PRODUCTIVITY OF SHEEP IN THE OPMM OUTREACH PROJECT AND FACTORS AFFECTING IT

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PRODUCTIVITY OF SHEEP IN THE OPMM OUTREACH PROJECT AND FACTORS AFFECTING IT

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ABSTRACT

The OPMM project was established in November 1991 with 12 smallholder rubber farmers who were each given four ewes and one ram. There are now (December 1994) a total of 31 farmers in the project and the flock size of the original 12 farmers averages 19 animals and average offtake from each flock has been 15 animals.

Mean litter size is 1.2; triplets are rare in OPMM. Ewe weight at lambing averages 20.8±0.2 kg (n=309), and is affected by both breed ($P<0.001$) and parity ($P<0.05$). Weights of lambs average 2.24±0.51 kg (n=379) at birth and 9.6±2.4 kg (n=199) at 3 months of age. Lamb weights are affected by sex of lamb, parity of ewe and litter size. Breed had no significant effect on lamb weights though the means for Virgin Island crossbred and Garut crossbred lambs were higher than the means for purebred Sumatra and Fat-tail crossbreds. There were significant effects of ewe weight ($P<0.001$) and farmer ($P<0.001$) on lamb weights. Pre-weaning mortality was estimated to be 9%.

Lambing interval averaged 239±5 days (n=182), and age at first lambing was only 410±6 days (n=96). On average, ewes produced 16.0 kg of weaned lamb per year. Mean sale price was Rp 54 000. Based on these estimates of price and productivity, the annual income from a flock of 10 ewes is Rp 432 000. There is scope for increasing flock productivity principally by improving feeding.

PRODUKTIVITAS DOMBA DI KEGIATAN UJI COBA MEMBANG MUDA (OPMM) DAN FAKTOR YANG MEMPENGARUHINYA

Ruth M Gatenby and Setel Karokaro

ABSTRAK

Proyek OPMM (Outreach Project Membang Muda) telah dimulai sejak November 1991. Sebanyak 12 orang petani PIR-Karet Gunung Lonceng diberikan paket ternak domba (4 induk dan 1 pejantan). Perkembanngan populasi ternak hingga Desember 1994 adalah rata-rata jumlah ternak di setiap petani yaitu 19 ekor dan hasil rata-rata setiap peternak adalah 15 ekor,

Jumlah anak per kelahiran (litter size) adalah 1.2; beranak tiga jarang terjadi. Berat rata-rata induk 20.8±0.2 kg (n=309), dan berat ini sangat terpengaruh oleh bangsa (P<0.001) dan melahirkan keberapa (parity). Berat lahir rata-rata anak domba 2.24±0.51 kg (n=379) dan berat sapih 9.6±2.4 kg (n=199). Berat anak dipengaruhi oleh jenis kelamin, melahirkan keberapa dan jumlah kelahiran anak. Bangsa tidak mempengaruhi berat anak walaupun rata-rata berat anak Virgin Island persilangan dan berat persilangan lebih tinggi dibanding berat anak domba Sumatra dan ekor tipis persilangan. Korelasi positip terjadi antara berat induk (P<0.001) dan peternak (P<0.001) terhadap berat anak. Mortalitas pra sapih diperkirakan 9%.

Jarak beranak rata-rata 239±5 hari (n=182) dan umur rata-rata pada kelahiran pertama hanya 410±6 hari (n=96). Secara umum rata-rata induk memproduksi anak sapih dengan berat 16 kg per tahun. Rata-rata penjualan Rp 54.000,- per ekor dan total pendapatan per tahun peternak dengan rata-rata populasi 10 ekor induk adalah Rp. 432.000,-. Peluang untuk meningkatkan produktivitas ternak secara prinsip dapat ditempuh dengan perbaikan pakan.

INTRODUCTION

In November 1991 the OPMM project was started as a collaborative effort between Sub-Balai Penelitian Ternak Sei Putih, Small Ruminant CRSP, Puslitkaret and PTP III (Scholz, 1992). Initially twenty smallholder rubber farmers were selected in the village of Gunung Lonceng in the PTP III rubber plantation of Membang Muda. Each farmer was given four ewes and one ram. The ewes were on loan which the farmers had to repay with twice the number of young ewes. The rams remained the property of SR-CRSP Sei Putih and are moved from one farmer to another each year.

In November 1993 eight new farmers in Gunung Lonceng joined OPMM and they were given young ewes which had been repaid by the original 20 farmers. In December 1994 a further eleven farmers joined OPMM; these new farmers were situated some distance away from Gunung Lonceng in Afdelings A and F. The number of farmers in OPMM is therefore now 31, but there are also a large number of neighbouring farmers who have taken up sheep rearing after seeing the success of the OPMM farmers.

The initial ewes were either local Sumatra or Virgin Island crossbreds. The first rams were of various genotypes including Sumatra, Virgin Island crossbred, Java Fat-tail and Garut. The farmers expressed a preference for Virgin Island crossbred sheep, and our research at Suka Dame had shown that these animals are bigger and lamb growth is faster. Therefore in 1993 all rams of other breeds were removed from Gunung Lonceng and replaced by first generation (H1) or second generation (HC) Virgin Island crosses.

A number of studies of the OPMM farmers have been reported by the Socio-Economics group at Sei Putih. The members of the family who have most responsibility for small ruminant production are boys and young men (Handayani et al, 1993b) who otherwise have little possibility of waged employment in Gunung Lonceng. Handayani et al (1993a) identified the two major problems facing smallholder rubber-sheep enterprises as overtapping of rubber and the low carrying capacity of the plantation at some stages of the rubber production cycle. One of the advantages of outreach research projects is that they act as demonstration units and neighbouring farmers take up introduced technologies (Sembiring et al, 1994). Kartamulia et al (1993) estimated that a net farm income of US$ 196 per year can be generated by smallholders rearing sheep in rubber plantations. This revenue is equivalent to 22% of net income from rubber production.

The purpose of the study reported here was to analyse the data collected through October 1994, to estimate the levels of productivity that have been achieved under reasonably good management and to identify the factors affecting production levels. A preliminary version of this analysis was presented by Gatenby et al (1994b).

METHOD

The farmers are visited regularly by a home-based extension agent (D Simangunsong) and are visited monthly by a team from Sei Putih. Usually all pertinent information is recorded, but there was a period in 1993 when systematic recording of data was not undertaken regularly, and this limits the accuracy of some estimates such as lamb mortality.

The data were entered onto the computer by J Sihombing and analysed by R Gatenby using the GLM procedure of SAS for unequal sub-class numbers.

The breed categories used in this analysis are

S	Sumatra
E1	Java Fat-tail x S, 1st generation
G1	Garut x S, 1st generation
H1	Virgin Island x S, 1st generation
HC	H1 x H1 (50% H, 50% S) 2nd and later generations
HS2	H1 x S (25% H, 75% S)

RESULTS

The numbers of sheep in the flocks of the initial 20 farmers have increased rapidly, and all have repaid several young ewes to the project. These young ewes have been given to further farmers. Table 1 shows that in December 1994, three years after the project started, the number of ewes (females aged 6 months or more) in the flocks of the initial farmers varied from 7 to 14 with a mean of 10 ewes, and the total number of animals varied from 12 to 33 with a mean of 19 animals. All the initial farmers have sold animals. Theft has occurred occasionally. Offtake (calculated as the total sold, slaughtered for home consumption and returned to the project) ranges from 7 to 19 animals with a mean of 15.

Table 1. Numbers of sheep present in each flock in December 1994, and numbers already dispersed.

Farmer	Present in flock				Dispersed			
	Ewes	Rams	Lambs F	Lambs M	Sold	Sla	Ret	Died	Stol
Farmers starting November 1991									
Jamaluddin	8	6	2	3	4	0	3	8	0
Lakon	10	6	0	3	14	0	5	0	0
Rosid	8	2	3	1	9	0	6	10	0
Sagimin	8	3	2	3	7	0	8	5	0
Sakirin	14	3	7	9	10	0	6	3	0
Semin	9	2	4	2	8	2	5	4	1
Slamat ST	7	3	0	5	5	0	6	5	0
Slamat Y	13	4	1	2	8	0	8	0	0
Sukemi	7	1	2	2	8	0	8	0	0
Tardi	12	4	5	5	8	3	8	0	0
Temu	10	5	2	4	10	1	8	0	0
Tugimin	10	1	2	3	12	0	5	1	9
Farmers starting November 1993									
Daliman	4	2	4	0	0	0	0	0	0
Darjo	4	2	3	1	0	0	0	0	0
Jumain	4	1	2	3	0	0	0	0	0
Kliwon	4	1	1	3	0	0	0	2	0
Saimun	4	1	2	2	0	0	0	0	0
Samsudin	5	1	4	3	0	0	0	0	0
Seono	4	2	2	2	0	0	0	0	0
Tugi	4	1	2	1	0	0	0	0	0
Farmers starting December 1994									
Bahrudin	4	1							
J Pangaribuan	4	1							
Saleh Munthe	4	1							
D Siagian	4	1							
L Siahaan	4	1							
Suratmin	4	1							
Wagino	4	1							
Edi	4	1							
Hj A Harahap	4	1							
Indra A T	4	1							
D Simangunsong	4	1							

Sla = slaughtered; Ret = returned to project; Stol = stolen.

Litter size

Litter size was recorded for a total of 319 lambings. Mean litter size was 1.20(±0.02), with a range from 1-3. Only two sets of triplets were recorded (Table 2) and the proportion of multiple births was less than 20%. This is considerably lower than has been observed for the same breeds of ewes in the experimental flock at Suka Dame which average about 1.5 (Gatenby et al, 1993b). The are two possible reasons for this difference. First, the farmers may simply ignore and fail to report some small lambs in multiple births if they are still-born or die soon after birth. Second, ewes are mated very soon after they have lambed and this may contribute to lower litter sizes.

Table 2. Litter size.

Litter size	Number of lambings	Percentage of lambings
1	258	80.9
2	59	18.5
3	2	0.6

Analysis of variance was conducted to identify which factors affect litter size. A model including breed of dam, parity and dam's weight (within breed) showed no significant effects of any of these factors on litter size. On the other hand, individual ewe had a very highly significant ($P<0.001$) effect on litter size showing that litter size has a high repeatability.

Ewe weight at lambing

Ewe weight at lambing was recorded for 309 lambings. Mean weight was 20.8(±0.2) kg, and the range was 14-34 kg. In contrast, ewe weights at Suka Dame average 23 kg for Sumatra ewes and 30 kg for Virgin Island crossbreds (Gatenby et al, 1993a). The low weights of ewes in OPMM can be attributed to (i) young age at first mating, (ii) short lambing intervals, and (iii) inadequate feeding in some flocks, which all result in low body condition scores. Analysis of variance showed that both dam's breed and parity affected ewe weight (Table 3)

Table 3. Factors affecting ewe weight at lambing.

	n	Mean(kg)+SE
Breed of dam		***
S and G1	146	20.6±0.3
E1	22	20.5±0.7
HS2	68	21.0±0.5
HC and H1	73	23.0±0.4
Parity		*
1	127	20.2±0.3
2	82	21.0±0.4
3	54	22.0±0.5
4	32	20.9±0.6
5	14	22.3±0.9

Weights of lambs

Complete data including body weight, sex, breed and dam's parity were available for 379 lambs at birth and 199 lambs aged 3 months. The exact weights for the lambs at 3 months were calculated from the weights at monthly intervals. The range of values was 1.0-3.0 kg for birth weight and 4.5-16.6 kg for 3-month weight. Mean weights were 2.24(±0.51) kg at birth and 9.6(±2.4) kg at 3 months. Mean growth rate to 3 months was 81 g/d.

The data were analysed to study the effects of sex of lamb, breed of lamb, parity of dam and litter size on body weight. The results are summarised in Table 4. The effects of sex, parity and litter size on lamb weights are similar to those seen in numerous previous studies. The effect of breed on lamb weights was not statistically significant, but Virgin Island and Garut crossbreds were heavier than purebred Sumatra and Fat-tail crossbreds.

Table 4. Factors affecting lamb weights at birth and at 3 months of age.

	Birth weight (kg)		Weaning weight (kg)	
	n	mean±SE	n	mean±SE
Overall mean	379	2.24±0.51	199	9.6±2.4
Sex		(*)		ns
Female	214	2.09±0.04	105	8.7±0.4
Male	165	2.16±0.04	94	8.8±0.3
Breed		ns		ns
S	31	2.06±0.07	11	8.8±0.7
E1	25	2.08±0.05	4	7.8±1.1
G1	18	2.25±0.10	9	9.1±0.7
HS2	156	2.13±0.03	84	8.9±0.2
HC and H1	149	2.12±0.03	91	9.1±0.2
Parity		***		ns
1	148	2.03±0.04	59	8.5±0.4
2	101	2.22±0.04	56	8.5±0.4
3	67	2.21±0.05	34	9.0±0.5
≥4	63	2.06±0.06	50	9.0±0.4
Litter size		***		***
1	262	2.48±0.03	144	10.1±0.4
≥2	117	1.78±0.04	55	7.4±0.4

Three subsequent analyses were conducted to study the effects of

1. individual farmer
2. individual ewe, and
3. ewe weight

in addition to the class variables listed in Table 4. All these three factors had highly significant ($P<0.001$) effects on lamb weights at both birth and three months.

At weaning the highest mean weights were recorded for Pak Semin (+0.9 kg compared to overall mean) and Pak Sakirin (+0.5 kg). The lowest mean was for Pak Rosid (-2.1 kg). This confirms that farmers can have a significant effect on the productivity of their flock by following good management practices, particularly feeding.

The regression coefficients of lamb weight on ewe weight were

Birth: 0.030(±0.006) kg lamb /kg ewe

Weaning: 0.24(±0.05) kg lamb / kg ewe.

showing that ewe weight is an important factor in determining weights of lambs.

Pre-weaning mortality

Pre-weaning mortality was calculated as the proportion of lambs which die before reaching the age of three months. Unfortunately several records from 1993 were incomplete. For the lambs with incomplete records an estimate of survival to 3 months was made from all records including subsequent sales and (for ewe lambs) lambing performance. For these reasons, the estimate of mortality calculated here should not be taken as an absolute figure, but as a rough estimate of the level of mortality.

Between January 1992 and June 1994 an estimated total of 396 lambs were born. Lambs born from July 1994 onwards were excluded from this analysis as their 3-month weights had not yet been collated. Of these 396 lambs, a total of 36 died before reaching 3 months of age. Thus pre-weaning mortality was (100*36/396) = 9%.

Lambing interval

Records of consecutive lambings were available for many ewes and these allowed 182 lambing intervals to be calculated. Mean lambing interval was 239(±5) days or almost 8 months. The range of lambing interval was from 161 to 585 days. Most ewes had intervals of 200-240 days, but some were much longer (Figure 1). It is likely that the intervals of more than 12 months were in this case associated with abortions; long lambing intervals are found in the stall-fed smallholder flocks in West Java where they are attributed to the scarcity of rams and thus the failure of ewes to be mated (Gatenby et al, 1988).

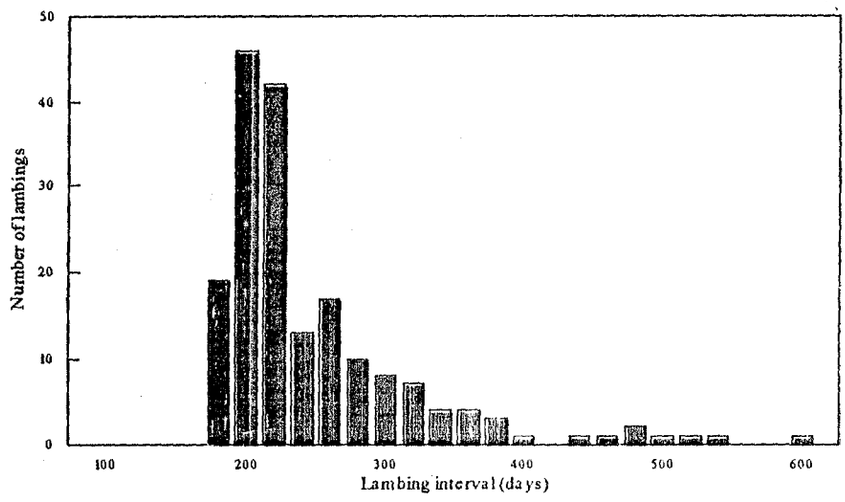

Figure 1. Histogram of lambing interval.

There were no significant effects of breed of dam nor weight of ewe on lambing interval (Table 5) but there was an effect of parity. The longest lambing intervals were for ewes which lambed for the first time. The shortest mean was for the interval between the fourth and fifth lambings.

Table 5. Factors affecting lambing interval.

	n	Mean±SE (days)
Breed of dam		ns
S and G1	98	232± 8
E1	8	264±30
HS2	26	266±16
HC and H1	44	207±13
Previous parity		*
1	76	268±10
2	54	230±12
3	32	256±15
4	13	216±21
Weight of ewe (within breed)		ns

Age at first lambing

Age at first lambing ranged from 255 to 560 days with a mean of 410(±6) days, n=96. Analyses of variance were conducted to study the factors affecting age at first lambing. There were no statistically significant effects of either breed of dam, litter size nor weight of ewe on age at first lambing. However, the highest mean age was recorded for S ewes (443±20 days, n=13) and the means for all the crossbreds were shorter than this.

In the experimental flock at Suka Dame, females are first given the chance to mate at about 10 months of age so that the age at first lambing is at least 460 days, and the mean is generally more than 500 days (Gatenby et al, 1994a). On smallholder farms in Sumatra the ram freely mixes with the ewes and as soon as a female lamb reaches puberty she is mated. In Gunung Lonceng the earliest mating resulting in conception must have been about four months of age. Conception at such an early age does not seem to have detrimental effects provided that nutrition is adequate.

Productivity index

The most common and useful index of productivity is the weight of lamb weaned per ewe per year. Where complete records are available the productivity index can be calculated for each ewe, but in this case the calculation of flock productivity index is more realistic.

Flock productivity index (FPI)

$$= \frac{\text{Litter size x Lamb weight x (1-mortality)}}{\text{Lambing interval (in years)}}$$

The components of this calculation are

Litter size = 1.20

Lamb weight at 3 months = 9.6 kg

Mortality = 0.09

Lambing interval = 239/365 years

Therefore

$$\text{FPI} = \frac{1.20 \times 9.6 \times (1-0.09)}{239/365}$$

= 16.0 kg per ewe per year.

Expressed per unit weight of ewe, this becomes

16.0/20.8 = 0.77 kg/y.

For comparison, the long-term productivity of ewes in the Suka Dame flock was estimated to be 15.2 and 22.4 kg/y, respectively, for Sumatra and Virgin Island crossbreds.

Sale price

Sale price was recorded for 65 animals, and ranged from Rp 20 000 to Rp 95 000 (Figure 2). Mean sale price was Rp 54 000 (±Rp 1 900). These values were obtained from records of the sale of 42 males and 23 females.

These prices are rather lower than the market prices of sheep observed by the SBPT Socio-Economists in other parts of North Sumatra. The reasons for this are that the farmers in Gunung Lonceng have had no previous experience of selling sheep and marketing channels are not well-established, and that the farmers have tended to sell sheep only when they desperately need money and at this time they are in a poor position for demanding a high price.

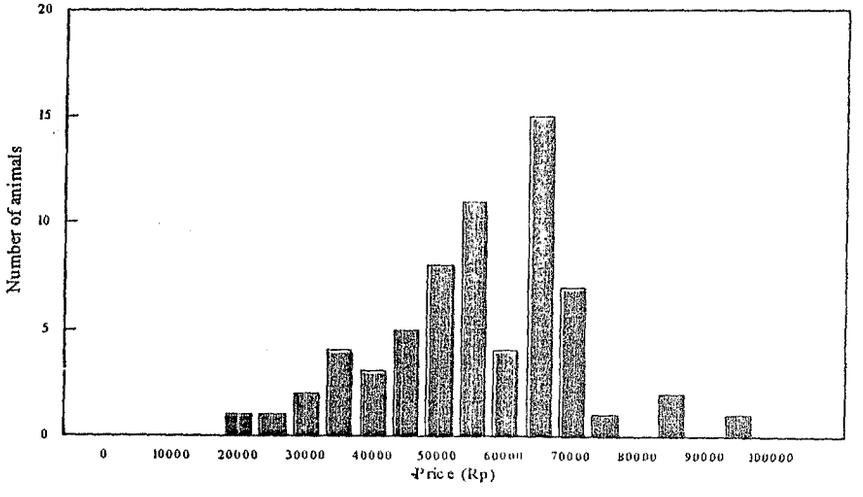

Figure 2. Sale price of sheep.

Neither breed of animal nor sex had a significant effect on price, though prices ranked S<HS2<HC showing that hair sheep crosses tend to fetch higher prices.

Farmer income from sale of all young rams can be calculated. Let us assume that all female lambs are kept as flock replacements; this is a conservative assumption as in practice some females too are sold.

According to the figures observed in this study each ewe produces (1.20 x 0.91 x 365/239) weaned lambs each year. Assuming that 50% of these lambs are males, the number available for sale is 0.8 per ewe per year. For a farmer with 10 ewes the number of males sold each year is 8. The income from the sale of these animals is Rp 432 000, a substantial contribution to family income. Of course this figure can be much higher if (a) flock size is larger, (b) lambs are fattened to greater weights before sale, (c) female as well as male lambs are sold, or (d) flock productivity is increased by improved feeding. This estimate of Rp 432 000 per farmer per year is similar to that of US$ 196 made by Kartamulia et al (1993).

CONCLUSION

Compared with the experimental flock at Suka Dame, lambing intervals in Membang Muda are shorter, and probably as a consequence of this litter sizes and lamb weights are lower. However, the mean values recorded for farmers in OPMM are similar to those recorded for farmers in ORP in Galang District, which were litter size 1.33, mortality to 3 months 7%, growth rate to weaning 79 g/d and lambing interval 217 days (Verwilghen et al, 1992).

In both the present analysis and that of Verwilghen, individual farmer had a large effect on sheep performance. This emphasises that management of the flock, particularly feeding, is a critical factor affecting productivity.

The low ewe weights, litter sizes and lamb weights recorded in OPMM suggest that considerable improvement in overall productivity could be made if the level of nutrition was improved. Some farmers currently do not graze their sheep for 8 hours per day, as we recommend, and some sheep are grazed on poor pasture near the village although there is adequate good quality grass further away in the plantation. Few farmers practise supplementary feeding, and the introduction of feeding low-price concentrates to ewes with twins and triplets, and to weaned lambs would give economic benefits to farmers.

Under the relatively limited feeding regime currently practised in OPMM there is little difference between the productivity of the various breed types, though the Virgin Island crossbreds have slightly higher growth rates. The greater potential of the crossbred sheep could be realised if nutritional standards were improved.

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