

# Supplementation of Sheep under Rubber in Indonesia

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## Abstract

Feed supplementation, either continuous or strategic, increased litter size, weight of the litter at weaning and reduced lambing interval. Supplementation also increased lamb growth rates and improved the efficiency of feed utilisation. However, supplementary feeding is not always economically feasible. Some important constraints to the integration of sheep with rubber plantations are discussed.

THE integration of sheep into rubber plantations has been practised since the mid-1970s in Malaysia (Ani et al. 1985) with a rapid expansion of commercial production by both private and government-supported programs. However, the research component, essential to the success of the enterprise, has not kept up with the demands of this growing activity. In Indonesia, the concept of integration of sheep into rubber plantations has not left the research station. There are only scattered small flocks around the edges of the plantations with primitive or non-existent management systems. Large plantation companies still prohibit grazing or harvesting of forage under the trees, a regulation that appears more related to keeping people off the plantations than to the actual damage that those activities might cause directly to trees.

This paper reviews part of the research conducted on the animal component of the integration of sheep into the rubber plantations by institutions under the umbrella of the Agency for Agricultural Research and Development of Indonesia, in conjunction with the USAID Small Ruminant Collaborative Research Support Program (SR-CRSP) at Sei Putih, North Sumatra, since 1985.

## Sheep Breeds

Among the components that determine the productivity of sheep, one of the most important is the breed. In Indonesia, there are three major breeds of sheep: the Javanese Fat Tailed (JFT), concentrated in the eastern part of Java and neighbouring islands, which is used in free grazing and in cut-and-carry

systems associated with plantations (e.g. coffee): the Javanese Thin Tailed (JTT), including the Garut fighting sheep, from the western part of Java, used predominantly in cut-and-carry systems in areas of intensive agriculture and dense population; and the Sumatran Thin Tailed (STT) of the island of Sumatra, which is grazed around plantations and agricultural areas. Recently the SR-CRSP introduced the White Saint Croix sheep, a hair-type sheep, in an attempt to increase the rate of gain and size of local sheep. A hair type was chosen in order to improve coat characteristics and therefore sheep adaptation and productivity in these hot and humid conditions.

## Management of Sheep

The results presented here were obtained with STT sheep and crosses with the St Croix sheep, the two main breeds so far utilised at Sei Putih. The management system involves either free or rotational grazing during the day (0800 to 1600 hours) on the native forage under rubber plantations. The main species consumed are the grasses *Paspalum conjugatum*, *Ottobachloa nodosa*, *Cytococcum oxyphylum*, the legumes *Pueraria phaseoloides* and *Centrosema pubescens*, the forb *Mikunia cordata* and the leaves, fallen or from spontaneous plantules, of the main crop *Hevea brasiliensis*. After grazing, the animals return to traditional wooden barns with elevated slat floors, where most management takes place, including supplementary feeding, mating, lambing and weighing.

Post-lambing ewes and lambs stay indoors for a period of about two weeks, or until the lambs are strong enough to keep up with flock, and are fed cut forage from the plantations or from the introduced forage plots. Most animals receive feed supplementation according to the research protocols,

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either in individual stanchions or by group, usually after grazing. Salt and mineral blocks are available in the pens. Water is provided outside the barn and sheep have access to it before and after grazing. Two systems of mating are used. One flock (STT ewes only) is in a continuous mating system with rams mixed with ewes only in the barn. Another group (STT and St Croix crosses) is in a seasonal mating system, with four breeding times each year. Internal parasite control is performed approximately every four months on the whole flock, with extra drenching for the ewes at lambing and for the lambs at weaning time. Various commercial anthelmintics are utilised alternately.

### Productivity of ewes under continuous supplementation

A flock of STT sheep was acquired from surrounding villages and for the first three years ewes were divided into four groups receiving one of four daily levels of energy supplementation (0, 0.6, 1.0 or 1.4% of body-weight) provided by concentrates made of a mixture of rice bran, cassava meal, molasses, fish meal, urea and limestone (Reese 1988). A constant level of protein was maintained. Ewes were kept in a continuous mating system and semi-rotational day grazing in an 18-year-old rubber plantation (Clone Avros 2037), with an initial stocking rate of 6.7 ewes/ha.

Table I presents a summary of results from this experiment. As can be observed, energy supplementation progressively improved the overall productivity of the ewes, both per head and per weight of the ewe. This was achieved by means of increasing litter size and weight of the litter at weaning, while reducing lambing interval. Weight of the ewes post-partum, and possibly body condition, was also ameliorated with supplementation. The increases in litter size in STT ewes are possible due to the existence of a major gene that controls prolificacy (Bradford et al. 1986). In the absence of the gene, ewes will produce one and occasionally two lambs. But in its presence, the number of lambs will be

determined in part by the nutritional status. In general, large litter sizes are related to higher ewe productivity.

Although Reese (1988) initially reported that the highest level of supplementation gave good economic returns, a more detailed analysis (Sanchez et al. 1989) revealed that none of the supplementation levels provided economic gains as high as the non-supplemented group. The expensive ingredients used and the fact that feed was provided daily, regardless of the nutrient requirements, contributed to this outcome.

### Productivity of ewes on strategic supplementation

An alternative way to reduce the amount of supplementary feed is to give it when the ewes need it most, in periods of high nutrient requirements. To study this strategic supplementation, a flock of STT and FI STT x St Croix (SC) ewes bred to SC rams was used. The mating system was seasonal, four times per year, and the grazing was with a shepherd. A mixed supplement was given to ewes for the last six weeks of pregnancy and during the three-month lactation.

The results of this work are summarised in Table 2. Litter size was slightly increased with supplementation, but there were significant increases in the weight of lambs weaned per lambing and a reduction in the parturition interval. The combination of these effects resulted in increased productivity per ewe (+ 36%) and per weight of ewe (+ 20%) in the supplemented animals compared with the control animals on grazing only. Supplementation reduced the average lambing interval by raising the proportion of ewes lambing approximately every six months from 56 to 76% in STT ewes and from 45 to 68% in FI STT x SC ewes. Milk production and milk fat were increased by supplementation (Sanchez et al. 1990) which contributed to higher lamb weaning weights.

### Supplementation of lambs

An essential component of sheep production systems oriented to rapid marketing is rearing of lambs after weaning. The purpose of these growing trials with lambs was to search for supplementation methods that

Table 1. Productivity of Sumatran Thin Tailed ewes with increasing levels of feed supplementation. After Reese (1988).

Feed level (% BW)	Litter size	Lamb weight per lambing (kg)	Lambing interval (days)	Yearly lamb weight (kg)	
				per ewe	per kg ewe
0	1.32 <sup>a</sup>	11.1 <sup>ab</sup>	219 <sup>a</sup>	19.0 <sup>a</sup>	0.92 <sup>ab</sup>
0.6	1.37 <sup>a</sup>	9.8 <sup>a</sup>	198 <sup>b</sup>	18.2 <sup>a</sup>	0.83 <sup>a</sup>
1.0	1.42 <sup>a</sup>	12.5 <sup>b</sup>	194 <sup>b</sup>	23.6 <sup>b</sup>	1.01 <sup>bc</sup>
1.1	1.83 <sup>b</sup>	13.2 <sup>b</sup>	193 <sup>b</sup>	25.1 <sup>b</sup>	1.13 <sup>c</sup>

Values within columns with different superscripts are significantly different ( $P < 0.05$ ).

**Table 2.** Productivity of ewes on strategic supplementation.

Treatment	Ewe breed	Lamb breed	Litter size	Lamb weight per lambing (kg)	Lambing interval (d)	Yearly lamb weight per ewe (kg)	Yearly lamb weight per ewe (kg)
Control	STT <sup>1</sup>	F1 <sup>2</sup>	1.20	9.5	2.50	14.3	0.68
	F1	BC <sup>3</sup>	1.35	10.0	232	16.9	0.65
Supplemented	S-l-l-	F1	1.41	9.7	213	16.9	0.76
	F1	BC	1.37	14.5	223	24.1	0.84
Probabilities							
treatment			ns	0.001	0.05	0.001	0.05
genotype			ns	0.001	ns	0.001	ns

<sup>1</sup> Sumatran Thin Tailed Sheep

<sup>2</sup> F1 cross of Sumatran Thin Tailed with Saint Croix sheep

<sup>3</sup> Back cross (75%) to Saint Croix sheep.

would allow rapid rates of gain during growth and fattening phases, when animals had plantation forage as the main component of their diets. For this work, lambs produced in the ewe flock were used, including STT, F1 STT x SC and back crosses (BC) with SC. Lambs were grazed during the day under rubber plantations with a shepherd and were fed individually the various concentrates in the barn. Only molasses supplementation was given on a group basis. These growing trials lasted 90-120 days.

Table 3 contains a summary of these growing trials, including the type of supplement, feeding levels, breed of lamb and average daily gains (ADG). Results obtained in the first trial (Sanchez and Boer 1989) indicated that a supplementation level of about 0.6% of body weight (BW) per day was adequate for an efficient utilisation in both STT and F1 lambs. In most of the subsequent trials this level was used. There was no advantage in adding fish meal (bypass protein) or broken rice (bypass energy) to palm kernel cake (Boer and Sanchez 1989). Neither was it beneficial to include bypass protein at various levels in cassava meal-molasses supplements (Sanchez and Pond, pers. comm.). The form of the extra energy, either soluble (molasses) or slowly degraded, partly bypass (broken rice) or their combination, did not give a different growth response (Sanchez and Pond 1989a).

Afternoon feeding of the concentrate produced an ADG which was 12% higher than morning feeding but this was not statistically significant (Sanchez and Pond 1989b). PKC supplementation allowed 40% higher ADG in lambs rotationally grazing at six and 12 head/ha (Sanchez et al. 1990). In general, supplementation produced increases from 27 to 65% in the ADG of lambs, with an average of 40%. Although the data are not included in this review, supplementation increased the efficiency of feed utilisation and in most cases gave economic returns.

### Some Current Limitations of Sheep Productivity

The STT sheep have given excellent levels of production under these systems of grazing in rubber plantations, comparable with or superior to those of the improved temperate breeds (Iniguez et al. 1990). However, some current limitations are:

(1) high mortality of lambs with low birth weights, caused by small size ewes at lambing and by large litters. Larger size should be attained before the first mating in order for the ewes to reach at least 80% of their adult body weight by first lambing. Ewes that consistently produce large litters (three or more lambs) should be selected against in these grazing systems;

(2) low weaning weights caused by insufficient milk. Selection, cross-breeding or supplementary feeding of the STT ewes is required to increase milk production to make it adequate for the litter size;

(3) the presence of internal parasite larvae in the pastures, in particular, *Haemonchus*, *Oesophagostomum* and *Eurytrema*, the pancreatic fluke. Effective methods of management combined with medication are required to reduce the deleterious effect of these parasites on the health and productivity of sheep;

(4) on the forage side, there is a mismatch between the increasing flock size in new operations and the continuous reduction of forage in new plantations. In already established plantations, with regular cycles of replanting schemes, projections of flock size can be made more easily;

(5) in progressive plantations there will be a reduction of forage available for sheep with the appearance of new, more productive, fast-growing clones. There is a need for specific effort in increasing forage growth by the use of special planting designs: and

**Table 3.** Average daily gain of Sumatran Thin Tailed and crossbred lambs when grazing with and without feed supplements.

Supplement	Feeding level (% BW) <sup>1</sup>	Average daily gain (g)		
		STT <sup>2</sup>	F1 <sup>3</sup>	BC <sup>4</sup>
None	0	47 <sup>a</sup>	68 <sup>a</sup>	—
Mixed concentrates	0.6	75 <sup>b</sup>	85 <sup>b</sup>	—
Mixed concentrate	1.2	80 <sup>b</sup>	93 <sup>b</sup>	—
None	0	63 <sup>a</sup>	-	—
Palm kernel cake (PKC)	0.6	97 <sup>b</sup>	-	—
PKC + 10% fish meal (FM)	0.6	93 <sup>b</sup>	-	—
PKC + 10% broken rice (BR)	0.6	103 <sup>b</sup>	-	-
PKC + 10% FM + 10% BR	0.6	83 <sup>b</sup>	-	-
Cassava meal/molasses (X():2())	0.6	72 <sup>a</sup>	100 <sup>a</sup>	120 <sup>a</sup>
+ 10% fish meal	0.6	54 <sup>a</sup>	104 <sup>a</sup>	89 <sup>a</sup>
+ 20% fish meal	0.6	60 <sup>a</sup>	122 <sup>a</sup>	81 <sup>a</sup>
+ 30% fish meal	0.6	52 <sup>a</sup>	132 <sup>a</sup>	119 <sup>a</sup>
None	0	45 <sup>a</sup>	48 <sup>a</sup>	-
Molasses	1.3	61 <sup>a</sup>	54 <sup>a</sup>	-
Broken rice	1.0	54 <sup>a</sup>	59 <sup>a</sup>	-
Molasses + 43% broken rice	1.2	56 <sup>a</sup>	61 <sup>a</sup>	-
Palm kernel cake morning	0.6	47 <sup>a</sup>	68 <sup>a</sup>	—
afternoon	0.6	53 <sup>a</sup>	76 <sup>a</sup>	—
None				
6 sheep/ha	0	-	-	80 <sup>a</sup>
12 sheep/ha	0	-	-	83 <sup>a</sup>
Palm kernel cake	0	-	-	-
6 Sheep/ha	0.6	-	-	117 <sup>b</sup>
12 sheep/ha	0.6	-	-	112 <sup>b</sup>

<sup>1</sup> Per cent body weight

<sup>2</sup> Sumatran Thin Tailed

<sup>3</sup> F1 cross between Sumatran Thin Tailed and Saint Croix sheep

<sup>4</sup> Back cross (75%) to Saint Croix

<sup>5</sup> Made from PKC 38.6%. rice bran 38.6%. molasses 20%. fish meal 1.5% and limestone 1.3%.

Values within columns with different superscripts are significantly different (p<0.01).

(6) the presence of the noxious weed *Imperata cylindrica* in rubber plantations not only competes with the trees for water and nutrients, but also replaces desirable forage species. Sheep do not voluntarily consume *Imperata*, so other special methods of control are still required.

### Other Constraints

Apart from the limitations mentioned above there are some other constraints on the successful integration of sheep into the rubber plantations in Indonesia. These are:

(1) prevalent prohibition of grazing animals or the taking of forage from plantations. A clear distinction should be made between the arguable potential effects of animals on the plantation, from the real damage caused by the behaviour of people associated with the

animals. In any case, uncontrolled presence of either of the two, animals or people, should not be permitted. However, a well organised system can be beneficial for all;

(2) the traditional cover crops are of low productivity and generally unpalatable for sheep, and thus cannot be used for purposes of integration. There is a need for more productive and palatable cover crops that can also be accepted by the plantation managers;

(3) the presence of plastic, bags in particular, thrown away by plantation workers, that are consumed by sheep in flocks and cause harmful effects. Often this plastic cannot be regurgitated and remains in the rumen, taking useful feed space and disrupting and blocking normal digestive processes;

(4) the high cost of traditional barns increases the capital required for starting a sheep operation.

Cheaper and movable barn designs should be designed and tested, in particular in relation to increased parasite larvae exposure, microclimate (humidity, temperature, air circulation) and security;

(5) animal theft; and

(6) predation by feral, vicious or underfed loose dogs.

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