Opportunities for Integration of Ruminants in Plantation Crops of Southeast Asia and the Pacific

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Abstract

The advantages of raising livestock in conjunction with tree plantations include increased and diversified income, better use of scarce land resources, soil stabilisation and the potential for higher plantation crop yield through better weed control, nutrient cycling and nitrogen accretion. This paper provides an overview of the plantation and livestock industries in the Southeast Asian and Pacific regions and explores the opportunities for integration.

THE raising of livestock in conjunction with tropical plantation crops is a well established practice. The advantages of such dual use of land are documented and include: (a) increased and diversified income; (b) better use of scarce land resources; (c) soil stabilisation; and (d) potential for higher plantation crop yield through better weed control, nutrient recycling and nitrogen accretion.

The topic has attracted significant research and development activity in many countries. An extensive literature documents the potential for integration of pasture and livestock in plantation agriculture (Shelton et al. 1987). In this workshop, it is not our intention to repeat all these previous findings. Our objective is to present the results of some recent research and to review some past experiences, both successes and failures, with the extension of pasture technology to farmers. We believe that this will lead to a better understanding of forage-plantation systems and of the limitations to greater use of forages in plantation crops, and ultimately to improved adoption of new techniques.

The purpose of this paper is to provide an overview of the plantation and livestock industries in the Southeast Asian and the Pacific regions and to explore the opportunities for better integration of the two industries. This will provide a conceptual setting for the workshop.

Plantation Industries

The plantation crops to be reviewed are rubber *(Hevea brasiliensis),* oil palm *(Elaeis guineensis)* and coconut *(Cocos nucifera).* These crops play an important role in the economies of the countries of Southeast Asia and the South Pacific. While other crops have potential for integration with livestock (e.g. cashews and mangoes in Thailand, cloves and vanilla in Indonesia, and forestry in the Pacific), they are of lesser importance.

Regional production data show that, relative to the rest of the world, Southeast Asia is the major source of all three commodities (Table 1). Within Southeast Asia, Malaysia and Indonesia are the major producers of rubber and palm oil while the Philippines and Indonesia are the main producers of copra (Table 2).

Table 1. Productivity of plantation crops by region ('000 t) in 1987.

Region	Rubber (latex)	Coconut (copra)	Oil palm (oil)
Africa	266	207	1 526
North and Central America	13	223	138
South America	46	28	333
Southeast Asia	3 682	5 105	6371
South Asia	360	1 468	–
Northeast Asia	202		200
South Pacific	1	409	158
World	4 574	7 440	8 727

Source: FAO (1988) and APCC (1987).

The South Pacific region is by world standards a minor producer of the crops (Table I). However, relative to its population and economies, coconut production is a very important activity. Only Papua New Guinea produces significant quantities of palm oil (Table 2) and minor quantities of rubber latex.

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Trade in copra was the principal feature of the early development of many South Pacific countries and involved both subsistence smallholder and large-scale foreign-managed plantations. While the larger countries such as Papua New Guinea and Fiji have now diversified their economies, countries such as Western Samoa, Tonga, Cook Islands, Kiribati and Vanuatu are still dependent on the sale of copra for export income (Ward and Proctor 1980).

Table 2. Productivity of plantation crops ('000 t) in 1987 in Southeast Asia and the South Pacific.

	Rubber (latex)	Coconut (copra)	Oil palm (oil)
Southeast Asia	3 682	5 105	6371
Burma	15		
Indonesia	1000	2 200	1 698
Malaysia	1 580	197	4533
Philippines	150	2386	25
Thailand	860	205	115
Vietnam	57	109	–
South Pacific,		409	158
Cook Islands	–	1	–
Fiji	–	13	–
French Polynesia	–	14	–
Kiribati	–	12	0
Marshall Is. and Micronesia	–	25	–
New Caledonia	–	1	–
Papua New Guinea	1	198	139
Western Samoa		34	–
Solomon Islands	–	47	19
Tonga	–	8	
Vanuatu	–	53	0

Source: FAO (1988) and APCC (1987).

The production systems employed vary among crops and between regions and this may influence acceptance of forage improvement. The dominant mode of production of palm oil in Southeast Asia is from large estates, often over 1000 ha; these may be managed by government or private interests. Only in Malaysia and Thailand are there significant commercial independent smallholdings (Barlow 1985).

The system of production of rubber is different as approximately 82% of rubber plantations in Southeast Asia are managed by smallholders. These holdings are less than 25 ha compared with the average estate holdings in Indonesia and Malaysia of approximately 600 ha (Barlow 1983). However, a significant proportion of the Malaysian smallholdings are managed as large blocks in government-coordinated land development schemes. This has enabled the standards of management to be closer to that achieved by the large estates.

We have no precise figures on the proportions of smallholder and estate-managed coconut plantations. However, smallholder involvement is high.

The future prospects for the three plantation commodities is mixed. There is little doubt that the future international demand for fats and oils will rise substantially, and for this reason continued expansion of the area and production of palm oil is anticipated, particularly in countries such as Thailand (Barlow 1985). However, the actual result will depend on the availability and price of competing oils, especially soybean, and on the share of palm oil in the total supply of all other oils and fats (Barlow 1985).

As with palm oil, the future of rubber and potential for expansion will depend on movements in international demand and prices. Following many years of growth, production and consumption of natural rubber has remained relatively stable during the 1980s (Barlow 1983) although there has been a recent increase in demand (Anon. 1989). Increases in the productivity per unit area following adoption of improved technology and management can be expected, especially in the smallholder sectors of Indonesia and Thailand where farmers are becoming more commercially minded (Barlow 1983).

The history of coconut development in Southeast Asia and the South Pacific is similar to that of rubber and oil palm, in that international trade of the commodity commenced about 1850 (Purseglove 1972). In contrast to rubber and oil palm, there has been little expansion in the area planted to coconuts since World War II. As with the other crops, world demand fluctuates, but lower profitability compared to the other crops has dictated little recent expansion or uptake of improved varieties or management. Consequently, many coconut plantations now comprise ageing stands of lower-yielding palms, and managers are experiencing reduced productivity. There has also been a general thinning of stand density, especially in the Pacific region, where destructive cyclones have occurred. The future of coconuts is therefore less certain than the other two crops.

Ruminant Industries

Livestock numbers

Ruminant livestock have been a significant historical component of the agricultural sector in Southeast Asia where they are a source of meat for human consumption and of power for transport and agriculture. Current estimates of numbers show a majority of large ruminants in the region, especially cattle (28 million), with only Indonesia possessing significant numbers of small ruminants (18.2 million) (Table 3).

Table 3. Ruminant density ('000 head) in 1987 in Southeast Asia and the South Pacific.

Country	Cattle	Buffalo	Sheep	Goats
Southeast Asia	28 003	18000	5 801	16925
Burma	9912	2 188	300	1 136
Indonesia	6 470	2 994	5 300	12 900
Malaysia	620	245	75	347
Philippines	1 695	2 857	30	2 027
Thailand	4931	6 350	73	80
Vietnam	2 775	2 666	22	432
South Pacific	586	0	7	128
Cook Islands			–	3
Fiji	159	–		59
French Polynesia	7		2	3
Kiribati			–	
Marshall Is. and Micronesia	12			4
New Caledonia	122	–	3	19
Papua New Guinea	123	–	2	17
Western Samoa	27	–	–	0
Solomon Islands	23			0
Tonga	8	–		11
Vanuatu	103	–	–	12

Source: FAO (1988).

Meat consumption projections for Southeast Asia point to a steadily increasing demand for meat which is likely significantly to outstrip production by the year 2000 when self-sufficiency may decline to 62%. This decline in self-sufficiency is expected despite a projected fourfold increase in the level of regional meat production (Remenyi and McWilliam 1986). Demand is being increased by rising living standards and a shift towards urban living.

In contrast to the Southeast Asian region, traditional subsistence animal production in the Pacific region is based on pigs and chickens. There is no tradition of ruminant animal production.

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).

Total numbers of ruminants in the Pacific region are small by comparison with Southeast Asia, but nevertheless they are significant in terms of the local economies, especially in Fiji, Papua New Guinea, New Caledonia and Vanuatu (Table 3).

As for Southeast Asia, meat production does not meet local demand which is rising dramatically as incomes increase (Ward and Proctor 1980). An exception is Vanuatu, where a modest export industry is being developed.

The ownership patterns for livestock are quite different to those operating for the plantation crops. In Southeast Asia, ruminants are largely in the hands of smallholders. In the Pacific, the majority are held on larger estates, either government or privately owned.

The production systems of the two regions are also entirely different. In Southeast Asia, the proportion of permanent pasture relative to arable land and total livestock numbers is small (Table 4), necessitating high stocking rates and close integration of animals with cropping systems. Farmers therefore rely heavily on crop residues and communal grazing land for feed supply, but it is not normal practice to grow forages. Farmers in Southeast Asia, who have a long history of management of ruminants, keep animals for agricultural as well as for social reasons, and are often not completely commercial in their outlook. These factors have implications for acceptance of pasture improvement technology as will be discussed later in these Proceedings.

Table 4. Comparative agricultural land use ('000 ha) in some Southeast Asian and South Pacific countries in 1987.

Countries	Arable	Tree crops	Permament pasture	Forest
Burma	9 574	486	362	32 385
Indonesia	15 800	5 420	11 800	121 494
Malaysia	1 040	3 340	27	19580
Philippines	4 530	3 400	1200	10950
Thailand	17810	2 240	750	14415
Vietnam	5915	555	315	12 950
Total (ha)	54 669	15441	14454	211774
(%)	18	5	5	71
Cook Islands	1	5		
Fiji	152	88	60	1185
French Polynesia	5	70	20	115
Kiribati	37			2
Marshall Is. and Micronesia	25	34	24	40
New Caledonia	10	10	277	708
Papua New Guinea	31	355	86	38 250
Western Samoa	55	67	1	134
Solomon Islands	40	17	39	2 560
Tonga	17	31	4	8
Vanuatu	20	125	25	16
Total (ha)	393	802	536	43018
(%)	1	2	1	96

Source FAO (1988).

The Pacific countries with their small populations are relatively well endowed with land. Cattle are therefore grazed largely on permanent pastures, either naturalised or improved in a 24-hour grazing system. The larger holdings are managed as Western-style grazing ranches or integrated in coconut plantations. Almost all smallholder cattle are grazed under coconuts. The standards of animal husbandry vary greatly among both groups.

Prospects for Increased Integration of Ruminants in Plantation Crops

The trends towards higher ruminant populations and increased meat consumption will require a greatly increased forage supply. Remenyi and McWilliam (1986) suggested the need for a doubling of forage supply over the 15 years to the year 2000. One obvious source of naturally occurring forage and of land for improvement of forage supply is the area under plantation crops.

The potential benefits of integration of forages under plantation crops are well known and some have already been outlined. However, the suitability of the three crops for integration with ruminant production varies. Rubber and oil palm have shorter life cycles than coconuts and planting configurations of the former are such that the period of high light penetration to understorey vegetation is short. This has implications for the duration of forage supply, a topic that will be discussed during this workshop.

Nevertheless, in Malaysia, the arguments for greater integration of ruminants in rubber and oil palm plantations are persuasive. The country produces only 15% of mutton and 55% of beef supplies, and consumption is expected to increase to 12 500 and 50 000 million t respectively by the year 2000 (Wan Mohamed et al. 1987). The same authors suggest that current feed reserves including forages and by-products from plantation crops are capable of supporting more than 1 million cattle or 6 million sheep; and that the progressive plantation sector is sufficiently skilled to integrate livestock to take advantage of diversified income sources and reduced costs of chemical weed control.

Coconut plantations, especially those utilising traditional tall varieties, are more long-lived and more open in their structure, and therefore long-term ruminant production is sustainable.

Smallholder involvement in coconuts is also common so that opportunities for combining livestock under coconuts are more directly relevant to this sector, especially in the Pacific (Shelton et al. 1986). The need for diversified income is also greater with coconuts because of its lower profitability, especially as plantations age and productivity declines.

Intensive commercial ruminant production under plantation crops will require the sowing of productive high-quality forage species which are able to persist under grazing in shaded environments. While considerable progress has been made in the identification of suitable species, especially for coconuts (Reynolds 1988), we believe there is scope for further selection, among world forage germplasm collections, of improved genetic material suitable for the variety of environments that may be found under plantation crops. To improve our chances of success, we must increase our understanding of the biology of shade adaptation.

Improved forage supply is only one aspect of successful integration of ruminants and plantation crops. We also need to understand the animal production parameters of ruminants grazing in plantations so that new developments will be based on sound economic analysis from realistic estimates of productivity.

As research biologists interested in promoting rural development based on the adoption, by conservative producers, of new forages or perhaps even totally new production systems, we must not forget that many other socioeconomic factors may influence the decisions of farmers. Factors such as marketing infrastructure, land tenure, social attitudes, management expertise and availability of credit and information may have a critical influence.

We look forward to a full and open discussion of all of these issues during the workshop.

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