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ECONOMIC ANALYSIS OF SHEEP PRODUCTION OF THE TRANSMIGRATION NUCLEUS ESTATE SMALLHOLDER IN NORTH SUMATRA

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SUMMARY

The purposes of this research were to evaluate farmers' income distribution and level of technology adoption after introduction of a sheep technology package scheme. The scheme was started in March 1993 involving 80 farmers. In the following financial year an additional 40 farmers were added. These original farmers were given credit consisting of a barn, 5 ewes, and 1 Hairsheep crossbred ram.

After three years of production at the Sosa II Transmigration Area, South Tapanuli, Indonesia, the number of farmers involved in the scheme increased by 68%. Total numbers of sheep, including those sold and returned to the scheme, rose from 720 to 3070 head, an increase of 326%. Average flock size increased by 133% to 14 head. Preweaning lamb mortality was 10.7% for males and 7.5% for females, still below the mortality technical coefficient (10 - 15%). The number of farmers at Subulussalam, South Aceh, receiving sheep increased by 15 farmers; an increase of 37%. The population of sheep increased from 240 head to 516 head, an increase of 115% while the average flock size of each farmer was 9 head, an increase in flock size 50%. The mortality levels were 27.5% for rams and 12.5% for ewes, with preweaning lamb mortality at 21%. The average birth weight of lambs in Sosa was 1.85 kg and in Subulussalam 1.79 kg. Average litter size was 1.73 and 1.69 in Sosa and Subulussalam, respectively. The average daily gain of lambs post weaning was 64.11 g/head/day (Sosa) and 62.6 g/head/day (Subulussalam) with average weaning weight 8.76 - 8.98 kg. Lambing intervals were 234 and 236 days at Sosa and Subulussalam, respectively.

Economic analysis of sheep production showed that the benefit cost ratio of sheep activity was 3.16 and 2.28, respectively, for Sosa and Subulussalam. The introduction of sheep technology packages in Sosa II allowed farmers to generate an additional monthly average income ranging between Rp. 89,000 - 141,000. During this time, monthly income increased by 61.8% with the majority of the increase due to sheep production. In the Subulussalam transmigration area, where crops were the main income source, farmers' income from livestock production increased from Rp. 53,900 to Rp. 123,500, an increase 129 % which was due mainly to sheep production.

Data analysis for levels of technology adoption indicated that 67.7% of all technology introduced was still adopted by farmers. The high level of enthusiasm of the farmers chosen to receive sheep packages, has resulted in high level of technology adoption.

INTRODUCTION

The transmigration program in Indonesia has existed for at least 40 years. The main purpose of the program is an effort to move human beings, mainly farmers, from the most populated areas of Indonesia (Java and Bali) to less populated areas (Sumatra, Aceh, Lampung and Jambi). There are several types of transmigration programs but they can be divided into two major groups, general and specific. The general transmigration scheme is one in which the transmigrant is granted 0.5 Ha of land ready for food crops plus 2 Ha of land which needs extra work to be made into a productive farming area (Anonymous, 1993). The specific transmigrant scheme also grants 0.5 Ha of land ready for food crops, but the additional 2 Ha of land is in the form of plantation and is considered as a loan. Both groups receive a living allowance (called Jaduk) for one year or sometimes longer by the time the farmers involved with the program arrive in the new location.

The transmigration area at Sosa II, South Tapanuli, North Sumatra, is a transmigration scheme where each transmigrant received 2 Ha of oilpalm plantation (3 years old) and 0.5 Ha land for food crops. Meanwhile the transmigration program at Subulussalam, South Aceh, is a transmigration scheme with the main source of income being from food crops (2 Ha) with 0.5 Ha land given for housing and other horticulture. In both locations the transmigration program started in 1991 with 500 families. The government target was to have an average income of Rp. 300,000/month (around US $ 136) coming mainly from oilpalm production at Sosa and from food crop production in South Aceh. However, it takes a period of five years before oilpalm trees begin production. To increase farmers' income generating during that period, the Department of Transmigration introduced an integrated production system with sheep as a source of additional income. In August 1992, the Sungai Putih Research and Assessment Installation for Agricultural Technology, along with the Small Ruminant Collaborative Research Support Program (SR-CRSP), introduced 80 sheep technology packages to farmers at Sosa II, South Tapanuli and 40 packages the following year for both Sosa and Subulussalam, South Aceh. The technology packages consisted of five Sumatran ewes and one hairsheep crossbred ram and included management system, nutrition, animal health and the introduction of improved forage species. All farmers participating in the scheme feed their animals using cut forage from the nearby plantations. However, farmers were also asked to plant 0.1 Ha *Paspalum dilatatum* and *Paraserianthes falcataria* as a supplement to these cut forages as recommended by Horne et al. (1994) and Ibrahim et al. (1989) .

The aims of the program are to diversify the farming system of the transmigrant farmers, and to increase farm income. This paper describes the results of the scheme from the economic point of view for both locations after three years of production.

METHODOLOGY

The program was started in March 1993 with 80 farmers chosen as cooperators at Sosa II, South Tapanuli. In the following year, an additional 40 farmers were added at Sosa and 40 were established at South Aceh. The original packages for each farmer consisted of a barn measuring 2m x 3m, 5 ewes which became their own and 1 hair sheep crossbred ram, which was on loan. The credit package had to be repaid in the form of 10 ewes (ready for mating) and 1 ram

(weighing more than 18 kg) within three years. Animals that are repaid are then distributed to other farmers wishing to join the scheme. In this way, it is expected that the sheep population can expand rapidly. The ram was loaned rather than granted to make it easier to rotate rams between farmers annually to avoid in-breeding.

Each farmer was given, free of charge, barn equipment, anthelmintic and mineral blocks. In each location, there were three extension workers which consisted of an animal scientist (1 person), veterinarian (1 person) and junior livestock school graduate (1 person) who helped the farmers directly in the field. These extensionists were considered essential for the success of the scheme.

To analyze the farmers income distribution, the regular recordings of liveweight, births, deaths and sale of animals were observed. The economic evaluation (Amir and Knipscheer, 1989) included the inputs and outputs during three years of production and is used to describe the farmer income.

RESULTS AND DISCUSSION

Since the introduction of the technology packages at Sosa II, the number of farmers having sheep has increased by 82 farmers; an increase of 68% (Table 1). The population of sheep, including sheep sold, after three years production increased from 720 head to 3070 head, an increase of 326%. In general, the mortality during production was low, being 9.2% for rams and 14.2% for ewes. The higher mortality for ewes was due to deaths following transportation to Sosa II from Sungai Putih. Preweaning lamb mortality was 10.7% for males and 8.4% for females, which was still below the mortality technical coefficient (10 - 15%). From the original flock size of each package given (6 head), average flock size in March, 1996, had risen to 14 sheep, an increase in flock size of 133%. Within three years of production, the average number lambs returned by farmers as a payment of credit was 13.6 head. A similar number returned (13.5 head) was found by Sirait et al. (1995), in an evaluation of a project at South Tapanuli, North Sumatra, Indonesia.

Table 1. Sheep population at Sosa II on March 1996.

Items	Total sheep (head)											
	Initial nos.		Ewes/rams dead		Offspring		Preweaning deaths		Sold/ returned		Present	
	M	F	M	F	M	F	M	F	M	F	M	F
Package 80	80	400	4	70	443	759	70	57	265	313	449	1032
Package 40	40	200	7	15	266	385	41	39	76	66	258	531
Distributed package	--	--	--	--	--	--	--	--	--	--	103	393
TOTAL	120	600	11	85	1229	1144	111	96	341	379	810	1956

After three years of production in Subulussalam, South Aceh, the number of participating farmers has increased by 15, an increase of 37% (Table 2). The population of sheep, including sheep sold, increased from 240 head to 516 head, an increase of 115%. The average flock size of

each farmer was 9 head, a 50% increase. The mortality level during production was high, 27.5% for rams and 12.5% for ewes, higher than that found in Sosa. Preweaning lamb mortality was also quite high, at 21%. The high mortality was generally due to wild dogs killing sheep during the night. The mortality rate of lambs outside of wild dog problems was only 6.1%. Currently, the wild dog problem has been taken care by farmers.

Table 2. Sheep population at Subulussalam on March 1996.

Items	Total sheep (head)											
	Initial		Ewes/rams dead		Offspring		Preweaning deaths		Sold/ returned		Present	
	M	F	M	F	M	F	M	F	M	F	M	F
Package 40	40	200	11	25	157	238	36	47	41	131	109	235
Distributed package	--	--	--	--	--	--	--	--	--	--	15	75
TOTAL	40	200	11	25	157	238	36	47	41	131	124	310

There was no significant difference in average birth weight of lambs at Sosa (1.85 kg) and Subulussalam (1.79 kg) (Table 3). The average litter size was 1.73 and 1.69 in Sosa and Subulussalam, respectively. An evaluation of a similar project at Gohor Lama rubber plantation (PTP III), North Sumatra by Elieser et al. (1994) found an average litter size of 1.72. Similar litter sizes were also reported by Gatenby et al. (1995) of 1.78 for local Sumatra and crossbred St. Croix ewes from an evaluation of sheep productivity in the Nucleus Estate Smallholder program at Membang Muda, North Sumatra and by Pitono (1992), 1.76, for Sumatra and crossbred St. Croix ewes in experiments conducted at Sungai Putih. The reported litter size is higher than the litter size found by Doloksaribu et al (1995), of 1.29 from an evaluation of an extension project in South Tapanuli, North Sumatra with similar breeds of sheep.

Data analysis indicated that the distribution of birth types was 68%, 29% and 3% for singles, twins and triplets, respectively. The highest mortality occurred in triplets which was expected, since the competition between lambs during pregnancy and milking periods affected the survival rate (Donald and Russels 1970; Fitzhugh and Bradford 1983). The average daily gain of lambs post weaning was 64.1 g/head/day (Sosa) and 62.3 g/head/day (Subulussalam). Average weaning weights ranged from 8.76 to 8.98 kg. Lambing interval was 234 and 236 days at Sosa and Subulussalam, respectively. Generally there were no significant differences in sheep productivity between Sosa and Subulussalam. However, the main problems for sheep development in Subulussalam was availability of forage since the Subulussalam area was programmed for crops as a main income source. This is compared to Sosa where the oilpalm plantation, with abundant forage, was targeted as the main source of farmer income. Due to forage constraints, transmigration schemes with plantation packages may be more suitable for the introduction of sheep than transmigration schemes stressing crop production.

Table 3: Sheep productivity in Sosa and Subulussalam

Items	Sosa		Subulussalam	
	N	Average	N	Average
Ewes weight (Kg)	812	18.10 ± 0.32	234	17.17 ± 0.23
Birth weight of lamb				
First	1242	1.85 ± 0.18	341	1.79 ± 0.18
Second	411	1.64 ± 0.24	54	1.62 ± 0.24
Weaning weight	1446	8.98 ± 0.23	312	8.76 ± 0.42
ADG of lamb (gr/d)	1411	64.11 ± 0.21	298	62.26 ± 0.17
Litter size	1653	1.73 ± 0.52	395	1.69 ± 0.22
Lambing interval (d)	797	234 ± 0.16	215	236 ± 0.27

Note : (N) = total amount of sheep observed

Economic Analysis

Monthly economic analysis of sheep production (Table 4) was conducted by subtracting the total yearly input (supplementation, medical treatment, barn and tools depreciation, grass preparation for 0.1 Ha land including fertilizer- TSP, urea, KCl, limestone) from total yearly output (animal sales). However, since the farmer and his family perform all production activities, labor was not included as an input cost. The management system currently applied includes utilization of rice bran and palm kernel cake as a supplement along with mineral block. Additionally, to control the cycle of parasitism between sheep and the pasture, every three months an anthelmintic (Valbazen) is given to all animals.

Analysis of data indicated that the benefit cost ratios of sheep production were 3.16 and 2.28, respectively, for Sosa and Subulussalam. This result was encouraging and economically profitable compared to current bank interest rates (18 % per year or 1.5 % per month). Soedjana et al (1995) indicated that for sheep enterprises with 100 ewes and 10 rams with a BCR of 1.8, the break even point was not reached on the 7th year. It is clear that through the introduction of sheep technology packages, farmers were able to generate additional average monthly incomes ranging between Rp. 89,000 - 141,000. Sheep development programs seem to be more profitable for transmigration area with plantation packages as a main source of income compared to crop as a main income. This difference may partially be due to the availability of forage to support productivity of sheep in Sosa.

Large increases in farmer incomes before and after introduction of sheep technology packages were seen at both Sosa and Subulussalam (Table 5). At the Sosa area, the farmer income from oilpalm production during the three years of sheep production increased about 60%. The income from livestock production, which was previously mainly from native chicken (Rp. 45,600) and some goat (Rp. 70,400), was increased to Rp. 141,100 (sheep) and Rp. 51,200 (native chicken), an increase in total monthly income of about 61.8%. In the Subulussalam transmigration area where crops were the main income source, farmer income from livestock production was increased Rp. 53,900 to Rp. 123,500, a 129% increase, due mainly to sheep

production. In the districts of North Tapanuli, Deli Serdang and Langkat, Karokaro et al. (1984), found that farmers' income was increased 48.9% through the adoption of sheep technology packages.

Table 4: Economic analysis of farmer income from rearing sheep

Items		Sosa	Subulussalam
Output:			
Animal Sales (Rp.)			
Mature	:	1,575,000	880,000
Growing	:	330,000	550,000
Young	:	280,000	480,000
Total output		2,385,000	1,910,000
Input:			
Supplementation	:	260,820	243,810
Medical treatment	:	66,000	70,000
Barn depreciation	:	50,000	50,000
Tool depreciation	:	25,000	25,000
Grass preparation	:	89,250	89,250
Grass fertilizer	:	200,750	360,750
Total input		691,820	838,810
Income (Rp./years)		1,693,180	1,071,190
Monthly income, Rp		141,098	89,265
BCR		3.45	2.27

Table 5. Analysis of farmer income before and after sheep technology introduction.

Sources	Change in income at Sosa (Rp. 000,-)			Change in income at S.Salam (Rp. 000,-)		
	Before	After	Increase	Before	After	Increase
1. Crop/ Oilpalm	248.8	398.1	60 %	171.2	212.0	25 %
2. livestock						
- sheep/goat	70.4	141.1	100 %	25.2	89.3	254 %
- native chicken	45.6	51.2	12 %	28.7	34.2	19 %
TOTAL	364.8	590.4		225.1	337.5	

Technology Adoption

Since the first scheme began, all technology packages were introduced to the farmers through the extension program, either by scientists or extension workers who stayed with farmers in each location. However, the extension program existed only two years due to Department of Transmigration rules. Since April 1995, the extension workers or scientists were not involved in the project. Technology adoption and persistence was evaluated by interviewing 156 farmers from the Sosa and Subulussalam transmigration schemes. Farmers were interviewed with respect to barn construction, mating system, health, especially althemintics program, and nutrition (utilization of mineral block, supplementation). Data analysis indicated that 67.7% of all technology introduced was still adopted by farmers. The level of adoption was related to the success of the sheep enterprises at each location. Similar adoption levels were found by Karokaro et al (1994), for a sheep project introduced to smallholder farmers in the rubber plantation areas in North Sumatra.

Table 6. Adoption level of introduced technology.

Technology adopted	Total	
	N	%
Barn only	18	11.1
Barn + Mating system	9	5.7
Barn + Mating system + Health + nutrition	105	67.7
Barn + Health + nutrition	12	7.8
Health + Nutrition	7	4.4
Nutrition only	5	3.3
Total	156	100

The rapid expansion of sheep numbers since this first scheme commenced, along with the generally high level of enthusiasm by farmers for the concept of sheep credit packets, has resulted in high levels of technology adoption. Planning for similar schemes was recommended to be developed in adjacent transmigration areas.

Lack of medical and mineral supplies available at the location will be one of the future problems as well as the rotation of rams. It is suggested that farmers establish a cooperative of sheep producers, ideally organized by livestock extension services. All supplies required will then be organized by this cooperative while the local extension office will provide advice on animal health problems.

The success of this scheme at Sosa and Subulussalam has led the Department of Transmigration to propose a new form of transmigration scheme (livestock nucleus smallholder) at Merino village, in which farmers would be given 2.0 hectares of land for production of forage and crops. As part of the package, farmers would given 25 ewes and 2 rams. This system is still in the conceptual stage but 200 packages are being planned to see if this form of transmigrant

farmer could achieve a base income of $US 136 per month. This scheme is locally called "PIRNAK" (livestock nucleus smallholder production as the main source of income).

CONCLUSION

In terms of sheep production and economic analysis of the sheep introduction scheme, it can be concluded that sheep can be introduced to areas with oilpalm plantation or crops as a main source of farmer income. During three years of production, the sheep population at Sosa II increased by 326%.from the original total number of sheep. In general the mortality during production was low and was still below the mortality technical coefficient (10 - 15%). From the original flock size number of each package given (6 head), current average flock size was 14 sheep, an increased of 133%. While sheep production parameters Subulussalam were numerically lower than Sosa, no statistically significant differences were found. The high mortality was generally due to wild dogs.

Monthly economic analysis of sheep production showed benefit cost ratios of 3.16 and 2.28 for Sosa and Subulussalam, respectively. By introducing sheep technology packages, farmers at Sosa were able to generate an additional monthly income of between Rp. 89,000 - 141,000 with total monthly income from oilpalm and livestock increasing 61.8%. In the Subulussalam transmigration area where crops are the main source of income, farmer income from livestock production increased from Rp. 53,900 to Rp. 123,500, an increase 129%, due mainly from sheep production.

Of the technology introduced to the farmers, 67.7% continued to be used, even though the farmers were not supervised anymore. This indicates that level of enthusiasm should be taken into consideration when additional farmers are chosen to receive packages.

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