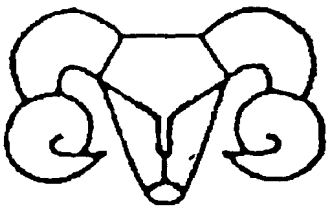
SMALL RUMINANT

COLLABORATIVE RESEARCH SUPPORT PROGRAM

SUNGAI PUTIH, INDONESIA

ANNUAL REPORT 1991 - 1992



SEPTEMBER 1992

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SR-CRSP SUNGAI PUTIH

ANNUAL REPORT 1991-1992

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NUTRITION AND FORAGE

INTRODUCTION

THE SMALL RUMINANT - CRSP IN SUNGAI PUTIH

The potential benefits that accrue from integrating sheep with rubber plantations include utilization of traditionally wasted feed resources, an increased and diversified income, stabilization of the soil, improved nutrient cycling and cheap weed control.

The overall objective of the SR-CRSP program at Sungai Putih is to develop improved systems of sheep husbandry in rubber plantations. Reserach is undertaken in three sub-programs:

1. Breeding, management and health.
2. Fodder production and animal nutrition.
3. Econoics and sociology.

The breeding program aims to develop a productive strain of hair sheep with superior genetic potential for resistance or tolerance to internal parasites, that is well-adapted to the climate and food resources of the humid and sub-humid tropics, and which lends itself to a variety of management systems to control major diseases and parasites with low cost inputs to minimise losses from morbidity and mortality.

The forage and nutrition program is investigating economic methods of supplementation and improved forages for shaded environments in rubber plantations.

The socio-economics program is working with farmers who raise sheep in conjuction with rubber plantations. The Outreach Research Project (ORP) is in an area adjoining rubber plantations near Sungai Putih and currently involves 27 farmers. The project has provided credit to these farmers in the form of sheep which have to be repaid after a period of time. Technical assistance with sheep raising is provided by trained extension staff. Biological and socio-economic aspects of production systems are monitored. A second outreach project started in June 1991 in Membang Muda about 200 km south-east of Sungai Putih. The objective is to test the technologies of sheep production with smallholder rubber producers in a nucleus rubber estate.

SR-CRSP results indicate that on average, farmers wtih sheep under rubber have an average net balance of Rp 44,20, and a return for labor equivalent to Rp 135 per hour greater than farmers without sheep. This represents a 33% higher profit and a 300% higher return for labor. The annual income one farmer gains by raising sheep is $ 600. Sheep provide 25% of monthly income to farmers with an average flock size of 20 animals. Sheep production provides what is often the only opportunity for teenage employment in the SR-CRSP project area.

Ten sheep can control the weeds in one hectare of rubber plantation. Grazing sheep under rubber trees reduces the labor needed for weeding by 18-31%. Reduced use of herbicides nationally saves $ 51 million per year, and minimises environmental contamination.

Research using crossbreeding and genetic selection has the potential to increase the productivity of individual sheep by at least 30%. Following guidelines developed by SR-CRSP, the use of cheap available supplementary feeds given to ewes for a few weeks after lambing can give a 40% increase in productivity and more than 200% gain in net benefit. Development of methods of control of gastro-intestinal nematodes (worms) and pancreatic fluke can increase ewe productivity by about 30%.

THE SR-CRSP FLOCK OF SHEEP

The majority of the flock are at Suka Damai, one of the original sites chosen by Alice Reese in 1984. Adult rams are now kept on the Sub-Balai Penelitian Ternak station to reduce the chance of unplanned matings. The flock continues to grow in response to the requirements of the breeding program and we now have more than 1500 sheep.

Most of the the sheep graze in the surrounding rubber plantations in four shepherded flocks, from 8 am to 4 pm each day. Starting January 1991 we have followed a rotational grazing pattern to control parasites (i.e. worms). Every three months all animals are given anthelmintic, then two days later are moved to the new grazing area.

The flock follows a mating system with 34-day mating periods starting in January, April, July and October. All ewes are mated individually so that the sire of each lamb is known.

At lambing, ewes are confined in individual pens for two days to establish a close bond between the lambs and their dam. They are then stall-fed in group pens until lambs are two weeks old. After this they go out to graze. Ewes with single lambs are given concentrate supplementary feed for only the first two weeks of lactation. Ewes with twins or triplets are fed concentrate for six weeks. All animals receive minerals, urea and a small amount of molasses.

Lambs are weaned at three months of age. At this time they are given anthelmintic and moved to group pens according to sex and size. There they are fed a concentrate mixture, grass and gliricidia, and are given salt licks.

Data recorded regularly include mating of ewes, ewe weight at mating, lambing of ewes, ewe weight at lambing, litter size, weight of lamb at birth and every two weeks until weaning at 3 months, wool score, mortality, worm burden and veterinary treatment. These data enable us to evaluate the performance of individual sheep and genotypes, and thus identify and select the best animals for use in the breeding program.

Sheep from the Suka Damai flock are used in nutrition and grazing trials, are distributed in SR-CRSP outreach programs, and are sold for distribution through the government animal husbandry service particularly to farmers in transmigration areas.

PERSONNEL

SR-CRSP staff in Indonesia

Dr Ruth Gatenby took up her position as Resident Scientist for the breeding program in September 1990. She is also the Indonesia Program Representative.

Dr Izuddin Kartamulia (Resident Scientist for the economics program) started work at Sei Putih in July, 1992. He replaces Dr Sibylle Scholz who was transfered to the SR-CRSP program in Bolivia in March 1992.

Dr Peter Horne, Resident Scientist for the forage and nutrition program arrived on July 27, 1992.

Health aspects of the Sei Putih project are coordinated by Dr Alan Wilson from INI ANSREDEF in Bogor.

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SR-CRSP staff in the USA

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Dr Eric Bradford, University of California, Davis. Breeding PI.

Dr Henk Knipscheer and Dr Enrique Ospina, Winrock International, Economics PIs.

Dr Mike Nolan, University of Missouri, Columbia, Sociology PI (but the sociology program will probably terminate in Indonesia).

Dr John Glenn, University of California, Davis. SR-CRSP Director.

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PRODUCTION OF SHEEP IN VILLAGES ADJOINING RUBBER PLANTATIONS

Joost Verwilghen, Ton van Schie,
A. Djoko Pitono and Elianor Sembiring

INTRODUCTION

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 (Soedjana et al, 1990).
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.

MATERIAL AND METHODS

Production data from August 1988 to February 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. 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.

Litter size

Litter size can be divided into litter size at birth and litter size at weaning. The differences between the two are an indication of the mortality rate of the lambs born. The average litter size at birth on the ORP farms is 1.33 lambs per litter. A single lamb was born in 71% of litters, 26% of the litters were twins and only 3% of the litters were triplets.
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.

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.

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 1.

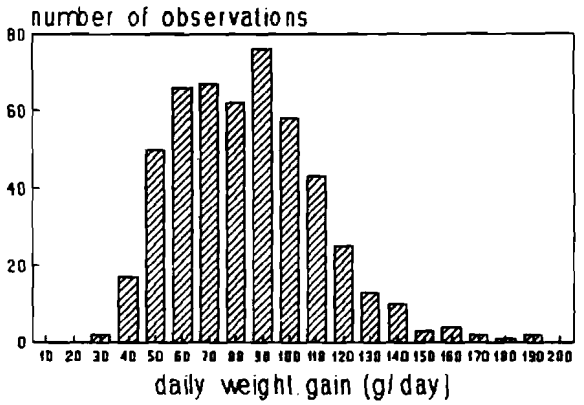

Figure 1: Daily weight gain (g/day) distribution for lambs from birth to weaning on ORP farms.

Daily weight gain is affected by litter size. The difference in growth between singles and twins and singles and triplets is significant, but there is no difference between twins and triplets (Table 1). 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 1.: 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).

Lambing interval

Various studies have shown lambing intervals in Indonesia of 7 to 9 months (Sitorus et al, 1985; Sutama, 1991; Aziz, 1991). The arithmetic mean of 226 known lambing intervals among the ORP farmers appeared to be 236 days. When the exceptional long lambing intervals (> 400 days) are disregarded, the mean is 217 days (just 7 months).

DIFFERENCES AMONG FARMERS

Twenty six farmers are involved in the ORP. 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.

Litter size

Differences in average litter size among farmers were significant (P<0.05). 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.

Daily weight gain

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

A distinction has been made between all lambing intervals and lambing intervals shorter than 400 days. This is 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.

DIFFERENCES OVER YEARS

When entering the ORP, most farmers had no experience with sheep farming. Therefore it might be that after four years their skills as sheepfarmers have been improved. Only data from the first 11 farmers who collaborate with the ORP since 1988 are taken into account.

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. The same was found for differences between the average litter size at weaning.

Ewe body weight

The mean ewe body weight was 22 kg. The average ewe body weight tended to decrease over the years, however differences were not significant.

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 2.

DISCUSSION AND CONCLUSIONS

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.

Table 2.: 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).

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 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 oflamb 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 increases the income of small holder farmers.

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THE EFFECT OF INCREASED SUPPLY OF SHEEP ON PRODUCER REVENUES

Craig Carlson and Sibylle Scholz

INTRODUCTION

The introduction of sheep to the small-holder rubber producer will lead to in an increase in total sheep production. An increase in sheep production without an equal increase in demand will result in lower producer prices. This paper examines the changes in producer income due to increasing sheep production.

METHODOLOGY

Data from four village traders were collected through daily self-reported activity logs, discussions, and through biweekly field observations. Traders travel on motorbikes which have a small basket on the back for transport of the animals. This basket fits a maximum of 5 sheep or goats. On average, these traders travel 100 km every day. Carlson went with the traders several times a week. Also, the data collected were checked and verified several times a week. The close contact with the traders meant that the data set collected has a high degree of accuracy.

Each animal bought is considered a single observation. The results presented here are based on a sample size of 236 observations. The entire study was conducted over a period of five weeks.

In order to estimate elasticity of demand several approaches can be used. An inverse demand is appropriate when there is a fixed supply and a given level of demand for a specific time period. Within this time period, the level of production cannot be altered. This holds true for the productions of sheep at the aggregate level. Therefore the equation to be estimated is:

$$Q_T[\ln P_T - \ln V_A] = \alpha + \beta_1 \ln Q_T + \beta_2 \ln Q_A \qquad (1)$$

where Q_T = total kilograms traded by single trader.
P_T = daily average purchase price/kg for single trader.
V_A = total value of animals traded by all traders (daily average purchase price/kg for all traders multiplied by total kilograms traded by all traders).
Q_A = total kilograms traded by all traders.

The coefficients will be so called price flexibilities rather than price elasticities with the inverse represented the lower bound of a regular price elasticity.

RESULTS

The results of the regression analysis using equation (1) for each type of animal are as follows (numbers in brackets are t-scores):

(A) Lambs: $1.76 - 2.69\ln Q_T - 0.66\ln Q_A$
$(1.32) \quad (2.22) \quad (0.73)$

(B) Young adults: $9.96 - 4.58\ln Q_T - 1.50\ln Q_A$
$(6.59) \quad (6.70) \quad (2.57)$

(C) Adults: $27.89 - 11.65\ln Q_T - 0.78\ln Q_A$
$(7.95) \quad (5.36) \quad (0.42)$

The reciprocal of the estimated values of parameter β_1 indicate that the demand for all three types of animals is inelastic. This is shown in Table 1.

Table 1: Trader's Demand Elasticity

Animal Type	Elasticity
Lambs	-0.37
Young Adults	-0.22
Adults	-0.09

Inelastic demand by the trader suggests that if sheep production increases, producers income from the production of sheep falls. Given the increasing marketing margin, both the producer and the trader would experience a drop in revenue as a result of increased production.

CONCLUSION

While these estimates of elasticity suggest that total revenue for the producer will decline as supply increases, this does not imply that small ruminant production will become an unprofitable enterprise. More subjective evaluations of the small ruminant market situation in North Sumatra seems to suggest that producing sheep and goats on a small commercial scale is very profitable.

PROGRESS REPORT OF OUTREACH PROJECT: MEMBANG MUDA, NORTH SUMATRA

March 1992

Edited by:
Sibylle Scholz

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INTRODUCTION

In June 1991, the SR-CRSP, Sei Putih, was approached by Puslitbun to investigate a possible new project in Membang Muda near Rantau Parapat, about 200 km east of Sei Putih. Ibu Tuti from Puslitbun, Dr. Gatenby and Dr. Scholz traveled to the site and visited several PIR villages, looking at the plantation and forage availability and speaking to the farmers.

During the PI meeting in July 1991 a budget of US$ 2000 was provided by Dr. Pond for use in the outreach project in Membang Muda (OPMM).

OBJECTIVE OF OUTREACH PROJECT

The general objective of a SR-CRSP outreach project is to provide opportunity for on-farm research to test technology packages. In the particular case of OPMM, integration of sheep under rubber for small farmers is researched with respect to breeds, nutrition, forage and economics.

Although an outreach project has existed since 1988 in Sungei Putih, these are farmers who don't own rubber plantations, and the sheep graze under rubber in an "informal" way. This means that research activities by the CRSP are restricted to breeding and nutrition with no formal opportunity to test forage species or to make sensible economic evaluations.

PROGRESS

The village was chosen in cooperation with PTP III. It is Gunung Lonceng where the farmers received 2 ha of rubber in 1986 when the plantation was 6 years old and the trees ready to tap. Diversification of income is crucial in this village because at present there is serious and widespread "overtapping".

(1) Socioeconomic Survey

In order to get a general feeling for the farmers' situation in Gunung Lonceng a survey was conducted in October to collect socioeconomic data. The survey is reported in Working Paper No. 128.

(2) Extent of Overtapping

A preliminary analysis on kg produced per year per farmer revealed that, when measured against a standard, overtapping has been increasing every year since 1986. In 1991, these farmers tapped 50 per cent more kg of latex than standard. At this rate, the plantation is expected to cease production within 5 years. Figure 1 shows the average actual and standard kg produced per year in Gunung Lonceng. The rate of overtapping is increasing and the seriousness of this situation cannot be overemphasized.

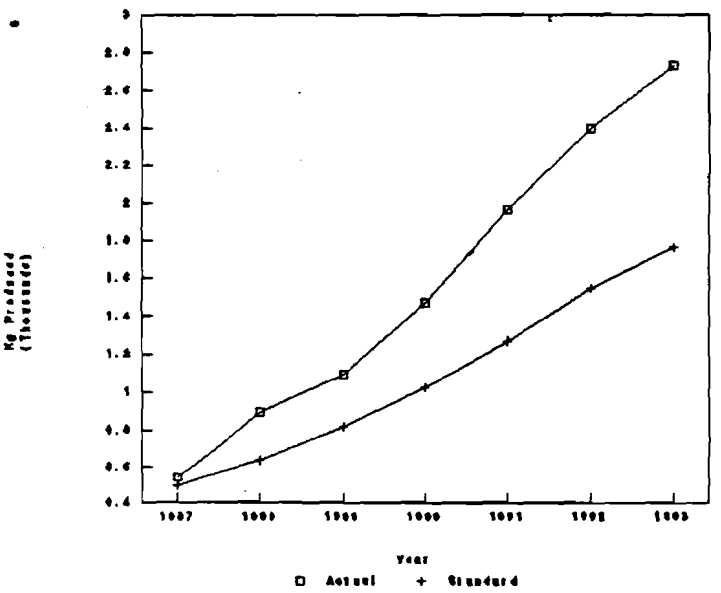

Figure 1. Average actual and standard Kg of latex produced per year

(3) Carrying Capacity

Joint research between Puslitbun and SBPT evaluated the quantity and quality of forage available in the plantation owned by the Gunung Lonceng farmers. They estimate, that this plantation, which was planted in 1982, can carry 48 animals per two hectares.

(4) Fecal Parasite Egg Counts

During the February visit, we collected and analyzed fecal samples for intestinal parasites, both in Afdeling I and Gunung Lonceng with 63 observations each. This data was used in Working Paper No. 130, which investigates the economic efficacy of anthelmintic treatment.

(6) Importance of Extension

Extension work provides the link between research results and the farmer and this link cannot be stressed enough. The benefits from good communication between research, extension and farmers are evident in the difference of sheep performance between Gunung Lonceng and Afdeling I.

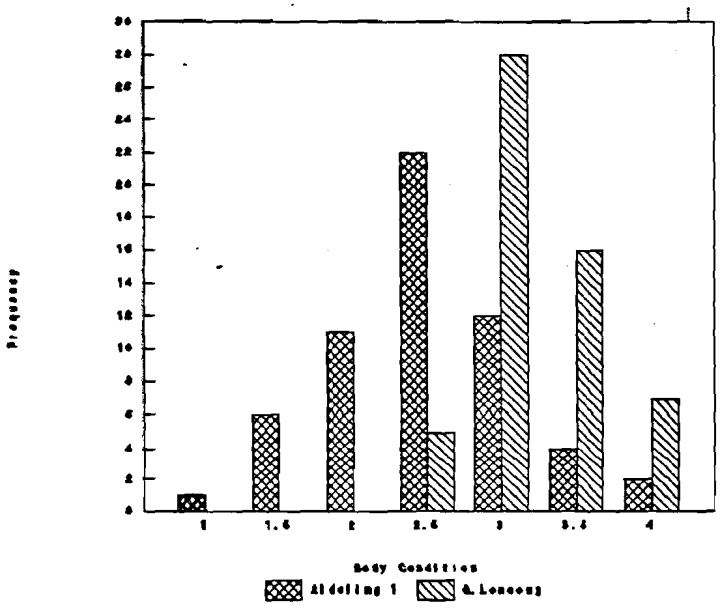

Figure 2. Frequency of body condition in Afdeling I and G.Lonceng

A comparison of body condition scores illustrated in Figure 2 reveals, that technical assistance greatly improves management skills and the performance of a flock. An overall better body condition score implies better ewe productivity and a higher value of the total flock.

In the Membang Muda outreach project great care has been taken to differentiate between technical assistance that conveys information about research results which are subject to market forces and those that are not. For instance, anthelmintics are bought by the farmers at free market prices. The extension part conveys the information about the importance of this, where it is available and how it should be used. The same holds true for mineral blocks and supplements.

To further strengthen the link between research and extension, regular visits with the regional Dinas Peternakan in Rantau Parapat have occurred every month. This effort has produced some favorable results. In one instance we were able to obtain 3 doses of Rintal free of charge. Additionally, Dinas Peternakan in Rantau Parapat is learning to cater to the needs of extension to sheep.

CONCLUSION

The research teams from SBPT and Puslitbun together with extension personnel established a well running outreach project in the 6 months from September 1991 to March 1992. The success is due in great part to the cooperation of PTP III Administration in Membang Muda.

The outreach project provides an excellent opportunity to test technology packages of sheep under rubber for smallholder. In particular, forage quality and quantity can be evaluated as grazing increases. Furthermore, the opportunity to introduce new forage species exists now. This can provide important information on the viability of commercial sheep schemes under rubber.

SOSIOECONOMIC SURVEY OF FARMERS IN MEMBANG MUDA OUTREACH PROJECT

Elianor Sembiring and Sibylle Scholz

INTRODUCTION

In September 1991, as a further step in technology transfer of sheep under rubber, the Small Ruminant Collaborative Research Support Program started a new outreach project in conjunction with PTP III, an Indonesian semi-private rubber estate, as well as Puslitbun, the Rubber Research Institute and SBPT the Livestock Research Institute both at Sungei Putih.

The farmers are part of Indonesia's NES project who received 2 ha of rubber plantation from the government. In October 1991 a short socioeconomic survey was conducted to gather basic information on the farmers who received sheep.

RESULTS

Table 1 reveals that these farmers are literate, which means that technology transfer is likely to happen more efficiently than if they were not literate (Jenck, 1973, and Priyanti et al. 1989, Kusnadi, 1984). Family size seems to be sufficiently large to ensure enough labor available for increasing livestock activities. Most farmers do have experience with livestock; some of these farmers presently own goats and chicken, but no large ruminants.

Table 2 reveals household expenditure patterns for the 12 farmers surveyed. The single largest expenditure is on rice. Bennett's law states that the "starchy staple ratio" declines as household income increases but Périssé demonstrated that there exists considerable substitution *within* the starchy staple category before the relative importance of starchy staples declines in the total diet (see Timmer et al., 1983). In Indonesia, at which rice is the most important. In this village considerable substitution between cassava and rice has taken place, but the starchy staple food ratio is still above 1 at 1.34. With an increase in livestock owned by households, it is expected that the starchy staple food ratio declines and that protein consumption increases.

Table 1: Farmers' age, education, previous occupation, livestock experience, family size, religion, ethnic group and origin

Farmer	Age	Ed	Previous Occupation	Livestock Experience years	Family Size	Religion ch=0,m=1	Ethnic b=0,j=1	Origin
Lakon	37	3	Farmer	2	6	1	1	N.Sumatra
Jamaluddi	41	9	Farmer	5	5	1	0	N.Sumatra
Temu	33	6	Farmer	16	5	1	1	N.Sumatra
Selamat J	35	6	Farmer	10	8	1	1	N.Sumatra
Semin	53	0	Farmer	1	4	1	1	Java
Tugimin	33	6	Farmlabor	13	7	1	1	N.Sumatr1
Rosid	40	6	Farmlabor	3	6	1	1	Java
Selamat S	37	6	Farmlabor	0	7	1	1	N.Sumatra
Sakirin	35	6	Farmer	1	9	1	0	N.Sumatra
Tardi	55	6	Labor	33	7	1	1	Java
Sagimin	32	5	Farmlabor	25	6	1	1	N.Sumatra
Subroto	20	8	Farmlabor	5	12	1	1	N.Sumatra

Table 2: Household Expenditure Pattern per Year

	Rice	Food	School	Uniforms	Cigarettes
Lakon	498960	360000	300000	45000	0
Jamaluddin	504000	360000	36000	80000	36000
Temu	582120	360000	356000	40000	0
Selamat J.	630000	600000	168000	0	132000
Semin	600000	600000	108000		126000
Tugimin	648000	600000	120000	80000	0
Rosid	432000	360000	420000	40000	90000
Selamat St	660000	600000	560000	400000	60000
Sakirin	831600	540000	22000	10000	144000
Tardi	540540	240000	270000	50000	0
Sagimin	498960	480000	48000	75000	0
Subroto	760440	240000	120000	55000	0
Average	598885	445000	210666	79545	

School fees and uniforms for school amount to 10 percent of yearly income. Also, some farmers spend as much as 5 percent of their income on cigarettes. Although not obvious from this small sample, it is likely that cigarettes have a high income elasticity which means that as income increases, a larger percentage of the additional income will be spent on cigarettes.

A major problem in this area is overtapping, which reduces the lifetime of a plantation by as much as half. Data collection on hours spent for various activities in the plantation showed no correlation between extend of overtapping and income.

CONCLUSION

The farmers in the Membang Muda outreach project, who are small holder rubber plantation owners, are literate suggesting promising adaptation of sheep technologies.

Expenditure patterns revealed that the largest proportion is spent on starchy food, but with the introduction of livestock an increase in protein consumption is likely.

The problem of overtapping implies, that livestock, rather than increasing total income for these farmers, will need to serve as the diversification of income in order to maintain long-term productivity of the plantation.

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GUIDELINES FOR A SHEEP AGRIBUSINESS ENTERPRISE: A FATTENING SCHEME

Leo Batubara and Sibylle Scholz

INTRODUCTION

Agribusiness enterprises in sheep fattening schemes become viable when the sheep population density in a given area reaches a critical point at which supply to the fattening scheme is readily available. In the Medan area in North Sumatra, this condition exists. A marketing study revealed that a single trader transfers as many as 250 sheep in one month between producer and the market in Medan, most at suboptimal weights (Carlson et.al. 1991)

The most important preliminary considerations for a commercial fattening scheme are (i) Size, (ii) Supplements, and, (iii) Cash Flow Calculations.

Size of fattening scheme

The size of a fattening scheme is determined by cost and benefit. The break-even point was calculated as 60 animals in a fattening scheme for 90 days. Returns to investment were calculated at 18 percent for a scheme with 200 animals.

Supplements

Supplement recommendations are derived from research results reported in Sanchez (1990). A concentrate mixture of rice bran, palm kernel cake, molasses, fishmeal and urea is used. The proportion of ingredients follows standard nutritional requirements of 15 to 18 grams of protein and 420 to 520 kcal of energy per day.

Cash flow and the size of credit

A cash flow chart for the first 5 months of operating a fattening scheme helps to determine the exact amount of credit needed. A common mistake in estimating the size of credit is to overlook the fact that no income is generated during the first 3 months of a scheme. Many businesses falter because they find themselves in a cash crunch right from the start. A detailed cash flow chart can avoid this problem.

Since the use of Lotus 123 is common now, a detailed description of a cash flow chart including formulas for individual cells is illustrated in the working paper.

CONCLUSION

An agribusiness enterprise in sheep fattening is viable in the Medan area and guidelines for preliminary considerations are detailed in Working Paper No. 129

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THE ECONOMICS OF TREATING PARASITES IN SMALL RUMINANTS

Sibylle Scholz

INTRODUCTION

This study focuses on one health aspect, namely parasite control, although it is not clear from previous research conducted in Java, if this is the most important health problem. For instance Diarrhoea was reported as a problem on 84 % of the farms surveyed (Adjid et al., 1989). These same farmers reported that they considered neonatal deaths and still-births, which occured on 57% of the farms, the most important problem. Unfortunately, parasites are not listed in that study.

Data from the Bogor slaughter house, for instance found that 82% of the sheep were infected with Haemonchus contortus (Darmono, 1982 in Gatenby et al., 1988). Preliminary research from Sumatra, where sheep are grazed in rubber plantations suggests, that almost 100 % of the sheep have parasites, but that some sheep seem to be resistant and consistently show zero or low parasite egg counts.

METHODOLOGY

A standard way of estimating the value of health care delivery in both human and animal populations is to estimate the loss in production due to illness or death. The present analysis estimates several such production parameters.

Loss in ewe productivity

Productivity is estimated over the entire lifetime performance of a ewe. The estimate has the following functional form:

$$TR = (1-b_i)\ Y_iP - C \qquad (1)$$

where TR = Total Revenue
b_i = lamb mortality rate
Y_iP= kilograms x Price
C = Cost of Rintal

The value of a flock

An alternative way of estimating the value of anthelmintic treatment is to estimate the value of a flock at a given time. A monetary value is computed for the total kilograms of a given flock size. The price used for computation varies with the average body condition score. The assumption is, that there is a relationship between fecal egg count and body condition, although other

variables contribute to the overall condition of an animal.

The following functional form is used:

$$TV = YP_i - C \qquad (2)$$

where TV = Total Value in Rp
YP_i = kilograms x Price
C = Cost of Treatment

RESULTS

Ewe productivity

Table 1 shows results from ewe productivity using different assumptions on mortality rates and kg produced per year. A wide range of mortality rate is reported in the literature, summarized in Gatenby et al. (1988).

Of particular interest are results on mortality rates from on station research conducted by Handayani and Gatenby (1988). They report a mortality rate of 0 and 0.28 for treatment and non-treatment trials. This compares to a mortality rate under village conditions (with no treatment) ranging from 0.15 to 0.38 (Subandriyo, 1985b).

Productivity of ewes is calculated at 1.5 litters per year for 5 years. The figures used for kg produced per ewe are less straight forward and more problematic because research trials involving anthelmintic treatment typically report weight gain of lambs per day and not kg weaned (the estimate used here). Key variables used here are reported in Subandriyo (1985a) with average litter weight at weaning to be 10.3 (± 0.81) kg, for JTT in villages, and 12,6 (± 1.23) kg at Cicades Experimental Station.

The crucial consideration for a farmer is to calculate marginal revenue. That is, what is the additional benefit from an additional input. This is shown in Table 1 where two figures are reported for mortality rate of 0.15 (0.85 = 1-b) row (i) and row (ii). Row (i) shows the village survival rate at 0.85 with no treatment, with 77 kg produced over the ewe's lifetime. The marginal revenue is Rp 15,435, which means, that improving survival rate from 0.85 to 0.87 using anthelmintics increases total revenue from Rp 143990 to Rp. 159,425. In other words, an investment of Rp. 4200 increases profits by Rp. 15,435.

Row (ii) shows the same calculations using one standard deviation above mean kilograms produced. At this point, marginal investment equals marginal revenue. From an economic point of view, this

investment is recommended. This implies, that for 66 percent of ewe population with 0.85 survival rate and 77 kg produced, parasite treatment increases output.

Table 1: Ewe Productivity

	Marginal Revenue	Total Revenue	(1-b)	Y	P	C
		204800	1.00	95	2200	4200
	9515	195285	0.98	93	2200	4200
	9295	185990	0.95	91	2200	4200
	9075	176915	0.92	89	2200	4200
	8855	168060	0.90	87	2200	4200
	8635	159425	0.87	85	2200	4200
(i)	15435	143990	0.85	77	2200	0
(ii)	4215	155210	0.85	83	2200	0
	8195	147015	0.83	81	2200	0
	7975	139040	0.80	79	2200	0
	7755	131285	0.77	77	2200	0
	7535	123750	0.75	75	2200	0
	7315	116435	0.72	73	2200	0
	7095	109340	0.70	71	2200	0

In reality output changes are probably much larger. For instance, if survival rate increases from 0.85 to 0.95, then marginal revenue is Rp. 42,000 an increase of 29 percent.

Value of flock

Fecal parasite egg counts were collected in one outreach village and one village where no previous technical assistance to sheep production was extended (the control group). Table 2 shows body condition scores and fecal egg counts for the various groups.

In general these data show that higher fecal egg counts are associated with lower body condition scores, although a regression analysis showed this relationship to be weak at best. This is because there is large variation in fecal egg count within each category of body condition.

The total weight for each flock was computed and the total revenue was calculated, summarized in Table 3.

A one time treatment for 1324 kg of sheep requires 66 grams of Rintal, which means a cost of Rp. 9,000. Using the more expensive tablet form of Rintal at Rp. 550 per 20 kg, the cost would amount

to Rp. 36,300. Doubling this cost for the retail level would imply a maximum cost of Rp. 72,600 for a flock with 68 animals. This means, that parasite control adds a minimum of Rp. 5,300 to the value of each animal or 12 %.

Table 2: Body condition and fecal egg counts from two villages

	<----------Eggs/Gram---------->					
	<-----Afdeling I[1]--->			<-------G.Lonceng[2]------>		
Body Condition	All	Ewes	Rams	All	Ewes	Rams
1.5	2850	3610	300	-	-	-
2.0	2798	2802	2775	-	-	-
2.5	1221	988	1956	-	-	-
3.0	934	1102	648	311	368	285
3.5[3]	3060	-	3060	267	327	210
4.0[4]	1770	-	1770	792	1125	172

[1] Afdeling I is the control
[2] G. Lonceng is the outreach project where animals receive regular parasite treatment.
[3 & 4] small sample size

Table 3: Value of flock

Number	Gender	Afleding I		G. Lonceng	
		Kg	Rupiah	Kg	Rupiah
47	Ewes	707	1,555,000	974	2,142,800
21	Rams	421	926,200	350	770,000
Total		1128	2,481,600	1324	2,912,800

CONCLUSION

A preliminary analysis of returns to health care investment in sheep showed large benefits for parasite control. In terms of ewe productivity a decline in lamb mortality rates and an increase in kg of lambs weaned can increase total revenue by as much as Rp. 42,000 under village conditions which is an increase of 29 percent. Given that parasite treatment costs as little as Rp. 4,200 for the ewe's lifetime, this seems a worthwhile investment.

In terms of the value of a total flock, parasite treatment showed satisfactory returns to investment. The value of an animal increases by 12 % even assuming maximum cost of treatment.

Such strong results suggest, that making parasite treatment available to farmers on a non-subsidized, free market basis is viable. The fast improvements in animal condition from just one treatment suggests, that farmers are likely to be willing to invest in parasite control given good information on

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THE DEVELOPMENT OF AN ANIMAL HEALTH DELIVERY NETWORK IN NORTH SUMATRA
Report of Phase 1

Ton van Schie, Joost Verwilghen,
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INTRODUCTION

In Indonesia new technologies are often available in urban areas, but they rarely reach the farmer in the field. The Animal Heath Delivery Network will make an attempt to improve this situation by developing a link between wholesalers and farmers, using existing marketing channels. The project is focused on improving animal health care of sheep in North Sumatra and is situated in the Galang District.

Since a major disease problem among sheep in North Sumatra is helminth infections (Heryanto et al, 1991), the emphasis will be on the delivery of anthelmintics for sheep. Anthelmintics have been proven beneficial for farming systems in which the sheep go out grazing every day, not only under experimental conditions, but also under village conditions (Beriajaya and Stevenson, 1986; Chaniago et al, 1984).

To establish a link between farmers and wholesale dealers, a network between wholesale dealers, merchants or distributors and smallholder farmers has to be designed. A diagram of a possible network is presented in Figure 1. Livestock traders, local shops and extension workers might purchase their supplies from wholesale dealers in Medan. There is also a possibility that traders and extension workers will buy in the local shops if more convenient. They will distribute the supplies among farmers who want to make use of the offered services.
The project contains four phases, spread over two years. Phase 1 is the description of the current situation in the Kecamatan Galang where the project is situated. In phase 2 the report of the first phase will be evaluated and a rough design for a network will be presented. In phase 3 all participants of the network will be informed and trained. After this the network will be started. In phase 4 the network will be controlled, monitored and evaluated two years after the beginning of the project. This report only contains the results of the first phase.

To describe the current situation, all parties which can possibly be involved in a future network were investigated.

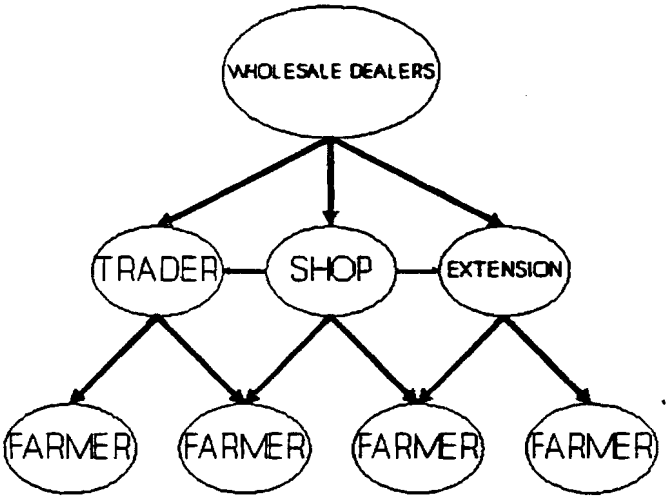

Figure 1 Possible design of an Animal Health care Delivery Network

THE FARMERS

In Kecamatan Galang a group of farmers is actively supervised by the Small Ruminant Collaborative Research Support Program (SR-CRSP) these farmers are the Outreach Research Project (ORP). Because a lot of information is known about those farmers and because they are familiar with the use of anthelmintics, this group are possible candidates to be selected for the initial group of the network which can expand to farmers outside this group after the initiation. These farmers were visited to obtain the wanted information. Also twenty non-ORP farmers in the Kecamatan Galang, not connected with SR-CRSP, were visited in order to investigate the knowledge of these farmers about animal health and the use of anthelmintics.

Farmers who are frequently visited by extension workers have high confidence in them and in general follow the advice of these people. There is still a big demand for extension among the farmers. ORP farmers seem to know more about anthelmintics and helminth infections than other farmers, but they don't know how to give the medicines to their animals. The non-ORP farmers who use anthelmintics are better informed about the way of medication. Farmers who know the benefits of the use of anthelmintics and other supplements are willing to pay for them, even if the price is higher than what they pay at the moment. Farms are in general very small, which excludes the possibility for the farmers to buy anthelmintics from wholesale dealers themselves because of the big quantities which are being sold at the moment.

LIVESTOCK TRADERS

Livestock traders are an important link between the farmers and the final consumers of sheep meat. Farmers are often not able to market their animals themselves and have to sell the sheep to traders. Because of regular visits of livestock traders to farmers even in very remote areas, traders may be able to distribute animal health care supplies to these farmers. In Kecamatan Galang and its surroundings, 5 livestock traders are active (Carlson and Scholz, 1991). These traders use either a motorbike or a bicycle for transportation. When they enter a village they sound their horn to get the attention of the inhabitants. If a farmer wants to sell an animal he calls the trader. The trader will also stop and ask for himself at houses of potential sellers.

For a period of two days one livestock trader was observed during his daily work. Slaughter houses in Medan collect animals twice a week at the traders house, without any extra transportation costs. He appeared to have a lot of knowledge about sheep and goats in general and about animal health care.

Livestock traders know a lot of farmers in the area. They are highly mobile and transportation costs don't have to be included in the economic calculations for these people, because they go to the villages anyhow. Livestock traders are probably willing to sell anthelmintics if some profit can be made. Economically it is almost impossible to gain a sufficiently high income from distributing medicines alone. So the distribution has to act as a profitable second branch and interference with his main job of selling and buying animals has to be kept low. The success of a distribution network with the use of a livestock trader also depends on how much the farmers trust the trader. A formal letter of recommendation from a known authority on animal production after a proper training to upgrade their knowledge about animal health care could increase the reliability of the trader.

LOCAL SHOPS

One possibility of distributing medicines and supplies is local shops. The advantage of using local shops is that not only anthelmintics can be distributed, but also other supplies such as mineral supplements. Besides, the farmer is able to buy the supplies at any time and does not have to depend on the visits by the livestock traders. In order to obtain information about shops in Galang which sell or might be able to sell animal health supplies in the future, personal interviews were conducted.

Only one shop in Kota Galang appeared willing to sell animal health care supplies. Before buying supplies the shopkeeper must be certain that the bought products will be sold, to avoid stock problems.

EXTENSION SERVICES

After the interviews with the farmers it appeared that there are two major sources of extension in the project area. First the extension worker of SR-CRSP and second; the local Dinas Peternakan. Interviews with the extension worker of SR-CRSP as well as with an employee of the Dinas Peternakan were conducted.

The SR-CRSP extension worker, Jeplin Sihombing, visits the farmers connected with the ORP on regular basis. His main job is to collect data and give extension to the farmers. The frequency of his visits is at least once-a-week. He has no professional contact with the government extension service, Dinas Peternakan, which has the same working area.

A general problem with government extension in developing countries is the lack of manpower and adequate mobility. Most agents have to cover too many farmers spread over a large area, because of which some farmers will not be visited at all and other farmers will not receive the attention they need for good farm management (Benor and Harrison, 1977). These problems also occur in Galang District. Farmers are visited when they ask for it. Mr. Sudijana is called about two times a week because of animal health care problems with any kind of farm animals. Another way for farmers to contact Dinas Peternakan is during meetings of farmer groups (kelompok) which take place once a week. These farmer groups receive information about agriculture in general. Animal production is one section of the program. In case of animal diseases, first an attempt is made to cure these with cheap traditional medicines, before the use commercial medicines is suggested by Dinas Peternakan. The treatments with commercial medicines are mostly given by an employee of Dinas Peternakan, because farmers generally don't know the dose and method of treatment.

The Dinas Peternakan supports the general idea that more medicines have to be available for farmers in Galang District.

WHOLESALE DEALERS

One of the reasons why farmers do not use those commercial animal medicines is because these medicines are normally not sold in small villages, but only in big cities. In Medan several medicine dealers were visited.

According to animal medicine dealers in Medan, smallholder farmers in North Sumatra do not realize the importance of using anthelmintics. Anthelmintics are bought from dealers in Medan mainly by the bigger enterprises which don't complain about the big size of packing.

CONCLUSION AND RECOMMENDATIONS FOR THE NEXT PHASES

Because most of the farmers are willing to pay more than the price they are paying right now (cost price) it is possible to start an independent delivery network in which some profit can be made by the distributors of anthelmintics.

There seem to be three possible methods of distribution in this district: livestock traders, local shops and the SR-CRSP extension worker. The livestock traders cover a large area and are able to visit a lot of farmers, but farmers do not trust them as much as an extension worker. However, the number of farmers visited by extension workers is limited. Local shops have the disadvantage that farmers have to go there to buy the anthelmintics; but an advantage is that farmers no longer depend on another person to deliver the medicines.

In general medicines are available in large packages. The wholesale dealers are not prepared to sell anthelmintics in smaller packages. So the distributors in the animal health care delivery network have to buy large amounts and make smaller packages themselves. This implies the distributors have to know how to use anthelmintics and how much is needed for one animal. All three of them don't have enough cash to pay for anthelmintics in advance or are not willing to take the risk of buying supplies without certainty of selling them. Therefore some financial arrangement should be made eliminate the risk for the distributors.

Since there is no proper and clear written information available for farmers on how to use anthelmintics, a sheet with all the necessary information should be designed. To be clear it must contain only limited information; what anthelmintics are, what the benefits of the use of them are and how to use them.

When the distribution network is initiated, the heads of all the villages in Kecamatan Galang should be informed. They can tell the farmers in their villages where they can buy anthelmintics for their small ruminants.

In order to see how the network is developing all three distributors should keep records of how much anthelmintic is sold and to where it is sold. If the distribution network is operating in Galang District and the results are satisfying, a similar network could be started in other districts as well.

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THE DEVELOPMENT OF AN ANIMAL HEALTH DELIVERY NETWORK IN NORTH SUMATRA
Preliminary Report of Phase 2

Izuddin Kartamulia,
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INTRODUCTION

A major disease problem among sheep in North Sumatra is helminth infection. Gatenby et al (1992) point out that the two most serious health problems of sheep in rubber plantations in North Sumatra are gastro-intestinals worms and pancreatic fluke.

Farmers know and use traditional remedies, while SR-CRSP/SBPT in North Sumatra is introducing commercially-produced drugs to treat animal diseases. Farmers are willing to use the drugs; however, these are not always available in the field.

To improve the situation, SR-CRSP/SBPT is developing an Animal Health Delivery Network (AHDN) which links drug wholesalers, extension agents, small ruminant traders, local poultry shops, and farmers under the coordination of SR CRSP/SBPT and Dinas Peternakan. The network objectives are: (1) to encourage farmers to use drugs, and (2) to make the drugs available in the field at a reasonable price.

The design of the network was originally proposed by van Schie et al (1992), a modification to the proposed design has been made to facilitate SR-CRSP/SBPT and Dinas Peternakan into the network.

This report illuminates the new design and the parties involved in the network as well as the participants' rights and responsibilities.

THE NETWORK DESIGN

Links between drug wholesale dealers, animal traders, shops, extension workers, SR-CRSP/SBPT and Dinas Peternakan are depicted in Figure 1.

SR-CRSP coordinates and promotes, while Dinas Peternakan, especially Dinas Peternakan Tingkat I in Medan supervises the network.

Drugs are distributed by wholesale dealers to farmers through traders, shops, and extension workers.

THE DRUGS

Two kinds of drug will be used, namely Valbazen and Rintal granules, both are broad spectrum anthelmintics produced by P.T. Kalbe Farma and Bayer, respectively.

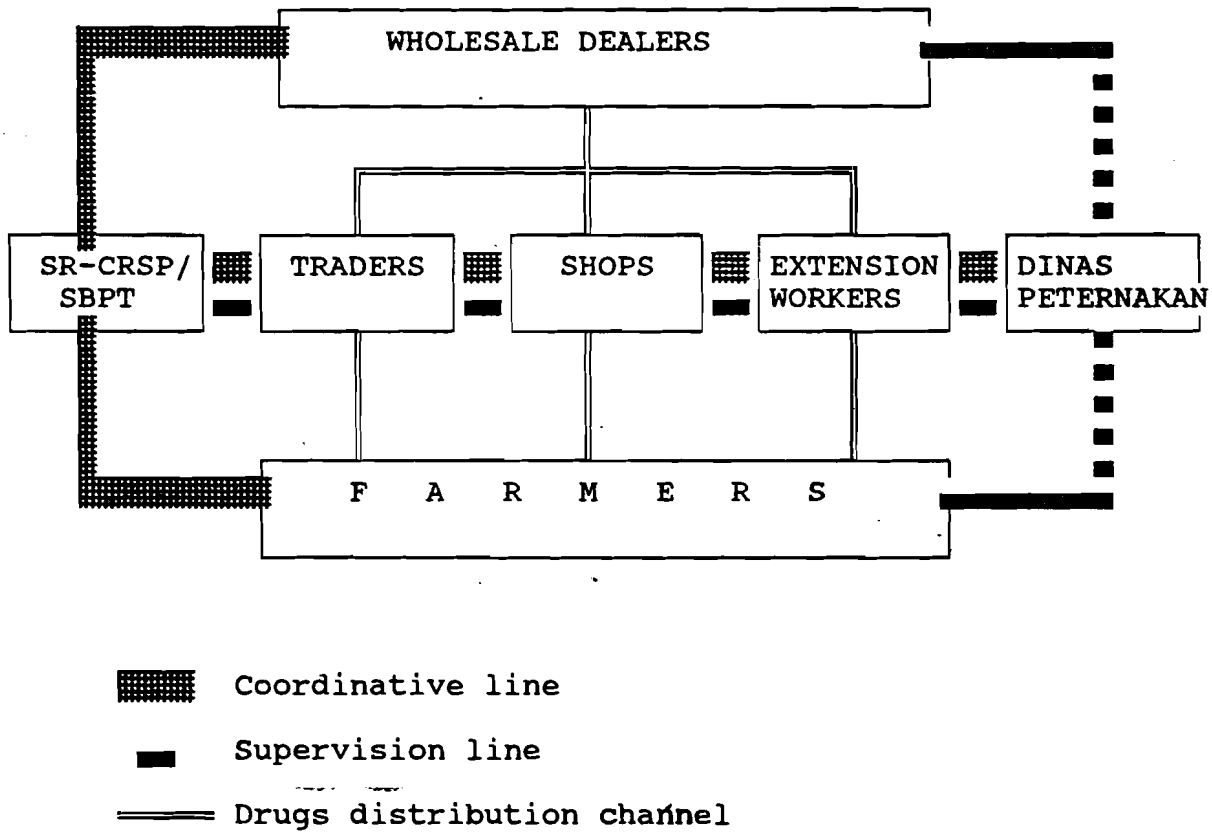

Figure 1. Animal health delivery network design

The active ingredient of Valbazen is Albendazole which is to be claimed to be effective against: stomach and intestinal worms, lungworms, tapeworms, liver fluke, and both roundworm an immature stages. Rintal contains Febantel which is declared as useful against worms and fluke.

Rintal has already been used by SR-CRSP extension workers (Jeplin Sihombing and Darwin Simangunsong) for ORP and non-ORP farmers in Kecamatan Galang and Membang Muda. Valbazen is new to the extension workers.

There is also a possibility of incorporating another drug namely Systamex which contains Oxfendazole and is produced by Wellcome, into the network. However, the company agent in Medan has not yet responded to the SR-CRSP/SBPT request. SR-CRSP will further explore the prospect of Systamex being included into the network.

PARTICIPANTS

Wholesale dealers

There are two wholesale dealers participiting in the network, namely PT. Kalbe Farma and PT. Djawa Maluku which supply Valbazen and Rintal, respectively. The address of PT. Kalbe Farma is Jl. Glugur By Pass No. 165 A/82 and of PT. Djawa Maluku is Jl. Iskandar Muda No. 75, Medan. Both have well-trained technical sales representatives.

Extension workers

SR-CRSP/SBPT has two extension workers for ORP Sei Putih and OPMM Membang Muda. Jeplin Sihombing is responsible for ORP Sei Putih. He has been working as extension worker for SR-CRSP/SBPT since 1990. Darwin Simangunsong, employed by PTP III, is responsible for OPMM. He has been working as extension worker since June 1991.

Since Sei Putih is located in Deli Serdang, while Membang Muda is in Labuhan Batu Regency (Kabupaten), government extension workers for each regency are appointed by the respective Dinas Peternakan Kabupaten.
The extension worker for the Sei Putih area is Pak Sudijana, Mantri for Kecamatan Galang , while the extension worker for Membang Muda/Rantau Prapat is Marwiyah

Local shops

Local poultry shops which are willing to dispense the drugs are Toko Maju Jaya in Galang and a shop run by Simanjuntak in Aek Kanopan (13 km from Membang Muda). The shops usually sell day-old chicks, chicken feeds, and drugs for poultry and cattle.

The farmers

All ORP and non-ORP farmers at Kecamatan Galang and Membang Muda are willing to join the network. The number of farmers and distribution of sheep kept by interviewed farmers both in Kecamatan Galang and Membang Muda are presented at Table 1.

Table 1. Number of farmers and sheep kept by farmers in Kecamatan Galang and Membang Muda

Farmers	Number of farms	# Young lambs		# Weaned lambs		# Mature sheep		Total sheep
		♀	♂	♀	♂	♀	♂	
ORP, Galang	26	53	37	67	58	242	46	339
Non-ORP, Galang	20	25	14	19	12	95	18	203
OPMM Membang Muda	12	12	15	23	10	110	12	182
Non-OPMM Membang Muda	10	16	17	49	35	40	0	157
Total	68	106	83	158	105	487	76	881

SR-CRSP

SR-CRSP (Small Ruminant Collaborative Research Support Program), located at Sei Putih, Galang, Deli Serdang, North Sumatra. The overall objective of its program is to develop improved systems of sheep husbandry in rubber plantations. There are three interlinked sub-programs of research, namely (1) breeding, management and health, (2) fodder production and animal nutrition, and (3) economics and sociology.

Sub Balai Penelitian Ternak (SBPT) Sei Putih is an animal research station. SR-CRSP is based at SBPT. There is close relationship between SR-CRSP and SBPT.

Dinas Peternakan

There are Provincial Dinas Peternakan (Dinas Peternakan Propinsi) located in Medan and Dinas Peternakan Kabupaten or Kotamadya at each capital of the kabupaten (regency) and kotamadya (municipality). At kecamatan (district) level, there are extension workers called mantri hewan or penyuluh. Dinas Peternakan in this paper, unless specified otherwise, means Dinas Peternakan Propinsi, Dinas Peternakan Kabupaten Deli Serdang, and Dinas Peternakan Kabupaten Labuhan Batu.

PARTICIPANTS' RIGHTS AND RESPONSIBILITIES

Wholesale dealer

Wholesale dealers are responsible for providing (a) anthelmintics at prices and unanimously approved by SR-CRSP, wholesale dealers and shops or extension workers and following an agreed system of payment, and (b) brochures on anthelmintic application to sheep in Bahasa Indonesia.

Wholesale dealers reserve the rigth to change the prices of their products.

Extension workers

Extension workers are responsible for (1) distributing anthelmintics to farmers regularly and administering the anthelmintics to sheep appropriately, (2) providing brochures and other information on anthelmintics to farmers, (3) following SR-CRSP/SBPT instructions, and (4) reporting without delay any problem of anthelmintic treatment.

Extension workers are allowed to get payment for their services. The payments are determined between farmers and the extension workers. However, SR-CRSP/SBPT and Dinas Peternakan reserve the right to make regulations controlling such "price" determination. "Price" may be changed at any time.

Local shops

Shops are responsible for dispensing drugs to farmers. Shops must follow SR-CRSP recommendations.

Shops obtain anthelmintics at the current market appropriate price, payment system, and margin.

Traders

Traders have the same rights and responsibilities as the extension workers and local shops.

Farmers

Participant farmers have the right to get (a) anthelmintic at appropriate price, and (b) services conveyed by extension workers.

Participant farmers will allow personnel of SR-CRSP/SBPT, wholesale dealers, and extension workers of Dinas Peternakan to gather data on sheep perfomance.

SR-CRSP/SBPT

SR-CRSP/SBPT is responsible for (1) promoting the network, coordinating wholesale dealers, shops, extension workers, and farmers in achieving network objectives, and (2) performing training on anthelmintic treatment for extension workers, shops, and traders in collaboration with wholesale dealers, Dinas Peternakan and other government services.

SR-CRSP/SBPT reserve the right on determine prices and change the anthelmintic being used.

Dinas Peternakan

Dinas Peternakan Tingkat I (Provincial Dinas Peternakan) supports, promotes, and supervises the network.

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THE POTENTIAL SUPPLY OF SMALL RUMINANT FROM INDONESIA INTO THE INTERNATIONAL MARKET

Setel Karokaro

INTRODUCTION

Indonesia is a large country. Its resources of livestock vary from region to region. Presumably, each region has comparative advantage on certain livestock production over the others. Therefore, a study on regional basis should be more appropriately conducted in attempt to support future development.

Sheep and goats are an important and preferred source of meat in Indonesia. Most of rural households own a few small ruminants, which are kept both for sale (especially for education and daily income needs)and home consumption. Research on economics and marketing as a whole has been predominantly concerned with the trade in staple food crops. This paper describes the current small ruminant production and its prospects for the international market.

RESULTS

Small ruminant population

Indonesia has the largest population of small ruminants in the ASEAN region, and these are distributed all over the country with high concentrations in Java, Nusa Tenggara and Sumatra. Table 1 shows that almost 60 percent of the small ruminant population is heavily concentrated in a few provinces on Java.

Table 1.Land areas and population distribution

Region	Land area (km^2)	Population/km^2 human	goat	sheep
Sumatra	473,606	59	4.29	0.93
Java & Madura	132,187	690	46.35	35.72
Bali & Nusa Tenggara	88,488	96	8.68	1.44
Kalimantan	539,460	12	0.36	0.02
Sulawesi	189,216	55	5.44	0.16
Maluku & Irian Jaya	496,486	5	0.41	0.01
Total	1,919,443	-	5.41	2.79

Source : Indonesia Small Ruminant Network (ISRN)-1990

Sheep and goats are generally raised in small flocks, ranging from 3 to 5 animals per household. Productivity of small ruminant enterprises is estimated to be 54 young animals per 100 animals peryear. This implies about 1.1 weaned lambs or kids per adult female (Sabrani,1982).

Livestock net supply and demand

Recent data on livestock numbers and meat production are found in Table 2. According to these data, estimated carcass production of meat in Indonesia is 29 thousand tons for sheep and 59 thousand tons for goats. A number of studies (Levine, 1990) have indicated that there is an increase in production of meat on the order of 4 per-cent peryear . However, the increased production is far below the demand. The domestic supply has not been keeping pace with demand. Data show offtake to be around 55 per cent in North Sumatra and in the rest of overall Indonesia.

Table 2. Estimated slaughter of livestock species in North Sumatra and Indonesia in 1987

	Sheep		Goats		Others	
	Indo.	N.Sumatra	Indo.	N.Sumatra	Indo.	N.Sumatra
Number slaughtered (000) head.	2,925	798	5,906	164	151,657	420
Production 29 (000) tons	7.98	59	16.40	622	172	
Percentage (%) offtake	55 %	55%	55%	55%	262 %	72%

Source : Directorate General Livestock Service (1989) and Regional Livestock Service, North Sumatra (1989).

Export of Livestock Products

In late 1971, the export of live animals was banned by the Government of Indonesia due to concern over rapidly increasing domestic demand. However, starting in 1989 there has been an attempt to market meat of sheep and goats to the Middle East. The Middle East dominates world trade in sheep and goats with imports of 6.5 million head in 1986 (Adnan, 1988). Based on data collected from Biro Pusat Statistik, 1990) only few goats and sheep have been exported from Indonesia to the Middle East. In 1990 the export of sheep and goats has ceased. The main constraint appear to be insufficient sheep and goat supply in Indonesia (author's interview with exporters). Because Indonesia is a largely islamic country,

sheep and goats has ceased. The main constraint appear to be insufficient sheep and goat supply in Indonesia (author's interview with exporters). Because Indonesia is a largely islamic country, Indonesia animals would have prefered for import into the Middle East over animals from other countries such as Australia.

CONCLUSION

Sheep and goats are in short supply in Indonesia. Although supply is increasing each year, domestic demand is increasing at a faster rate. Provided that production of sheep and goats can be increased, there appears to be a large potential market in the Middle East.

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SOCIOLOGICAL RESEARCH

Sri Wening Handayani and Ralph Brown[1]

SURVEYS OF SIX TYPES OF HOUSEHOLDS IN NORTH SUMATRA

The primary of this research was to examine the att
itudes and labor allocation of farmers with very different circumstances and and characteristics within the plantation. Results are intended to help determine who is the most appropriate target population for SR-CRSP technology in this plantation context.

Introduction of SR-CRSP technology has and will continue to create adjustments in households previous labour practices. We are interested in analyzing what some of those adjustments have been. Additionally, since major changes in farming practices often require significant adjustment in the amount of labor and the times it is required and by whom, We wanted to examine a wide spectrum of households types within the plantation to see how each allocates labor and how it has or may adjust.

We administered four different surveys to six different houseld types. Those groups which had received SR-CRSP or SBPT sheep were given the same survey as those which had their own animals (one survey for Nucleus Estates Smallholders (NES) and one for permanent labor respectively).

Each household type was represented by 12 respondent households. The number of respondent households was limited by the number of farmers who had received sheep from the project--twelve. The six survey groups are as follows :

1) Nucleus Estates Smallholders with SR-CRSP Sheep Out Reach Project Membang Muda (OPMM)
2) Nucleus Estates Smallholders without SR-CRSP Sheep or other animals--Membang Muda.
3) Nucleus Estates Smallholders without SR-CRSP Sheep but with their own animals (Sheep, Goats, or Cows)-- Membang Muda

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[1] Principal investigations for this project are Michael F. Nolan and Jere L. Gilles. Collaborators in the Women's Study were Artaria Panjaitan and Juniar Sirait. Collaborators in the Household Study at OPMM were Setel Karo-karo, Jeplin Sihom bing, and Simangunsong. We aknowledge the support of Ruth Gatenby and Leo Batubara, and the comments of Corinne Valdivia.

4) Permanent laborers which received SR-CRSP sheep in 1988.
5) Permanent laborers with no animals.
6) Permanent laborers with their own animals.

The first three survey groups were Nucleus Estates Smallholders (NES). NES is a project of the Indonesian Government and the World Bank. The NES is to provide two hectares of land for trees, new high yielding rubber clones, land and material for housing, credit, and extension services to its participants. A major goal of NES is land reform.

Participants--most often from the poorest economic strata of Indonesian society--are to receive a certificate of wonership after a specified period of time working the rubber tress. Though the NES is composed primarily of the "economically weak", it includes many different types of people--from those with no previous rubber experience to former plantation laborers. In October, 1991, the SR- CRSP and SBPT made a commitment to a test "out reach project" in a NES area--Gunung Lonceng, Membang Muda. To date, twelve participants have received sheep from the project. We wanted to monitor how the project was running in terms of social adjustments to the sheep and the technology associated with them. Additionally, the unique project structure and mix of human capital provided an opportunity wherein different household types (i.e., dif-ferent asset structures, social positions, and cropping experiences) could be studied effectively to determine their impact(s) on them.

The last three survey groups concentrated on permanent laborers of the rubber estate. These are people who are provided housing and a wage by the plantation. Their main livelihood and potential pension comes from a monthly salary from the rubber estate and not from ownership, or eventual ownership of land. In 1988, twelve permanent laborer house-holds received sheep from SBPT. Though the SBPT has maintained exten-sion links with these households through an estate extension worker, direct linkages have not been maintained. In all six surveys groups, the issues of land ownership titles, additional income generating activities or plans for such, households labor activities, and household expenses were examined. Additionally, labor allocations and various problems associated with the keeping of animals were explored for those households who had animals. Analysis of this datw is in progress and technical report with the title "The Social Economic Assessment of OPMM" has been completed.

WOMEN'S AND CHILDREN'S LABOR ROLES AND ALLOCATIONS

Findings of existing research from Indonesia on women's and children's labor roles in household sheep production are confusing and inconsistent. A possible reason for this mixed bag of results in the choice of research methodology used--it has relied heavily

on survey techniques. However, in a culture which strongly sanctions personal assertiveness, the likelihhod of a person accurately reporting the type and extent of labor he/she performs is minimal. In such a culture environment one would expect personal reports of labor to be consistently underestimated and/or credited to the male head of the household. To test these hypo-theses, we built labor allocation questions into our surveys for a comparison base. We intent to compare the findings of the survey data with findings using observational data from the same population. While administering the survey our commitment to the observational approach was continually reaffirmed as responds would consistently report virtual inactivity from household tasks in the evening hours (while we were interviewing them) even though they were folding clothes, bathing children and other chores as we spoke!

We prepared a methodological approach which would require Wening and other women researcher to "live" with a family for a day and document the tasks performed by the members. They would do this with twelve families in ORp and twelve in OPMM. It was expected that this data would serve two purposes for the SR-CRSP : First, it should give a much clearer picyure of actual labor allocation within the household. This hould help in determining the relative ability of different types of families to adopt the SR-CRSP technology. Second, it should show why, on a comparative basis, survey research done in this area is not an appropriate toll for studies of this type. This should clear the water for more accurate and useful research results in the future.

Research was to get underway on the 10th of July and continue until the end of the month. However, at the time of this writing, due to the logistic probelms of getting the researchers back out in the field at OPMM, the observational portion of this analysis on the second population remains unfinished; data collection was completed for ORP, while only the survey data for OPMM farmers was collected. A preliminary report has been completed with the title "Bio-Social Roles in Peasant Small-Ruminant Production: The Importance of Children Versus Gender in Secondary Economic Activities".

CROSSBREEDING OF SUMATRA THIN-TAIL EWES WITH THREE BREEDS OF HAIR SHEEP

Ruth M Gatenby, A Djoko Pitono, Endang Romjali,
G Eric Bradford, Hakan Sakul and E. Sinulingga

INTRODUCTION

The local breed of sheep in North Sumatra is known as the Sumatra Thin-tail. It has a high repoductive potential, but is small and has some coarse wool which is not used. In some other parts of the humid tropics, sheep are larger and have no wool. The performance of different types of hair sheep is not well documented.

The objective of this program is to evaluate various genetic stocks of hair sheep and their suitability in the humid tropics, and to establish a genetic improvement program and source of breeding stock suitable for areas of the humid tropics where there are available and potential fodder resources for expanded sheep production.

METHOD

Location

This comparison is carried out at the Suka Damai unit of the Research Institute for Animal Production, Sei Putih in North Sumatra (3 deg N, 99 deg E). Altitude is about 50 m above sea level. Annual rainfall totals about 1800 mm, with rain in every month. Mean minimum temperature is 23 deg C and mean maximum temperature is 32 deg C, with little seasonal variation.

Animals and management

Study of Sumatra Thin-tail sheep in Sungai Putih started in 1985. Virgin Island sheep were introduced in 1986, and East Java Fat-tail sheep in 1991. Data have regularly been collected on the performance of these sheep and their crosses.

In October 1991, a simultaneous mating program was conducted. More than 400 Sumatra Thin-tail and crossbred (Garut x Sumatra Thin-tail) ewes weighing 14.5 to 30.8 kg and aged between 1.5 and 4 years were individually mated to rams or semen of one of the following breeds:

(i) S, Sumatra Thin-tail.
(ii) B, Barbados Blackbelly, from the Caribbean, which was introduced using imported semen rather than live animals which would have been too expensive.

(iii) E, East Java Fat-tail sheep, known in Indonesia as Ekor Gemuk.

(iv) H, Virgin Island, also known as St Croix, originally from the Caribbean.

The offspring of these four genotypes are denoted S, B1, E1 and H1, respectively.

Each ewe was allocated to one sire breed, and within that breed to a particular ram. The matings were allocated systematically to ensure that there was no bias in the results. Ewes allocated to AI with the Barbados Blackbelly semen were also allocated to another breed for natural mating in case they did not conceive to the AI.

The artificial insemination of Sumatra Thin-tail ewes using Barbados Blackbelly semen was conducted by Martin Dalley in October 1991. We had intended to inseminate 160 ewes, but because of the poor quality of semen, only ninety-five were inseminated.

Natural matings took place in October and November 1991. Natural services were individually supervised following detection of oestrus by vasectomised rams. All ewes were given the chance to mate again in January-February and April-May 1992.

All the genotypes are treated as similarly as possible. However, the synchronisation technique used with the AI may have affected litter size, the ewes bearing B1 lambs were given 200 g/d concentrate for one month before lambing, and the B1 lambs were born an average of about 3 weeks before the others so were subjected to slightly different grazing management and parasite burdens.

Ewes with single lambs are given concentrate for only two weeks after lambing, and those with two or more lambs receive concentrate for six weeks. All ewes are given a small amount of molasses. The weaned lambs are reared in pens containing all four genotypes, to prevent bias towards any genotype.

A small number of ram lambs from each lambing period which are not required for breeding are subjected to well-defined grazing management then slaughtered to study nematode and trematode infestation in the four genotypes.

Starting August 1992, a trial is being conducted with weaned ram lambs to examine the response of the four genotypes to three levels of energy in the diet.

Assessment of birthcoat type continues as previously. There are two categories: curly (keriting) and straight (lurus). In addition, the wool coat of older animals will be scored at the following times:

Females - weaning, 3 mth 6 mth, 9 mth, 12 mth, 15 mth, mating, lambing
Males - weaning, 3 mth 6 mth, 9 mth, 12 mth, 15 mth, annually.

RESULTS

Analysis of data obtained for lambs born between January 1991 and March 1992 showed that weaning weight was significantly affected by birth weight ($P<0.01$), breed ($P<0.01$), litter size ($P<0.01$), faecal egg count ($P<0.01$) and sex ($P<0.05$).

Least squares means for each breed are shown in Table 1. Mean weaning weights were significantly higher for Virgin Island and its crosses than for Sumatra Thin-tail, East Java Fat-tail and Garut crossbreds.

Table 1. Least squares means and maximum observed values for weaning weights of each genotype.

Genotype	n	Weaning weight (kg) Mean±SE	Maximum
Sumatra Thin-tail (S)	161	8.56±0.19 a	14.5
East Java Fat-tail (E)	23	8.69±0.42 a	12.6
Garut x S (G1)	8	8.99±0.72 a	12.9
Virgin Island and backcrosses to S (H, H3, H2)	59	10.75±0.27 b	23.2
Virgin Island x Sumatra inter se crosses (HC)	119	11.37±0.21 b	18.1

Comparison of the maximum weight recorded for each breed with the mean confirms that there is considerable variation in weaning weight within genotypes, and thus there is scope for genetic selection.

Simultaneous comparison of genotypes

Three hundred and seventeen Sumatra and Garut x Sumatra ewes lambed in March and April 1992, and data were obtained for 491 lambs born.

Litter size. Overall average litter size was 1.55. The only factor affecting litter size was breed of ewe ($P<0.05$); Sumatra ewes had an average litter size of 1.47, while the Garut crossbreds averaged 1.81.

Birth weight. Overall average birth weight was 1.8 kg. Birth weight was significantly affected by litter size ($P<0.01$), body weight of ewe ($P<0.01$), age of ewe ($P<0.01$), breed of ram ($P<0.01$) and sex of lamb ($P<0.05$). Average values are shown in Table 2.

Table 2. Least squares means for lamb birth weight

	n	Mean	SE
Breed of ram			
Sumatra	124	1.44 a	0.05
East Java Fat-tail	150	1.48 a	0.05
Barbados Blackbelly	83	1.63 b	0.06
Virgin Island	134	1.63 b	0.05
Sex of lamb			
Female	228	1.50 a	0.04
Male	263	1.59 b	0.04
Age of ewe			
Less than 2 years	213	1.46 a	0.04
2 - 5 years	252	1.65 b	0.04
More than 5 years	26	1.53 ab	0.09
Litter size			
1	172	2.23 a	0.04
2	242	1.68 b	0.04
3	57	1.22 c	0.06
4	4	1.05 c	0.10

Means within each category, with different post-scripts are significantly different, $P<0.05$.

Lamb birth weights averaged 2.2, 1.7, 1.2 and 1.1 kg for litters of 1, 2, 3 and 4 lambs, respectively. The regression of birth weight on ewe body weight immediately after birth showed that every kg increase in ewe weight was accompanied by a 0.04 kg increase in lamb weight. Ewes aged between 2 and 5 years gave birth to heavier lambs (1.65 kg) than younger (1.46 kg) or older ewes (1.53 kg).

Lambs sired by Barbados Blackbelly or Virgin Island rams were heavier (1.63 kg) than those sired by East Java Fat-tail (1.48 kg) and Sumatra (1.44 kg) rams. Ram lambs (1.59 kg) were heavier than ewe lambs (1.50 kg). Breed of dam had no significant effect on birth weight.

Perinatal mortality. Peri-natal mortality of lambs to two days of age was 8%. Litter size ($P<0.05$) and birth weight significantly ($P<0.01$) affected peri-natal mortality.

The highest mortality was for lambs born as triplets (17%). Mortality averaged 8% for single lambs and 5% for twins. Every kg increase in birth weight was accompanied by a reduction of 12% peri-natal mortality for the same type of birth. Breed of ewe, breed of sire, sex of lamb and body weight of ewe did not significantly affect mortality.

Future plans for this project

Lambs from the June and September 1992 lambings will be treated to the same procedures as those from the March 1992 lambing.

Ten males from each genotype will used for breeding in 1993. These will be two from each sire, and within sires selected at random (excluding ram lambs more than 2 sd from the mean, i.e. not runts).

Of the ewe lambs, fifty (or as many B1 as possible) from the March lambings will be kept to compare the reproductive performance of the four ewe genotypes. The remainder of the ewe lambs, and the majority of the ram lambs will be offered to the nutrition-forage program for experiments.

When the ewe lambs chosen to be parents join the main flock they will be in mixed pens with their contemporaries, each pen containing 15-20 ewes. Fifty per cent will first be mated in January 1993, and 50% in April 1993. The animals in each of these two categories will be selected at random, NOT the biggest in January then the smaller in April. This is to see the rate of maturity of the four genotypes.

HEALTH OF SHEEP GRAZING IN RUBBER PLANTATIONS

Alan J Wilson, Ruth M Gatenby, Endang Romjali, Melinda Hutauruk, Beriajaya and A Djoko Pitono

This paper reports recent work in the investigation of animal health problems in the flock of sheep at Suka Damai, North Sumatra. This program is part of a research contract between SR- CRSP and INI ANSREDEF, involving staff of the Research Institute for Veterinary Science, Bogor, and follows the initial work of Dr. Ian Carmichael (Carmichael et al, 1992).

OBJECTIVES

The objectives of the research protocols can be summarised as follows:

1. Monitoring levels of helminth parasitism in sheep at Sungai Putih.

2. Monitoring seasonal fluctuations in nematode burdens of sheep.

4. Monitoring the effect of pasture spelling on gastro- intesti nal parasitism.

5. Investigation of genetic resistance to helminths in grazing lambs.

6. Establishment of a simple health management package for sheep at Sungai Putih.

7. Studies on pancreatic fluke.

In addition, a study on the transmission of helminths was conducted by Mr Ari Zabell (page 57). Protocol 3 was completed previously.

RESULTS

Protocol 1. Gastro-intestinal parasitism remains a serious problem at Sungai Putih. The uptake of helminths is high throughout the year. High levels of helminths, as measured by faecal egg counts, are reached within two weeks of giving anthelmintic. Benzimidazoles remain very effective in the Sungai Putih situation.

Protocol 2. The total numbers of nematodes taken up by sheep in the project area, measured on a monthly basis, are shown in Table 1. These results indicate high uptake of Haemonchus contortus and Trichostrongylus colubriformis throughout the year. The levels of Haemonchus are potentially very pathogenic.

Table 1. Mean nematode burdens acquired during one month in grazing sheep.

Grazing period	Mean worm burden			
	H.c.	T.c.	C.c.	O.a.
February 1990	1705	4320	5375	63
April 1990	745	1320	100	33
June 1990	1265	1860	530	19
January 1991	1480	2050	230	40
April 1991	620	610	130	12

Symbols: H.c. Haemonchus contortus
T.c. Trichostrongylus colubriformis
C.c. Cooperia curticei
O.a. Oesophagostomum asperum

Protocol 4. Moving the flock to clean pasture every three months (system A) results in a slower uptake of worms and much lower helminth levels than grazing in paddocks with a one-month rotation (system B) which is in effect a continuous grazing system. In system A eggs appeared around 22 days after treatment compared with around 14 days in system B. The levels of helminths in sheep are shown in Table 2. In some cases levels were around ten times higher in sheep under system B.

Pasture spelling is therefore more beneficial for the sheep than continuous grazing, but requires more land. The results of larval culture show that Haemonchus is by far the most important worm throughout the year.

Protocol 5. Faecal egg counts of all lambs are collected at weaning and again at an age of 6 to 12 months after they have recommenced grazing. The data are entered onto the computer. A preliminary summary of the pre-weaning values for lambs born between January 1991 and March 1992 is shown in Table 3.

Table 2. Mean nematode faecal egg counts (epg) in sheep moved to clean pasture every three months (A) and those grazed continually on the same pasture (B).

Day	Month	System A	System B
0	Jan	1521	4235
14	Feb	0	0
28		0	365
42	Mar	214	3589
84*	Apr	263	8923
98		0	0
112	May	700	296
126		1029	5030
168*	June	250	2550

* indicates administration of anthelmintic.

Table 3. Mean egg counts of lambs at weaning.

Breed	n	Log(EPG) Mean±SE	Geometric mean EPG
Sumatra x Garut (G1)	8	2.63±0.28 a	430
Virgin Island crosses (H2, H3)	65	3.21±0.10 ab	1600
East Java Fat-tail (E)	23	3.50±0.17 bc	3100
Sumatra x Virgin Island inter se (HC)	123	3.49±0.07 c	3100
Sumatra Thin-tail (S)	163	3.54±0.06 c	3500

Means without the same postscript are significantly different ($P<0.05$).

These preliminary results show that the susceptibility of lambs to helminths is rather less for the introduced Virgin Island and East Java Fat-tail genotypes than for the local Sumatra Thin-tail lambs. Thus introduction of the new breeds does not increase susceptibility to worms. The genotypes with the lower egg counts are the F1 animals. The purebreeds and the inter se crosses have

higher EPGs suggesting that hybrid vigour may contribute to worm resistance. There is considerable variation in faecal egg count between individuals within genotypes.

Total worm counts are being used to assess the worm burdens of four genotypes of sheep, namely Sumatra Thin-tail (S) and its crosses with Barbados Blackbelly (B1), East Java Fat-tail (E1) and Virgin Island (H1). Starting in August 1992, four lambs of each breed, with an initial average weight of 12 kg were grazed for one month with the communal flock. After one month stall- feeding to allow maturation of the worms, the animals will be slaughtered at the end of September, and total worms counted. This trial will be repeated for S, E1 and H1 lambs in November 1992 and February 1993.

Protocol 6. A program for improved feeding of ewes after lambing, pasture spelling and anthelmintic treatment every three months for the whole flock, and systematic post-mortems with collection of tissues for histo-pathology has resulted in improved productivity and a better-defined disease situation.

A summary of the results from the histopathology from 61 post-mortems is shown in Table 4.

These results indicate that (a) pancreatic fluke play an important role in the pathogenesis of disease at Sungai Putih; (b)pneumonia caused by Pasturella bacteria is a serious con

Table 4. Summary of the primary causes of death of 61 animals whose tissues were processed by the histo-pathology laboratory in Bogor.

Cause of death	Number of animals
Pancreatic fluke	17
Acute, generalised, alveolar, fibrinous pneumonia	12
Parasitic gastro-enteritis	6
Liver fluke	1
Screw worm	1
Aflatoxicosis	2
Toxicity of unknown origin	4
No visible lesions	17
Tissues rotten	1
Total	61

straint to production at certain times of year; and (c) a significant number of deaths were associated with toxicity, the cause of which should be investigated.

Lamb mortality rate to weaning was 15.9 % in 1991 compared with 21.6% in 1990. This has great economic significance.

Protocol 7. The disease caused by pancreatic fluke is very common in sheep aged above one year. The disease has been divided into two types depending on the severity of lesions.

Type (a) is associated with significant destruction of the glandular and islets tissue of the pancreas, generalised liver degeneration and massive fibrosis around the pancreatic ducts. Type (b) is associated with fibrosis around the ducts. Large numbers of fluke, both immature and mature, are detected in both types. The incidence of both types is similar (Table 5) and it is assumed that Type (b) is an early stage of Type (a)

Table 5. An analysis of the prevalence and severity of lesions caused by pancreatic fluke in the sample of 41 animals processed by the histopathology laboratory.

	n	%
Number with severe lesions in the pancreas associated with liver degeneration	17	41
Number with worms in ducts which were hyperplastic and fibrotic	16	39
Total number of animals processed (aged >1 year)	41	

An experiment conducted to examine the effects of three drugs on the treatment of the disease caused by the pancreatic fluke indicated that with the regimes used, albendazole was the most effective, and nitroxynil the least effective. This experiment is reported on page 59.

ACKNOWLEDGEMENT

We thank Ari Zabell and Hakan Sakul for contributing to the analysis presented in Table 3.

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Report 43 14/92 INI ANSREDEF, Bogor, Indonesia.

NATURAL TREATMENT OF FORAGE TO REDUCE TRANSMISSION OF STRONGYLE PARASITES IN SHEEP

Ari Zabell, Melinda Hutauruk and Ruth M Gatenby

INTRODUCTION

The infection of sheep with internal parasites depends on the ingestion of infective forms of the parasites. The aim of the experiment described here was to assess the effect of simple methods of forage treatment on the rate of infection of sheep with helminths.

METHOD

The experiment was conducted at the Suka Damai station of the Research Institute for Animal Production in North Sumatra in June 1992. Thirty Sumatra Thin-tail ewes, three months post-lambing, were treated with febantel anthelmintic (Rintal) and divided into five groups of six animals. Each group was given one of the following treatments:

1. GRAZED. Grazed from 0800 to 1600 each day, in a large flock of sheep.

2. (-) CONTROL. Stall-fed with parasite-free forage.

3. (+) CONTROL. Stall-fed with contaminated forage.

4. WASHED. Stall-fed with contaminated forage which was washed before feeding.

5. DRIED. Stall-fed with contaminated forage dried in the sun for 24 hours before feeding.

The parasite-free forage was cut daily from a rubber plantation where no animals grazed. The contaminated forage was cut from an area on which faeces had been spread. The grazing animals grazed in a flock of about 700 ewes in a rubber plantation, on a three-month rotational system.

Apart from the times when the ewes in group 1 were grazing, all animals were confined in a sheep house with a raised slatted floor. The stall-fed animals were provided with grass in wooden troughs inside each of four group pens. All stall-fed animals were moved to a communal pen at night.

Faecal samples were obtained from each animal 1, 2, 3 and 4 weeks after anthelmintic treatment, and examined for strongyle eggs.

RESULTS

Anaysis of the faecal samples 1 and 2 weeks after anthelmintic treatment showed zero egg counts. In week 3 the mean counts for each group are shown in Table 1.

Table 1. Mean strongyle counts three weeks after anthelmintic treatment

Group	EPG	
	Mean ± sd	
(-) CONTROL	0 ± 0	a
GRAZED	40 ± 66	a
WASHED	40 ± 66	a
(+) CONTROL	210 ± 227	b
DRIED	240 ± 151	b

Means without identical postscripts are significantly different ($P<0.05$)

These results indicate that washing forage, feeding forage from an ungrazed area, and grazing in a rotating system, all result in slower transmission of strongyle parasites than feeding contaminated forage either fresh or dried.

In week 4, the egg counts of all stall-fed aniamls were all high, and it is thought that while the animals were all in the same pen at night there was cross-contamination between treatments by animals picking up small pieces of forage from the floor. This highlights one problem encountered when conducting studies of parasite infection.

ACKNOWLEDGEMENTS

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COMPARISON OF THREE DRUGS TO CONTROL PANCREATIC FLUKE (EURYTREMA PANCREATICUM) IN SHEEP

Ruth M Gatenby, Endang Romjali, Alan J Wilson, Melinda Hutauruk, John Glenn and A Djoko Pitono

INTRODUCTION

In the past three years, it has become clear that a large proportion of sheep in North Sumatra are infected with pancreatic fluke, Eurytrema pancreaticum. This conclusion has been reached from inspection of animals that have died naturally, those that have been slaughtered because they were emaciated and apparently healthy animals slaughtered for meat (Arasu et al., 1991; Carmichael, 1991; Carmichael et al, 1992). Some observers have commented that the problem is particularly serious among imported sheep and their crosses.

The pancreatic fluke has two intermediate hosts - land snails (Tang, 1950) and grasshoppers (Basch, 1965). In North Sumatra it has been confirmed that the species of grasshopper which are the second intermediate host are long-horned green grasshoppers of the family Tettigonidae (Arasu et al, 1991).

Sheep are infected by eating grasshoppers. It is unlikely that healthy grasshoppers would allow themselves to be eaten, but those infected with the metacercariae of fluke are probably sick and do not jump away from the sheep's mouth. The fluke migrate from the small intestine of the sheep to the pancreas, and can be seen in the pancreatic ducts. Maturity of fluke in the pancreas is achieved about seven weeks after ingestion, but the life-span of adult fluke in the sheep is not known.

Although some authors (Hammond and Sewell, 1991) state that the disease is usually of little pathogenicity, in North Sumatra pancreatic fluke appear to be causing morbidity and probably are contributing to mortality. Of nineteen adult sheep which died at Sungai Putih in 1991, post-mortem examinations suggested that in seven animals pancreatic fluke contributed towards death (Wilson, 1992). In these seven sheep, there were very severe necrotic lesions in the pancreas tissue in conjunction with severe degeneration of the liver hepatocytes. In other animals in which pancreatic fluke was not thought to be a factor contributing to death, there was normal pancreas tissue with fluke in the pancreatic ducts which showed severe fibrosis.

There is not yet a recognised chemical for the treatment of Eurytrema pancreaticum. Examination of the literature suggested that nitroxynil and praziquantel may be effective, and we also included albendazole in the study. The purpose of the experiment therefore was to test the efficacy of nitroxynil, praziquantel and

albendazole in the control of pancreatic fluke (Eurytrema pancreaticum) in sheep, and to gain more knowledge about the course of infection.

METHOD

The experiment was conducted at the Research Institute for Animal Production at Sungai Putih in North Sumatra. Forty Sumatra Thin-tail ram lambs were grazed for five weeks in an old rubber plantation which had previously been grazed by ewes and lambs. It was intended that in this period they would become infected with pancreatic fluke. The animals grazed from 0800 h to 1600 h each day, and at night were confined in a sheep house with a raised slatted floor.

The average age of the lambs at the beginning of the trial in September 1991 was almost 6 months, and their average weight was 13.7 kg. Previously, from the age of two weeks to three months these lambs had grazed, but after weaning at three months of age they had been confined and stall-fed. After the five-week period of grazing in September and October the animals were confined in the house until the completion of the trial.

During the whole of the trial, concentrate was given at a rate of about 200 g/d. During the periods when the animals were not grazed, they were given grass cut from an ungrazed area. No anthelmintic of any sort was given during the initial part of the trial, and four animals died.

Administration of drugs

In February 1992, four months after the animals ceased grazing, they were divided into four similar groups on the basis of body weight and the average of the previous three measurements of fluke and nematode eggs in the faeces. Each group contained eight animals. The treatments were randomly allocated to the groups.

The four treatments were

N. Nitroxynil subcutaneous on days 0 (10 mg/kg) and 20 (30 mg/kg).
P. Praziquantel oral at 20 mg/kg on days 0 and 2.
A. Albendazole oral at 15 mg/kg on days 0 and 2.
C. Untreated control.

All three drugs were first administered on 22nd February (day 0). Praziquantel and albendazole were given a second time on day 2, and nitroxynil on day 20.

Measurements

Every two weeks during the initial part of the trial, and every week after the drugs were given, the animals were weighed and samples of faeces collected. The faecal samples were examined for eggs of pancreatic fluke and nematodes.

On March 22nd and 23rd 1992, all 32 animals in the experiment were slaughtered. The complete pancreas were removed from the carcasses, and samples of pancreas and liver were later subjected to histological examination. All organs in the body were studied, and abnormalities recorded. In the laboratory the numbers of fluke in each pancreas were counted.

RESULTS

The mean value of pancreatic fluke eggs per gram of faeces (epg) preceeding treatment was 171, and mean nematode epg had risen to more than 4000. Samples taken at two-weekly intervals from individual animals exhibited great fluctuation in fluke epg, suggesting that there is not a steady release of eggs from the adult fluke in the pancreas. The average growth rate of lambs before the drugs were given was 30 g/d, and body weight on the day of treatment averaged 18.5 kg. Age at treatment averaged 11 months.

After treatment mean fluke epg of group N was high, similar to C, but that of P was consistently lower. Group A showed a peak in fluke epg two weeks after treatment, which then fell to a low level. Geometric mean values of the three final fluke epg (N 50, P 17, A 5 and C 45) were significantly ($P<0.05$) affected by treatment. Nematode epg remained high in groups C and P, and fell to very low levels in animals treated with N and A, confirming that nitroxynil and albendazole effectively control gastrointestinal nematodes. Mean growth rates (g/d) were N 34, P 44, A 46 and C 23, showing that all drugs increased growth rate to some extent, although differences were not significant.

At slaughter all pancreas contained fluke. Treatment had a significant ($P<0.05$) effect on geometric mean numbers of fluke, which were N 737, P 153, A 176 and C 408. There was a positive correlation ($P<0.05$) between numbers of fluke in the pancreas and fluke epg on the day of slaughter. Ninety-one per cent of animals showed fibrosis of the pancreatic ducts. Only three animals showed some necrosis in the liver confirming that infection was still at an early stage. Inter-lobular fibrosis in the pancreas was less severe for A than for the other three groups ($P<0.05$), and intra-lobular fibrosis was more severe for C than for the other three groups ($P<0.05$).

Although albendazole and praziquantel significantly reduced the level of infection of pancreatic fluke, neither drug reduced it to a negligible level. More frequent doses of the drugs or higher dose rates may be more effective, but would almost certainly not give an economic response. Nitroxynil appeared to be ineffective in controlling pancreatic fluke.

Further details of the experiment can be obtained from the complete working paper (Gatenby et al, 1992).

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

Simon P Ginting, Ruth M Gatenby, Endang Romjali,
Manuel D Sanchez, A Djoko Pitono and Kevin R Pond

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, but can significantly increase if supplements are provided.

Also the production of ewes in terms of daily gains of pre-weaned lambs, lamb survival rate and thus kg of lamb weaned significantly increases when supplements are available to the animal around the year. However, the increased production of ewes which are continually supplemented is rarely economically advantageous. Some modification of production system is necessary in order to achieve maximum profit from increased production of supplemented sheep.

The ideal solution may 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.

METHOD

An experiment was conducted to study the effects of three supplementary feeds on the productivity of Sumatra Thin-tail ewes in a rubber plantation. Fifty-one local Sumatra Thin-tail ewes aged 1 to 4 years were allocated to one of three treatments. 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.

Further details of this experiment are given by Ginting et al (1992).

RESULTS

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.

CONCLUSION

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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THE EFFECT OF ASYSTASIA ON THE GROWTH OF YOUNG RUBBER IN POLYBAGS

Tuty Kustyanti and Peter Horne

INTRODUCTION

Asystasia intrusa is a herbaceous plant belonging to the family Acanthaceae, native to India and Ceylon. It can grow under light or shaded conditions, up to 300 m above sea level, reaching 1.5 m height in favourable conditions (Backer and van Den Brink, 1965; Soedarsan et al, 1983; Teoh et al, 1982). It adapts well to almost any type of soil, but especially on well aerated deep soils, peat and even on sandy beaches (Abdullah, 1985).

Asystasia spp. have been reported to be serious weeds in oil palm in Malaysia, because of a high demand for nutrients, particularly nitrogen and potassium. In one case, the eradication of very dense stands of Asystasia (especially A.intrusa) in an oil palm plantation resulted in a 12% increase in fresh fruit bunch production. As a prolific seeder,A. intrusa spreads very fast in most Malaysian plantations and smallholdings (Abdullah, 1985; Teoh et al, 1982). Although A. intrusa has been reported in North Sumatra since 1940, there have been no reports of it becoming a noxious weed, both in oil palm and rubber plantations (Nasution, 1986).

Despite these detrimental effects Asystasia intrusa can be used as a high quality feed for sheep. It has a high protein content (24%) compared to other common plantation weeds, such as Mikania micrantha, Ottochloa nodosa, and Paspalum conjugatum (Arope et al, 1982). Given this potential and the lack of information about the competitive effects of Asystasia on rubber, further research was deemed necessary.

OBJECTIVE OF THE EXPERIMENT

To determine the effects of competition for nutrients on growth of rubber underplanted with Asystasia in polybags.

MATERIAL AND METHODS

The experiment began in June 1992 and will be conducted for one year at the Experimental Station of Puslitbun Sungai Putih, North Sumatra. A completely randomized design with 5 treatments and 3 replications was used (each replication consisting of 5 polybags).

The treatments which Asystasia and rubber were grown in single-and-mixed-species were as follows :

A. A. intrusa
B. A. gangetica
C. Rubber
D. Rubber + A. intrusa
E. Rubber + A. gangetica

The soil used is an ultisol with a pH of 5.4. No fertilizer was added. The rubber planting material used was budded stumps of clone RRIM 600. The Asystasia planting material used was 2-node cuttings planted when the first whorl of the rubber leaves was almost mature. The polybags used were filled with 16 kg of air dried soil. To prevent leaf disease, 0.2% Daconil 75 WP (chlorothalynyl) was applied once every two weeks.

During the experiment regular measurements are to be made on:
- The height of Asystasia
- Leaf colour of Asystasia (using a score/rating from 1 : very green to 5 : yellow).
- Fresh and dry weight, number of flowers and pods of Asystasia. Harvest sill be timed to occur when the Asystasia are about to produce mature seeds.
- Height and diameter of rubber.
- Number of fully expanded leaves, and number of expanding leaves of rubber.
- Leaf colour of rubber.

At the end of the experiment, root yields will be measured. Soil mineral content, particularly N, P, K, Ca, and Mg will be analysed before and after experiment.

PRELIMINARY RESULTS

The experiment is still at an early stage. Rubber tree heights and diameter measurements before Asystatsia was planted are presented in Table 1, and two months after planting in Table 2. Heights of Asystasia a month and two months after planting are presented in Table 3 and 4.

Table 1. Rubber height (cm) and diameter (mm) before planting the Asystasia *)

Treatments	Plant height (cm)				Diameter (mm)			
	Rep1	Rep2	Rep3	Average	Rep1	Rep2	Rep3	Average
Rubber (single-sp)	26.1	25.8	27.5	26.4	5.6	6.0	5.4	5.7
Rubber (mixed with A. intrusa)	25.1	25.1	25.5	25.2	5.6	5.8	5.6	5.7
Rubber (mixed with A. gangetica)	25.1	25.1	25.7	25.5	5.4	6.0	5.2	5.5

*) Average of 5 measurements

Table 2. Rubber height (cm) and diameter (mm) two months after imposition of the treatments.

Treatments	Plant height (cm)				Diameter (mm)			
	Rep1	Rep2	Rep3	Average	Rep1	Rep2	Rep3	Average
Rubber (single-sp)	33.6	36.6	34.2	34.8	7.4	7.8	7.2	7.5
Rubber (mixed with A. intrusa)	31.8	37.0	32.2	33.6	6.8	7.6	6.8	7.1
Rubber (mixed with A. gangetica)	30.6	38.0	30.2	32.9	6.8	7.6	6.8	7.1

*) Average of 5 measurements

Table 3. Asystasia height (cm) a month after planting *)

Treatments	Plant height			
	1	2	3	Average
A. intrusa (single-sp)	32.5	40.4	46.6	39.8
A. gangetica (single-sp)	13.7	13.5	27.5	18.2
A. intrusa (mixed-sp)	27.8	20.7	13.5	20.7
A. gangetica (mixed-sp)	18.6	15.6	23.4	19.2

*) Average of 5 measurements

Table 4. Asystasia height (cm) two months after planting *)

Treatments	Plant height			
	1	2	3	Average
A. intrusa (single-sp)	51.6	62.9	77.3	63.9
A. gangetica (single-sp)	24.0	45.3	70.9	46.7
A. intrusa (mixed-sp)	40.4	32.0	49.5	40.7
A. gangetica (mixed-sp)	25.6	31.8	25.7	27.7

*) Average of 5 measurements

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THE EFFECT OF SHEEP REARING IN RUBBER PLANTATIONS ON SOIL COMPACTION

Sugyanto and Peter Horne

INTRODUCTION

The contribution of smallholders to rubber production in Indonesia is higher than from estates but productivity per hectare is very low. Sheep rearing under rubber plantations has the potential to raise the income of smallholder rubber producers with a technology that is already a part of other farming systems of the region (Ginting et al., 1986). The integration of sheep with rubber is especially advantageous during the early stage of growth prior to tapping. During this stage, the rubber leaf canopy is open and light transmission to the ground is adequate to support growth of forages (Ibrahim et al., 1990). Thereafter light penetration declines sharply to less than 20% at 5 to 7 years after planting.

A potential problem of sheep grazing under young rubber is the effect that the sheep may have on soil compaction and hence growth of the young trees. Most research on soil compaction has focussed on the effects of machinery and cultivation, with less emphasis on grazing animals (Hillel, 1982). Compaction of soil by sheep will be a function of both soil parameters (such as particle size distribution, structure and strength) and animal parameters (weight, surface area of feet). Ginting et al. (1986) reported that under optimum stocking rates of 7 sheep per hectare under rubber, the bulk density of the soil increased by only 0.04 g cm^{-3}. However, they concluded that sheep rearing may have a significant effect on soil compaction in the longer term.

The aim of this experiment was to further investigate the potential soil compaction that may result from sheep rearing under rubber plantations.

MATERIAL METHODS

The experiment was conducted on the experimental plantation of the Research Institute for Estate Crops, Sungai Putih from July to September 1992. To simulate the effects of moderate stocking rates on soil compaction in the long term, a range of grazing pressures were imposed, from zero grazing to very heavy grazing pressures. The four treatments consisted of a control (no sheep) and sheep with weights of 10-12 kg, 20-24 kg and 40-45 kg. Seven sheep of each weight class were penned in plots 20m^2 in area for one hour every four days. The treatments were

arranged as a randomized complete block design, with four treatments in each of four blocks. The procedure was repeated 12 times for block.

Bulk density of the top soil (0-10cm) was measured before and after the compaction treatments were imposed (four samples per plot). Soil dry bulk density was calculated using the core method.

PRELIMINARY RESULTS

Soil bulk densities before the treatments were imposed (Table 1) show that there was some variability between the blocks. In block 4, the soil bulk density was lower than all other blocks, due to a difference in soil texture.

The soil bulk densities after the imposition of treatments (Table 1) show that the effect of even very high stocking rates of heavy sheep was not as great as was expected. The soil bulk density for the heavy and medium sheep treatments were only 0.07 and 0.05 g cm $^{-3}$ higher than from the control respectively. These increases were statistically significant but of marginal agronomic significance.

The experiment will be repeated in the wet season when soil compaction may be a more serious problem.

Table 1. Soil bulk density (g cm^{-3})* at 0-10 cm prior to and following imposition of stocking rate treatments.

	Prior to Treatments					After Treatments				
	Blocks					Blocks				
Treatments	1	2	3	4	Mean	1	2	3	4	Mean
Control	1.33	1.31	1.31	1.15	1.28	1.33	1.32	1.30	1.16	1.28[a]
Light Sheep	1.33	1.31	1.31	1.15	1.28	1.33	1.32	1.30	1.15	1.28[a]
Medium Sheep	1.33	1.31	1.31	1.15	1.27	1.36	1.36	1.36	1.20	1.32[b]
Heavy sheep	1.34	1.31	1.31	1.15	1.28	1.40	1.38	1.36	1.23	1.34[b]

* Average of 4 measurements
Means with identical superscripts are not significantly different using Duncan's Multiple Range Test

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EFFECT OF TANNINS FOUND IN TREE LEGUME SPECIES ON GROWTH RATE AND DIETARY PROTEIN UTILIZATION IN GROWING LAMBS

R. Merkel and K.R. Pond

The use of tree legumes as ruminant feedstuffs has long been a tradítional practice in Indonesia (Rangkuti et al. 1990). The SR-CRSP Outreach Project has given participating farmers Gliricidia sepium to plant as a supplementary protein source. The usefulness of Gliricidia and other tree legume species has been studied previously at Sei Putih (Ibrahim et al. 1988). In that study grazing sheep were fed a concentrate and offered shrub legumes in the afternoon at 5% body weight. Liveweight gains were 57, 33.9 and 33.4 g/d for Albizia falcataria, Gliricidia sepium and Calliandra calothyrsus respectively. A second trial supplementing native forage with Calliandra calothyrsus in conjunction with palm kernel cake and rubber seed meal has been recently completed by Ginting.

Leaves of some leguminous trees have been found to contain high tannin levels (Ahn et al., 1989). The chemistry of tannins to bind proteins reducing both protein and carbohydrate digestibility, act in reducing voluntary intake and possibly affect ruminal digestion, have been summarized and reviewed by various authors. Possible benefits from tannins in reversibly binding proteins to escape ruminal degradation have been postulated (Meuller-Harvey et al., 1988; Butler, 1989; Woodward and Reed, 1989; Lowry, 1990). Determination and characterization of tannin content in common Indonesian legume tree species has been completed by Budi Tangen-djaja as part of the SR-CRSP small grant program.

Three studies have been initiated to more closely study the effect of tannins found in three tree legume species (Albizia falcataria, Gliricidia sepium and Calliandra calothyrsus) on growing lambs at SBPT, Sei Putih. The first of these trials will determine the long-term effects that feeding these three species have on growth and intake of growing lambs. Concentrate based diets containing 14% crude protein have been formulated for 42 ram lambs divided into seven groups. Each tree species is being fed to two groups at protein substitution levels of 25 and 50% of total dietary crude protein. A control group is receiving Paspalum dilitatum along with a concentrate. Concentrates consist of available by-products from local oil palm, sugar cane, cassava and rice industries. The trial will continue for 90 days.

Following the growth study three lambs from each group will be housed in metabolism crates for digestibility determination through total fecal and urinary collection. Through this trial the effect that tree legume supplementation has on total dietary and protein digestibility can be determined. The final trial will track the disappearance of protein from the digestive tract. To accomplish this lambs from the digestibility trial will be dosed with chromic

oxide and slaughtered for digesta sampling. Digesta will be sampled throughout the digestive tract and analyzed for nitrogen. Relative concentrations of nitrogen found in different parts of the system will indicate where protein is being digested and absorbed. If tannins are binding nitrogen irreversibly a higher proportion will be expected farther along the tract.

Results from this series of trials will reveal the effect these tree legume species have on growth, intake, dietary digestibility and protein utilization. These results will affect the decision on which tree species to recommend to farmers and the amount that can be fed to lambs with no adverse effects upon growth rate. The potential relative capacities of these species to reversibly bind protein creates the possibility of diet formulation including tree legumes as a source of by-pass protein.

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EFFECT OF DURATION AND TIME OF GRAZING ON INTAKE OF SHEEP GRAZING UNDER RUBBER IN NORTH SUMATRA, INDONESIA

R.C. Merkel, S. Ginting, and K.R. Pond

INTRODUCTION

Time spent grazing by sheep under plantation crops such as rubber and oil palm varies according to management and available labor for shepherding. Grazing periods typically reported range from 7.5 to 9.5 hours per day (Yusoff, 1988; Salleh et al. 1989; Vanselow, 1982). Present management at the Sei Putih research site allows 7 grazing hours each day. Small holder farmers who participate in a sheep extension/research project at Sei Putih generally graze their sheep for roughly four hours in the afternoon. Most farmers also provide cut and carry forages in the early morning although others do not provide any additional forage. The present study was designed to evaluate the effect on forage intake of ewes grazing half-day (4 hours) versus full-day (7 hours) and to compare morning versus afternoon grazing.

MATERIALS AND METHODS

Sumatra Thin-tail ewes, one to two years of age, were selected from a large group of ewes purchased from local farmers. In the first of two replicates ewes grazed under 20 year old rubber trees in an area that had been previously grazed by sheep for six years. The second replicate was on a new grazing area under 3 year old rubber trees. All animals had access to drinking water, a molasses/urea mixture and mineral block.

A total of 33 ewes in replicate one and 47 ewes in replicate two were divided into three groups and randomly assigned to one of three treatments: AM, grazing 8a.m.-12p.m., PM, grazing 12p.m.-4p.m. and FD, grazing 9a.m.-4p.m. After a 7 day adaptation period, 10 animals per group in replicate one and 12 in replicate two received chromic oxide marker(500mg/d for 14 days) to determine fecal output. The chromic oxide was given at 7a.m.(300mg) and at 7p.m.(200mg). During the last 7 days rectal grab fecal samples were taken, dried, composited by day for each animal and analyzed for chromium (Kimura and Miller, 1957). Digestibility of grazed vegetation was determined and intake calculated by ratio. Analysis of variance for the randomized complete block design was conducted (Steel and Torrie, 1980) and due to unequal group numbers least square means were calculated (SAS/STAT, 1988) and used in the analysis. In replicate one three ewes lambed and one aborted and in replicate two a single ewe lambed necessitating their removal from the trial.

RESULTS

There was significant replicate*treatment interaction for both intake ($p<.04$) and intake as %body weight ($p<.02$). Replicates were therefore analyzed separately. In both replicates intake and intake as %body weight(BW) was higher for full day than half day ($p<.0001$). Intake in both replicates was not different ($p>.1$) between AM and PM grazing. Intake as %BW was not different in replicate two although in replicate one AM ewes had a higher ($p<.03$) intake as %BW. Intake data are summarized (Table 1) with AM and PM values given as percentages of FD values. Intake as %BW was significantly higher ($p<.02$) in the AM versus PM group in replicate one and tended to be higher in replicate two. In replicate one AM ewes weighed slightly less than PM ewes and this combined with slightly higher intakes resulted in a higher intake as %BW.

These results suggest that 4 hours grazing is not sufficient to allow for adequate intake and therefore longer grazing times are recommended. The practice followed by most farmers of providing supplemental forage to their sheep will help to compensate for the reduction in intake caused by short grazing times. Whether longer grazing times such as those recommended by Velayuthan and Lim (1986) of 10 to 11 hours would be beneficial needs further investigation. Cooler morning temperatures may also play a role in intake by resulting in less heat stress on grazing animals. Thus an earlier grazing time such as 7a.m. could be beneficial. The effect of forage supplementation on intake of sheep grazed for half days in order to maximize intake should be studied in future trials .

Table 1. Intake and Intake as %Body Weight of Ewes Grazing under Rubber Plantation for 4h in the morning (AM), 4h in the afternoon (PM) or 7h full day (FD), Expressed as %FD Values.

	Intake(% of FD)			Intake %BW(% of FD)		
	FD	AM	PM	FD	AM	PM
Rep 1	100	80.8	76.7	100	87.0[a]	78.2[b]
Rep 2	100	80.4	80.1	100	84.6	82.8

a,b differ $p<.02$; in both replicates AM, PM<FD $p<.0001$

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