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The Economic Value of Sheep Grazing to Manage Weeds in Rubber Plantations

Setel Karokaro

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Winrock International, Morrilton, Arkansas

Small Ruminant Collaborative
Research Support Program, Sungai Putih,
North Sumatra, Indonesia

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Setel Karokaro

Sungai Putih Research and Assessment Installation for Agricultural Technology
PO Box 1, Galang, Deli Serdang. North Sumatra -Indonesia 20585

ABSTRACT

The purposes of this research were to evaluate the performance of sheep grazing under rubber trees, the effect of grazing sheep on rubber production and the economic value of grazing sheep on reducing weeding cost. Grazing sheep had no effect upon girth of rubber trees. It was found that grazing sheep under rubber trees tended to increase rubber production, though not statistically significant. The impact on rubber production may be significant over a longer time period. Grazing sheep in rubber plantations has been shown to be a low cost and effective method of controlling weeds compared to herbicides or manual weeding methods. Grazing sheep under rubber trees was able to reduce weeding costs by 22.74%. However, the sheep management system, appropriate grazing systems and manipulation of stocking rates are main concerns in order to achieve optimum results.

INTRODUCTION

The management of weeds in plantations in Indonesia has been a major problem, especially since the cost of herbicides and labor has increased. In general, weeds in plantations are controlled by spraying herbicides or hand weeding. The establishment of leguminous cover crops in the interrows of rubber has long been practiced to control weeds as well as to derive other benefits from legumes. However, when the rubber canopies close, the legumes gradually decline, mainly due to light limitation, and are eventually succeeded by grasses, ferns and broadleaf plants usually termed as weeds. These weeds may effect the growth of rubber trees as they compete for nutrients and moisture (Ismail and Chong, 1990). Soil analysis has shown that grazing sheep under rubber trees did not increase soil compaction in the rubber plantation (Reese et al., 1986).

The Indonesian government is encouraging the application of integrated farming systems to improve resource allocation among various agricultural enterprises. The integration of sheep and plantation production systems is an example of the implementation of this approach. In Indonesia, the Agency for Agricultural Research and Development, in line with Government policies, has established a research program on integrated production system. This program is located in North Sumatra, where there are vast areas of plantations.

In order to evaluate the benefits of sheep production in rubber plantations, as well as an effort to reduce the reliance on herbicides, the biological method of weed control using sheep grazing under rubber has been introduced. This experiment was located in Nucleus Estate Smallholder (NES) PTP I Alue Ie Mirah, East Aceh. The first experiment was located at Afdeling II CV IX Alue Bugeng with 30 ha of rubber planted in 1983/1984 with the clone AVROS 2037. The second experiment (30 ha) was located at Afdeling III and planted in 1986/1987 with clone GT 1.

MATERIALS AND METHODS

The purposes of this research were to evaluate the effect of grazing sheep on rubber production and how grazing sheep was able to reduce weeding costs. The experiment was conducted in the flock at the NES project of PTP I, Alue Ie Mirah, East Aceh. In December 1990, a 30 hectare plot at Afdeling II CV IX Alue Bugeng with clone AVROS 2037 planted in 1983/1984 and another 30 hectare plot at Afdeling III with clone GT 1 planted 1985/1986 were designated as grazing sites. Each of the 30 hectares sites was divided into 3 pastures. Sheep changed pastures every four weeks. Over 220 sheep (200 local Sumatran ewes and 20 Garut rams with average body weights of 15.8 kg and an approximate age of 6 months) were grazed on these areas. There were 20 farmers as cooperators each with a flock size of one ram and ten ewes raising them individually. Another ten farmers with similar flock sizes raised their sheep in a group. The data collected consited of the productivity of sheep after two years of production, which were years 1991 and 1992. Following those years, there was a local armed dispute in the surrounding area causing most of the cooperator to abandon the location. Additionally, the data collected included the changes in rubber production, changes in the girth of trees and changes in the cost of utilization of herbicides after grazing sheep under trees.

RESULTS AND DISCUSSION

Data of sheep population after two years of the project (Table 1) indicated that the performance of sheep was good. In two years of production the preweaning mortality was 12.7% and 16.7% for males and females, respectively. The sheep population, in two years of production, increased approximately 157%. However, in terms of the amount of distributed packages (from offspring returned distributed as new packages) there was only 11% increase (6 new farmers).

Table 1. Sheep population at Alue Ie Mirah, East Aceh in Dec' 1991.

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 (20)	20	200	5	24	126	215	16	36	0	0	125	355
Distributed package (6)	--	--	--	--	--	--	--	--	--	--	10	50
TOTAL	20	200	5	24	126	215	16	36	0	0	135	405

In terms of sheep productivity, the Alue Ie Mirah area is suitable for sheep development (Table 2). There were no significant differences in sheep performance between single and group farmers. Pitono et al. (1992) reported results from the research station of Suka Dame located at the Sunagi Putih Research and Assessment Installation for Agricultural Technology that the birth weights of lambs were 1.53 kg and 1.78 kg for the first and second parturition, which are similar to the East Aceh results. Also, data of sheep production reported by Karokaro et al. (1996), in oilplam plantations in Bah Jambi (PTP VII), showed similar results to the Alue Ie Mirah project. Average weaning weights at Alue Ie Mirah ranged from 8.51 to 8.62 kg. Lambing interval was 235 - 237 days , which was longer compared to data of Pitono et al. (1992). Generally there were no significant differences in sheep productivity between the two systems of rearing sheep (individual and group). However, the main problem encountered for sheep development in Alue Ie Mirah was that there was no continuation of the project after the local war erupted.

Table 2. Sheep productivity in Alue Ie Mirah, Dec' 91

	Individual farmers		Group farmers	
Items	N	Average	N	Average
Birth weight of lamb				
First	157	1.74 ± 0.15	166	1.82 ± 0.02
Second	139	1.53 ± 0.04	127	1.62 ± 0.42
Weaning weight	270	8.51 ± 0.19	283	8.62 ± 0.24
ADG of lamb (gr/day)	252	46.21 ± 0.22	212	47.15 ± 0.09
Litter size	289	1.68 ± 0.08	311	1.72 ± 0.34
Lambing interval (day)	237	234 ± 0.26	235	236 ± 0.32

Note : (N) = total number of sheep observed

Measurements of the girth (Table 3) of rubber clones GT 1 (planted 1985/86) and AVROS 2037 (planted 1983/84) were conducted every three months. Data showed that there was no significant difference in tree girth between ungrazed (control) and grazed areas indicating no effect of the presence of sheep upon tree growth. The difference in girth between ungrazed and grazed areas was quite small. The average girth of trees in the control group of AVROS 2037 was 46.2 cm, 54.5% greater than the average of control trees of GT 1 (21 cm). However, this large difference was due to year of planting. The Avros 2037 was planted in 1983/84, which meant that the trees had been producing latex around three years, while clone GT 1 planted in 1985/86, had produced latex just one year. The average tree girth of Avros 2037 in grazed areas, measured in January, March and May , was 47.2 cm while clone GT 1 was 21.6 cm. The difference in average girth between ungrazed and grazed areas of the rubber clone Avros 2037 was 1.0 cm (2.16 %), and clone GT 1 was 0.6 cm (2.8 %).

Table 3. Effect of grazing on tree girth (year 1991)

Year planted	Average tree girth (cm)			
	December (Control)	January	March (After grazing)	May
Avros 2037				
1983/84 (P1)	47.6	47.9	48.1	48.3
1983/84 (P2)	44.3	45.0	47.2	47.4
1983/84 (P3)	46.8	47.0	47.3	47.5
Average	46.2	46.6	47.5	47.7
GT 1				
1985/86 (P1)	27.7	27.9	28.2	28.3
1985/86 (P2)	16.3	16.9	17.1	17.6
1985/86 (P3)	19.0	19.4	19.6	19.9
Average	21.0	21.4	21.6	21.9

Note : P1,2,3 were plots of rubber trees.

Data analysis of rubber production (Table 4) indicated that during one year of observation, the average rubber production of Avros 2037 between grazed and ungrazed treatments was 1140.5 and 1101.3 kg/year/hectare, respectively. The rubber production of grazed areas was 39.2 kg/year/hectare (3.4 %) higher compared to ungrazed areas. However, the difference was not statistically significant. With clone GT 1 the average rubber production of grazed and ungrazed areas was 858.4 and 934.4 kg/year/hectare, respectively. The rubber production of ungrazed areas was 76 kg/year/hectare (8.8 %) lower compared to grazed treatments. Again, the difference was not statistically significant. Reese et al. (1986) found no significant effect of grazing sheep on rubber production integrating sheep with rubber plantations in Sei Putih, North Sumatra. However, no firm conclusions regarding the effect of grazing sheep on rubber production can be reached based on less than one year's data.

Data analysis of rubber production/tree/ tapping showed that for both clones (Avros 2037 and GT 1), the rubber production on grazed treatments was always higher than ungrazed treatments. This indicates that grazing sheep under rubber trees tended to increase the rubber production. Total impact on production , while small in a single year, could be significant over a longer period of grazing. The impact of sheep manure as fertilizer for the trees is also an effect that will be noticeable over longer periods of time.

Table 4. Effect of grazing on rubber production, kg/ha/year, (grams/tree/tapping)

	Avros 2037		GT1	
Month	Grazed	Ungrazed	Ungrazed	Grazed
January	110.2(51.4)	112.4(50.9)	91.7(40.1)	114.3(52.5)
February	82.7(44.6)	83.5(39.3)	67.8(28.9)	80.8(38.7)
March	74.3(42.3)	76.5(43.1)	66.7(27.6)	78.9(35.4)
April	75.6(43.1)	76.9(44.2)	65.4(28.3)	77.2(34.6)
May	95.3(48.2)	94.6(48.8)	66.7(30.2)	64.3(33.2)
June	89.1(45.6)	85.6(43.1)	69.5(30.1)	78.1(38.9)
July	108.5(44.5)	111.3(46.0)	52.1(22.1)	64.3(30.6)
August	74.6(41.6)	68.7(37.5)	57.4(26.8)	60.8(33.7)
September	79.0(46.9)	76.6(37.6)	60.1(25.9)	61.4(33.2)
October	89.9(47.6)	73.2(36.1)	65.6(28.9)	61.3(30.8)
November	109.5(57.6)	95.2(47.3)	80.9(30.3)	98.9(42.3)
December	151.8(67.7)	146.8(62.6)	84.5(35.9)	94.1(45.2)
kg/ha/year	1140.5	1101.3	858.4	934.4
g/t/t	(48.4)	(44.7)	(29.6)	(37.4)

To evaluate the effect of grazing on weeding cost (Table 5), all herbicide use per year was tabulated. There were four herbicides periodically used each year, such as Dalapon, 2.4 D. Amine, Herbicides pra growing and Paracol. Other expenditures for herbicide use were water and a drum for mixing. In ungrazed areas, annual use was approximately 28 kg of Dalapon, 4 kg of 2.4 D.Amine, 1.5 liters herbicides pra-growing, 3 liters paracol mixed with 1000 liters of water in one drum. The total annual herbicide cost per hectare without grazing sheep was Rp. 122,250. Data analysis on annual herbicide cost per hectare after one year of grazing sheep showed that the quantity of herbicides used was reduced. The main reason for reduction was identified as less need for spraying after grazing. Sheep controlled the edible forage leaving only the unpalatable species left that required spraying. After one year of grazing, there was a significant difference in weeding cost between grazed and ungrazed treatments with grazed areas spending approximately Rp. 27.800 (22.74 %) less compared with ungrazed areas.

Table 5 : Effect of grazing on weeding cost

No	Herbicides (items)	Ungrazed (Control) (Rp)	Grazed (Rp)
1	Dalapon	89775	57455
2	2.4 D. Amine	9900	6335
3	Herbicides Pra Growing	12825	8335
4	Paracol	19350	12575
5	Water	1500	1500
6	Drum	8250	8250
	Total	122250	94450

CONCLUSION

Data of sheep population indicated that the performance of sheep was acceptable. In two years of production, the preweaning mortality was low, 12.7% and 16.7% for males and females, respectively. Generally, there were no significant differences in sheep productivity between the two systems of rearing sheep (individual and group). However, the main problem for sheep development in Alue Ie Mirah was that there was no continuation of the project after the local war erupted. Measurements of the girth of rubber trees showed no significant differences in girth between ungrazed (control) and grazed areas

Data analysis of rubber production between grazed and ungrazed areas indicated that during one year of observation, the average rubber production of clone Avros 2037 in the grazed area was 39.2 kg/year/hectare (3.4 %) higher compared to ungrazed areas. Clone GT 1 produced 858.4 and 934.4 kg/year/hectare, respectively, for ungrazed and grazed areas. The rubber production of ungrazed area was 76 kg/year/hectare (8.8 %) lower compared to grazed treatments.

Data analysis of latex production/tree/ tapping showed that for both types of clones (Avros 2037 and GT 1), production on grazed treatments was always higher than ungrazed treatments indicating that grazing sheep under rubber trees tended to increase the rubber production. The total annual herbicides cost per hectare for ungrazed and grazed treatments were Rp. 122,250 and Rp. 94,450. The effect of sheep grazing was to reduce the weeding cost by approximately Rp. 27.800 (22.74 %) compared with ungrazed treatments.

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