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IDENTIFICATION OF AN ECONOMIC FORM OF SUPPLEMENTATION FOR EWES IN RUBBER PLANTATIONS

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SUMMARY

An experiment was conducted to study the effects of three supplementary feeds on the productivity of Sumatra Thin-tail ewes in a rubber plantation. The supplements were a concentrate mixture (S1); concentrate + rubber seed meal (S3); and rubber seed meal + Gliricidia sepium (S3). These supplements were offered to ewes during the last two weeks of pregnancy and the first six weeks of lactation. The rates of supplementation were S1, concentrate 1.4% BW/d; S2, concentrate 0.5% BW/d + rubber seed meal 0.5% BW/d; and S3, rubber seed meal 0.6% BW/d + Gliricidia sepium 0.45% BW/d. Ewes were mated each time estrus was identified.

Litter size significantly ($P<0.05$) affected lamb weights. Pre-weaning growth rates were 90 g/d for single lambs but only 63 g/d for multiple lambs. Litter weights for single and multiple lambs, respectively, were 2.3 kg and 3.3 kg at birth and 10.9 kg and 14.7 kg at weaning. The ratio of litter weight at birth to ewe weight was 45% higher for ewes with multiples those with single lambs. Ewe weight at lambing was not related to litter size. Lambing intervals ranged from 179 to 304 d, with an average of 224 d. Ewes therefore lambed an average of 1.61 times per year. The average weight of lamb weaned per ewe per year was 20.2 kg, equal to 93% of ewe's liveweight.

No differences in lamb production at birth and at weaning, pre-weaning growth rate of lambs, ewe weight at lambing, lambing interval nor kg lamb weaned per kg ewe weight per year were observed among treatments. Economic analysis suggested that the combination of rubber seed meal and Gliricidia sepium provided the highest profit. It is concluded that supplementing ewes during the only strategic phase of their production cycle before and after lambing can be practised in order to reduce the amount of supplement given, while still maintaining the productivity of the ewes. A mixture of rubber seed and Gliricidia sepium should be considered as an alternative to commercial concentrate.

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RINGKASAN

Penelitian dilakukan untuk mempelajari pengaruh pemberian tiga jenis pakan tambahan terhadap produktifitas induk domba yang dipelihara di perkebunan karet. Pakan tambahan yang diberikan adalah (S1) konsentrat; (S2) konsentrat + tepung biji karet; dan (S3) tepung biji karet + Gliricidia sepium. Pakan tambahan diberikan kepada induk selama dua minggu terakhir masa kebuntingan dan selama enam minggu pertama masa laktasi. S1 diberikan sebanyak 1,4% BB/h; S2, konsentrat 0,5% BB/h + biji karet 0,5% BB/h; dan S3, tepung biji karet 0,6% BB/h + Gliricidia sepium 0,45% BB/h. Induk dikawinkan setiap kali terlihat gejala estrus.

Meningkatnya jumlah anak per kelahiran secara nyata ($P<0,05$) menurunkan berat lahir anak dan pertambahan berat badan sebelum sapih (90 g/h untuk kelahiran tunggal vs 63 g/h untuk kelahiran lebih dari satu), akan tetapi meningkatkan berat anak yang dilahirkan dan berat anak disapih (10,9 kg untuk kelahiran tunggal vs 14,7 kg untuk kelahiran lebih dari satu). Perbandingan berat anak dilahirkan terhadap berat induk pada saat melahirkan lebih tinggi 45% pada induk yang melahirkan lebih dari satu dibandingkan dengan induk yang melahirkan anak tunggal. Tidak terdapat hubungan antara berat induk pada saat melahirkan dengan jumlah anak yang dilahirkan. Jarak beranak berkisar antara 179 - 304 h, dengan rataan 224 h. Dengan demikian, induk rata-rata melahirkan sebanyak 1,61 kali per tahun. Berat anak disapih per induk per tahun meningkat nyata pada kelahiran lebih dari satu dibandingkan pada kelahiran tunggal (17,8 kg pada kelahiran tunggal vs 24,0 kg pada kelahiran lebih dari satu). Rataan berat anak disapih per tahun mencapai 93% dari berat badan induk saat melahirkan.

Tidak terdapat perbedaan produksi anak yang dilahirkan dan di sapih, pertambahan berat badan sebelum sapih, berat induk pada saat melahirkan, jarak beranak, maupun berat anak disapih per berat induk per tahun antar perlakuan pakan tambahan. Analisis ekonomi menunjukan bahwa pemberian campuran tepung biji karet dan Gliricidia sepium memberikan keuntungan paling tinggi. Disimpulkan bahwa pemberian pakan tambahan kepada induk domba hanya selama periode strategis bagi produksi sebelum dan sesudah melahirkan dapat diterapkan untuk mengurangi jumlah pemberian pakan tambahan, namun masih mampu mempertahankan produktifitas induk. Campuran tepung biji karet dan Gliricidia sepium merupakan alternatif pakan tambahan terhadap konsentrat komersil.

INTRODUCTION

The low availability of energy and protein from forages grown in rubber plantations is a serious constraint that limits the animal's ability to express maximum productivity. Daily gains of young sheep grazed on natural forages in plantations are low, ranging from 30 to 40 g (Daud and Yusuff, 1983; Reese, 1988); but can significantly increase if supplements are provided (Boer and Sanchez, 1988, Batubara et al., 1990).

Also the production of ewes in terms of daily gains of pre-weaned lambs, lamb survival rate and thus kg of lamb weaned significantly increase when supplements are available to the animal around the year (Reese et al, 1990; Iniguez et al, 1991). However, Reese et al (1990) found that the increased production of ewes which are continually supplemented is economically advantageous only at the highest level of supplementation. A proper feeding system is necessary in order to achieve maximum profit from increased production of supplemented sheep.

The goal could be approached through the modification of the composition of supplements to obtain the lowest price of supplements, developing a strategic supplementation scheme to reduce the amounts of supplement offered, or a combination of both. The objective of this experiment is to study the productivity of ewes supplemented with different supplements before and after lambing.

MATERIALS AND METHODS

Location and animals

This experiment was conducted at the Suka Damai unit of the Sub-Balai Penelitian Ternak in North Sumatra. The experiment began in February 1990 and finished in December 1991. Fifty-one local Sumatra Thin-tail ewes aged 1 to 4 years were divided at random into three groups, and each group of seventeen ewes was allocated to a supplementation treatment.

Supplements

The three supplements were: concentrate (S1), concentrate + rubber seed meal (S2), and rubber seed meal + Gliricidia sepium (S3). The concentrate consisted of rice bran (44.3% DM), molasses (20.7% DM), cassava meal (31.4%), fish meal (1.4%DM), urea (1.03% DM) and limestone (1.07% DM).

Rubber seeds collected from the rubber plantation were manually ground to separate the coat from the contents. The contents were sun-dried for 2-3 days and ground manually to obtain rubber seed meal. Gliricidia sepium was cut every day in the morning, and leaves separated from the stems. The leaves were sun-dried for 2-3 days and mixed thoroughly with the concentrate. The chemical composition of supplements are shown in Table 1.

Supplements were provided in the morning before grazing during the last two weeks of pregnancy and in the first six weeks of lactation. Concentrate in S1 was provided at 1.4% BW/d, each of concentrate and rubber seed meal in S2 was at 0.5% BW/d, and in S3 rubber seed and gliricidia were provided at 0.6% and 0.45% BW/d respectively.

Table 1. Chemical composition of feedstuffs used as supplements

Ingredient	DM	CP	ADF	Ca	P
	%	% in DM			
Cassava meal	87.9	1.1	8.1	0.45	0.03
Fish meal	90.0	61.2	4.9	5.82	2.03
Rice bran	89.2	8.2	2.3	0.01	0.45
Limestone	95.6	12.3	11.0	22.29	3.64
Rubber seed meal	96.9	21.9	7.6	0.10	0.48
Gliricidia sp.	87.3	25.1	31.8	1.11	0.22

Management

To detect ewes in estrus, a vasectomized ram was put into the pens of ewes every day in the morning before grazing and in the late afternoon. Ewes found to be in estrus were mated. Mating dates were recorded and used to estimate lambing dates. Ewes were weighed two weeks before expected lambing date and at lambing to determine the amount of supplement which had to be offered. During the experiment which lasted until ewes lambed three times, ten ewes died.

Sheep were grazed under rubber trees from 8:00 to 16:00 and were confined in a raised barn during the rest of the day. They had access to water outside the barn and to salt blocks in the pens. During the first two weeks after lambing ewes and their lambs were kept in barn, and ewes were offered forages cut from rubber plantations. The lambs were weaned at 98 days.

Statistical Analysis

The data were analysed by analysis of variance with unequal replication. Pre-weaning gain, lamb production at birth and at weaning, ewe weight at the day of birth and lamb/ewe weight ratio were tested with lamb litter size and treatment as main effects. As there were very few triplets, twins and triplets were grouped together in the analysis.

RESULTS AND DISCUSSION

Pre-weaning growth of lambs

Average pre-weaning daily gains were not statistically different ($P>0.05$) among treatments (Table 2). In all treatments lambs born as multiples grew more slowly ($P<0.05$) than lambs born as singles. Growth rates averaged 89 g/d for singles and 63 g/d for multiples. Thus daily gains of multiple lambs were 70% of those born as singles.

In treatment S2 average daily gains of single lambs were relatively higher while gains of multiples were relatively lower than in S1 and S3. This resulted in a larger difference in growth rates between single and multiple lambs.

Table 2. Average growth rates of pre-weaned lambs (g/d)#

Treatment	Type of birth [a]	Gain
S1	Single (14)*	84.0 ± 26.2
	Multiple (25)	64.5 ± 20.0
	Overall (39)	72.0 ± 29.3
S2	Single (17)	93.8 ± 30.6
	Multiple (16)	54.2 ± 18.2
	Overall (33)	77.3 ± 34.0
S3	Single (16)	89.3 ± 23.7
	Multiple (18)	65.2 ± 17.1
	Overall (34)	76.5 ± 24.1
All treatments	Single (47)	89.6 ± 27.9
	Multiple (59)	62.8 ± 17.7
	Overall (106)	75.6 ± 27.0

#Data were obtained from only the first two lambings
[a])ANOVA test of effect of litter size on pre-weaning daily gain ($P<0.05$).
*Values in parentheses are numbers of lambs weaned.

The overall growth rate of 76 g/d is similar to the value of 73 g/d reported by Reese et al (1990) for lambs produced by ewes at Suka Damai supplemented around the year with concentrate of the same composition as was used in this experiment.

Lamb production at birth and at weaning

Treatment did not significantly (P>0.05) affect lamb weight nor litter weight at birth and at weaning (Table 3). Lamb weight at birth averaged 2.27(±0.50) kg for single lambs and 1.54(±0.36) kg for twins and triplets. Weights of lambs at weaning averaged 11.28(±2.81) kg for singles and 7.77(±1.73) for lambs born in multiple litters. The overall average weights of lambs were 1.93(±0.57) kg at birth and 9.66(±2.75) kg at weaning. Table 3 shows that litter weight increased with increase in litter size (P<0.05)

Table 3. Litter weight at birth and at weaning

Treatment	Type of birth[a]	Litter weight (kg) at birth	Litter weight (kg) at weaning[#]
S1	Single	2.1 ± 0.5 (26)	10.3 ± 2.6 (18)
	Multiple	3.3 ± 0.7 (16)	15.6 ± 5.1 (12)
	Overall	2.5 ± 0.8 (42)	12.4 ± 4.6 (30)
S2	Single	2.4 ± 0.4 (27)	11.4 ± 2.7 (15)
	Multiple	3.4 ± 0.7 (9)	14.1 ± 3.5 (9)
	Overall	2.7 ± 0.7 (36)	12.3 ± 3.2 (24)
S3	Single	2.4 ± 0.6 (25)	11.1 ± 2.4 (16)
	Multiple	3.3 ± 0.8 (14)	14.6 ± 5.4 (10)
	Overall	2.7 ± 0.8 (39)	12.5 ± 4.2 (26)
All treatments	Single	2.3 ± 0.5 (78)	10.9 ± 2.6 (49)
	Multiple	3.3 ± 0.8 (39)	14.7 ± 4.7 (31)
	Overall	2.6 ± 0.8 (117)	12.4 ± 4.1 (80)

*Data from first two lambings only.
[a]Effect of litter size on kg lamb born and weaned was significant (P<0.05).
[e]Values in parentheses are number of lambs born or weaned.

The weights of multiple litters were 43% higher than those of single lambs at birth, and 35% higher at weaning. This increase in kg of lamb weaned was obtained despite the higher mortality rate observed for lambs born in multiple births (17%) than in single births (7%) (Ginting et al, 1992).

Increasing the survival rate of lambs born in multiple litters will help to fully utilise the production potential of these prolific ewes which give multiple births.

Ewe Weight at Lambing

The average weights of ewes at lambing was 21.6 kg. Ewe weight was not different (P>0.05) among treatments (Table 4), nor was there a consistent relation between ewe weight and type of birth. In contrast, a positive correlation between ewe weight and litter weight was observed for Sumatra Thin-tail sheep by Iniguez et al (1991) and for Javanese Thin-tail ewes by Inounu et al (1991).

The ratio of litter weight at birth to ewe weight was not influenced (P>0.05) by treatment, but increased with litter size. For ewes that give birth to single lambs, the lambs averaged 11% of ewe weight. For ewes producing multiple lambs, litter weight was 16% of ewe weight.

Table 4. Ewe weight at lambing, and ratio of litter weight to ewe weight

	Treatment			All Treatments
	S1	S2	S3	
Ewe weight (kg)				
Single	20.3±3.0	22.5±3.2	21.4±3.1	21.5±3.2
Multiples	23.7±3.5	20.9±3.4	20.8±5.3	21.9±4.3
Overall	22.0±4.0	22.1±3.3	21.0±4.0	21.6±3.7
Ratio of litter weight to ewe weight				
Single	0.10±0.02	0.11±0.03	0.11±0.02	0.11±0.02
Multiples	0.14±0.03	0.17±0.04	0.16±0.04	0.16±0.04
Overall	0.11±0.03	0.12±0.03	0.12±0.04	0.12±0.03

Lambing interval

The frequency distributions of lambing intervals of ewes completing three lambings are shown in Figure 1. The lambing intervals of S1 ewes were all in the range 179-262 days. In S2 and S3, lambing intervals ranged up to 304 d. Mean lambing interval in S1, S2 and S3 was 222 ± 6.4, 229 ± 7.1, and 222 ± 6.6 d, respectively. Ewes in S1, S2 and S3, therefore lambed an average of 1.65, 1.59 and 1.64 times per year. Since there was no statistically significant effect of treatment on lambing interval, the data were pooled together and the overall frequency distribution is shown in Figure 2.

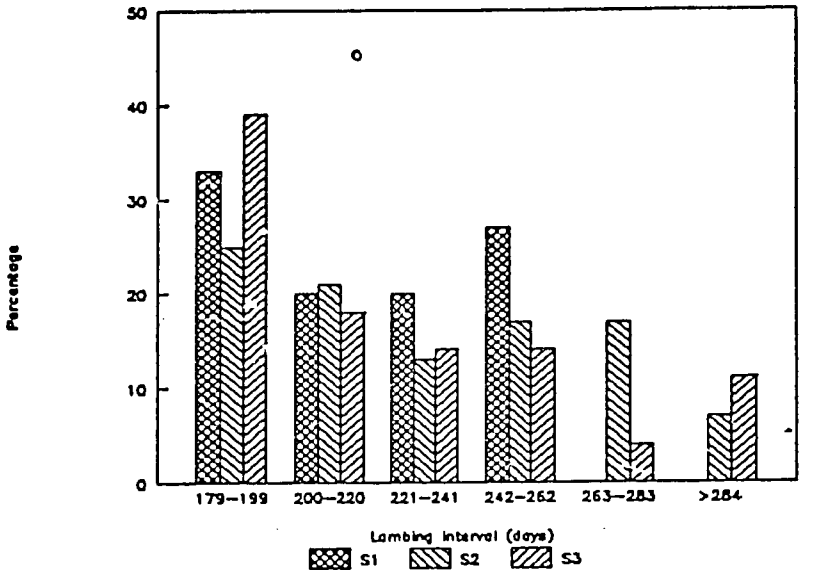

Fig 1. Frequency distributions of lambing interval for the three treatments

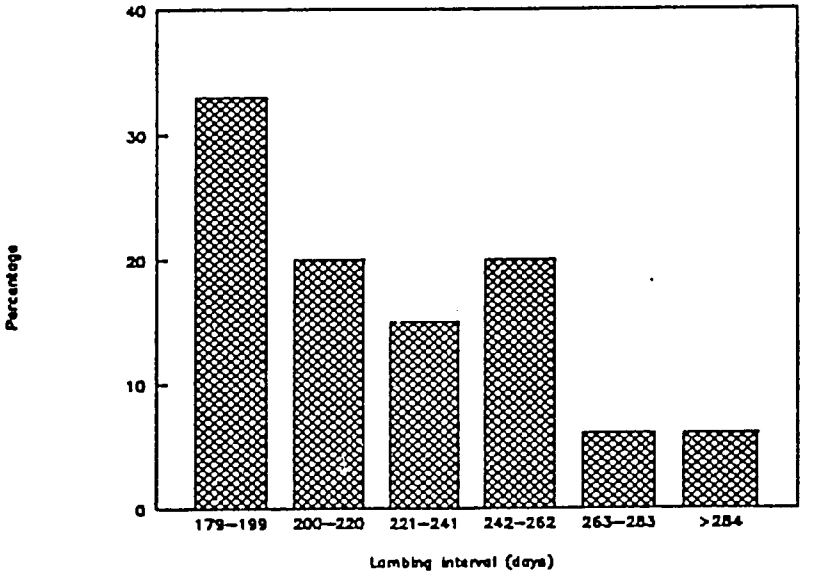

Fig 2. Frequency of distribution of lambing interval in all treatments

With overall lambing interval averaging 224 d, the ewes lambed at average of 1.61 times per year. This is only slightly lower than the frequency of 1.82 observed for ewes at Suka Damai supplemented around the year with concentrate similar to that used in this study (Iniguez et al, 1991).

Yearly lamb production

The total weight of lambs born and weaned per ewe per year was calculated for each treatment and litter size using average values of litter weights and lambing intervals. The values shown in Table 5 show that total weight of lambs born and weaned increased ($P<0.05$) with litter size, but was not affected by treatment.

Table 5. Weight of lambs born and weaned per ewe per year

Treatment	Litter size[a]	Weight of lambs born		Weight of lambs weaned	
		kg/y	% ewe weight	kg/y	% ewe weight
S1	Singles	3.4	17	17.0	84
	Multiples	5.4	23	25.7	108
	Overall	4.2	19	20.5	93
S2	Singles	3.9	17	18.1	80
	Multiples	5.4	26	22.4	107
	Overall	4.3	19	19.5	88
S3	Singles	3.9	18	18.2	85
	Multiples	5.4	26	24.1	116
	Overall	4.5	21	20.5	98
All treatments	Singles	3.7	17	17.8	84
	Multiples	5.4	25	24.0	111
	Overall	4.2	19	20.2	93

[a]Anova test of effect of litter size on kg lamb born and weaned ($P<0.05$).

Overall productivity measured in terms of weight of lamb weaned per unit ewe weight per year averaged 93%. In contrast values for flocks in semi-arid Africa, Central and South America are in the range 47 to 60% (Fitzhugh and Bradford, 1983; Gatenby, 1986). This reinforces the fact that Sumatra Thin-tail ewes are highly productive even when supplementation is restricted to eight weeks in the reproduction cycle. The values were 84% for single births and 111% for multiple births, an increase of 27 percentage units.

Economic analysis

A summary of the economic analysis of the three supplementation treatments is shown in Table 6. The productivity of all three groups of ewes was similar, but the costs of S2 and S3 were lower than the cost of S1. The greatest benefit of Rp 48,600 per ewe per year was obtained for S3. Therefore substituting a commercial concentrate mixture by rubber seed and gliricidia gives economic benefit. This form of supplementation reduces feed costs from Rp 5,900 to Rp 2,400 per year, and yet maintains gross income at Rp 51,000. Replacing part of the concentrate with rubber seed (S2) slightly reduced the profit.

Table 6. Partial budget analysis of the three supplements

	S1	S2	S3
Feed consumption (kg/ewe/lambing)	18.2 (C)	6.31 (C) 6.31 (RS)	5.08 (G) 7.45 (RS)
Feed consumption (kg/ewe/year)	30.03	10.03 (C) 10.03 (RS)	8.33 (G) 12.22 (RS)
Feed cost (Rp/ewe/year)	5883	3971	2444
Lambs weaned (kg/ewe/year)	20.5	19.5	20.4
Gross income (Rp/ewe/year)	51,150	48,750	51,050
Benefit (Rp/ewe/year)	45,267	44,779	48,606

Feed prices (April 1992): C, Rp 195.9/kg; RS, Rp.200/kg.
Lamb price (April 1992): Rp 2500/kg live weight.
Lambing frequency/year: 1.65 (S1); 1.59 (S2); 1.64 (S3).

The differences among treatments are relatively small. The calculations did not include the cost of purchasing the concentrate, the ingredients of which are mostly available only in towns far from plantation areas. The true cost of supplementing sheep with the concentrate would have been more, and the profit even less than that for rubber seed and gliricidia which are readily available or easy to grow in plantations.

CONCLUSION

Providing supplements to ewes before and after lambing can be practised in order to increase the productivity of ewes without the prohibitively high costs of year-round supplementation. Under the supplementation scheme used in this experiment the product-ivity of Sumatra Thin-tail ewes, and in particular their high reproductive potential can be utilised. The use of rubber seed and Gliricidia sepium as supplements should be considered for sheep reared in rubber plantations. Rubber seed is readily available and Gliricidia sepium is easy to grow. Data obtained in this experiment indicate that providing these feedstuffs as supplements results in similar productivity and higher profits than the feeding of concentrate.

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