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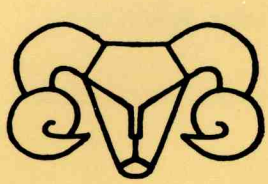
Small Ruminant Production Systems in South and Southeast Asia

Proceedings of a workshop held in Bogor, Indonesia, 6–10 October 1986



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Small Ruminant Production Systems in South and Southeast Asia

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Editor: C. Devendra

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Abstract This publication presents the results of a meeting held in Bogor, Indonesia, 6-10 October 1986, that focused specifically on the assessment of small ruminant production systems in South and Southeast Asia. It considered the prevailing circumstances, the innovations, and the strategies that are pertinent for stimulating increased productivity from goats and sheep. The present patterns of production were examined in detail with reference to characteristics of the small farms, existing management methods, and nature and components of the production systems. These systems include extensive systems, systems combining arable cropping, and systems integrated with tree cropping. The discussion of the systems were further highlighted by country case studies, issues and policies that considered the available production resources, especially the genetic and feed resources available, constraints to production, and potential means to achieve desirable improvements. An important session was devoted to examining research methodology, strategies for development appropriate to individual systems, and a conceptual framework for on-farm economic analysis. Together, these discussions enabled a definition of research protocols and the priorities for future direction that are likely to have a major impact on productivity from small ruminants.

Résumé L'ouvrage présente les conclusions d'une réunion tenue à Bogor, en Indonésie, du 6 au 10 octobre 1986, portant sur l'évaluation des systèmes de production touchant les petits ruminants en Asie du Sud et du Sud-Est. On y a brossé un tableau de la situation actuelle, des innovations et des stratégies susceptibles d'accroître la productivité dans l'élevage de la chèvre et du mouton. On a examiné en détail les méthodes actuelles de production dans la perspective propre aux petits exploitants, les éthodes actuelles de gestion, le type de systèmes de production et leurs éléments. Il s'agit ici des systèmes extensifs, des systèmes associant la culture des terres, et des systèmes intégrant la sylviculture. Les discussions ont été étayées d'études de cas, de problèmes et de politiques émanant des divers pays et portant sur les ressources disponibles pour la production, spécialement les ressources génétiques et fourragères, les contraintes à la production, et les possibilités d'amélioration qui existent. Une importante session fut consacrée à l'examen de la méthodologie de la recherche, des stratégies de développement convenant à chaque système, et d'un cadre conceptuel pour l'analyse économique des activités sur le terrain. Toutes ces réflexions ont permis de définir des plans de recherche et d'établir les priorités qui, dans l'avenir, auront vraisemblablement un impact majeur sur la productivité liée à l'élevage des petits ruminants.

Resumen Esta publicación presenta los resultados de la reunión celebrada en Bogor, Indonesia del 6 al 10 de octubre de 1986, cuyo temp principal fue la evaluación de los pequeños sistemas de producción de rumiantes en el

Sur y Sureste asiático. En la misma se analizaron las circunstancias imperantes, las innovaciones y las estrategias pertinentes para estimular la mayor productividad del ganado caprino y ovino. Se examinaron detenidamente los patrones actuales de producción con respecto a las características de las pequeñas granjas, a los métodos de manejo existentes y a la naturaleza y componentes de los sistemas de producción. Estos sistemas incluyen sistemas extensivos, sistemas que combinan el cultivo de tierras arables y sistemas integrados con plantaciones de árboles. La discusión de estos sistemas estuvo acompanada del análysis de etudios de casos en diferentes países, así como de problemas y políticas relacionados con los recursos de producción disponibles, especialmente los recursos genéticos y alimenticios disponibles, las limitantes de la producción y los posibles medios para obtener las majoras deseadas. Una importante sesión estuvo dedicada a examinar la metodología de las investigaciones, las estrategias para el desarrollo apropiadas para cada sistema individual, y un marco conceptual para la realización de análisis económicos en las granjas. En su conjunto, estas discusiones permitieron definir los protocolos de investigación y las prioridades para el futuro, que probablemente habrán de tener importantes repercusiones sobre la productividad de los pequeños rumiantes.

CONTENTS

INTEGRATION OF SMALL RUMINANTS WITH RUBBER AND OIL PALM CULTIVATION IN MALAYSIA

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Abstract *The feasibility of integrating small ruminants with oil palm and rubber cultivation is reviewed in relation to the resources that are available within the plantation sector. Earlier reports and current progress suggest that sheep are more compatible than goats when reared under a semi-intensive system in oil palm and rubber areas. In view of this, sheep are being experimented with on a large scale and preliminary results are very promising. A lambing rate of about 80%, with 85% singles and 15% twins, is obtained with 8-month lambing intervals. Growth of crossbreds has been most encouraging, with a daily gain of up to 120 g recorded when the lambs are supplemented with concentrate feeds. However, the experiences strongly highlighted the lack of technical information in the industry. These constraints are discussed with the view of achieving a rapid development in integrated small ruminant production systems in Malaysia.*

Malaysia has achieved self-sufficiency in the production of eggs, poultry, and pork. However, enhanced development in animals and the dairy industry is currently being actively pursued. This is in view of a projected increase in demand with an improved standard of living, an increased population, and requirements for a wider choice of meats. Several livestock-production systems have been investigated and the results, which show the development of livestock through integration with plantation crops such as rubber and oil palm, are very promising. This paper reviews the status, concept, progress, and constraints in the development of integrated livestock-production systems, with particular reference to goat and sheep production.

STATUS OF SMALL RUMINANTS

Goats and sheep are synonymous to the small ruminant industry in Malaysia. It is often described as a small, disorganized enterprise mainly because the animals are reared by smallholders with 1-2 ha of land. The farm is characterized by small flock size with low levels of productivity. This is particularly so because most farmers are agriculturists and the limited available land is usually "prioritized" for crop cultivation. This leaves the remaining area, if any, for livestock production. Under these circumstances, goats and sheep survive mainly by foraging crops and pastures in and around villages, wastelands, irrigation banks, roadsides, or crop areas.

These situations, coupled with lack of support and basic infrastructures, adversely affect the growth of the industry: over the last 20 years, the population has dropped slightly for goats and increased slightly for sheep (Table 1). Both goats and sheep, however, have a long association with the Malaysian rural economy. Furthermore, the importance of small ruminants is exemplified in demand and in recent developments in the production system. Demand is significantly large and is projected to increase substantially during the next 15 years (Department of Veterinary Services 1984). Based on a price of about MYR 12.00/kg carcass weight (in 1986, 0.772 Malaysian ringgits (MYR) = 1 United States dollar (USD)), the small ruminant industry is projected to grow from its present value of about MYR 80 million to MYR 136 million by the year 2000 (Table 2). Recent developments in the production system suggest that sheep and, to a lesser extent, goats may be integrated with the cropping system.

CONCEPT AND POTENTIAL OF INTEGRATION

The integrated or "zero-land" livestock-production system was formally discussed in Malaysia in the late 1970s (Abraham et al. 1978). The concept is to develop the livestock industry without having to depend on new land for pasture production. In this context, it may be defined as exploitation of untapped or underutilized resources within the present set-up for the production of livestock.

The resources and their direct and indirect relationship with the development of livestock industry is illustrated in Fig. 1. The primary objective is to establish a cost-efficient

and effective production system for crops as well as animals. The system (Fig. 1) demonstrates that the feeds, which are the most critical factor in ruminant production, may be made available at a lower cost than the conventional, monoculture animal-production system. These potential feed resources may be categorized as undergrowth, cultivated pastures, and agro-by-product.

Table 1. Goat and sheep population (x 10^3) in Peninsular Malaysia, 1965-1984.

Year	Goats	Sheep
1965	308	37
1970	333	38
1975	329	45
1980	312	59
1984[a]	274	60

Source: Malaysia Department of Statistics.
[a] Interim values.

Table 2. Current and projected demand and value of beef and mutton in Malaysia.

	Cattle/buffalo			Sheep/goat		
Year	Demand (t)	Head (x10^3)	Estimated value (MYRx10^6)	Demand (t)	Head (x10^3)	Estimated value (MYRx10^6)
1985	27530	157.3	275.3	6735	500	80.8
1990	33500	191.3	335.0	8015	600	96.2
1995	40000	228.6	400.0	9540	710	114.5
2000	50000	285.7	500.0	11350	840	136.3

Source: Department of Veterinary Services (1984).

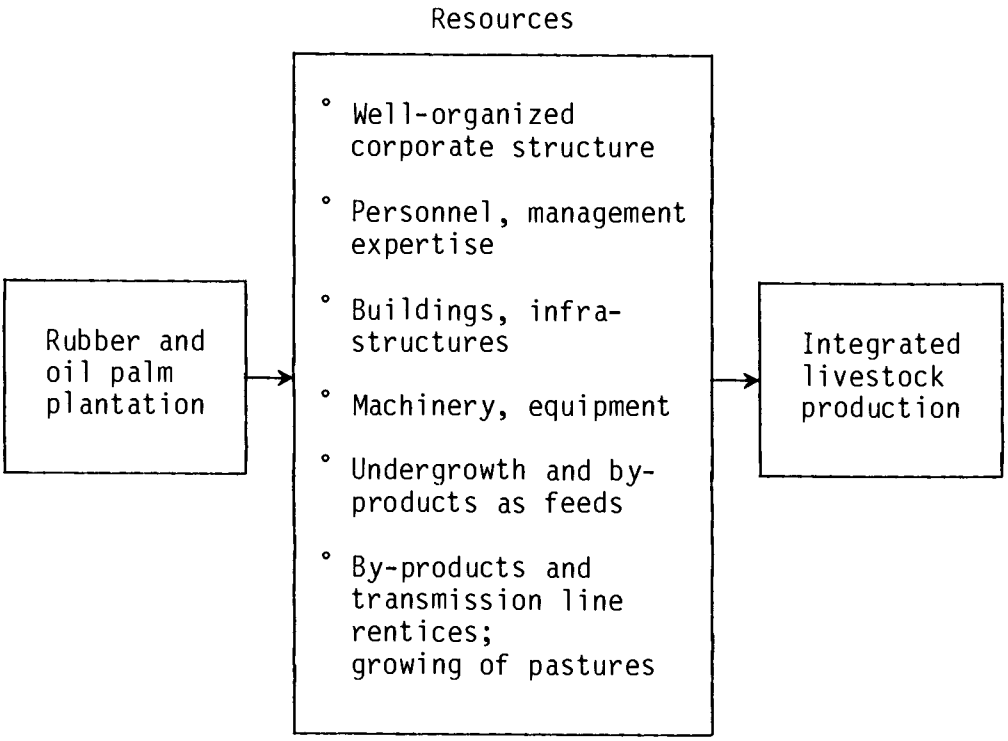

Fig. 1. Available resources in the plantation industry.

Undergrowth

The undergrowth or ground vegetation forms part of the ecosystem of oil palm and rubber cultivation. This complex mixture of flora is generally classified under cultivated leguminous covers, grasses, and broad-leaved plants.

The botanical composition, yield, and quality of undergrowth is constantly changing because of the tremendous influence of many interacting factors. These factors include agronomic management, types and ages of main crops, soil types, rainfall, and terrain. A clear distinction in botanical composition is commonly observed between the estate and the smallholding because of differences in agromanagement practices. For example, the cultivation of cover crops in the ratio of 3:3:1:1 (*Pueraria javanica* - *Calopogonium muconoides* - *Calopogonium caeruleum* - *Centrosema pubescens*) is carried out by all estates but not by smallholders. This could be substantiated by earlier assessment showing the ground vegetation

under estate management to have a higher percentage of leguminous cover than smallholding ground vegetation, particularly where the trees are less than 5 years old (Wan Mohamed 1977).

The age of the tree crop has also been shown to have a marked influence on the botanical composition of ground cover in both the oil palm (Fig. 2) and rubber (Fig. 3) plantations. The cultivated legume covers (excluding C. caeruleum) tend to decline and account for less than 20% of the total herbage yield about 3 years after planting. Besides botanical composition, the dry matter yield declines rapidly when the rubber is more than 3 years old (Fig. 4). A similar trend was reported for the ground vegetation under oil palm (Chen and Othman 1983). This is due to shading by the tree crop, which reduces the photosynthetically active radiation reaching the ground vegetation.

Although more experimental evidence is required to optimize undergrowth utilization, Mahyuddin et al. (1978) and Devendra (1982) noted that Malaysia's demand for lamb and

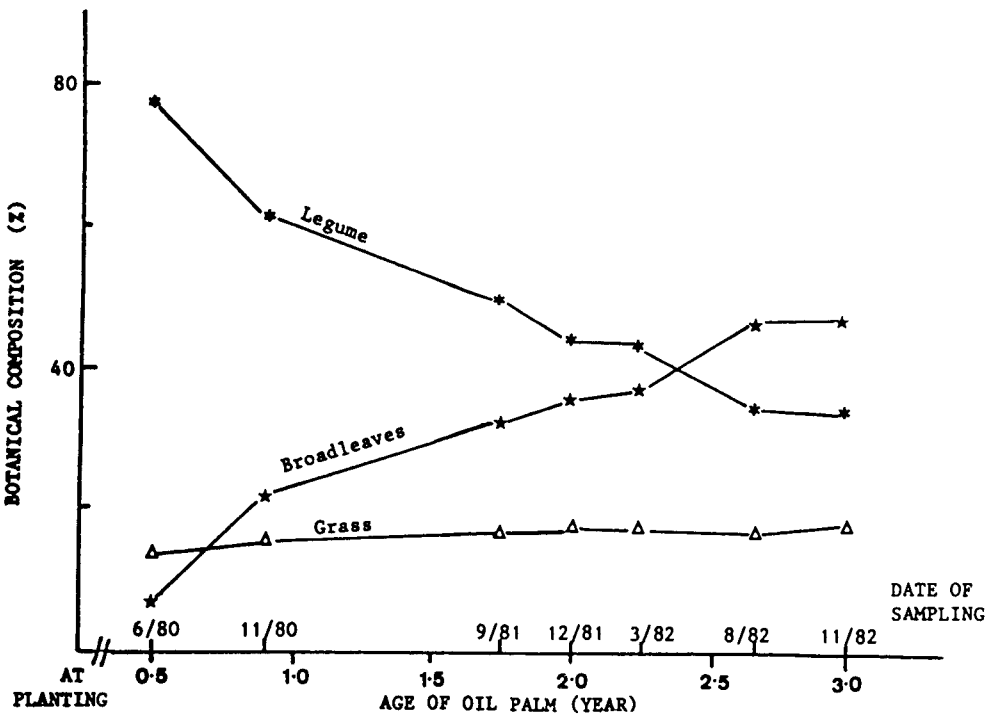

Fig. 2. Changes in botanical composition in relation to age of oil palm (adapted from Chen and Othman 1983).

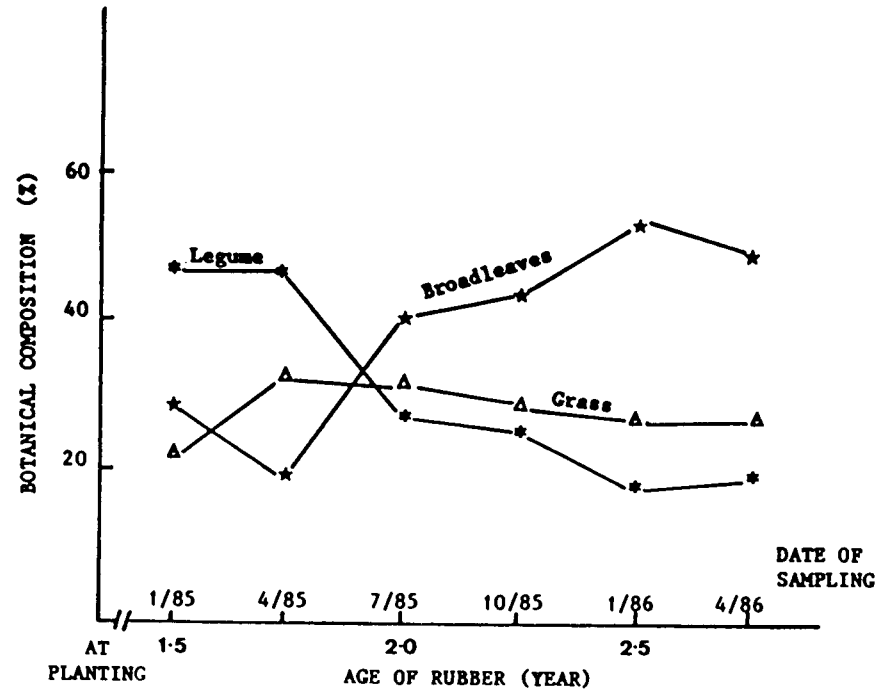

Fig. 3. Changes in botanical composition of ground vegetation in relation to age of rubber.

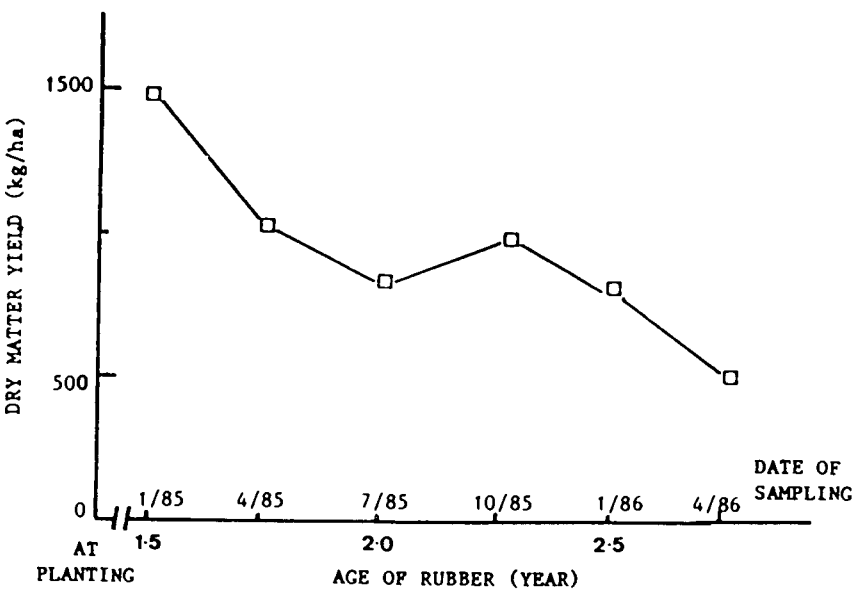

Fig. 4. Dry matter availability of ground vegetation in relation to age of rubber.

mutton could easily be met by using the herbage under 2.8 x 10^6 ha of rubber and oil palm.

Cultivated Pastures

Pasture cultivation under an integrated system is mainly aimed at achieving specific objectives such as

- Production of fat lambs or fattening of store lambs before finishing;
- To optimize the use of land that is not cultivated with tree crops; and
- To optimize the use of rubber and oil palm effluent as a primary source of fertilizer, thereby increasing stock-carrying capacity and reducing costs of effluent treatment.

These considerations, however, are suitable only for estate operation where land is not limited or utilized for specific reasons. For example, a census of Kumpulan Guthrie's Estates, one of the biggest plantation companies in Malaysia, showed 1.25% or about 1050 ha of the total area was not cultivated because of a number of factors (Table 3). Assuming that 50% (525 ha) of the uncultivated area is suitable for pastures (average annual yield, 20,000 kg/ha), an additional 15,000 to 20,000 sheep or goats may be produced annually.

Table 3. The status and size of vacant land in Kumpulan Guthrie, Malaysia.

Status	Size (ha)	Percent
Vacant (no reason)	442.8	41.12
Powerline rentices	140.0	12.90
Swamp	410.0	38.05
Acid sulphate	84.2	7.93

The other important consideration for pasture cultivation under an integrated livestock-production system is the use of rubber and oil palm effluent as fertilizer. Our trials at Guthrie Research Chemara (GRC) (Pillai and Tan 1977) showed highly satisfactory dry matter and crude protein yields from two grass varieties fertilized with rubber skim and mixed effluents (Table 4). Work on the use of oil palm effluent in pastures is in progress and preliminary results are promising (GRC 1986).

Table 4. Effects of rubber skim and mixed skim effluent on annual dry matter (DM) and crude protein (CP) yield (kg/ha) of napier grass (Pennisetum purpureum) and star grass (Cynodon plectostachyus).

Grass variety	Treatment	DM	CP
Napier grass	No fertilizer	16850	3020
	Compound fertilizer[a]	42380	6950
	Skim effluent[b]		
	10 mm RE[c]/month	51550	10100
	20 mm RE/month	50400	10500
	30 mm RE/month	57200	12450
Star grass	Compound fertilizer[a]	33800	4220
	Mixed effluent[b]		
	25 mm RE/month	42600	6600
	50 mm RE/month	46100	7600

Source: Pillai and Tan (1977).

[a] N-P_2O_5-K_2O, 17:8:17, at an annual rate of 6400 kg/ha (napier grass) or 5540 kg/ha (star grass).

[b] Skim effluent (kg/ha): N,667; P_2O_5,91; K_2O,610; MgO,18; CaO,16. Mixed effluent: N,150; P_2O_5,30; K_2O,130; MgO, 16; CaO,40.

[c] Rain equivalent.

Agroby-product

The potential and availability of agroby-products as animal feed have been extensively reviewed by a number of workers (e.g., Devendra 1978; Hutagalung 1978; Jaafar and Khusahry 1983; Lim 1983); the most significant potential is in the oil palm industry. This is mainly because of the amount of by-products produced annually. A diagramatic illustration of oil palm yield and its derivatives is presented in Fig. 5. Palm press fibre (PPF), palm oil mills effluent (POME), and palm kernel cake (PKC) form the most important source of feed. Realizing the area of land under oil palm production, the potential availability of oil palm by-products during the next 5 years is high and, therefore, important in supporting the growth of the animal industry (Table 5).

COMPATIBILITY AND PROGRESS OF INTEGRATION

The potential and compatibility of integrating small ruminants with oil palm and rubber cultivation have been stressed on numerous occasions. These topics were given particular attention during the seminar on integration of animals with plantation crops, held in Penang, Malaysia, in 1978.

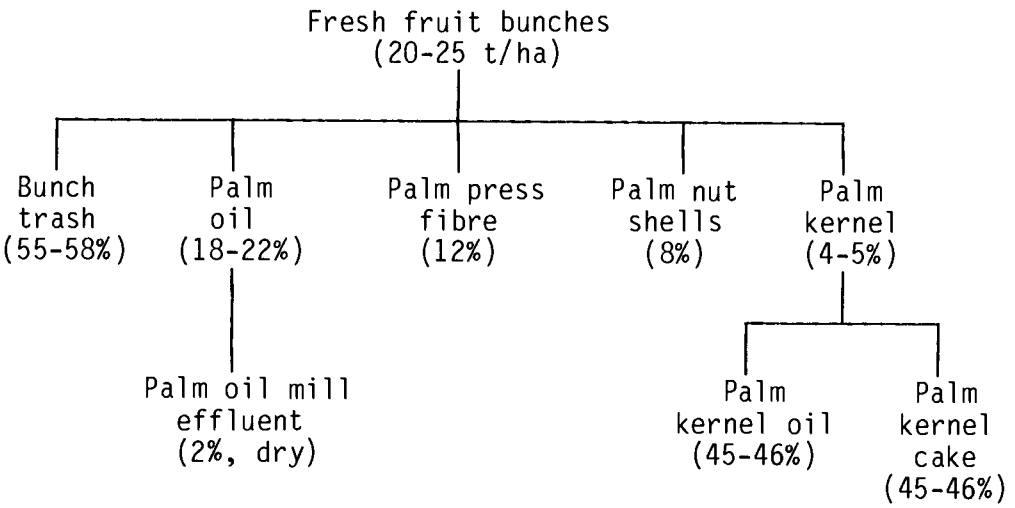

Fig. 5. Principal products and by-products of oil palm fresh fruit bunches.

Table 5. Estimated availability (t) of oil palm by-products in Malaysia, 1986-1990.

Year	By-products[a]		
	PKC	POME	PPF
1986	560	88	2750
1987	600	96	3000
1988	650	104	3250
1989	700	112	3550
1990	770	120	3750

Source: R.I. Hutagalung, University Pertanian Malaysia, Serdang, Malaysia, personal communication, 1986.

[a] PKC, palm kernel cake; POME, palm oil mills effluent; PPF, palm press fibre.

From 1975 to 1981, the Rubber Research Institute of Malaysia (RRIM) evaluated goats reared under rubber cultivation. Their biological performance (Table 6) is comparable with those reared under monoculture systems; however, their compatibility with tree crops depends largely on the type of management. The semi-intensive system (a system that is commonly practiced in Malaysia where the animals are herded to graze during the day and back to the homestead (shelter) in the evening) is not very suitable because

- Goats tend to graze and browse over wide areas; a permanent paddock system is costly because of a low carrying capacity, the cost in herding and mustering the animals is high;
- Damage to young areas, particularly debarking of rubber trees and browsing of palm fronds, is common; and
- Where goat is suitable, e.g., under mature areas, the ground vegetation is sparse and, therefore, a larger area and more labour are required to muster the animals.

Because of these limitations, alternative systems such as stall or semistall feeding must be investigated.

Table 6. Reproductive performance of goats under two systems of production.

Biological index	Integration[a]	Monoculture[b]
No. of offspring per dam per year	1.75	1.65
Kidding intervals (days)	259	259±22
Single kids (%)	79.4	35.5
Multiple kids (%)	20.6	64.5
Birth weight (kg)	1.34	1.50
Daily weight gain (g) up to 3 months	77.5	66.7
Kid mortality	31.2	NA

Note: NA, not available
[a] Mean from two farms. Source: Lee et al. (1978).
[b] Source: Devendra (1983).

Sheep have been reported to be more compatible with rubber and oil palm cultivation than goats. Earlier work by the RRIM with farms ranging from 20 to 400 breeding ewes (Wan Mohamed 1977, 1978, 1982; Tan and Abraham 1982; Wan Mohamed and Hamidy 1983) showed that sheep are not only useful in complementing the use of herbicides and reducing costs of weeding, but also in increasing returns per unit area of land. In view of this, Kumpulan Guthrie pioneered a large-scale research and development investigation in integrated sheep-production systems. Two upgrading and multiplication farms, each with 1000 breeding ewes, were established between 1984 and 1985.

The results over 18 months have been most encouraging. Parturition and lamb performance (Table 7) are comparable with earlier reports by RRIM. Singles were most common and

Table 7. Parturition and lamb performance index between mid-1984 and March 1986.

	Locals, May 1984[a]	F_1 crossbreds			
		Feb. 1985[a]	July 1985[a]	Oct. 1985[a]	March 1986[a]
Ewes tupped	NA	580	470	650	455
Births	439	427	371	529	325
Lambing (%) (normal births)	NA	73.6	78.9	81.4	71.4
No. of lambs	474	445	379	565	333
Singles	404	365	317	437	283
Twins	70	80	62	128	50
Prolificacy (%)[b]					
Singles	92.0	90.6	91.6	87.9	85.0
Twins	8.0	9.4	8.4	12.1	15.0
Birth weight (kg)	1.32	2.06	2.29	2.36	2.15
Singles	1.46	2.18	2.39	2.42	2.55
Twins	1.10	1.46	1.55	1.67	1.61
Mortality (%) (preweaned)	67.3	23.8	6.1	4.1	1.8
Singles	63.4	20.0	4.4	1.8	0.7
Twins	90.0	41.3	14.5	11.7	8.0
Stillbirths	33	21	12	11	16
Abortions	17	3	2	10	5

Note: NA, not available.

[a] Lambing period.

[b] Prolificacy = $\frac{\text{no. of single or twin births}}{\text{total births}}$.

accounted for about 85% of the total births. A significant improvement in lamb birth weight and survival rate were obtained with crossbreeding and improved management. Growth of F_1 crossbreds is most encouraging and far superior than that of the local indigenous breed. Furthermore, the crossbreds were found to be responsive to supplementation with high-energy diets (Fig. 6) and may be "finished" at an age of about 8-10 months.

CONSTRAINTS AND SUGGESTION IN INTEGRATION

The constraints of integration are somewhat similar to the development of small ruminant industry in Malaysia. They are very evident in all aspects of production and marketing.

Breeding and Selection

The genetic resources of our goat and sheep populations are too limited for a rapid development of the industry. The lack of official breed characterization, especially in the case

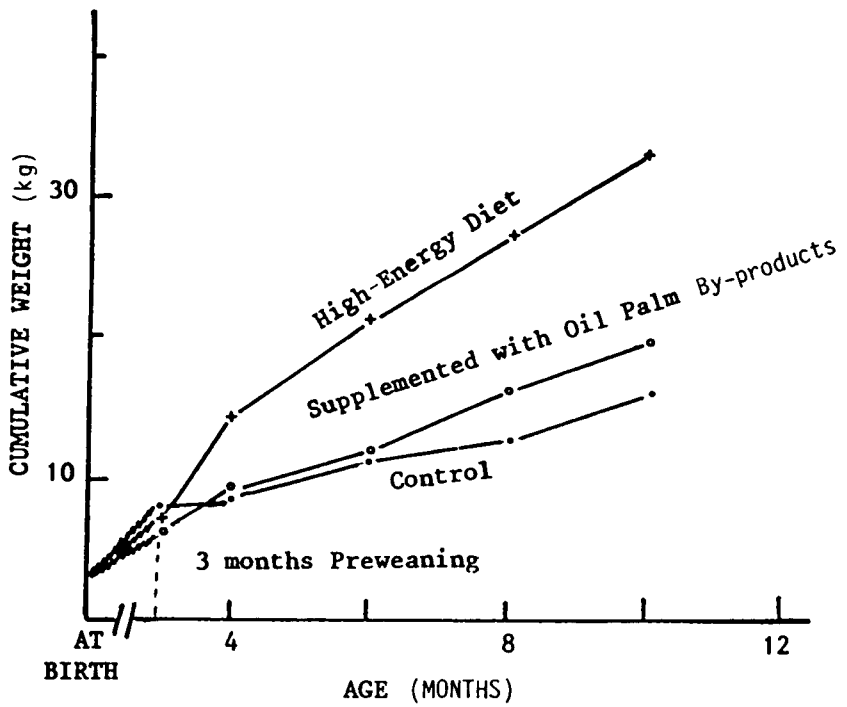

Fig. 6. Growth of F_1 crossbred with three types of supplemented feeds.

Table 8. Factors affecting availability and utilization of feed and feed resources with integration.

Feed and feed resources	Availability, production	Utilization
Ground vegetation	Reduces rapidly with increasing age of tree crops	Not accessible to stock when trees/palms are young
	Competition with animals from neighbouring farms	Herbicide spray of tree crop planting rows
	"Wide" area of coverage, thus reducing grazing time, increasing security risk, and wasting energy and time in herding and mustering	Rat baiting (only under oil palm)
Cultivated pastures	The suitability of pasture species	No major problems
	Availability and distribution of nonutilized lands	
	Availability and distribution of rubber and oil palm effluents for pastures	
Agroby-products	No major problems	Low-quality, particularly PPF and POME
		High copper concentration in PPF, POME, and PKC, which leads to copper toxicity problems

of sheep, is hampering the national breeding policy and breeding programs. Also, the availability of does and ewes is limited and, therefore, selection for breeders is based on availability rather than quality. The other factor that limits the progress of upgrading and multiplication is the choice of exotic sire breeds. Little attention is given to this factor and, therefore, potential breeders are subjected to high risk factors.

Health and Diseases

Health is one of the most important areas that affects small ruminant production. Losses because of ill health and disease have not been quantified in economic terms, but the experiences at Guthrie's Estates (Wan Mohamed 1986) showed major problems in endoparasites and ectoparasites, pneumonic pasteurellosis, enterotoxemia, meliodiosis, Escherichia coli, contagious karatoconjunctivitae (pink eye), and contagious ecthyma. Pneumonic pasteurellosis is most common and causes the high mortality among lambs and newly purchased adults.

Treatment of bacteria-related diseases such as pneumonic pasteurellosis using antibiotics often fails to give satisfactory results. This is due to the difficulties in identifying the affected animals during early stages of infection. Because of this, a national flock health and disease-prevention program must be introduced. Vaccination to combat common diseases has to be examined to prevent potential losses.

Feed and Feed Resources

The availability and management of feed and feed resources are critical in integration. For example, the ground vegetation that forms the primary source of feed in semi-intensive systems of production is highly variable in terms of quality and yield. The problem is more acute in the smallholdings and small estates (<250 ha), where the tree crops are generally planted in one phase.

Although the problem is less critical under estate operation, the availability and utilization of feed and feed resources is considered critical to production. Some of the major problems are described in Table 8. Intensive research involving feeding of oil palm by-products to small ruminants is essential.

Processing, Advertising, and Marketing

Apart from the establishment of abattoirs in some areas of the country, other strategies such as processing, marketing, and public campaigns have not significantly increased consumption. Therefore, to stimulate and promote sustained growth of the small ruminant industry, the country has to formulate concerted efforts in marketing.

CONCLUSIONS

The "zero land" or integrated livestock production system offers exciting possibilities in the development of an efficient and productive farming system in Malaysia. However, large-scale development of the industry under integration will have to be preceded by sound practical field research and development programs. An area that urgently requires examination is the problem of disease, especially as related to large farm operations. Metabolic and other health problems that are related to feeding of oil palm by-products should also be given priority. Earlier reports and current progress, however, suggest that sheep and, to a lesser extent, goats may be successfully integrated into the rubber and oil palm industry.

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