observations from a trip to study the Canadian tobacco industry and its implications for improving tobacco cultivation in Fiji.

Dass, C. M. 1937. Fiji hybrid cotton No. 172. *Fiji Agricultural Journal*, 8(3), 18–19.

This hybrid cotton plant was especially bred for Fijian conditions. Its origins are traced from 1926, a short history is given of its development, and its marketable qualities are described.

Parham, B. E. V. 1937. Field notes on cotton growing in Fiji. *Fiji Agricultural Journal*, 8(4), 26–27.

The Department of Agriculture in Fiji was interested in stimulating cotton production as an export crop with an assured market, and had kept close contact with private growers. Three problems of the time were outlined in the article: the deleterious effects of some deep black soils on seed germination; caking of some soils after rain; and some hill slopes subject to erosion under normal rainfall. Growers complained of problems with labour for cultivation, picking and sorting, while buyers complained about undue picking-over.

1950–1959

Parham, B. E. V. 1951. 'Kenaf'. *Fiji Agricultural Journal*, 22(1), 29.

A brief description is provided of kenaf as a cash crop. Mention is made of small experiments in its cultivation in Fiji with good results. However, it had taken off nowhere as a commercial crop despite yielding well under local conditions.

ANNUAL REPORTS

*DEPARTMENT OF AGRICULTURE,
MINISTRY OF AGRICULTURE, FORESTS AND FISHERIES,
MINISTRY OF PRIMARY INDUSTRIES*

1950–1959

Department of Agriculture, Fiji 1955. Annual Report of the Department of Agriculture for the Year 1954. Suva, 18 pp.

Notes are given on cocoa growing, control of *Oryctes* and *Graeffea crouani* (stick insect) on coconut, control of scab moth in banana, and the introduction of parasites of fruit flies and lantana.

Department of Agriculture, Fiji 1957. Annual Report of the Department of Agriculture for the Year 1956. Suva, 20 pp.

Progress is reported on the campaign against Rhinoceros beetle and a small colony of wasps, *Scolia oryctophaga*, from Madagascar. There are also reports on soil treatment using dieldrin for rose beetle control, zinc-based spray for banana leaf spots, and herbicides to kill trees infected with citrus canker.

1960–1969

Department of Agriculture, Fiji 1960. Annual Report of the Department of Agriculture for the Year 1959. Suva, 24 pp.

Banana spacing of 11 ft × 6 ft gives higher yields than 11 ft × 11 ft with fertiliser inputs, providing increases of 3–6 cwt/ac and 2–4 cwt/ac with urea and potassium sulphate. Details are provided on scab moth control with DDT sprays or dust and spraying of coconut with diesoline containing BHC to control stick insects.

Department of Agriculture, Fiji 1961. Annual Reports of the Department of Agriculture for the Years 1960 and 1961. Suva, 29 pp.

In both reports, the following research work is summarised: fertiliser, spacing, time of planting and pest and disease control trials on banana; variety and fertiliser trials on cocoa; coffee fertiliser trials; coconut fertiliser trials; tobacco varietal trials; fertiliser trials on market garden crops; chemical induction of pineapples; and biological control of banana scab moth (*Nacoleia octasema*) and the small coconut leaf moth (*Agonoxema argaula*).

Department of Agriculture, Fiji 1963. Annual Reports of Divisional and Specialist Officers. Bulletin No. 39, Fiji Department of Agriculture, Suva, 19 pp.

The following research work is cited: chemical control of the rhinoceros beetle and coconut stick insect; biological control of rhinoceros beetle, banana scab moth, citrus fruit flies and weeds; fertiliser trials on bananas, cocoa and pineapples; wind damage to coconut palms; cocoa fermentation tests; copra drying; gas ripening of bananas; packing materials for bananas; and cultural trials on bananas, passionfruit, coffee and tobacco at the Principal Agricultural station, Koronivia, and Sigatoka.

Department of Agriculture, Fiji 1963. Annual Report of the Department of Agriculture for the Year 1962. Suva, 29 pp.

Report are provided on: the progress of fertiliser and cool storage trials on bananas; selection and manuring of cocoa; fertiliser trials on coconut; banana scab moth and coconut stick insect control; and the effect of *Rhadopholus similis* on banana yield.

Department of Agriculture, Fiji 1964. Annual Report of the Department of Agriculture for the Year 1963. Suva, 31 pp.

Banana trials are reported in respect of pest and disease control, pruning and fertiliser trials, packaging and storage. Spacing, selection and fertiliser trials on passionfruit are described, as well as fertiliser trials on cocoa and coconut. There is a report on selection studies on *Dioscorea* and varietal trials on onion, lettuce and cauliflower. Finally, there are progress reports on the biological control of the coconut stick insect and a study of the coconut leaf moth (*Agonoxema arguala*).

Department of Agriculture, Fiji 1966. Annual Report of the Department of Agriculture for the Year 1965. Suva, 40 pp.

Reports are given on the following research activities: control of black leaf streak, a new disease of banana; varietal and fertiliser trials on cocoa; fertiliser trials on coconut; varietal trials on ginger; spacing and fertiliser trials on passionfruit; varietal trials on rock melons, tomatoes, lettuce and beans; banding materials to control rats in coconut; biological control of coconut stick insects; and control of aphids transmitting bunchy top virus in bananas.

Department of Agriculture, Fiji 1967. Annual Report of the Department of Agriculture for the Year 1966. Suva.

The following crops were subject to research work: banana—black leaf streak control, nematode problems and fertilisers; cocoa—pruning, fertilisers and varietal trials; coffee—pruning and cultivation; passionfruit—collar rot control; guava—multiplication of the cultivar, Beaumont, from Hawaii; onion—varietal and storage trials; tomato—hybrid trials; rock melons, cucumbers, capsicums, and beans—varietal and cultural trials; banana—investigations on leaf diseases and aphids; and cocoa—investigations on black pod and stem canker.

Department of Agriculture, Fiji 1968. Annual Report of the Department of Agriculture for the Year 1967. Suva, 34 pp.

An evaluation is made of bunchy top virus-free materials and chemicals for control of black leaf streak in bananas. Trials were also conducted on insecticides and fertiliser applications. There is a report on establishment trials in citrus and coffee, and varietal trials on macadamia, mango, onions and pineapples.

1970–1979

Department of Agriculture, Fiji 1971. Annual Report for the Year 1970. Suva, 34 pp.

Investigations briefly reported include the following: for Chinese cabbages, a nitrogen fertiliser and spacing trial; for tomatoes, cultural and variety trials; variety trials with onions and okra; plant spacing, fertiliser and herbicide trials in bananas, and the control of black leaf streak (*Mycosphaerella fijiensis*); for cocoa, a shade and fertiliser trial, pruning trial and the control of rodents; breeding and selection, and biological control of rhinoceros beetle (*Oryctes rhinoceros*) in coconuts; for tea, a fertiliser trial and various rooting media compared for vegetative propagation; breeding work involving rice, pineapple and coconuts; varietal trials of onions, groundnuts, yams, sweet potato and cassava; a citrus rootstock trial; assessment of a breeding line, LF63-863, of sugar that gives high yields of cane, has a high sugar content and is resistant to the two main local cane diseases; for cocoa, a test of 26 clones for susceptibility to *Phytophthora palmivora*; collection of banana varieties assessed for susceptibility to black leaf streak; tests of various tomato varieties; and, for ginger, spacing and fertiliser trials, hot air drying, herbicide trials and the control of nematodes.

Department of Agriculture, Fiji 1971. Department of Agriculture Annual Report for the Year 1969. Suva, 37 pp.

Reports are made on: a pot-screening technique for assessing yields and biochemical characteristics in sugarcane; varietal trials and breeding work in sugarcane, capsicum, cauliflower, carrot, sweet corn, melon, pulses, onion, pineapple, yam, sweet potato, cassava, grasses, coconut and macadamia; biological control of the bean pod borer with hymenopterous parasites; chilli variety trials; selection of superior Smooth Cayenne pineapples; pineapple variety trials; spacing trials on ginger; coconut variety trials; control of the coconut stick insect by Azodrin and residue levels; fungicide trials on bananas; trials with the Veimama banana clones;

banana fertiliser trials; spray treatments to control banana leaf streak; compatibility studies on cocoa clones; cocoa fan branch pruning trials; growth studies on *Forastero* cocoa with and without shade; a comparison of cocoa plantation systems; studies on cocoa canker; rat poison trials in cocoa; a comparison of tea plucking methods; tea clonal selection; robusta coffee trials on multiple stem systems; evaluations on 20 selected mandarin orange trees; rootstock trials; budwood propagation of West Indian limes; *Troyer citrange* and *Trifoliata* seedling rootstocks and resistance to *Phytophthora*; and macadamia seedling propagation. In rice, crosses were performed between the local Fijian variety, BG75, and selected parents from the Philippines, USA, Australia, Malaysia and Surinam. Taichung Native 1 gave good yields in both dryland and wetland conditions. In cocoa, the Trinitario clone, SI070, showed moderate resistance to *Phytophthora palmivora*.

Department of Agriculture, Fiji 1972. Annual Report for the Year 1971. Suva, 37 pp.

Investigations briefly reported include the following: for bananas, comparison of several types of planting material, plant spacing and herbicide trials, and the control of black leaf streak; for cocoa, a shade x fertiliser trial, pruning trial and the control of rodents; for coconuts, variety trials and biological control of rhinoceros beetle; for sugarcane, breeding and selection, herbicide trials and intercropping with other crops; variety and fertiliser trials for onions; variety and spacing and fertiliser trials in tomatoes; fertiliser trials with cabbages, carrots, Chinese cabbage and lettuces; a citrus variety trial; a passionfruit fertiliser trial; breeding work involving coconut; and varietal trials of maize, potato, forage grasses and vegetables.

Department of Agriculture, Fiji 1973, Annual Report for the Year 1972. Suva, 42 pp.

Trials and investigations are reported on variety trials in sugar cane for resistance to Fiji virus, and groundnut, cocoyam and cassava variety trials.

Ministry of Agriculture, Fisheries and Forests, Fiji 1976. Annual Report for the Year 1973. Suva, 54 pp.

This report includes, in a section on crops (pp. 6–18), a number of references to entomological observations and research, especially in relation to the growing of coconut, rice, potato, soya bean and pigeon pea. There is a report in a section on entomology and plant pathology (p. 31) on intensive investigations of exotic biological control agents that

were released in Fiji in 1971. Only *Rhyzobius pulchellus* (Montr.), a coccinellid that preys on *Aspidiotus destructor* Sign. on coconut, and *Uroplata girardi* Pic, which feeds on the weed, lantana, were found to be established.

Ministry of Agriculture, Fisheries and Forests, Fiji 1978. Annual Report for the Year 1975. Fiji Parliamentary Paper No. 20 of 1978, Suva, 36 pp.

Part I describes the state of the industries under various headings such as production, area and cropping, marketing and prices, general aspects, development, constraints and research. Crops covered include sugar, rice, ginger, cocoa, coconuts, passionfruit, broom corn, root crops, vegetables and pineapples. Research work highlighted for rice is the introduction and screening of varieties from IRRI.

Ministry of Agriculture, Fisheries and Forests, Fiji 1978. Annual Report for the Year 1976. Parliamentary Paper No. 41 of 1978, Suva, 35 pp.

The report includes a mention of fertilising practices of yams and taro, drainage works in sugarcane areas, and nitrogen fertilising and cultivation of rice in various irrigation projects.

1980–1989

Ministry of Agriculture and Fisheries, Fiji 1983. Annual Report for the Year 1980. Fiji Parliamentary Paper No. 22 of 1983, Suva, 40 pp.

Plant protection research (p. 29) briefly covers chemical and biological control of insect pests of coconut, cocoa, rice, and the water weeds, water fern (*Salvinia*) and water hyacinth.

Ministry of Agriculture and Fisheries, Fiji 1983. Annual Report for the Year 1981. Fiji Parliamentary Paper No. 26 of 1983, Suva, 62 pp.

A progress report is given of plant protection investigations into: chemical control of *Nilaparvata lugens* and *Susumia exigua* on rice, and of *Plutella xylostella* on cabbage; biological control of rhinoceros beetle in coconut using *Baculovirus oryctes* and controlling ground cover to control the coconut stick insect; and biological control of water weed using *Neochetina eichhornia* and *Paulinia acuminata* against water hyacinth, and *Samea multiplicalis* against water fern, *Salvinia*.

Ministry of Agriculture and Fisheries, Fiji 1983. Annual Report for the Year 1982. Fiji Parliamentary Paper No. 66 of 1983, Suva, 80 pp.

Reports are provided on the status of the following industries covering area and production, marketing and prices and general aspects: sugar, coconuts, rice, ginger, cocoa, passionfruit, root crops, vegetables, citrus, pineapples, coffee, broom corn, peanut/pulses, maize, tobacco, fish, beef, dairy, poultry, goats, pigs, sheep and bees. Progress in an integrated farming project is also mentioned. Research highlights for the various crops are as follows (pp. 51–56): citrus—rootstock, liming and fertiliser trials; cocoa—hybrid evaluation, breeding and selection, fertiliser, spacing and pruning studies; coconuts—variety, demonstration, fertiliser and intercropping investigations; pulses —intercropping sugarcane with peanuts and cowpeas, variety trials of maize, urd, mung bean and pigeon pea, rotational trials and *Rhizobium* inoculation trials; rice—breeding and screening of locally produced and introduced lines; root crops—variety and planting material trials of taro, staking studies and anthracnose control in yams, maturity period investigations in cassava, and manuring and fertiliser trials in ginger; vegetables—varietal trials of potato, tomato, garlic, onion, lettuce, long bean, cucumber, Chinese cabbage, wonbok, eggplant, chilli, celery and parsley; fruit—evaluation of Hawaiian cultivars of papaya, and mango yield trials and flower induction. Plant protection research focused on the biology and biological and chemical control of rice leaf roller, coffee berry borer, cocoa bark beetle, fruit sucking moth, bean pod borer, rhinoceros beetle and biological control of water weeds, and chemical control of sweet potato weevil and sweet potato scab disease. Investigations continued into the causes of kava wilt and collar rot of passionfruit. Crop rotation of cassava, taro and ginger to control nematodes also continued. Herbicide trials were conducted in root crops and vegetables.

Ministry of Primary Industries, Fiji 1984. Annual Report for the Year 1983. Parliamentary Paper No. 68 of 1984, Suva, 82 pp.

The status of the crop production, livestock and fisheries industries is described and details are presented of the work of the different departments of the Ministry in 1983. Notes are presented on about 50 projects on the production, improvement and protection against pests and diseases of citrus, cocoa, coconuts, pigeon peas, cowpeas, rice, root crops, kava, vegetables, fruits and pastures.

Ministry of Primary Industries, Fiji 1985. Annual Report for the Year 1984, Suva, 109 pp.

Brief reports are given on the status of research into sugarcane, rice, coconuts, cocoa, root crops, vegetables, fish, beef, cattle, poultry, pigs, sheep, goats and bees. Work of the various divisions is outlined. Results are summarised of research on rice, root crops, vegetables, cocoa, coconuts, citrus, other fruits, pulses and maize.

Ministry of Primary Industries, Fiji 1986. Annual Report for the Year 1985. Parliamentary Paper No. 79 of 1986, Suva, 77 pp.

Summaries are given of the area, production, yield and value of output of sugarcane, coconuts, rice, ginger, cocoa, coffee, passionfruit, citrus fruits, pineapples, other tropical fruits, root crops, vegetables, sorghum, maize, groundnuts, pulses, tobacco, fish, beef and dairy cattle, poultry, goats, pigs, sheep and bees. Other aspects of work of the Ministry are outlined, such as education, training, research, extension, information, economic planning and statistics, animal health and production, quarantine, drainage and irrigation, fisheries and the agricultural tribunal. Reports on agricultural research in Fiji (pp. 35–41) include: rice (varietal trials, fertilisers and the biology and control of weeds, diseases and insect pests); root crops (varietal trials and the control of diseases and nematode pests); vegetables (varietal trials, control of diseases and the biological control of diamond back moth on cabbage); tropical fruits (varietal trials, fertilisers and the biological control of the noctuid, *Othreis fullonia*, on citrus); maize (varietal trials for resistance to maize mosaic virus), cocoa (varietal trials and the control of pests and diseases); and coconut (intercropping with annual crops and microbial control of rhinoceros beetles with the virus, *Baculovirus oryctes*).

Ministry of Primary Industries, Fiji 1989. Annual Report for the Year 1987, Suva, 123 pp.

Part 1 covers the status of the various industries and Part 2 details the activities of the Ministry. Research activators on crops include: rice—breeding for tolerance to drought, low pH, yield and resistance to pest and diseases, and evaluations for dryland and wetland conditions; fertiliser and spacing trials for saline and acid sulphate soils, chemical weed control, control of the leaf roller, *Marasima exigua*, development of machines for small holdings and farmer training; vegetables—varieties and line testing of potato and time of planting, irrigation and mulching, storage studies, mulching and irrigation for garlic, evaluation of onion varieties, tomato cultivation practices and nematode control, new lines of cabbage,

cauliflower, beans, cucumber, watermelon, lettuce, carrots, capsicum and eggplant introduced and screened, control of diamond back moth in cabbage, and chemical control of whitefly; cereals—selection and evaluation of maize lines; tropical fruits—root stock trials for Marsh grapefruit, Cutter Valencia orange, Dancy tangerine, Key lime and Frost Lisbon lemon, fertiliser trial, fruit sucking moth control, cropping pattern of West Indian lime, evaluation of Hawaiian varieties of papaya and fertiliser trials, off-season hormone induction of pineapple, passionfruit pollination and fertiliser trials, and mango variety evaluation; coconut—hybrid evaluation, seed garden establishment, and rhinoceros beetle and flat moth control; cocoa—evaluation of clones introduced from PNG, hybrid evaluation, spacing and fertiliser trials, and black pod control investigations; root crops—breeding new clones of taro, sweet potato multiplication and evaluation, nematode control in ginger, rotation trials with cassava, taro, yellow turmeric and ginger, work on the taro beetle using baculovirus, and continuing studies on kava wilt; and pulses—multi-locational testing and variety testing of cowpeas, pigeon pea, mung bean, peanut and urd, and intercropping pulses with sugarcane.

1990–present

Ministry of Agriculture, Fisheries and Forests, Fiji 1993. Annual Report for the Year 1992. Parliament of Fiji, Parliamentary Paper No. 38 of 1993, Suva, 126 pp.

Part 1 has two sections. The first describes the status of the various food and crop industries, and the second covers the work of the various divisions in the Ministry. Part 2 reports on the activities of Department of Co-operatives, and Part 3 reports on activities of the Department of Forestry. Research activities reported are: rice—evaluation of varieties under wetland and dryland conditions, testing for drought tolerance, brown plant hopper resistance, fertiliser trials on problem soils of Dreketi, trials with JICA on agronomic evaluations of varieties, demonstration trials on pilot farms, farm machinery evaluation and training courses; coconut—maintenance of coconut seed garden and nursery, multiplication blocks, hybrid varieties and fertiliser trials, interacting with ACIAR's project on the production and dissemination of improved coconut cultivars and other projects; cocoa—integrated control of black pod disease, hybrid varietal and spacing trials and a survey on fertiliser requirements of cocoa; vegetables and cereals—farmer training in potato seed production, intercropping potato with sugarcane, control of diamond back moth in cabbage using integrated pest management, evaluation of downy mildew-resistant corn, and screening of

broomcorn; fruits—mango flower induction and quality testing trials, flower induction trials in pineapple for the off-season, boron and irrigation in papaya, and screening of passionfruit for resistance to potyvirus; and pulses—multi-location trials on pigeon pea, genotype evaluation of cowpea and varietal trials on peanut and mung bean.

Ministry of Agriculture, Fisheries and Forests, Fiji 1994. Annual Report for the Year 1993. Parliament of Fiji, Parliamentary Paper No. 34 of 1994, Suva, 123 pp.

Part 1 has two sections. The first describes the state of the various food crop and livestock industries, and the second covers the work of the various divisions in the Ministry. Part 2 reports on the activities of the Department of Forestry. The main research activities undertaken—largely a continuation of existing projects—are reported to be: a food quality assurance program; regional fruit fly project; insecticide screening for the control of taro beetle and brown plant hoppers; biological control of the bean pod borer, lantana, giant sensitive plant, rhinoceros beetle and the fruit-piercing moth; control of cabbage pests; various trials to increase the yields and quality of root crops; evaluation of rice cultivars; rice fertility trials; varietal evaluation, progeny testing and fertiliser trials in coconuts; varietal evaluation in pigeon peas, cowpeas and peanuts; screening and evaluation of vegetables; potato/sugarcane intercropping trials; economic analysis of maize fertiliser response; new plantings of assorted tropical fruits, nuts and spices; and germplasm maintenance of recommended varieties of vegetables, pulses and rice.

Ministry of Agriculture, Fisheries and Forests, Fiji 1995. Annual Report for the Year 1994. Parliament of Fiji, Parliamentary Paper No. 52 of 1995, Suva, 146 pp.

Part 1 has two sections. The first describes the state of the various food crop and livestock industries, and the second covers the work of the various divisions in the Ministry. Part 2 contains activity reports of the various divisions. Parts 3, 4 and 5 give accounts of the year's activities in Fisheries, Forestry and the Agricultural Tribunal, respectively. The main research activities reported are predominantly a continuation of existing projects, as reported in the annual report for 1993. There is also an outline of the various PRAP and SCEP research activities.

Ministry of Agriculture, Fisheries, Forests and ALTA, Fiji 1996. Annual Report for the Year 1995. Parliamentary Paper No. 49 of 1996, Parliament of Fiji, Suva, 162 pp.

Part 1 describes the status of the following industries: sugar, rice, cocoa, coconut, ginger, fruits, vanilla, vegetables, root crops, beef, dairy, sheep, goats, pigs, poultry and honey. Part 2 contains activity reports of the various divisions. Parts 3, 4 and 5 give accounts of the year's activities in Fisheries, Forestry and the Agricultural Tribunal, respectively. Research activities on crops include: root crops—improvement of quality of ginger and taro, mineral nutritional studies conducted by SCEP, evaluation of taro varieties, control of taro beetle, testing of SPC tissue culture materials of sweet potato, and testing cassava varieties of cassava to bacterial leaf blight; cocoa—varietal evaluation; fertiliser factorial trial, and plant spacing studies; coconut—production of hybrid nuts, control of rhinoceros beetle by baculoviruses, monitoring of coconut spathe moth damage, and training in coconut replanting and coconut-based farming systems; vegetables and maize—evaluation of disease-resistant varieties in English cabbage, lettuce, broccoli and cauliflower, off-season cultivation of tomatoes and studies with the Republic of China Agricultural Technical Mission, maize resistance to downy mildew, and evaluation of sunflower varieties for oil and snack food; tropical fruits—flowering and production studies of mango varieties, evaluation of passionfruit lines, a fertiliser trial on papaya, and hormone application to induce flowering in pineapples. There is a report on a SCEP research project with root crops and vegetables in different soil types and localities. Entomology research emphasised: the biological control of fruit-piercing moth in citrus; biological control of diamond back moth in cabbage under the German Biological Control Project; controlling the spirally white-fly with ladybird beetles; control of rhinoceros beetle with baculoviruses and *Metarrhizium anisopliae*; and chemical control of taro beetle and diamond back moth. Fruit fly control activities included fruit fly surveillance, conversion of brewery-spent yeast to protein bait, host testing status, post-harvest quarantine treatment, the commercialisation of the hot forced-air treatment unit, negotiations on quarantine protocols and training of personnel. Weed control focused on herbicides testing on wetland rice and peanuts, and African tulip tree control.

Ministry of Agriculture, Fisheries, Forests and ALTA, Fiji 1997. Annual Report for the Year 1996, Suva, 158 pp.

Part 1 describes the status of the following industries: sugar, coconut, taro, ginger, kava, fruits, vegetables, cocoa, other root crops, rice, vanilla, beef, dairy, sheep, goats, honey, pigs and poultry. Part 2 contains activity reports of the various divisions of the Ministry, Part 3 covers the activities of the Department of Fisheries, Part 4 the activities of the Department of Forests, and Part 5 the activities of the Agricultural Tribunal. Research activities on crops, soil and plant protection (pp.106–117) include: vegetables and cereals—germplasm maintenance and development, agronomy (fertilisers, manuring, mulching, production practices), pest and disease management of potato, tomato, carrot, cucumber, English cabbage, okra, capsicum, chillies, eggplant, basil, dill, beans, sunflower and maize; fruit—quality fruit production of papaya, germplasm maintenance of passionfruit, mango and pineapple fruit production; root crops—improving quality and production of ginger and taro through a mineral nutrition study, nematode control, varietal evaluation, and bulking of seed and planting material; cocoa—evaluation and monitoring of locally produced hybrids, phosphate fertiliser trial and monitoring of black pod disease response; rice—low-key evaluation of cultivars for yield potential, resistance to lodging and susceptibility to pests and diseases; pulses—improvement and diversification programs. Plant protection activities include: the fruit fly project, rhinoceros beetle control, control of the fruit-piercing moth, control of diamond back moth, control of *Mimosa invisa* and *Lantana camara*, taro beetle control, pesticide registration and advisory diagnostic services. Progress reports are provided on other crop programs such as the Agriculture Technical Mission, Republic of China/MAFF project, PRAP and SCEP.