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Small Ruminant -- CRSP

PRODUCTION OF SHEEP IN VILLAGES ADJOINING RUBBER PLANTATIONS

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Working Paper No. 133, April 1992

SR-CRSP/SBPT, P.O. Box 1, Galang 20585
Deli Serdang, North Sumatra, Indonesia

SUB-BALAI PENELITIAN TERNAK, SUNGAI PUTIH

BALAI PENELITIAN TERNAK

PUSAT PENELITIAN DAN PENGEMBANGAN PETERNAKAN

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PRODUCTION OF SHEEP IN VILLAGES ADJOINING RUBBER PLANTATIONS[1]

Joost Verwilghen[2], Ton van Schie[2],
Djoko Pitono[3] and Elianor Sembiring[3]

ABSTRACT

Production data from 1988 to 1992 of farmers of the Outreach Research Project (ORP) were analysed in order to get an impression of the level of sheep production and the development over the years. Average litter size at birth was 1.33 and increased with age of the ewe until the third parity. The survival rate of lambs was high (92.5%) and differences were found between survival of singles, twins and triplets. The average daily weight gain from birth until weaning was 79 g/day, with an significant difference between singles and lambs from mutliple litters. Male lambs grew significantly faster than female lambs (82 and 76 g/day resp.). The average lambing interval was only 217 days, and there was no influence of previous litter size. Ewe body weight increased until the third parity. Birth weight of lambs was significantly affected by litter size; singles, twins and triplets had birth weights of 2.16 kg, 1.82 kg and 1.58 kg resp.. Some differences among farmers were detected, such as litter size, daily weight gain, lambing interval, ewe body weight and birth weight, which illustrate the influence of management. Over the years ewe body weight tended to decrease and daily weight gain decreased significantly. Flock size however increased over the years the data were collected. In general productivity levels are good, and sheep production substantially increases the income of these smallholder farmers.

INTRODUCTION

As the second largest producer of rubber in the world, Indonesia relies heavily on income from production of natural rubber and palm oil. North Sumatra is one of the regions in Indonesia where large rubber and oil plantations are situated. About 51 per cent of the rubber in Sumatra is produced by smallholder farmers (Scholz, 1983). These farmers own in general a area of about 2 ha. Their income from rubber production is in general low. One way to increase the income of small holder farmers is to integrate sheep into the rubber plantations (Handayani et al, 1986).

In 1988 the SR-CRSP in collaboration with the Sub-Balai Penelitian Ternak (SBPT) and the Pusat Penelitian Perkebunan (Puslitbun) in Sei Putih, North Sumatra started the Outreach Research Project (ORP). The primary objective of the ORP was to show farmers production methods that could help small-scale farmers improve their living standard by increasing the productivity of their small ruminants. Another objective was to test the performance of St-Croix breed crosses on farm level (Soedjana et al, 1990). In this paper first the ORP will be explained briefly and after this some production characteristics of sheep under village conditions, differences among farmers and differences over years will be described.

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THE OUTREACH RESEARCH PROJECT IN NORTH SUMATRA

The Outreach Research Project is situated in villages in Galang District in North Sumatra. The project was started in December 1987 with a baseline study involving 24 farmers from five villages: Galang Suka, Tanjung Gusti, Jaharun A, Pulau Gambar and Pulau Tagor. In April 1988, 12 of these 24 farmers were selected for the ORP. A map of the Galang District is presented in Appendix 1. The villages can be divided in two different locations. One location is rubber plantations only and the other location is rubber mixed with rice-cropping. Each selected farmer received a grant to build a barn. After completing the barns each farmer was given one ram and four pregnant local ewes, two of which had been bred to a local ram and the other two to a St-Croix purebred ram. The ram remained the property of the SR-CRSP and every one or two years the farmers received a new ram to prevent inbreeding. The farmers had to return two lambs for each ewe received and these were distributed to other farmers, for expansion of the project. Farmers who joined the project after 1988 received 4 crossbred ewes (St-Croix X Sumatra local). During the last four years the number of farmers participating in the ORP has increased from the initial 12 to 26 farmers at the beginning of 1992. One farmer who was one of the first 12 farmers in 1988 moved in 1989 to Java. All farmers have to keep records of each parturition and growth of lambs and have to report sold, dead or lost animals. Right from the beginning all sheep received anthelminthics. A more detailed description of the ORP is given by Soedjana et al. (1990). The names, residences, starting year and flock size of all ORP farmers at the moment are presented in Appendix 2.

In the past four years data have been collected from the ORP farms on litter size, mortality, medical treatment, birth and weaning weights of lambs and ewe body weights. The data from notebooks of farmers were collected on a regular basis by the extension worker from SR-CRSP. An example of a page in that notebook is given in Appendix 3. In the next paragraphs of this paper some productivity characteristics will be presented and discussed. The data used for these calculations were collected in the period from August 1988 until February 1992.

For the analysis of the data, the programs MSUSTAT (MSUSTAT, 1988 version 4.11) and LOTUS 123 (LOTUS, 1986 version 2.3) were used.

PRODUCTIVITY IN GENERAL

On farm level the most important factors responsible for economic returns are litter size, survival rate, growth rate of lambs and lambing interval. In this part the above mentioned factors will be described. Also some attention will be paid to ewe body weight and birth weight of lambs.

Litter size

Litter size can be divided in litter size at birth and litter size at weaning. The differences between those litter sizes are an indication for the mortality rate or survival rate of the lambs born.

The average litter size at birth on the ORP farms is 1.33 lambs per litter. The distribution of litter sizes is illustrated in figure 1. A single lamb was born in 71% of litters, 26% of the litters were twins and only 3% of the litters were triplets.

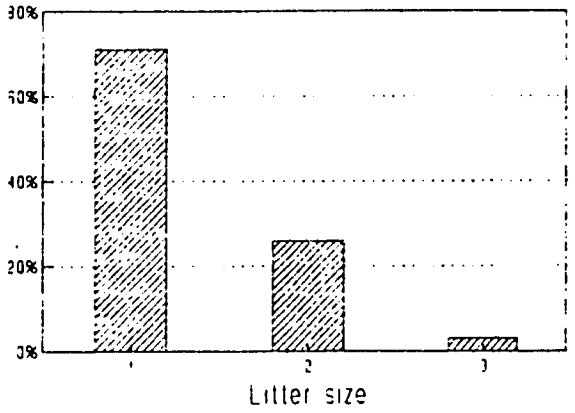

Figure 1.: Distribution of litter size at birth

At weaning there was only a slight change in these figures. Percentages of litters of singles, twins and triplets were respectively 74%, 24% and 2%. The average litter size at weaning was 1.27 lambs per litter. The litter size at weaning is defined as the average of litters containing more than zero lambs. This means that litters from which all lambs died are not included. The difference between litter size at birth and litter size at weaning is due to mortality. This will be described in the next paragraph.

Another factor which could have an effect on litter size is parity of the ewe. In general first parity ewes have smaller litters than second or third parity ewes (Visscher, 1990). The same trend was found for the sheep on ORP farms. Litter sizes for the different parities are given in table 1. However the differences between litter sizes due to parity are not significant.

Table 1.: Litter sizes for different parities.

Parity	Number of ewes	Litter size
1	187	1.28
2	115	1.30
3	69	1.42
4	44	1.32
5	18	1.61
6	14	1.36
7	2	1.50

Survival rate

Survival rate is defined as the percentage of lambs born that are still alive at weaning. The overall survival rate for lambs born at ORP farms is 92.5%. Survival rate of lambs strongly depends on litter size. The survival rate of singles, twins and triplets was 96%, 91% and 77% respectively. Sembiring and Pitono (1991) found

for the same group of farmers in 1991 survival rates for singles, twins and triplets of 96%, 89% and 67% respectively. These survival rates are considerably higher than the survival rates found by Tiesnamurti et al (1985) among lambs born at the Cicadas research station near Bogor. Here a mortality rate of 9.1% at birth and 13% from birth to weaning was reported.

Especially among triplets mortality was high. A reason for this might be that ewes under village conditions are not able to produce enough milk to feed more than two lambs. Most farmers don't give their sheep supplements like concentrate, so maybe because of a limited intake of nutrients, milk production of the ewes remains low.

Daily weight gain

Daily weight gain of the lambs is calculated as the difference between birth weight and weaning weight divided by weaning age in days. The average daily weight gain of lambs on the ORP farms is 79 grams per day with a standard deviation of 20 grams per day. A daily weight gain distribution is presented in figure 2.

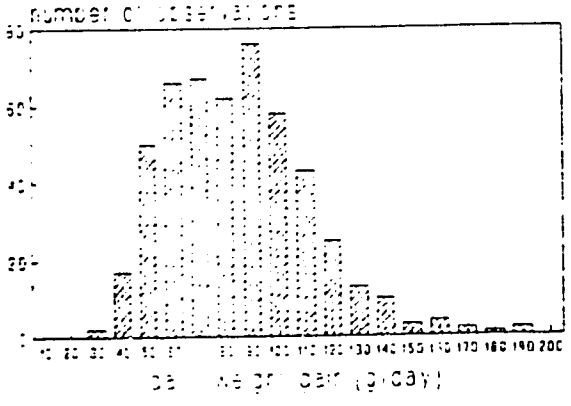

Figure 2: Daily weight gain (g/day) distribution for lambs from birth to weaning on ORP farms.

Daily weight gain is affected by litter size. Lambs born as singles have better performance than lambs born as twins and triplets (see table 2). The difference in growth between singles and twins and singles and triplets is significant, but there is no difference between twins and triplets. An explanation for this could be that the mortality among triplets is much higher than the mortality from singles and twins. A lot of the triplets may be born as triplets, but because one of the lambs dies they are raised as twins.

Table 2.: growth rates for singles, twins and triplets (g/day).

Litter size	number	daily weight gain
1	273	87[a]
2	194	70[b]
3	37	70[b]

Within the same column, numbers with a different postscript are significantly different ($P<0.05$).

Sex had a significant effect on the daily weight gain of lambs. Ewe lambs had a daily weight gain of 76 grams per day and rams lambs gained 82 grams a day (See table 3). This is not similar to what was found by Waldron et al (1985) in a study on growth rates of lambs in villages in West Java. Here, although it is commonly accepted that male animals grow faster than female animals, no significant effect was found.

Lambs from ewes with a higher body weight had a higher daily weight gain than lambs from ewes with a low body weight. The coefficient of correlation for this relation was 0.22, which is, taking the 467 observations into account, significant ($P<0.01$).

Table 3.: Effect of sex on daily weight gain (g/day) of lambs.

Sex	Number	Daily weight gain	SD
female	253	76[a]	25
male	252	82[b]	29

Within the same column, numbers with a different postscript are significantly different ($P<0.05$).

The average weaning weight of lambs on ORP farms was 9.2 kg (at a weaning age of 90 days). Because of a difference in daily weight gain among singles, twins and triplets, the average weaning weight of singles was significantly higher than the weaning weight of twins and triplets. However the total litter weight of triplets and twins was higher than the litter weight of singles (See table 4).

Table 4.: Weaning weight (kg) and litter weight (kg) for different litter sizes.

Litter size	N	Weaning weight	N	Litter weight
1	273	10.01[a]	273	10.01[a]
2	195	8.19[b]	105	15.09[b]
3	37	7.99[b]	15	19.71[c]

Within the same column, numbers with a different postscript are significantly different ($P<0.05$).

Lambing interval

Various studies have shown lambing intervals among Indonesian sheep breeds of 7 to 9 months (Sitorus et al, 1985; Sutama, 1991; Aziz, 1991). The arithmic mean of 226 known lambing intervals among the ORP farmers appeared to be 236 days. However, the distribution of the lambing interval is not normal (see figure 3). When the exceptional long lambing intervals (> 400 days) are disregarded, the mean is 217 days (just 7 months). A lot of ewes seem to have a lambing intervals of around 6½ months. Similar results were found by Romjali et al (1991). In a study at the Suka Damai experimental station it appeared that the interval between lambing and first oestrus after lambing was around 50 days.

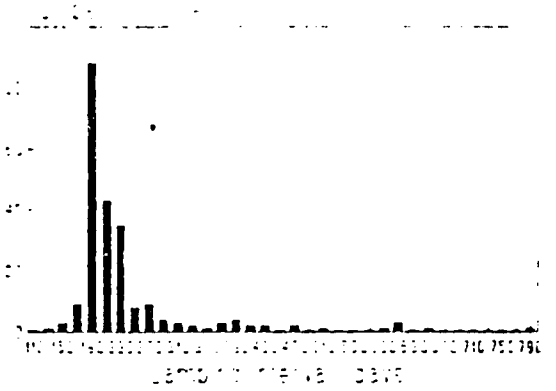

Figure 3.: Distribution of lambing interval

The lambing interval is primarily determined by environmental factors. One of the factors which can possibly influence the lambing interval is the size of the previous litter. In other studies the lambing interval tends to be longer for ewes with a previous multiple litter than a previous single litter, although this difference was not significant (Sitorus et al, 1985). Also in the case of the ORP farmers no significant difference was found (see table 5).

Table 5.: Lambing interval (days) according to previous litter size.

Previous litter size	N	Lambing interval	SD
Singles	146	215	46
Multiples	66	219	36
Overall	212	217	43

Ewe body weight

Ewe body weight is measured each time after lambing. The mean ewe body weight on ORP farms is 21.8 kg. Ewe body weight is affected by parity of the ewe. In table 6 the ewe body weights for each parity are presented.

Table 6.: Ewe body weight at different parities.

Parity	N	Ewe body weight
1	170	21.1^{a}
2	95	22.0^{b}
3	67	23.2^{c}
4	39	22.7^{bc}
5	17	22.2^{abc}
6	13	22.0^{abc}

Within the same column, numbers with a different postscript are significantly different ($P<0.05$).

Differences in ewe body weight for the first three parities are significant. After three parities the ewe body weight reaches its maximum. After the third parity the ewe body weight is going down again. This might be an indication that after three parities, or after three years, the sheep reach their adult weight.

Birth weight

Birth weight of lambs is measured a few hours after birth. Birth weight is affected by litter size at birth. Lambs born as singles had the highest birth weight and lambs born as triplets had the lowest (See table 7).

Table 7.: Birth weight of lambs (kg) from different litter sizes

Litter size	N	Birth weight
1	320	2.16[a]
2	228	1.82[b]
3	48	1.58[c]

Within the same column, numbers with a different postscript are significantly different ($P<0.05$).

Ewe body weight had a significant effect on the birth weight of the lambs. Ewes with higher body weights produced heavier lambs. The relation between ewe body weight (EBW) and birth weight (BW) is:

$$BW = 1.25 + 0.03*EBW$$

Looking within litter size an effect of ewe body weight on total litter weight was only found for ewes with singles.

DIFFERENCES AMONG FARMERS

In the ORP 26 farmers are involved. Although all farmers receive extension from the same person and received the same information before they started, each farmer has his own way of keeping sheep. This may cause differences in performance of ewes and lambs. Another possibility is that differences between farms are not due to differences in management of the farmers, but that location is the responsible factor. Location 1 is rubber plantations only and location 2 is rubber plantations mixed with rice-cropping. 14 farmers have their farms in location 1 and the other 12 farmers in location 2.

In this part of the report differences in productivity and performance of the sheep due to differences in management of farmers and location will be described.

Litter size

As mentioned before the average litter size at birth was 1.33. Differences in average litter size among farmers were significant ($P<0.05$). The average litter size on the farms are presented in figure 4. Since the farmers are divided between two different locations, it might be that these differences are due to environmental differences. Average litter size on location 1 was 1.34 and on location 2 average litter size was 1.31. This difference was not significant.

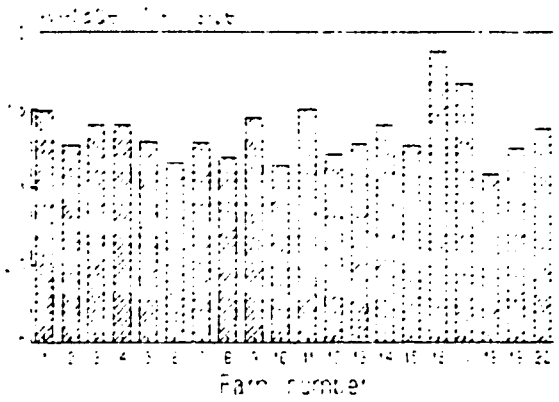

Figure 4: Average litter size on ORP farms

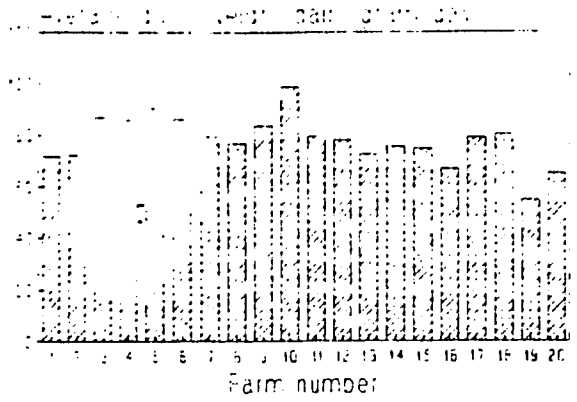

Figure 5: ADWG (g/day) of lambs on ORP farms

Daily weight gain

Average daily weight gain (ADWG) for lambs at ORP farms was 79 grams per day. It is known that daily weight gain is influenced by a lot of factors such as feeding level and occurrence of diseases, which depend mainly on management.

In figure 5 ADWG on each farm is presented. Differences in ADWG at different farms were significant ($P<0.05$). ADWG on location 1 was 78 grams per day with a standard deviation of 27 grams per day whereas the ADWG on location 2 was 81 grams per day with a standard deviation of 27 grams. This difference however was not significant. Since there is a difference in litter size among farmers it could be possible that ADWG is affected by litter size.

Lambing interval

Lambing interval is mainly affected by time of weaning and feeding level of the ewes (Nuryadi et al, 1986). These factors mainly depend on the management. In figure 6 the average lambing intervals on ORP farms are presented.

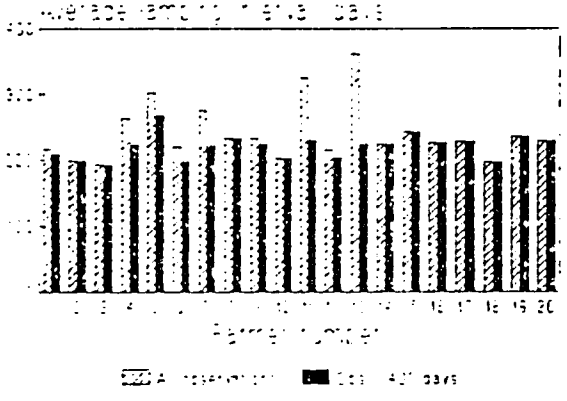

Figure 6.: Mean lambing intervals (days) at ORP farms.

In this figure both the averages of all lambing intervals and the average of lambing intervals shorter than 400 days are illustrated.

This distinction has been made because a lambing interval of more than 400 days is an exception, but has a large effect on the averages.

In both situations differences in lambing interval among farmers were significant (P<0.01). Location had no significant effect on lambing interval.

Ewe body weight

Ewe body weight is affected by management. Averages of ewe body weights on the ORP farms are presented in table 8.

Table 8.: Average of ewe body weights (EBW in kg) at ORP farms.

Farmer	Location	EBW
Wagiman	1	21.5
Miskun	1	22.5
Sarman	1	21.5
Kartomijo	1	21.1
Jusuf	1	22.3
Paimun	1	22.4
Sudirman	1	22.0
Fairen	1	22.1
Ahmat	1	17.8
Misdan	1	18.9
Suprayetno	1	20.5
Average location 1		21.7
A.Gani	2	22.4
Sutarman	2	21.1
Ngatimin	2	21.9
Kliwon	2	22.8
Kusdi	2	22.8
Toiran	2	22.1
A.Waltef	2	21.9
M.Najir	2	22.7
Amron	2	23.8
Average location 2		22.2

The differences between farmers are significant (P<0.01), but also the difference between locations is significant (P<0.05). Ewes in location 2 are heavier than ewes in location 1. Within locations differences between farmers in location 1 are significant (P<0.05). Differences within location 2 are not significant.

Birth weight

Also birth weight shows a significant difference (P<0.01) among farmers. Again there is a significant difference (P<0.01) between the locations. Birth weight in location 1 was 1.94 kg whereas the birth weight in location 2 was 2.04 kg.

DIFFERENCES OVER YEARS

When entering the ORP, most farmers had no experience with sheepfarming. Therefore it might be that after four years their skills as sheepfarmers have been improved. In this part differences among 11 farmers who collaborate with the ORP since 1988 are presented and discussed.

Litter size

The average litter size at birth was 1.33 lambs per litter over the 11 farmers who started in 1988 and are still connected with the ORP. Differences over 1988 to 1991 were not significant (See table 8). The same was found for differences between the average litter size at weaning. The average litter size at weaning was 1.27 lambs.

Ewe body weight

The mean ewe body weight was 22 kg. The same as with litter size, some differences were found. The average ewe body weight tends to decrease over the years. However differences were not significant. The average ewe body weights over the years are also presented in table 9.

Table 9.: Ewe body weight (kg), litter size at birth and litter size at weaning in 1988 to 1991.

	Litter size				Ewe body weight	
	at birth		at weaning			
Year	N		N		N	
1988	31	1.32	31	1.26	30	22.42
1989	62	1.45	58	1.33	42	22.59
1990	101	1.34	90	1.30	91	22.07
1991	138	1.28	135	1.24	129	21.69

Flock size

In 1988 the farmers started with 4 ewes and 1 ram. At the beginning of 1992 the average flock size was 24 animals, of which 11 were adult ewes. This means a yearly growth of the breeding flock of about 30%. In appendix 2 the flock size of each farmer is presented. There is much difference in flock size. The largest flock consisted of 39 animals whereas the smallest flock was only 14 animals.

Daily weight gain

The average daily weight gain of lambs was 79 grams per day. In the first and the second year lambs grew significantly faster than in the third and fourth year after the start of the ORP. Averages of daily weight gain over the years are presented in table 10.

Table 10.: Daily weight gain (g/day) in 1988 to 1991 on ORP farms.

Year	N	Daily weight gain
1988	37	97.14[a]
1989	74	86.43[b]
1990	107	72.73[c]
1991	160	75.71[c]

Within the same column, numbers with a different postscript are significantly different ($P<0.05$).

DISCUSSION AND CONCLUSIONS

Some relations found in this paper are generally known and are only presented as facts. In this part only some interesting relations will be described.

Among the ORP farmers the mortality was lower then under experimental station conditions. A reason for this may be that these farmers give more attention to their animals. Flocks are smaller and the affinity with the animals is higher.

The lambing interval among ORP farmers were shorter than the used standard of 8 months. A lot of farmers seem to mate their animals very quickly and the animals give birth 6½ months after the last litter. This may be caused by the fact that a lot of farmers don't use a breeding strategy. Rams are often kept in the same pen as the ewes and at the moment the ewe has her first estrus, the ram is able to mate her. A few physically impossible data may be due to incorrect recording.

Ewes start mating at approximately 8 months of age, but they reach their adult weight only after the third parity. Also litter size at birth increases until this age, although not significantly. So, using a lambing interval of 7 months, the ewe is in her peak of production in the third year of life.

Some differences among farmers were found. Differences in litter size, birth weight, ewe body weight, lambing intervals and average daily weight gain were found. These parameters are an indication of the management skills of the farmer. But also the location in which the farmers are located have their influence. In location 2 birth weights as well as ewe body weights were bigger. Location 2 is the mixed rice and rubber area. A possible explanation is that in location 2 supplementary feedstuffs are more available, like ricebran and other waste products.

The data show some interesting developments over the years; ewe body weight and daily weight gain seem to decrease, something that is the opposite of what is expected. Experience should increase management skills. One possible explanation is the growth in flock size. The farmers have been expanding since the beginning of the project. More animals receive less individual attention and the time spent on the sheep may not increase according to the increase of the number of sheep kept. The reasons for the increase of animals and the suitable flock size in this area are not known.

Presumably the more sheep they have, the more income is generated and there are sufficient resources to keep largish flocks. An investigation of motivations and objectives of sheep farmers could provide more information about this. Another explanation of the decrease in daily weight gain and ewe body weight is that since the beginning of the project the percentage of St.Croix genes may have gone down, because of input of purchased local ewes. More research is needed to investigate the influence of genetic changes in the population on production parameters.

The production levels in general are at least as good as the production levels on station. Survival rates in the villages are even higher than the survival rates on station. With an average litter size at birth of 1.33, a survival rate of 92.5%, a lambing interval of about 7 months and an average flock size of 9 ewes, the average number of lambs weaned per ORP farm is 19 lambs per year. The average weaning weight on ORP farms is 9.2 kg, so in general a total of 175 kg lamb per farm is weaned. The productivity per ewe is 2.1 lambs per year and a total of 19 kg lambs weaned.

Assuming that the weight of lambs at sale is 15 kg and the price per kg live weight is Rp 2500,- (US$ 1.20), the average gross returns per farm per year are Rp 710 000,- (US$ 350). The average gross returns per ewe on ORP farms are Rp 79 000,- (US$ 39) per ewe per year. From the eleven ORP farmers who started in 1988, the average annual income in 1989 was about Rp 1.8 million (US$ 900), without the returns from sheep farming (Soedjana et al, 1990). Thus the income from sheep has raised farm income by about 40%. In general the costs associated with sheep farming are very low. The conclusion is that integrating sheep into rubber plantations is a way to increase the income of small holder farmers.

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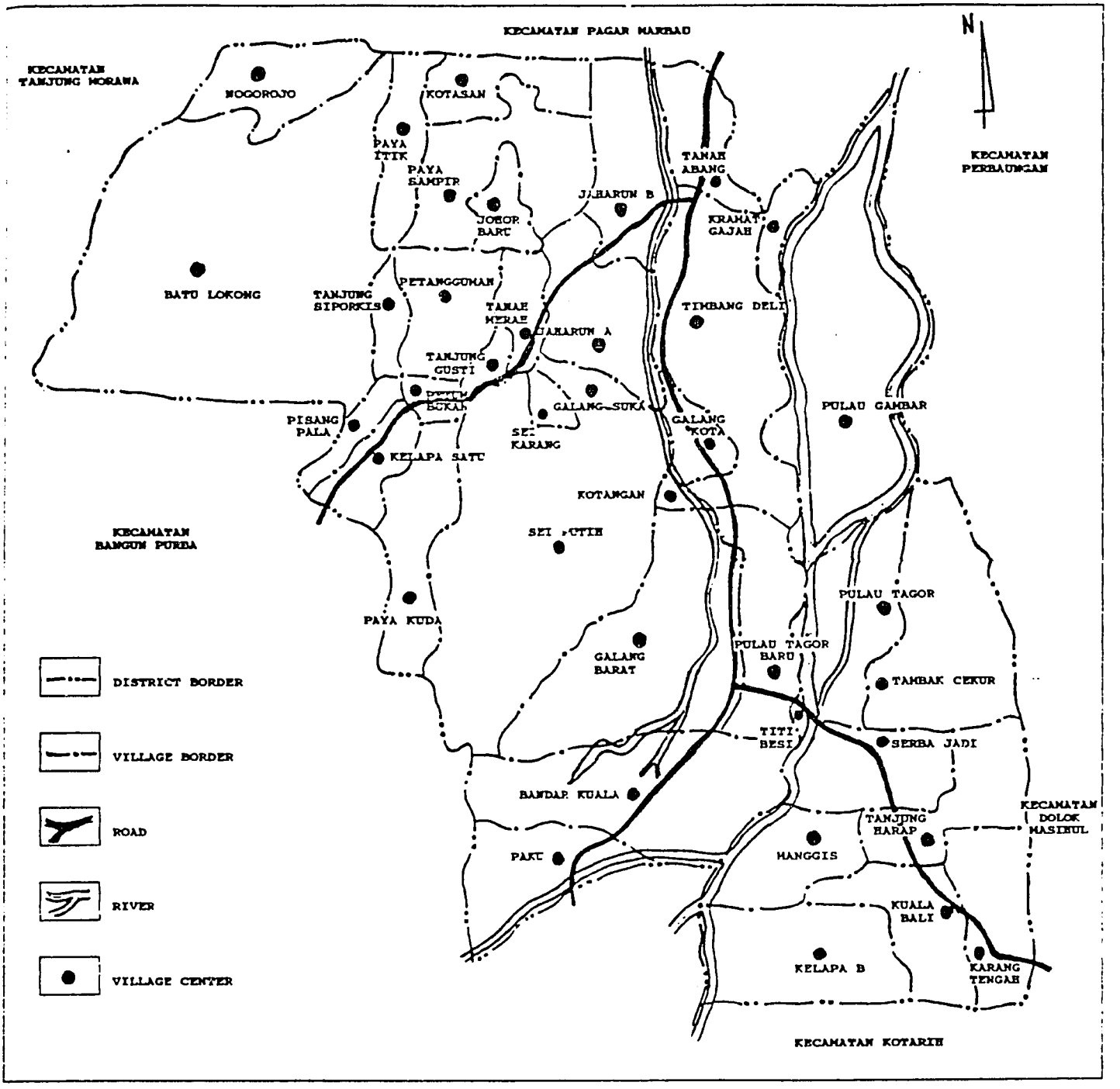
APPENDIX 1.

MAP OF THE GALANG DISTRICT

(KECAMATAN GALANG)

Scale: 1 : 100,000



APPENDIX 2

Name, residence, starting year and flock size of farmers participating in the ORP.

No	Name	Residence	year	# ewes	# sheep
01	Wagiman	Galang Suka	1988	18	36
02	Miskun	Galang Suka	1988	15	30
03	Sarman	Galang Suka	1990	11	17
04	Kartomijo	Jaharun A.	1988	12	21
05	Jusuf	Jaharun A.	1988	9	21
06	Paimun	Tanjung Gusti	1988	9	18
07	Sudirman	Tanjung Gusti	1988	10	17
08	A. Gani	Pulau Tagor	1988	10	23
09	Sutarman	Pulau Gambar	1988	10	23
10	Ngatimin	Pulau Gambar	1989	10	15
11	Kliwon	Pulau Gambar	1988	6	21
12	Kusdi	Pulau Gambar	1988	15	39
13	Toiran	Pulau Gambar	1988	7	14
14	A. Waltef	Pulau Tagor	1991	11	22
15	M. Najir	Pulau Tagor	1990	7	16
16	Amron	Pulau Tagor	1989	8	15
17	Fairen	Sei Karang	1990	5	26
18	Ahmat	Sei Karang	1990	7	24
19	Misdan	Galang Suka	1991	6	9
20	Suprayetno	Galang Suka	1990	7	14
21	Misran B.	Galang Suka	1990	8	12
22	Misro	Pulau Tagor	1990	8	14
23	P. Batubara	Sei Putih	1991	3	8
24	Ferri Aruan	Pulau Gambar	1991	8	14
25	Sumardi	Galang Suka	1991	10	18
26	Sutrisno	Pulau Gambar	1992	12	18

APPENDIX 3

Page from the note book for ORP farmers.

SR-CRSP

Livestock recorder

Number_____ Sex_____ Breed_____ Colour_____

Birth date_____ Litter size at birth_____ Ewe number___ Ram___

Body weight: Birth_____ Weaning_____ Owner_____

birth date	body weight ewe	number of lambs	lamb number	body weight lamb at birth	weaning	breed	sex	remarks

Diseases

Date	Medicine	Date	Medicine