The Development of Integrated Forage Production System for Ruminants in Rainy Tropical Regions—the Case of Research and Extension Activity in Java, Indonesia.

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Abstract

According to the fact that 60% of inhabitants of Indonesia live in Java, the Island is the large market for animal products, and, therefore, the most of ruminants (59%), especially beef cattle, dairy cattle and sheep are kept here. The serious problem in livestock production in Java is limited land area for forage production and high number of poor farmers (ca. 82%). For this situation, the comprehensive program for the development of forage production in integrated system has been conducted to improve forage availability (production and quality) and carrying capacity of the region. The program included identification of non-pasture land contribution for providing natural forages and investigation of local grass species that is adapted to shading and improvement of local grass. Non pasture lands that were dominated by local grasses (62-87%) contributed 1.5-88.6% to forage supply, and improved carrying capacity 0.57-0.95 animal unit per ha per year. We have concluded that increase in ruminant population of Java will be possible by introducing the integrated cultivation of local and introduced grass and legume cultivars in various non-pasture lands and plantations.

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Key words : Java Island, forage, integrated system, local grasses, non pasture lands

As indicated by the huge areas used for various agricultural purposes, Indonesia is an agricultural country. By 2003, the agricultural land area was around 96.6 million ha or more than 70% of total area, which is sufficiently large to increase agricultural production further to meet the increasing demand. Large number of inhabitants (about 225 million) and growth of people's income are expected to increase in demand of agricultural products in the future, in particular livestock products. Livestock in Indonesia will play important role on national food security, social status, farmer income (in some cases in the village farmer keep animals for saving).

From the economical view point livestock contributes to national GDP by 42.4 billion US dollars in fiscal year 2003 (2.03%), or it is about 15.5% of agricultural GDP. The livestock products contribute to improvement of people's nutritional status, as well. However, protein consumption of Indonesian people is still very low (just 5.1 g/capita/day in 2004) in comparison with other South East Asian countries like Malaysia, Thailand and the Philippines. This is mainly because the capability of the people to access to animal products is very low, hence the price of animal products like red meat and milk products are relatively expensive for most Indonesian people. The main reason of high price of those livestock products is low product supply, as a consequence of low ruminant animal population. As depicted in Table 1, we have total increase of meet and milk production every year. However, the domestic meat (in particular, red meat from ruminant animals) and milk productions supply only 30.1% and 38.2% of national demand, respectively, in 2004.

The large proportion of demand for animal products is in Java, because about 60% of inhabitants of total Indonesian people live in Java and the Island is the large market for animal products. Therefore, most of ruminant animals are kept in Java, especially beef cattle (45.3%), dairy cattle (97.6%), buffalo (23.5%), goat (55.8%) and sheep (91.9%) (Direktorat Jenderal Peternakan, 2004).

With a large number of ruminant animals in Java, serious problem in forage supply arises due to limited available land areas and high number of poor farmers (ca. 82%). The average land area owned by farmers in Java is very narrow, just ca. 0.2 ha for each farmer (BPS, 2002). With this size of area, each farmer can only keep about 3-4 heads of cows because they do not have enough land for providing forages, leading to inefficient and not profitable business in any reason. The minimum number of dairy cattle that gives more profit is considered as 10 heads (PPSKI, 2005), which means that farmers have to provide three fold of forage amount. For dairy cattle, forage is important to stabilize milk fat content because the milk containing high fat is more expensive than those contain low fat. Actually, the impact of limited land for forage production led to the reduction of up to 17 dairy companies during 1994-1999, because forage supply could not meet forage demand due to high cattle population.

Approaches for Management Improvement

The ruminant animals consume 60-80% of total ration with forages, or about 30-40 kg of fresh forage/head/day, resulting in about 9 million ton of forage that must be

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Table 1. Domestic meat and milk production and consumption in Indonesia

(thousand tons)

Commodity	2001	2002	2003	2004	2005*
Cattle	336	330	370	380	417
Buffalo	44	42	41	48	49
Goat and Sheep	94	127	145	154	190
Pig	160	165	177	186	195
Poultry	923	1,104	1,137	1,164	1,349
Total Meet Production	1,559	1,708	1,871	1,932	2,200
Meet Consumption	1,601	1,808	1,911	1,970	2,113
Milk Production	480	493	553	596	667
Milk Consumption	1,262	1,266	1,517	1,560	1,679

Source : Direktorat Jenderal Peternakan (2004), * expected value

Table 2. Possible contribution of non-pasture lands to forage supply

Land Use	Dry Matter* (kg/ha/year)	Average (% ha)	Range (% ha)
Wetland	2,355	2.26	1.45-3.79
Tegalan	5,852	24.45	5.12-28.21
Oil palm (3-4 years)	13,280	80.04	82.90-88.65
Rubber (8-12 years)	11,118	72.76	68.99-77.24
Timber : Albizia (8-10 years)	10,504	68.55	65.75-73.22

*Natural herbage production of Non-pasture land area

supplied in Java throughout a year. This means the land area required to meet such amount of forage demand is about 180,000 ha, but actual available pastureland in Java is just 47,971 ha (BPS, 2002) that supplies only 26.7% of total forage demand. The fact indicates that more than 70% of forages originate from non-pasturelands. Java has about 7.65 million ha of non pasturelands, consisting of wetland area (3.39 million ha), tegalan (food crops, dry land and fallow; 2.99 million ha), estate (0.72 million ha) and wood land (0.54 million ha). These non-pasturelands are responsible to buffer larger portion of carrying capacity of ruminant animals for many years under traditional integated-management-system.

Based on the above reason, the development of forage production program in integrated system in Bogor and Sukabumi region in West Java has been conducted to improve forage availability (production and quality). The integrated forage production system can be simply defined as a 'sharing system' of resources between non-pastureland and livestock (particularly ruminant animals) in providing forages, with aiming to increase of land productivity in total including increase of the ruminant animal production. This program is expected to increase carrying capacity of the region, and, in turn, improve farmer's income. The program includes (i) identification of land areas of non-pasture lands and their contribution to providing natural forages (equivalent value) and determination of land area equivalent on forage supply, (ii) selection of local grasses and non grass species that can grow well under shading and have synergistic effect on other crops, and (iii) improvement of local grass productivity with appropriate management (defoliation and fertilization) and introduction of cultivated grasses in integrated system.

Improvement on Herbage Production and Carrying Capacity

The results of the program show that the contribution of natural vegetation to herbage supply varies among non-pasture lands (see Table 2), depending on vegetation, climate, soil condition and farmer management. Estate and wood land areas contribute higher herbage supply than wet land or tegalan. This is comparable to the data of Budiasa (2005) who found the same characteristics of forage production under coconuts and cacao plantation in Bali. However, in estate or wood land area, animals are not allowed to graze forages, so that farmers need to cut grasses in those areas and carry them to own stables. The estate company has an obligatory upon the management to stabilize the nutrient balance in their estate area. Tree canopy in rubber, oil palm and *Albizia* plantation affects diversity of forage plants grown under the trees. There is a tendency that higher covering of canopy causes less diversity and simpler botanical composition of grasses and legumes than those of low canopy covering. Low herbage production in wet land is because the land is used for rice cultivation or forages are grown by swampy vegetation. Herbage from paddy field is mostly originated from field dike, which has limited the growth of grasses or legumes for herbage.

In relation with vegetation composition, natural grasses occupied about 62-87% in average, and legume 3-32% and others 4-10% (see Table 3). From the nutritional view point,

Table 3. The composition of herbage sources under different land use (%)

Herbage sources	Wetland	Tegalan	Oil palm plantation	Rubber plantation	Albizia plantation
Natural Grasses	87.49	81.52	62.94	85.64	79.21
Legumes	3.65	9.33	32.95	4.66	10.16
Others	8.86	9.15	4.11	9.7	10.63

Table 4. Herbage production of natural grasses, *Setaria arbatum*, *Stenotaphram secundatum*, and *Brachiaria humidicola*

Land use	Natural grasses	*S. barbatum*	*S. secundatum*	*B. humidicola*
Wetland	2,355	—	—	—
Tegalan	5,852	7,223	6,077	9,287
Oilpalm	13,280	16,533	15,836	17,881
Rubber	11,118	14,624	13,074	16,618
Albizia	10,504	10,940	12,525	14,629

this composition indicates that local forages contribute to energy supply, because grasses have high percentage of digestible energy. Mineral content of natural grasses was found to be very high, being indicated by high level of ash content (12-14% of dry matter) (CCA-GKSI, 1997). The local grasses we found mostly in those areas were *Paspalum barbatum*, *Panicum reppens*, *Paspalum conjugatum*, *Stenotaphrum spp.*, *Hymenachne amplexicaulis*, and some non graminaceous species like *Commelina nudiflora*, *Borreria latifolia*, and *Gallinsonga parviflor*, the most of which are palatable, have moderate to good nutrient contents and are adaptable to environment.

Improvement of natural grasses under canopy trees were conducted by improving cultivation management which was combined with the introduction of St. Augustine grass (*Stenotaphrum secundatum*) and creeping signal grass (*Brachiaria humidicola*). Improvement of cultivation management was conducted on local grass *Setaria barbatum*. There was an increase of herbage production about 1.37 t/ha in tegalan, 3.2 t/ha in oil palm plantation, 3.5 t/ha under rubber canopy and 0.44 t/ha under *Albizia* canopy by the improvement of cutting methods and nutrient supplement (see Table 4). An increase of herbage production occurred if natural grasses were replaced with both St. Augustine grass and signal grass grown under oil palm-, rubber- and *Albizia* plantations. As shown in Table 4, the increment of fresh herbage production ranged 0.2 - 2.7 t/ha and 3.4 - 4.1 t/ha, respectively, by introducing St. Augustine and signal grass. Both of these grasses grew well under oil palm, rubber and *Albizia* plantations. However, the creeping signal grass had lower tillering rate than St. Augustine grass (Kurniawan, 2005), because the grass tended to be more sensitive to shading (Sirait, 2005).

According to the investigated record on carrying capacity in the fields, the improvement of natural grass productivity and introduction of St. Augustine grass and signal grass increased the number of animals (animal unit = au, 1 au is equal to 1 cow or 14 heads of sheep) kept by farmers, who can afford to harvest the herbages of 0.57 au/ha from tegalan, 0.82 au/ha from oil palm plantation, 0.95 au/ha from rubber plantation, and 0.71 au/ha from *Albizia* plantation, respectively.

Conclusion

According to the series of field works we have made, it can be concluded that the increase in population of animal ruminants in Java will be possible and successful if the integrated cultivation we have proposed is introduced in particular non-pasture lands for forage production and the improvement of management of natural grasses in plantations is conducted.

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