

A Study on Sustainability of Small Holder Dairy Farming on Agroforestry System

W. Alzahra¹, B.P. Purwanto², M.F.Syuaib³, M. Komatsuzaki⁴

¹Faculty of Animal Science Bogor Agriculture University, Japan; ²Vocational School, Bogor Agricultural University, Indonesia; ³Faculty of Agriculture Engineering, Bogor Agriculture University, Japan; ⁴Graduate School Faculty of Agriculture, Ibaraki University, Japan
Corresponding email: windialzahra@gmail.com

ABSTRACT

Dairy farming practice is one of the empowerment agriculture sectors in Indonesia, due to Labor and nutrition fact on milk. The fastest dairy farming development found in Java island, where is the most populated island in Indonesia. In the future, the development of dairy farming will force serious problem regarding limitation of farming area and forage scarcity. Therefore the objective of this research was to explore the potency of agroforestry system, as a potential source of forage for the sustainability of small holder dairy farm. Several plots were observed to measure fresh forage production according to the time of plant plantation in agroforestry. The data was also collected from the dairy farmers in Lembang, West Java. It was known that more than 36% of dairy farmers attempted the forage by utilizing forest area. It was calculated the highest forage yield was gained in low-density forage as 21.01 Mg/ha. Lower forage yield 7.09 Mg/ha was found in middle density plot. The evaluation of the forage supply in agroforestry system was evaluated by TDNA (Total Digestible Nutrient Available). It was gained as 15782 LSU (Livestock Unit) was required approximately 35.895,15 TDN Mg/yr. The result suggested that Agroforestry system in Lembang was supported for 19.53% of totally TDN demand of the dairy cattle.

Key Words: Sustainability, Agroforestry, Smallholder dairy farm

INTRODUCTION

Recently, the amount of dairy cattle reaches 597.000 heads and produces 925.775 tons of milk. It covers 30% of national milk production. However, the National total milk production is insufficient to fill domestic milk demand (Director General of Livestock and Animal Health 2011). As consequently, Indonesia Government supposed to do milk import from New Zealand, Australia, Netherland, France, Belgium, United Kingdom, United State, Japan and Germany, with the total values US\$1.108.519.078 (Ministry of Industry Indonesia 2011).

In decade, the development of dairy farming practices in Java Island will trap on serious problem, regarding forage scarcity. Dairy farming is different from other sectors of agriculture, as it is a combination of two types of production processes, i.e. animal production and plant production (forage). (Chapman et al. 2007, Van Calker et al. 2005). Dairy farmers were trying to fill forage demand by varied ways to solve this problem. One suggested movement was mixed farming, forage-forest based systems, agroforestry for sustainable dairy farming practices.

In many parts of the world, this system has been recommended as a technique to ensure sustainability in animal production systems (Paciullo et al. 2010). In West Java, dairy farming found closely to the forest area. Therefore, farmers are utilized forest area as a mixed farming, crop-animal system. For more than two decades agroforestry has been heralded and actively promoted as a practical and beneficial land-use system for smallholders in developing countries. Furthermore, sustainability should be assessed on the basis of three aspects: economic, social, and ecological sustainability (Shearman 1990). Agroforestry; Mixed farming, crop-animal system or Agroforestry might attain sustainability of dairy

farming. Therefore the broad objection of this research is to explore the potency of Agroforestry system, as a potential source for forage production due to sustainability of small holder dairy farming.

MATERIAL AND METHOD

The observation of Agroforestry system was conducted in Lembang (West Java 6°47'S, 107°38'E). Lembang sub-district area was part of West Bandung district area, West Java Province with the total area 9826.54 ha. It is located at >1000 meter of above sea level with the average of annual rainfall is 4.300-5.200 mm/year, temperature ranging from 22-25°C and. Agroforestry in Lembang is dominated by *Pinus merkusii*.

Several plots were designed in Agroforestry system in Lembang, West Java. The plots were divided based on the age of plantation; low-density plot (planted in year 2002) middle density plot (planted in year 1998) and high density plot (planted in year 1975). The trees height selected were varied; 6.27 ±1.25 m (low-density plot), 11.51±1.74 m and 15.21±2.88 m for middle-density and high-density plot respectively. Sampling of forage under the plantation was done by quadrats method of 1 x 1 m².

The carrying capacity in Agroforestry system was measured, which is defined as the capacity of an ecosystem that could maintain its productivity, adaptability, and capability of renewal. Carrying capacity was predicted by calculating of TDN (Total Digestive Nutrient). Conversion of all these materials into TDN is essential to determine the carrying capacity (Tahpa 1999). It was determined by using following equation:

$$C = \sum \frac{TDNA}{TDND}$$

Where C is the livestock carrying capacity of land resources; TDNA is Total digestive nutrient (TDN) available; TDND refers to TDN demand per livestock standard unit (LSU). Some information regarding socioeconomic aspect on Agroforestry system was also assessed. A deeply interview and discussion with 78 farmers involved in order to obtain further information on Agroforestry system.

RESULT AND DISCUSSION

Agroforestry system has leaded the change of socioeconomic paradigm in Lembang, West Java. As the deeply information was obtained from dairy farmers, it showed that as 36% of dairy farmers now a days considering Agroforestry system as a way in enhancing forage production.

However, some problems faced by the dairy farmers due to low production of forage grown under plantation. In general, this situation might occur as the impact of low light intensity, low nutrient, competition between the tree and forage. In older tree and higher tree height showed the higher levels of shade, consequently forage yield was dramatically decreased. This situation was found in middle and high-density plot. In these plots, forage yield was as 7.09±1.71 Mg/ha.

It was recorded that there was 1502, 78 ha forest areas in Lembang, West Java (BPN 2009). This amount was potentially significance for forage supply for of dairy cattle. In the early information, we calculated TDN potency as the TDNA (Total Digestible Nutrient Available). LSU facilitated the aggregation of livestock from various species and age as per convention, using of specific coefficients established initially on the basis of the nutritional or feed requirement of each type of animal (Table 1).

Table 1. The information of dairy cattle population and TDND based on its growing stage.

Dairy cattle	Amount (LSU)	TDN demand (kg/day)
Dairy cow	11409	10.65
Heifers	2664	4.84
Calf	1164	2.88
Bull	635	5.82
Total	15872	

The amount of TDND was pronounced seen in dairy cow. The calculation of TDN demand was calculating for a year. It was gained that as 19.53% of totally TDN demand of the dairy cattle was supported from agroforestry system in Lembang, West Java (Table 2).

Table 2. The calculation of TDND and TDND

	TDN (Mg/yr)
TDND	35,895.15
TDNA	7,012.04

CONCLUSION

Agroforestry no arguable could be attained as the way in providing forage. It takes a significance part in enhancing sustainability of dairy farming. Further it is emphasized the role of Agroforestry on supporting forage production, by carrying capacity estimation. In this study, the carrying capacity of agroforestry resources based on was analyzed by total digestive nutrient (TDN) supply and demand in Lembang, West Java. TDN was used as the best approach, in order to estimate the energy value of feedstuffs. Moreover, it used to calculate total digestible nutrient (TDN) level using summative equation based upon analyzable components of feedstuffs.

REFERENCE

- Badan Pertanahan Nasional [BPN]. 2010. Peta Dasar, Land Use Kecamatan Lembang. Badan Pertanahan Nasional Kabupaten Bandung Barat
- Director General Of Livestock And Animal Health. 2011. Livestock Statistical Book, Jakarta, Director General of Livestock and Animal Health
- Chapman D. F., S. N. Kenny, D. Beca, I.R. Johnson. 2008. Pasture and forage crop systems for non-irrigated dairy farms in southern Australia. Physical production and economic performance. *Agricultural Systems* 97: 108-125.
- Ministry of Industry Indonesia. 2011. Export-Import List. Jakarta. Department of Industry and Trade.
- Van Calker K.J., P. B. M. Berentsen, G. W. J. Giesen, R. B. M. Huirne. 2005. Identifying and ranking attributes that determine sustainability in Dutch dairy farming. *Agric. Human Values* 22:53 - 63.
- Paciullo D. S. C., C. R. T. Castro, C. A. M. Gomide, P. B. Fernandes, W. S. D. Rocha, M. D. Muller, R. O. P. Rossiello. 2010. Soil bulk density and biomass partitioning of *Brachiaria decumbens* in a silvopastoral system. *Sci. Agric.* 67:401-407.
- Shearman R. 1990. The meaning and ethics of sustainability. *Environmental Management* 14: 1-8.
- Thapa G. B., G. S. Paudel. 1999. Evaluation of the livestock carrying capacity of land resources in the Hills of Nepal based on total digestive nutrient analysis. *Agric. Ecosyst. Environ.* 78: 223-235