

Prospects for Improving Forage Supply in Coconut Plantations of the South Pacific

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Abstract

This paper analyses the reasons for success or failure of forages and cattle under coconuts and discusses the future potential for improvement of forages under coconuts within the physical and socio-economic environment of the South Pacific.

The South Pacific Region

THE countries and people of the South Pacific have many unique characteristics which separate them from the Asian region with which often they are erroneously grouped.

South Pacific countries have small populations in relation to land area and are isolated geographically from the rest of the world and from each other. In many cases, populations are isolated even within a country due to the fragmented nature of the multi-island states and, in the case of the Western Pacific countries, due to the rugged terrain of their volcanic islands. These countries are highly dependent on agriculture but their characteristics impede agricultural development because of difficulties in transportation, communication and marketing of produce.

The South Pacific countries (Table 1) are located between the latitudinal range of 5°N to 23° they support a population of about 5 million, occupy around 545 000 km² and are spread over approximately 1200 islands (Crocombe 1987).

This paper briefly describes the salient environmental features which impact on the ruminant industries of the region. The objective of the paper is to identify the present role and future potential for improvement of forages under coconuts within the physical and socio-economic environment of the South Pacific.

Geology and soils

The South Pacific countries span the zone of interaction between the Indian and Pacific tectonic plates. Both historical and recent volcanic and earthquake activity have contributed to present landforms and geologic features from which the soils

of the region have been derived (Ward and Proctor 1980). Common soils are those formed on uplifted coral reefs, but sometimes improved with deposits of volcanic ash. It is on these soils that the majority of coconut plantations can be found. Soils formed on the older volcanic deposits are often steep and eroded or highly weathered, and therefore of limited fertility. Recent volcanic activity gives rise to very fertile soils such as occur on the southern Vanuatu island of Tanna. Fertile alluvial soils may be found on river deltas such as the Guadalcanal Plains in Solomon Islands and on Viti Levu and Vanua Levu in Fiji.

Steep dissected mountains of volcanic, metamorphic and sedimentary materials form the spine of Papua New Guinea, Solomon Islands and most Western Pacific countries, and render a large proportion of the land mass unsuitable for agriculture (Ward and Proctor 1980). No coconuts are grown in these areas.

Climate

Temperature maxima and minima at coastal stations at low latitudes average 32-29°C in January and 29-23° in July (Ward and Proctor 1980). Coconut plantations are generally found at or near sea-level. Pasture production clearly will not be limited by temperature in these areas, but rainfall is generally the more significant climatic influence due to orographic and rainshadow effects. Extremely high rainfalls of 4500 mm/year occur on the southern flanks of the central mountains of Papua New Guinea and Solomon Islands. In rainshadow areas, mainly on the north-western side of the islands, precipitation may be as low as 1200 mm/year, with water deficit occurring between the months of May and October. In wetter areas, heavy cloud cover significantly reduces radiation and pasture growth.

Agriculture

The countries of the South Pacific are still largely dependent on land and agriculture for employment, food supply, social cohesion and, more recently,

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export earnings. Islanders were originally subsistence gardeners cultivating coconut and various root crops which formed their staple foods. Following European and Asian settlement during the 1900s there was alienation of significant areas of land to foreign-controlled estates initially for copra production. These larger estates led the way toward commercialisation of agriculture and, in many cases, export of commodities such as copra, palm oil, sugar, cocoa, coffee and fruits. Traditionally, livestock production has been based on the subsistence husbandry of pigs and chickens. While there is no tradition of ruminant animal production (except by Fijian Indians) there are now substantial numbers of ruminants in Pacific countries (Table I).

Ruminant production is now promoted by all governments of the region, with the aim of promoting import substitution, improving the nutritional status of rural populations, and providing farmers with cash income (Bilong 1986).

Table 1. Ruminant livestock numbers in some countries of the South Pacific.

	Cattle	Buffalo	Goats	Sheep
Cook Islands	200	-	3 000	-
Fiji	159 000	-	59 000	-
Kiribati		-	-	
Solomon Islands	23000	-	2 000	-
Tonga	8 000	-	11 000	-
Vanuatu	103000	-	12000	-
New Caledonia	122 000	-	19000	3 000
Western Samoa	27 000	-	900	-
Papua New Guinea	123 000	1500	17000	2 000

Sources: Ward and Proctor 1980. FAO Yearbook 1987.

Forages, Cattle and Coconuts

Cattle

The total number of cattle in the Pacific Island countries is approximately 565 000 head; Fiji (159 000), Papua New Guinea (123 000) and Vanuatu (103 500) have the largest populations (Table I).

The first cattle, mainly dairy breeds, were introduced into the South Pacific region by missionaries in the late 19th century. Subsequently, cattle became important for weed control in coconut plantations managed by expatriates. World War II had a devastating effect on cattle numbers, particularly in Papua New Guinea and Solomon Islands, but numbers began to increase rapidly in these countries during the 1960s and 1970s with promotion and funding from local governments and international agencies (Shelton et al. 1986).

Assistance was given in two forms, firstly by establishing government-controlled nucleus cattle ranches, and secondly by promoting the ownership of cattle among indigenous smallholders. Smallholders were assisted with cheap credit, training, subsidies for fencing and pasture improvement, and with supervision by enthusiastic expatriate cattle extension officers. In Vanuatu, there was also a number of cattle ranches run by expatriates, while in Fiji large numbers of cattle were kept for draught purposes by Indian cane-farmers.

Approximately one-third of the total cattle population in the Pacific Islands is owned by smallholders. Almost everywhere, actual cattle numbers are much fewer than the projected numbers which were expected to result from various development schemes in the 1970s. This can be attributed to a number of factors.

- Indigenous smallholders had no prior experience with cattle, with the result that their standards of animal husbandry were lower than expected.
- Smallholders were encouraged to take part in commercial cattle production too quickly, and on too large a scale. There was no opportunity for the industry to evolve and consolidate.
- Many projects were located at a great distance from potential markets, and sometimes on islands remote from abattoirs.
- It was difficult for buyers to achieve a regular supply of adequate numbers of cattle, since smallholders tended to have many small herds in inaccessible areas.
- Brahman cattle obtained from government ranches were sometimes wild and difficult to control.
- Social status was attached to the ownership of cattle, and farmers were sometimes reluctant to sell (i.e. they were not commercially oriented).
- Disputes over the ownership of customary land interfered with management.
- Some smallholders encountered serious soil nutrient deficiencies which affected both pasture growth and animal nutrition.
- There was a significant slaughter, which finally had to be limited by legislation, of breeding cows.

As a result, some smallholder projects were abandoned and many had loan repayment difficulties. Projects were poorly managed and overstocked, resulting in loss of improved pasture species and serious weed infestation (Shelton et al. 1986).

Coconuts

The importance of the coconut in the Pacific Islands can hardly be overemphasised. Its significance to village people, particularly in atolls and outer island situations, is unlikely to change rapidly. The coconuts provide smallholders with a regular income which, while not a living, is a useful supplement to other

sources of family income. However, unless productivity is improved on estates and plantation-mode smallholdings, its competitiveness with other crops will diminish even more (Ward and Proctor 1980).

Many coconut plantations are now old and past their most productive phase with little replanting of higher-yielding hybrids under way. Ageing coconuts are, however, very suitable for inter-planting either with other cash crops such as cocoa and coffee or with forages for cattle production. Supplementary activities such as these are important not only to increase family income but also to offset fluctuations in copra prices. For these reasons, grazing of land under coconuts will become an increasingly important activity in the South Pacific.

Forages under coconuts

The major grazing resource in the Pacific region is natural forage under the ubiquitous coconut plantations. Cattle ownership by smallholders is largely under coconuts (especially in Solomon Islands, Vanuatu and Western Samoa), therefore programs designed to assist smallholders must direct their attention to this sector. Special advantages of the coconut-cattle system are the contribution of cattle to weed control, the lower pasture establishment costs (no land clearing) and the availability of cash from copra sales which offsets the cost of setting up a small livestock enterprise (Shelton et al. 1986).

Historically, establishment and management of productive improved forages under coconuts have not been given high priority by cattle owners in the region. Managers of the large plantations in Solomon Islands and Vanuatu viewed cattle primarily for grass control under coconuts. Little attention was given to improved methods of husbandry or pasture improvement. Similarly, smallholders were constrained by a range of economic, social, marketing and expertise limitations and had neither the will nor the resources seriously to consider pasture improvement (Shelton et al. 1986).

Government and aid donors, on the other hand, gave priority to pasture improvement and supported substantial research programs in Papua New Guinea, Solomon Islands, Fiji and Western Samoa. Unfortunately, adoption of pasture technology by primary producers has been disappointing. The livestock industries in many countries currently are being consolidated, and increasing awareness of the importance of improved animal management, feeding and marketing will mean greater interest in pasture improvement in future. Currently, the major problem in the Pacific is the low level of adoption rather than an inadequate research effort (Shelton et al. 1986).

Prospects for Increased Use of Forages under Coconuts

From the foregoing discussion it can be seen that, historically, both cattle and coconut industries in the South Pacific have suffered from uneven development with a number of constraints hindering progress. It is also clear that the two industries must be better integrated to make profitable use of their inherent complementarity.

An analysis is now given of the future prospects for improving forages in coconut plantations using as examples the contrasting experiences of Solomon Islands and Vanuatu. Beef production is languishing in Solomon Islands with cattle numbers down from a high of 23 000 to around 8000 currently, and abattoirs unable to meet local demand for meat. In contrast, Vanuatu cattle numbers are rising, albeit slowly, the number of commercial producers is increasing, a small export industry of 1000 t meat/year is flourishing and confidence is rising.

There are similarities and differences between these two countries which may help explain these apparently opposite outcomes. These are now discussed in relation to the prospects for introducing forages into coconut plantations.

Availability of appropriate technology

Both countries have received assistance from the same Australian institution with the development of appropriate pasture improvement technology under coconuts. The University of Queensland and private consulting companies, with support from Australian aid funds, conducted research into pasture improvement in Solomon Islands from 1973 to 1982, in Vanuatu in 1985, and then from 1988 to the present time. The thrust of the research was similar in both cases as work was directed primarily to finding new species for shaded environments, developing methods of pasture establishment, understanding soil fertility limitations to pasture growth, the identification and control of weed species, and the production and management of grazing animals. In both cases, the work was well publicised in pasture handbooks (Steel et al., 1980; Macfarlane and Shelton 1986).

Both countries suffer from a small number of nationals adequately trained in forage improvement, as well as in other areas of the cattle industry. Scholarships for overseas study have been provided to address this issue but limited local expertise remains a problem.

Some differences in approach and in the situation at the commencement of the programs can be identified. In Solomon Islands, pasture research staff had no formal extension roles and were structurally and physically separated from the authority responsible for development of the cattle industry. This meant that

there was little interaction between research and extension workers and producers. In Vanuatu, research and extension efforts are well integrated and pasture agronomists have regular contact with producers creating a three-way flow of information which appears to have promoted both understanding of local production systems and rates of adoption of new technology. Both large estate managers and smallholders show keen interest in pasture improvement.

There are other differences. Pasture research workers in Vanuatu benefited from and built upon Solomon Islands experience. They brought with them an understanding of humid tropical natural ecosystems, soil fertility constraints and weed control measures. They were also surprised to find that a well adapted and extremely robust grass was already in use under coconuts. Buffalo couch (*Stenotaphrum secundatum*) was first widely planted 30-50 years ago in both estate and smallholder plantations. Its success is due to shade tolerance, its wide adaptation to the various soil types, a prostrate habit making it suitable for growing under coconuts, and a vigorous stoloniferous growth characteristic which ensures that it forms a relatively weed-free sward, even under heavy grazing. In view of the wide variety of weeds (e.g. *Cassia tora*) found under coconuts, this last characteristic is of great importance.

The productivity and quality of buffalo couch was originally thought to be too low to fatten animals (Macfarlane and Shelton 1986). However, recent evidence from Vanuatu indicates that when it can be combined with naturalised high-quality legumes such as *Desmodium canum* and *Vigna hosei*, excellent liveweight gains can be obtained (B. Mullen, pers. comm.). More work is required to test the suitability of alternative persistent legumes such as the tree legume *Leucaena leucocephala*, the herbaceous legume *Desmodium heterophyllum* and the stoloniferous and rhizomatous accessions of the *Arachis* genus, for combining with buffalo grass. Moreover, other grazing-tolerant grasses are required to provide plantation managers with greater flexibility of choice of forage species for planting in different situations.

Social and cultural values of cattle owners

Some sociologists are concerned with the principle of introducing ruminants into the Pacific (R. Crocombe, pers. comm.). They argue that while there is a long history and tradition of pig production in the Pacific, there is no tradition of or familiarity with ruminants. This factor is given as the main reason for the failure of many livestock projects in the Pacific.

Solomon Islands and Vanuatu have differing histories in this respect. Dairy cattle were first introduced into Vanuatu in 1845 to provide milk to the missions and since that time there have been

continuing introductions from Australia and France of a variety of dairy and beef breeds (Weightman 1989). The consequence was a numerous and diversified cattle herd and greater familiarity of the indigenous people with cattle management.

Currently, in Vanuatu, there is even a partial replacement of pigs by cattle in rural society on those islands where commercial opportunities exist. Several advantages of cattle over pigs were identified. Cattle are viewed as requiring less management than pigs, fit readily into existing coconut plantations, can be converted into cash when desired and are a very suitable source of meat for feasts at traditional ceremonial and custom occasions (J. Kamphorst, pers. comm.). The adoption of cattle by rural society has not occurred to the same extent in Solomon Islands.

Another difference between the two countries is in the attitudes of the managers of the larger foreign-owned coconut estates. In Vanuatu, there is a greater consciousness of the role of cattle as a source of additional income while in Solomon Islands, cattle have been primarily used for brush control.

The differences outlined in this section can be related to historical differences but also to different current marketing opportunities. This latter aspect is discussed later.

Animal husbandry

The standards of management of cattle under plantations in the Pacific have been poor and characterised by general neglect.

In the smallholder sector there were often no stockyards; no selection, castration of bulls or culling of unproductive animals and therefore no control of breeding; no separation of different classes of stock, and no sub-division fences; and no permanent stock water supply or pasture improvement. Under these conditions, it is impossible to have animals in good condition for slaughter (Weightman 1989).

In the estate sector, although plantations were subdivided into a number of paddocks, the strategy was directed at improving coconut collection. Cattle were moved ahead of coconut gatherers and grazed at very high stocking rates to clear and trample grass and weeds as much as possible.

Programs directed at improving the standards of animal husbandry in both Solomon Islands and Vanuatu have been supported by foreign aid from Australia and British development assistance sources, respectively. These programs appear to have been more effective in Vanuatu where the extension activities of the Department of Agriculture, and in particular its Livestock Service, have significantly raised the standards of cattle and pasture management in both smallholder and larger plantation sectors (Weightman 1989).

Land tenure

There are many diverse systems of tenure of land in the Pacific although most were originally devised to suit the needs of subsistence agriculture rather than those of commercial agricultural production (Crocombe 1987). The situation was complicated between 1850 and 1900 when European settlement alienated substantial areas of land. Currently, most countries have introduced land reform measures in an attempt to meet the needs of modern agricultural production. Vanuatu, while still struggling with the problems of land reform, has developed a successful system of long-term leases for expatriates wishing to farm previously alienated plantations. In some cases, leases were granted while the issue of land ownership was still being investigated.

The overall result of this enlightened approach is that Vanuatu has a core of innovative expatriate plantation and estate cattle managers who, in the past, have provided the majority of cattle for slaughter in abattoirs. This has ensured a relatively reliable supply of slaughter animals and ensured the early viability of the industry. In the meantime, Ni-Vanuatu managers have slowly improved their expertise and their contribution to the commercial viability of the industry. Ultimately it is expected that the majority of animals for slaughter will come from Ni-Vanuatu properties.

Marketing

The commercial marketing of livestock in the Pacific Islands is limited by a number of difficulties. Animals are spread in small numbers over many islands, so that transport to abattoirs requires a complex infrastructure of buyers, holding yards and inter-island barge transport. Effective systems are few, and usually depend on foreign aid.

Most Pacific countries have abattoirs. However, these are necessarily near major population centres, and it is difficult for smallholders from outlying islands to gain access to them, even though prices offered at abattoirs are generally higher than those obtained locally. Consequently, abattoirs are usually underutilised and barely profitable while many animals are slaughtered using bush slaughter methods. Increased commercial ruminant production by smallholders, coupled with improved marketing methods, would improve the efficiency and profitability of abattoirs.

Again Vanuatu has had greatest success in overcoming the limitations outlined above. The Livestock Service has worked hard and successfully to encourage the participation of smallholders in the commercial industry. This has been achieved by provision of animal collection points and barges to outlying islands and remote areas to encourage sale of store animals for fattening on better quality pastures

close to abattoirs. In this way, structural integration of the industry is being achieved. An integral aspect of this marketing strategy is a system of graded payments providing financial incentive for young, properly finished animals.

A recent development in Vanuatu is private small-scale cattle collection and transportation on the island of Santo. Small trucks and cattle-crates supplied by private entrepreneurs, but encouraged by judicious government assistance, ensure that smallholders get their animals to market.

Conclusions and Future Directions

Cattle numbers have increased dramatically in the Pacific region this century. Over the past 20 years indigenous smallholders have become increasingly involved, but with variable success. Significant pasture research has been carried out, but the level of successful adoption of permanent improved pastures remains disappointingly low, although awareness of the importance of improved pastures to animal productivity is increasing. The outlook for the cattle industries is relatively optimistic, with the possible exception of Solomon Islands, and governments are proceeding with plans for further inputs to the industry to achieve self-sufficiency and, in some cases, develop export markets. As the Pacific economies improve, demand for beef can be expected to increase.

There is a need for assistance and progress in several sectors of the industry, to ensure that the incentive for pasture improvement is not limited by other factors. For instance, herd management and cattle husbandry, marketing infrastructure and credit facilities are often limiting and should receive appropriate attention. Without such balanced development farmers cannot be expected to adopt improved forages.

It is clear from experiences to date that future research should aim to provide simple and robust systems suitable for indigenous smallholders with only recent experience of pasture and cattle management. Systems such as those developed with *Stenotaphrum secundatum* in Vanuatu should be tested more widely in the region. There is a need to collate and integrate all existing, often fragmented information on species performance and soil fertility data for the benefit of all countries in the region. Species introduction and evaluation and soil fertility testing will continue to be research priorities, as management of poorer soils is likely to involve choice of adapted species rather than fertilizer addition, at least in the short term. Further investigation of the utilisation of naturalised legumes such as *Leucaena leucocephala* and *Desmodium heterophyllum* and new legumes such as *Arachis* species should be given priority because of their demonstrated productivity and persistence in shaded environments.

The problem of poor adoption of improved pastures by primary producers must be faced. Research workers must work more closely with extension officers and innovative farmers to ensure that research emphases are realistic and that extension recommendations are practical and appropriate.

The low number of nationals in pasture agronomy and their lack of expertise are also serious limitations to further development. There is clearly justification for direct technical assistance to meet short-term needs and for training assistance to increase local competence. This may take the form of workshops, study tours, regional seminars or tertiary study. In this way the potential for greater integration of forages and cattle under coconuts may be realised.

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