Ruminant Production and Feed Utilization in Indonesia

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Abstract

The population of ruminant livestock in Indonesia, increased during the past ten years, at an annual rate of 6.73% (beef cattle), 18.58% (dairy cattle), 5.07% (sheep) and 4.84% (goats). Feed for ruminants was mainly obtained from native grasses/legume shrubs and tree leaves and, to a lesser extent, from crop by-products and residues. The use of concentrate feeds was still limited to dairy cows. Seasonal variations particularly regarding rainfall, pose a constraint on forage supply in most of the regions of the country. Technology for the improvement of the feeding systems has been based either on the improvement of the environmental capacity to produce forage throughout the year or on the improvement of the animal physiological capacity, which is mainly achieved by manipulating the digestive tract ecosystems. The three strata forage production system has been introduced to farmers to ensure the continuous year round forage availability. Rumen microbial fermentative control has also been a subject of interest in order to improve the efficiency of feed utilization. The future prospects of research in nutrition and physiology of ruminants will be very likely directed toward research on and application of treated crop by-products and concentrate feeds produced by biotechnology.

Introduction

Remarkable success in agricultural production in Indonesia has been achieved in some sub-sectors, for instance, in the case of rice production where a level of self-sufficiency has been attained since 1984. In other sub-sectors, such as in livestock production, the production of animal protein does not satisfy yet the domestic demand. Most of the animal protein for human consumption originates from poultry and ruminant livestock represent the second potential source of meat supply in the country. The productivity of ruminant livestock, feed availability and constraints as well as the research achievements in ruminant nutrition during the past ten years are discussed briefly in this paper.

Population of ruminant livestock

The population of ruminants and their off-take rate determine, to a certain extent, the potential of animal production. As a whole, the population of ruminant livestock in Indonesia increased during the past ten years. The ruminant livestock population in each province of the country in 1988, is shown in Table 1. Beef cattle are predominantly raised in Java (44.7 % of the country's beef cattle population) and their number increased at an annual rate of 6.73%. Dairy cattle are primarily raised in Java (96% of the dairy cattle population) and showed the most outstanding rate of increase (18.58% per year). Part of this growth was due to the importation of animals from overseas. Most of the dairy cattle population consists of

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Table 1 Ruminant livestock population in Indonesia by province, 1988

Province	Dairy cattle	Beef cattle	Buffaloes	Goats	Sheep
D. I. Aceh	–	419,930	351,071	363,040	88,274
North Sumatra	7,185	179,024	192,128	262,076	61,850
West Sumatra	2,128	352,600	181,609	215,664	3,359
Riau	–	80,337	38,668	152,193	805
Jambi	–	70,946	55,453	74,495	39,348
Bengkulu	136	89,106	90,231	142,097	33,975
South Sumatra	130	315,239	131,456	461,288	107,983
Lampung	–	163,024	42,102	247,462	34,682
DKI Jakarta	5,180	–	1,575	9,465	4,536
West Java	79,118	151,080	491,513	1,699,929	2,920,931
Central Java	79,917	1,116,349	300,631	2,422,268	1,270,103
D. I. Yogyakarta	3,536	185,353	14,936	260,518	74,988
East Java	84,666	2,912,677	186,750	2,061,177	973,230
West Kalimantan	–	93,390	3,267	48,867	–
Central Kalimantan	–	37,665	6,340	16,501	1,355
South Kalimantan	71	101,681	51,081	57,496	4,871
East Kalimantan	131	35,313	15,791	57,540	2,936
North Sulawesi	81	230,627	3,627	89,583	–
Central Sulawesi	–	329,007	35,308	207,313	17,402
South Sulawesi	–	1,198,234	519,913	598,365	13,840
Southeast Sulawesi	–	174,866	13,666	109,311	364
Bali	136	426,478	8,222	80,378	562
West Nusa Tenggara	–	343,030	226,496	266,598	44,651
East Nusa Tenggara	–	611,855	174,362	414,377	89,427
Maluku	9	67,559	20,485	162,933	5,574
Irian Java	245	33,076	4,448	42,696	1,047
East Timor	–	57,139	336,995	82,617	28,777
Total	262,669	9,775,585	3,498,124	10,606,247	5,824,870

Source : Anonymous, 1990.

Friesian Holstein or FH grades. Buffaloes are mainly raised in Sumatra (30.95% of the total population). The rate of increase in number was 4.92% per year. Fig. 1 illustrates the changes in the population of beef cattle and buffaloes during the past ten years. Fig. 2 shows the changes of the number of dairy cows. In the small ruminants, sheep represent about 30% of the total small ruminant population and showed a rate of increase of about 5.07% per year. Although fluctuations in the population of goats occurred in the period 1985-1986, this species showed a net increase with an annual rate of 4.84%. Fig. 3 indicates the changes in the small ruminant population.

Production of meat and milk

Production of meat from ruminant livestock amounted to 400.7 thousand tons in 1989, while the production of milk was 279.2 thousand tons (Anonymous, 1990). These production levels are still below the level to satisfy the recommended standard requirements (7.6 kg meat and 6 kg milk per capita/year). Therefore, importation of both meat and milk to fill the production gap still continues. The domestic production and imports of meat and milk during

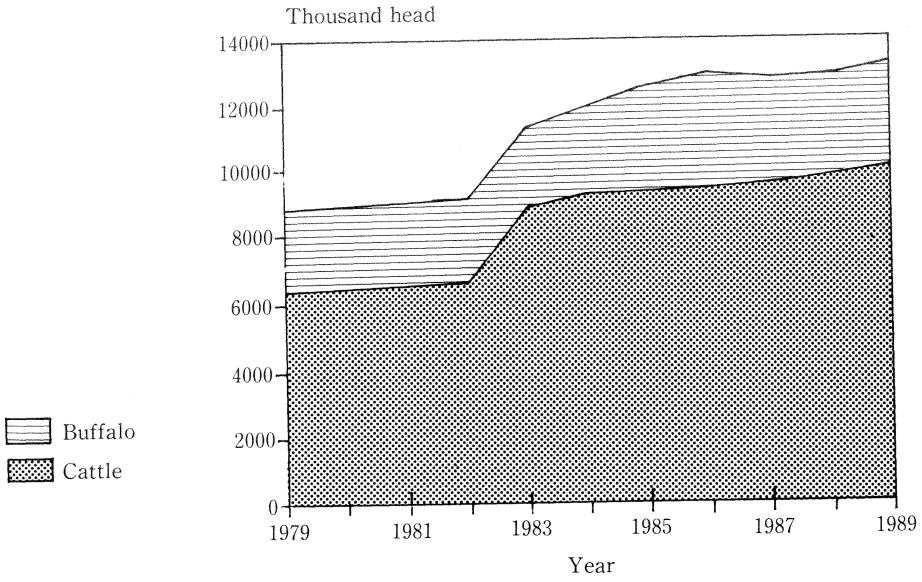

Fig. 1 Population of cattle and buffalo in Indonesia, 1979–1989.

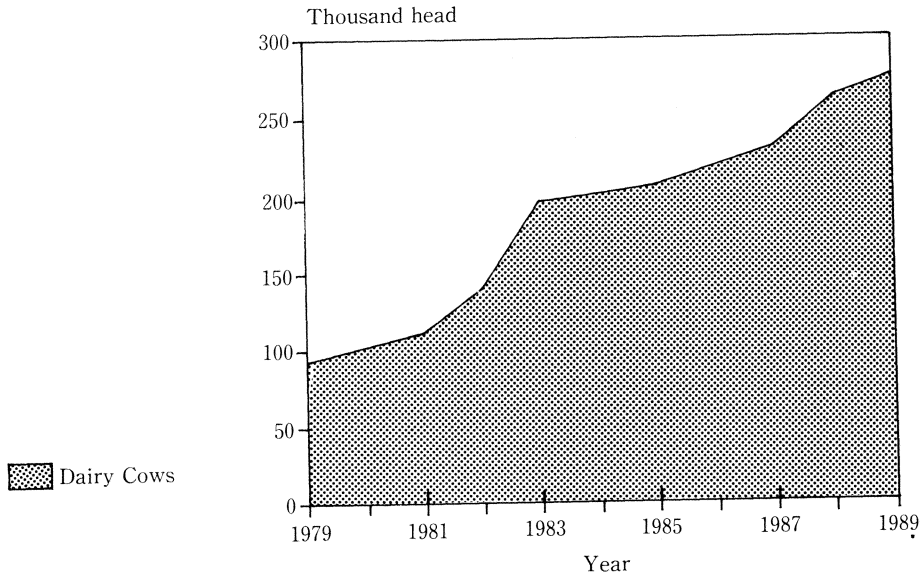

Fig. 2 Population of dairy cattle in Indonesia, 1979–1989.

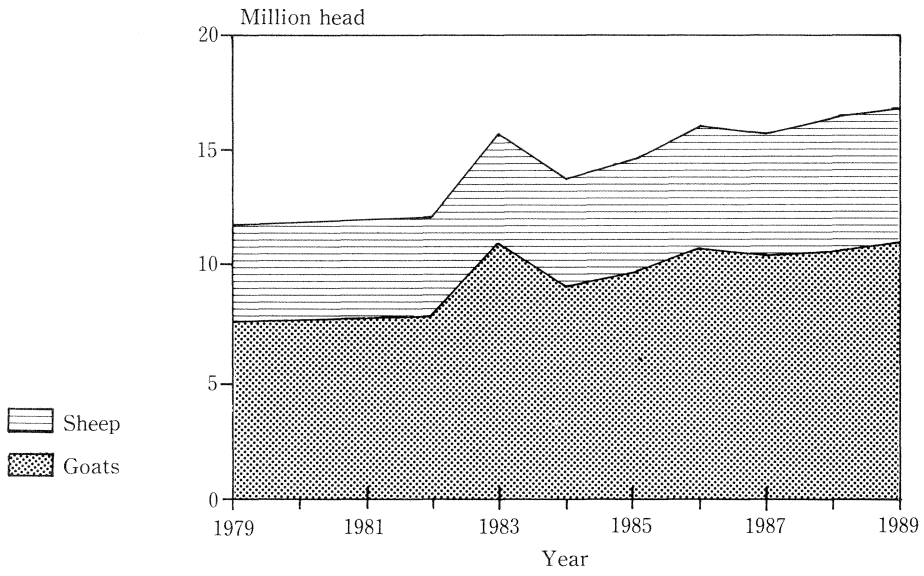

Fig. 3 Population of sheep and goats in Indonesia, 1979-1989.

Table 2 Production and imports of meat and milk in Indonesia, 1983-1988 (,000 ton)

Year	Meat		Milk	
	Domestic production	Imports	Domestic production	Imports
1983	684.7	2.0	124.5	393.7
1984	742.2	2.4	160.6	462.3
1985	808.4	1.7	188.6	353.1
1986	879.0	1.5	179.2	392.7
1987	895.5	1.7	205.5	452.7
1988	937.0	1.6	231.8	497.8

Source : Anonymous, 1988, 1990.

the period of 1983 to 1988 are presented in Table 2. Large ruminants accounted for 35% of the domestic meat supply, while small ruminants for only 1.2% (Haryanto, 1989). The other major source of meat supply is poultry which contributed to nearly 50% of the total meat production in the country. One of the challenges of the livestock sub-sector in Indonesia is, therefore, to increase the ruminant productivity. This could be achieved by fully exploiting the genetic potential, increasing the population and improving animal nutrition. The needs for improvement of production are evident by inspecting data of the characteristics of performance levels of ruminant livestock in Indonesia. In the case of small ruminants, for instance, low weights are also associated with low rates of gain. In fact, Astuti (1984) reported that the average daily weight gains of kacang goats, etawah crossbred and local sheep were 106, 86 and 95 g/day for males during the preweaning period, and they decreased to 61, 70 and 51 g/day from weaning to one year. Female rates were approximately 25%

lower than those of males for the same periods. Similar results were reported by Ngadiyono *et al.* (1984) and Setiadi and Sitorus (1984). Research has showed that these rates could be improved to some extent (Chaniago *et al.*, 1984). In cattle and buffaloes, results of several experiments indicated a maximum daily gain of 0.67 kg for cattle and 0.54 kg for buffaloes when they were fed primarily with agricultural by-products or native grasses with different levels of supplementation. Usri (1983) reported that the birth weight of male Ongole crossbred cattle was influenced by sex and season. The average birth weight was 23 kg and reached 125 kg at weaning.

Feed availability and its constraints

In a densely populated area such as Java, feeds for ruminants are primarily obtained from cultivated grass and legume forages and limited utilization of agricultural by-products and residues. In the other less densely populated areas, native grasses and legumes (grazing areas) and sometimes introduced species of grasses and legumes are the main source of forage for ruminants. The area considered as natural grazing land covers nearly 3 million hectares distributed throughout many islands (Table 3). Areas used for plantation crops such as rubber, oil palm and coconut are also potential sources of forage production. In these areas, vegetation growing under the main tree crops represents a potential source of forage. Utilization of these areas involves an integrated livestock-tree cropping management system. Area of smallholder rubber plantation covered 2.36 million hectares, coconut 3.09 million hectares and oil palm 0.204 million hectares, while the estate rubber plantations covered 0.488 million hectares and oil palm 0.51 million hectares in 1987 (Anonymous, 1989). Of the coconut plantation areas in Java, only 21.3% was planted with coconut alone, while the rest was usually diversified with either perennial crops or seasonal crops or both (Darwis, 1990). The use of concentrates (commercial feeds) in ruminants is still limited to dairy cattle. Only some if any, of commercial feeds is given to meat-producing ruminants. The availability of forage for ruminants is influenced by the seasonal rainfall variations. Forage production during the rainy season is usually adequate, and sometimes in excess to feed ruminants; however, the moisture of the plants is high which limits the fulfillment of dry matter requirements. Dry matter intake in addition to that of protein and energy is the major measure adopted to improve ruminant productivity. Digestibility coefficients of forage dry matter and those of other nutrients are slightly higher during the rainy season compared to that in the dry season, even though sometimes conflicting results have been reported. This is reflected in the fluctuations of body weight changes of cattle through the transition between the rainy and

Table 3 Distribution of natural grassland areas in Indonesia (hectares)

Island (s)	Areas	Percent
Sumatra	770,342	25.54
Nusa Tenggara	733,187	24.31
Sulawesi	618,120	20.50
Kalimantan	351,946	11.67
Irian Java	305,254	10.12
Maluku	177,473	5.89
Java	59,277	1.97
Total	3,015,599	100.00

Source : Anonymous, 1989.

dry seasons. The drop in body weight during the dry season may reach 30 kg, followed by up to 105 kg of recovery during the rainy season under natural pasture conditions in the eastern regions of Indonesia (Bamualim, 1988).

In areas of intensive agriculture such as Java, the crop by-products and residues may become substantial feeding sources for ruminants, even though their digestibilities are relatively low. Reksohadiprodjo *et al.* (1984) reported that the dry matter intake of straws from rice, maize, sorghum, and peanut by sheep ranged from 39 to 80 g per unit of metabolic weight with digestibility coefficients ranging from 38.8 to 67.1%. The potential of agricultural crop by-products and residues in Java and Bali has been estimated to range from 22.9 to 34.4 million tons of dry matter per year with an average of 28.7 million tons (Lebdosukoyo, 1983).

Industrial by-products such as oil palm kernel cake, rubber seed, kapok seed meal, cotton seed meal, copra meal (coconut oil cake), cassava waste have also been utilized for feeding ruminants.

Research achievements in ruminant nutrition

Research activities in ruminant nutrition were undertaken by many Indonesian research agencies and academic centers. These efforts aimed at improving the utilization of agricultural crop by-products and residues, manipulating the rumen fermentative processes and incorporating the use of foliages of legume trees and shrubs as a source of protein.

Rice straw followed by sugarcane tops and secondary crop by-products such as maize, soybean and cassava are the most abundant crop by-products in the country. Improvement of the digestibility of rice straw for feeding of cattle has been achieved by treating the straw with sodium hydroxide (NaOH) or calcium hydroxide (CaOH). Ammoniation of rice straw was another method used to improve its nutritive value (Soeyono, 1990). Utilization of *Pleurotus* sp. (fungi) was also reported to increase the straw's *in vitro* dry matter digestibility (Soeyono, 1984). Although experiments with sugarcane tops indicated promising results, the use of this feedstuff is still limited to sugarcane plantation areas where almost all the farmers feed their cattle with sugarcane tops, particularly during harvesting time.

Research directed to manipulate the rumen fermentative processes included the use of ionophores and the provision of nutrients required for the rumen microbial growth. Monensin has been included into the diets of sheep and buffaloes. In sheep, a monensin supplement (330 μg monensin/kg feed) caused a 20% increase of the growth rate, while dry matter intakes remained unchanged (Astuti *et al.*, 1989). In buffaloes, monensin did not affect daily weight gains nor feed conversion (Parakkasi, 1988).

Urea mineral molasses blocks have also been fed to goats or dairy cows to ensure a continuous supply of nutrients for rumen microbes (Hendratno *et al.*, 1989). Supplementation with molasses blocks for 8 hours per day resulted in a 2.8 fold increase in rumen microbial cell production and was reflected in a faster growth rate.

Combination of grass and legume tree foliage fed to sheep increased the protein content of the forage diet; therefore, a mixture of Napier grass and *Glyricidia* foliages as the basal forage, supplemented with energy, led to faster growth rates in sheep compared to animals fed Napier grass alone as the basal forage (Haryanto, 1990).

Sodium and copper concentrations in forages were found to be low to marginal in most of the areas (Little, 1986). There are also indications that zinc is potentially marginal, but not selenium, molybdenum nor cobalt. Calcium and magnesium concentrations appear to be adequate. Although the phosphorus concentration seems inadequate, the variability in terms of forage supply may eliminate the problem. Sulfur is generally adequate except in Timor island where it is found to be consistently low.

Three strata forage production systems have been developed to ensure all year round

Table 4 Relative response of three strata forage production system to the conventional system

Yields	Relative response
Food crops	− 43
Livestock feeds	+ 91
Firewoods	+ 46
Crude protein content	+ 13
Cattle weight gain	+ 13
Feed utilization	+ 24
Carcass fat	+ 10
Carcass rump portion	+ 9
Stocking rate, rainy season	+ 45
dry season	+ 30
Carrying capacity	+ 52
Soil erosion	− 57
Soil organic matter	+ 11
Soil moisture	+ 10
Total farm income	+ 30

Source : Nitis *et al.*, 1989.

availability of forage for cattle in Bali (Nitis *et al.*, 1989). Basically, the three strata forage production system which is a whole production system involving food crops, grasses and legumes, shrubs and trees sees to it that adequate forage supply for ruminant livestock can be maintained during the rainy and dry seasons. Results of the application of this management system are summarized in Table 4. The three strata forage production system almost doubled the availability of livestock feed compared to that of the conventional system. Other advantages of this system include: increase of the carrying capacity of the area, greater cattle weight gain, increase of firewood availability, increase of total farm income, and prevention of soil erosion.

Prospects of research in ruminant nutrition

Research activities in ruminant nutrition are limited by funding. In view of this, collaborative research work between governmental institutions and non-governmental organization has been encouraged.

The fluctuations in forage supply between dry and rainy seasons will remain the main constraint for the next decade. Crop by-products and industrial by-products may be more widely used for feeding ruminants in intensive agricultural systems and densely human populated areas. The application of biotechnology to improve the nutritive value of the feedstuffs is an open and interesting research avenue that should be explored. Manipulating the protein-energy ratio for a better rumen fermentative efficiency and the possible use of chemical compounds having β-adrenergic agonistic activity may also be emphasized in the next ten-year activities in ruminant nutrition research.

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Discussion

Sekine, J. (Japan) : Why is 60% of the ruminant population concentrated on Java island where natural grasslands account for only 2% of the total?

Answer : This is due to the fact that 50% of the Indonesian population lives on Java island where 80% of the population consists of farmers. However the transmigration schemes for human population from Java may help distribute the ruminants to other islands as well.

Argañosa, A. S. (Philippines) : What binding material are you using in preparing the urea molasses blocks? We use cement which is not appreciated by the farmers.

Answer : I assume that pollard or rice bran and the molasses serve as binding materials after being mixed, heated and pressed.

Pradhan, K. (India) : What are the potential and possibility of recycling animal wastes such as poultry litter wastes as animal feed?

Answer : There is a possibility to utilize animal wastes such as poultry litter wastes for feedstuffs in cattle ration. Some studies have been carried out in Indonesia in this field.