Production System of Peranakan Etawah Goat under Application of Feed Technology: Productivity and Economic Efficiency

(Sistim Produksi Peternakan Kambing Peranakan Etawah dengan Penerapan Teknologi Pakan: Produktivitas dan Efisiensi Ekonomi)

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Abstract. Feed resources are the major constraint in increasing goat production in the village. The main constraints to goat raising are related to feeds (i) the high cost of transport of crop residues and grass to the homesteads, (ii) the low nutritive value of feeds used, particularly in the dry period. This research was design to evaluate goat productivity and economic efficiency of goat farming under application of feed technology production system in Peranakan Etawah goat farmer group of Gumelar Banyumas Central Java. All farmers were taken as respondents using census methods. On farm research with participative *focused group discussion*, indepth interview, and farm observation. Descriptive analysis and independent t test methods were used to analyze the data. Results of this study showed that there was a significant improvement goat productivity on production system with the application of feed technology. Body weight at weaning, survival rate till weaning, and doe productivity were increased 7%, 2% and 5%, respectively. There was no evidence of significant different of farmers income and economic efficiency before and after the applied feed technology (P>0.05). The calculation was based on cash flow. Before application, farmers income per year and economic efficiency were Rp14.404.520,00 and 1.21, then insignificantly improve into Rp16.487.100,00 and 1.27, respectively.

Key Words: Livestock production system, Peranakan Etawah goat, feed technology aplication, productivity and economic efficiency.

Introduction

Small ruminants especially goats contribute to the livelihoods of millions of the tropical rural population such as in Indonesia (Sodiq and Tawfik, 2004). Goats play many roles and contribute to the diversification of the economy because they use a variety of marginal land resources that they transform to a multitude of products (meat, milk, hair, hide and dung). The majority of goats in Indonesia are concentrated in the Island of Java (DGLS, 2008) with the major breeds are the Kacang and Peranakan Etawah (PE) goats. PE goats are descended originally from crossings between the Kacang with Etawah goats. They have a larger body frame, long hanging ears, a convex face and larger horns.

In Indonesia, mostly goats are found in the hands of small holders in the village such as in Gumelar Banyumas. In small-holder farming systems, goat production is usually closely integrated into overall food production. Feed, commonly, is low in protein and high in fiber, and also the quality and quantity varies considerably throughout the year (Evans, 1986). Goats are usually part of integrated farming systems. The important contribution of integration livestock system reported by Devendra and Thomas (2002): increasing production, income generation, and the improving sustainability of agriculture systems.

Feed resources are the major constraint in increasing goat production in the village. Because feed is collected away from the farm, feed availability is determined by farm size (Sabrani *et al*., 1982). In general, the main feed is native grass as the source of roughage, but its nutritive value and composition vary. In addition to grasses, some farmers also provide tree leaves and agricultural by-products as feed supplement. The main constraints to goat raising are related to feeds (i) the high cost of transport of crop residues and grass to the homesteads, (ii) the low

nutritive value of feeds used, particularly in the dry period.

The development of feeding system which is based on the local resources is the milestone in supporting sustainable and competitive goat production systems in Indonesia. The residues, and by- products of many kinds of food crops, horticultures and plantation crops are potential sources of locally available feeds for goat production (Ginting, 2004). In Central Java area producing by agriculture product containing 34.5 million ton total digestible nutrient and 4.3 million ton crude protein (Syamsu *et al*., 2003). The applicable feed technology should be studied further as a means of improving the feed supply in time of shortage of forages. Simple processing methods of crop residues and by-products could raise their nutritive value. Therefore efforts must be made towards optimizing profit margins especially through improved feeding practices using local feed resources. This research was design to evaluate goat productivity and economic efficiency of goat farming under application of feed technology production system in PE goat farmer group of Gumelar Banyumas Central Java.

Research Methods

The study was conducted at the PE Goat Farming Group in Gumelar, Banyumas, Central Java, Indonesia. Livestock characteristic in the location reported by Sodiq and Sadewo (2008), characterized by larger body frame, long hanging ears, a convex face, larger horns, and coat colour dominated by white (88,02%), brown (6,69%), and black (5,29%). External body dimension of height at withers and ears length are 86±8.03 cm and 31.70±2.70 cm (buck), and 77±4.60 cm and 29.07±03 cm (doe), respectively.

Goat Farming Group in Gumelar, the only center of PE Goat Breeding in Banyumas Region. All farmers were taken as respondents using census methods (Black, 1999; Nurgiyantoro, 2002). Variables of the research were productivity of PE goat and economic efficiency goat farming. On farm research with participative *focused group discussion*, indepth interview, and farm observation were applied in this research. Descriptive analysis and independent t test were used to analyze the data (Zeller, 2000; Sanders and Smidt, 2000).

Results and Discussion

Production System of PE Goats

Gumelar has been stated as center for PE Goat breeding in Banyumas Regency of Centra Java, Indonesia. In whole days, PE goats are keep in stilted housing. Besides security reasons, housing is also provided for management reasons such as the control of animals to prevent damage to crops, ease of feeding and collection of excreta. The stilted housing type is more commonly used, since in the humid tropics rainfall is heavy and temperatures are high. This type of housing protects the animals from the wet and facilitates easy cleaning and collecting of the faces and urine for fertilizer. The resulting air movement in stilted houses also reduces the effects of high temperatures on goats.

The most common feeding practice which can be found in Gumelar was traditional cut and carry system. With this system, it was very unlikely to control forage composition since the forage availability was vary during season. Feed nutrition has a significant effect on goat growth. Norton and Waterfall (2000) reported that in many tropical countries, the low quality of native grasses and straws limits the productive potential of ruminant animals. Protein supplements from both plant and animal sources, and non-protein nitrogen sources, are commonly used to improve animal performance on these low-quality roughages. There is an increasing interest in the use of both local and introduced leguminous trees and shrubs as inexpensive sources of protein for livestock feeding (Gutteridge and Shelton, 1994). The foliage of leguminous trees is usually high in protein and minerals, and has been used as either a supplement of low-quality hay and straw or as a sole source of feed.

Goat farming in Gumelar was dominated with small scale farming with average of 17 heads per farmer equal to 10,92 animal unit (AU) ranged from 2,2 – 33,15 AU. 64,5% farmers have less than 11 AU, only 16,10% who have more than 20 AU. The farmers indicated that the maximum flock size of PE goats was constrained by feed availability. Without application of feed technology, farmers have difficulties to get daily forages for their goat. Sabrani *et al*. (1982) reported that feed resources are the major constraint in increasing goat production in the village. Because feed is collected away from the

farm, feed availability is determined by farm size. About 90% of feed came from off-farm sources. Sodiq and Sadewo (2008) found that management of PE goats was intensive by cut and carry feeding system. Goats are feed by leguminous such as *Gliricidia maculata*, *Calliandra callothyrsus meissn*, *Leucaena glauca*, and also some shrubs and leaves (banana, cassava, jackfruit, and other trees).

Since 2006, technology complete feed was adopted by a number of PE goat farmers in Gumelar. Application of feed technology addressed to optimizing profit margins especially through improved feeding practices using local feed resources. El Aich and Waterhouse (1999) reported that waste product need treatment and can use as a feed complete to gave highest consumption. Spearmann rank correlation showed a significant relation of farm size to adoption rate of complete feed ($P<0.01$; rs = 0,951). Farmers argued that without complete feed, they could not increase their farm scale. With average of 10 AU, farmers should prepare at least 35-40 kg of forages everyday. Farmers choose to sold the goat whenever they have more goat to feed and found a difficulties to prepare fresh forages. Therefore, their farm size was constantly small.

Two aspects of strain was investigated. They were difficulties to prepare daily fresh forages and difficulties to produce complete feed. Farmers argued that preparing daily fresh forages for their goat was rather difficult especially during dry season. Median of 4 (scale 1–7) indicated that statement. Moreover, 61.30% farmers found considerable difficulties to prepare forages during years. Spearmann rank correlation showed a significant relation between difficulties to prepare forages and adoption of complete feed ($P<0.01$; r = -714). This strengthen the previous statement that problem faced by farmers to increase their goat farming was mostly forages availability.

Farmers also mentioned that technology complete feed could be easily adopted. They gave median score of 6. Moreover, 80.70% farmers claimed that have no particular problem in adopting the innovation. Spearmann rank correlation showed that difficulties to produce complete feed has no correlation to its adoption rate ($P>0.05$). Decision to not adopted the technology was not based on its difficulties to produce, but rather to the farm scale and the absence of farmers' ability to prepare the equipment.

Goat production is an integral part of the farming system in the location of study area. Limitation of land has contributed significantly to the high degree of dependence between the crop and the livestock subsystems. Through the farmers' experience, the crop by-products are extensively utilized as PE goat feed. The manure from the goat is in turn used on the vegetable crops to maintain soil fertility. Budisatria *et al.* (2007) found that in smallholder systems livestock manure is still an important source of nutrients to fertilize the land. Tanner *et al*. (2001) demonstrates that livestock are traditionally used to produce high quality compost and provides evidence to support the hypothesis that integration of livestock into Javanese agriculture is essential to sustaining some of the world's most intensive smallholder farming systems. The important contribution of integration system, reported Devendra and Thomas (2002) increasing production, income generation, and the improving sustainability of agriculture systems. The challenges and benefits for the future include improved efficiency of natural resource management, agricultural growth, reduced poverty, improved livelihoods of the poor and environmental sustainability (Devendra, 2002 and 2007). The importance of the integrated system also reported many authors, Thorne and Tanner (2002), Thornton and Herrero (2001), and Preston and Rodríguez (2004).

Productivity of PE Goat

Overall goat productivity in Goat Farming Group of Gumelar reported by previous researcher Sodiq and Sadewo (2008) notes that the average litter size at birth, preweaning mortality, and kidding interval were 1.64±0.03 kids; 5.9%; and 285±2.59 days, respectively. Results of that study revealed there were non-genetic factors exerted significant influences on reproductive performance and preweaning mortality of PE goat. The level of reproductive performance is dependent on the interaction of genetic and environmental factors (Greyling, 2000; Barding *et al*., 2000).

Litter size is defined as the number of kids per kidding. Twin births were 56%, followed by singles

(40%) and triplets (4%). In overall litter size of 1.6 is indicative of the existence of multiple births and of the good reproductive potential of PE goats. Data on kidding interval (number of days between 2 successive kiddings) for the does in the different system are relatively same (281-281 days). Goat productivity in overall improved after implemented complete feed in their husbandry practice (Table 1). Body weight at weaning and survival rate till weaning, and doe productivity were increased 7%, 2% and 5%, respectively. Weaning weight and growth during the pre-weaning period is largely determined by maternal milk production (Steve, 2001; Urdaneta *et al*., 2000). Madibela *et al*. (2002) concluded that birth weight was positively correlated with the growth rate. Sex of kid influenced the weight at weaning and male kids tend to be heavier than female Kochapakdee *et al*. (2000), Zhou *et al.* (2003) and Lusweti (2000).

Kidding percentage under traditional village farming system can be improved through the practice of supplementation, particularly during the pre-mating period (flushing). Supplementation will also contribute to improve the body condition of the does and subsequently result in better kidding performance (Saddul *et al*., 1999). With a gestation period of 150 days and an oestrus cycle of 17 days, a minimum kidding interval of 167 days can be expected before a female becomes pregnant in the first day of the cycle. The kidding interval of 9.4 months indicates the ability of the goats to breed throughout the year. There is a need for supplementary feeding during the whole reproductive period to ensure that the does attain adequate body condition at mating and a rapid recovery of body condition post-kidding. Rae *et al*. (2001, 2002) reported the effect lifetime reproductive function of female sheep of under nutrition during late gestation and early neonatal life. The low protein diet influenced the body weight and weight gain of growing lambs (Polkowska *et al*., 2003).

El Aich and Waterhouse (1999) revealed that waste product need treatment and can use as a feed complete to gave highest consumption. Many researchers working on the improving production system related to feeding practice in order to improve productivity. Ramirez (1999) study on feed resources and feeding techniques. Moraless *et al*. (2000) study on improvement of biosustainability of a goat feeding system with key supplementation. Devendra and Thomas (2002) study on crop–animal systems in Asia. Mixed crop-livestock systems for producing food (Herrero *et al*., 2007, Liyama *et al*., 2007). Mathius *et al*. (2003) working on feeding evaluation of dairy goat. Borwick *et al*. (1997) study on the effect of under nutrition of ewes. Batubara (2004) study on utilize by products on farm and oil palm industries level as additional feed. Bhatta *et al*. (2007) revealed that the performance of animals fed on complete feed mixture. The development of feeding system which is based on the local resources is the milestone in supporting sustainable and competitive goat production systems in Indonesia (Ginting, 2004). The residues, and by-products of many kinds of food crops, horticultures and plantation crops are potential sources of locally available feeds for goat production.

Economic Efficiency of PE Goat Farming

Goats play many roles and contribute to the diversification of the economy (El Aich and Waterhouse. 1999). Small ruminant breeding, especially goats, does not require high capital and may help to upgrade to more profitable production.

Table 1. Productivity of PE goat before and after applied of feed technology

Variable	Productivity before applied of feed technology	Productivity after applied of feed technology
Weaning weight (kg)	17.71[a]	18.97[b]
Preweaning mortality (%)	11.58[a]	9.81[b]
Kidding interval (days)	281[a]	282[a]
Doe productivity (kg/doe/year)	36.66[a]	38.51[b]

Means with a different superscript in each row are significantly different (P<0.05)

Due to its prolificacy and rusticity, range goats produce very high returns which make them one of the best possible investments. The contribution of rearing goats to the total farming income is substantial, and was about 17.1, 26 and 14.8 percent for the three categories of lowland, rubber plantation and upland areas, respectively (Sabrani and Knipscheer, 1982). The important implication of these figures is that goats provide a vehicle to improve the income of poor and destitute farmers.

Economic performance of PE Goat farming in Gumelar was analyzed based on its income and R/C ratio. The different performance before and after practices the feed technology was then analyzed using student t test.

There was no evidence of significant different of farmers income before and after the applied complete feed technology (P>0.05). The calculation was based on cash flow. Before application, farmers income was Rp14.404.520,00, then insignificantly improve into Rp16.487.100,00 per year. Farmers main income was goat selling. Just a few farmers who milking their goat. Application of complete feed has not effect to improve farmers' income yet. However it also informed us that cost to prepare the equipment for complete feed application was not decrease farmers' income. In a long period, it could be assumed that in line with the improvement on weaned weight and decreasing rate of pre weaned mortality, application of complete feed will improve farmers' income. Astuti *et al*., (2000) study on dairy goat in Purworejo demonstrated that goat's feed cost really affected income of the farmer. Increasing production cost including cost of the feeding, farmer's income will be decrease. The major income from dairy goats is derived from their milk; therefore, factors that reduce milk quantity and quality can cause high economic losses to the farmers (Leitner *et al*., 2008)

Based on R/C ratio, there was no significant difference on economic efficiency for both before and after the adoption of complete feed, i.e. 1,21 and 1,27 respectively. However, both indicator showed that R/C ratio was more than 1, it means that the PE Goat Farming in Gumelar still feasible to manage. Additional investment to apply complete feed was still economically rational as compare to its capability to decrease cost for preparing daily fresh forages. This research finding lower than reported by Chamdi (2004). The R/C value of small holder goat farming in Gumelar Sub-district Banyumas Regency is 2.21. It means that in every one unit of cost spent in goat farming in a year will produce revenue of Rp.2.21. The higher value of revenue per cost ratio is the more efficient farming.

The results from this study are in accordance with the results of Sianipar *et al*. (2004). Utilization of the waste products and leaf as a feed in economic analyses is not efficient because the processing cost (are employment, grinding or fermentation cost) to make price ration is higher. Another researcher, Connell *et al.* (2004) revealed that low-input livestock systems result in low outputs for livestock production and limited income generation potential. In addition to slow growth from inadequate feed, free-ranging livestock are more susceptible to loss and disease. In relation to economic efficiency of goat farming, Morales *et al*. (2000) demonstrated that use of local resources allowed the economical feasibility of the diet and consistent production levels. Utilization of fibrous diets by ruminants can be manipulated in various ways. Digestibility and intake was improved, apparently due to elevation of rumen pH and augmentation of degradable bacterial synthesis from supplementation with essential amino acids, non-protein nitrogen, sulfur and phosphorus, which improves cellulose utilization. Sormunen and Eki (2000) study on Finnish Landrace goat kids revealed that to avoid health problems in growing kids, intensive feeding is not recommended.

Conclusions

Improving production system with the application of feed technology can significantly improve productivity of PE goat. Body weight at weaning, survival rate till weaning, and doe productivity were increased 7%, 2% and 5%, respectively. There was no evidence of significant different of farmers income and economic efficiency before and after the applied feed technology. The calculation was based on cash flow. Before application, farmers income per year and economic efficiency were Rp14.404.520,00 and 1.21, then insignificantly improve into Rp16.487.100,00 and 1.27, respectively.

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