Production Systems and Income Generation from the Smallholder Beef Cattle Farming In Yogyakarta Province, Indonesia

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Abstract. This study was aimed to determine the production systems of beef cattle which can generate the income of smallholder farmers. The study was conducted in Bantul and Sleman Regencies, Yogyakarta Province, Indonesia. In total of 210 beef cattle farmers were involved in semi structural interview. Data was collected in the dry season (July to September) of 2015. Descriptive analysis was carried out for the demographic, social, economic characteristic of respondents and beef cattle farm practices. Enterprise budgeting of beef cattle farms was made to analyze farm profit, return to management and family labour that could be used in further planning for better business management. Beef cattle farming founded as an alternative that can be developed in rural communities. In order to generate the incomes in both systems, breeding and fattening, production system in term of feeding practices has to be improved so that the cost can be reduced. Scientific processing of manure has to be done for value addition in the farming system. Calving interval has to be improved in breeding system, that the best condition is 12 months and the existing condition on the respondents was 16 months. For fattening, optimizing the duration for fattening period less than 3.6 months is the best improvement. Government policy is needed to improve beef farm economic condition especially in breeding farm.

Key words: Beef cattle farming, enterprise budgeting, farm profit, family labour, production system and return to management.

Abstrak. Penelitian ini bertujuan untuk menentukan sistem produksi sapi potong yang dapat menghasilkan pendapatan petani kecil. Penelitian dilakukan di Bantul dan Kabupaten Sleman, Provinsi Yogyakarta, Indonesia. Total 210 responden sapi potong terlibat dalam wawancara dengan metode *semi structural*. Data dikumpulkan pada musim kemarau (Juli-September) 2015. Analisis deskriptif dilakukan untuk mengetahui kondisi demografi, karakteristik sosial ekonomi responden dan pengelolaan peternakan sapi. *Enterprise budgeting* digunakan untuk menganalisis keuntungan, penerimaan dari manajemen dan penggunaan tenaga kerja keluarga pada usaha sapi potong, yang dapat digunakan untuk perencanaan usaha dalam manajemen bisnis yang lebih baik. Hasil penelitian menunjukkan usahatani sapi potong merupakan alternatif yang dapat dikembangkan untuk masyarakat pedesaan. Dalam rangka untuk menghasilkan pendapatan yang lebih baik pada usaha pembibitan dan penggemukan, sistem pemberian pakan harus diperbaiki sehingga biaya bisa ditekan namun memenuhi syarat kebutuhan, teknologi pengolahan pupuk perlu dilakukan untuk dapat memberikan nilai tambah. Calving interval dalam sistem usaha pembibitan harus diperbaiki, dimana kondisi terbaik adalah 12 bulan dan kondisi yang ada pada responden adalah 16 bulan. Pada usaha penggemukan, perlu mengoptimalkan lamanya periode penggemukan lebih cepat dari kondisi saat ini 3,6 bulan. Kebijakan pemerintah diperlukan untuk memperbaiki kondisi ekonomi peternakan sapi terutama pada usaha pembibitan.

Kata kunci:, peternakan sapi potong, *enterprise budgeting,* tenaga kerja keluarga, sistem produksi dan keuntungan manajemen

Introduction

Since 2005, Indonesian government has been launching a beef meat self-sufficiency program, with one of its criteria was that the maximum import of beef meat must be less than 10%. However, this program seems to be unsuccessful, since the importation of beef meat has reached to 33.2 % of the total national beef consumption (CBS, 2013; Widiati, 2014). About 95% of beef cattle production is in

smallholder farming systems which characterized by less than 5 heads of cattle per household (Widi, 2015) because of lack of capital. In rural areas, farmers keep livestock as a living bank which can be sold by farm families at any time to meet the family needs in the time of financial constraints (Widiati, 2012; Verschelde et al., 2013; Huyen et al., 2012) also reported that, resources of smallholder farmers in developing countries are limited to meet as per varied agricultural conditions, such as land and soil fertility, types of crops and livestock farming. Ndoro (2014) has also pointed out that in rural South Africa, the sustainability of cattle-based livelihoods is threatened by competition for natural resources such as land and water. However, it is believed that animals are kept by smallholder farmers to eliminate poverty, especially in the poor and developing countries (Lloyd et al., 2014). Maart-Noelck and Musshoff (2013) stated that the behaviour of farmers in decision making to invest in order to expand its business was to learn from previous investments and judgement of the value obtained from the enterprise time to time. If the investment is supposed to provide added value or benefit, only then the farmers will decide to invest. Therefore, the smallholder livestock farmers need to understand their production systems to plan and decide for profitable business activity. Enterprise budgeting is a tool that can be used for decision making of the farmers in order to increase profits. Only a proper and correct analysis will lead to making the right decision (Kay et al., 2008). Paudel et al. (2013) used enterprise budgeting as a tool to determine a decision of input strategy on peanut crop based on its economic criteria. Enterprise budgeting is an accounting technique which can be used to handle problems related to scale of economies, replacement of durable inputs, inflation and technological change. It can help farmers to plan for profits from the enterprise (Bradford and Debertin, 1985).

The combination of budgeting and economic principles provides some powerful, practical, and useful techniques for the manager/farmer to use when analyzing alternatives that are suitable for the farmer. In these perspectives, present study was carried out with the objective to determine the production systems of beef cattle which can generate the income of smallholder farmers in Yogyakarta Province, Indonesia.

Materials and Methods

Study areas

Yogyakarta Province is considered as a densely populated area and one of beef cattle sources in Java. In 2012, the human population was 3.71 million, beef cattle population was about 414,381 heads, and agricultural land was about 132,987 ha. In 2007-2012 beef cattle population increased by 8.81% exceeding the national increase which was only 6.78% (CBS, 2013).Two districts, Sleman and Bantul were used as study areas. Both areas are both lowland and fertile, consequently these areas had abundance of feed resources for cattle. Quantitative and qualitative data were descriptively analysed.

Data collection

A total 210 smallholder farmers in the 2 districts (90 farmers in Sleman and 120 farmers in Bantul) were selected as respondents in this study, which was proportionally determined based on population density of these areas. The samples of the farmers were identified through administrative services using snowball sampling method to make accurate estimates about characteristics of hidden populations such as smallholder's activities (Salganik and Heckathorn, 2004; Heckarthorn, 2011). Data collection was done during the dry season, (July to September 2015). The farmers were individually interviewed using semi structured questionnaire. The questionnaire contained the following topics: identity of the respondent,

production systems of beef cattle farming and performance of the cattle. The administrative services in the study areas accompanied and facilitated us during data collection. The amounts of feeds were estimated on the basis of farmers' estimates and direct observation on kinds and amounts of feeds offered to each animal. Average of body weights (BW, in kg) of the cattle were estimated by measuring girth of chest (GC, in cm) and transformed the average of GC using measurement tape (developed by FHK Ogawa Seki Co. Ltd, Tokyo, Japan).

Data analysis

Both quantitative and qualitative variables were derived from questionnaires by tabulating and editing the data that was used as a basis for further analysis. The data can be grouped as follows; (1) Identification of beef cattle production systems: location, environment, and information of techniques that were done and affected the inputs used and outputs produced; (2) Farm structures: availability of family labour, education and experience of the farmers, available cropland and the livelihoods of family farmers; (3) Livestock performances: feeding, housing, breeding system, service per conception (S/C), calving interval, and fattening system; and (4) Economics variables : price of inputs and outputs

Quantitative and qualitative data were descriptively analysed. The enterprise budgeting for beef cattle farm was made to analyse profitability, return to management and family labour that could be used for further planning for farmers to better business conditions (Paudel et al., 2013; Kay et al., 2008; Bradford & Debertin, 1985).

Results and Discussion

Characteristics of the farmers

Most of the farmers had formal education. The average of respondents went to junior high school (9 years of formal education) and continued to senior high school. High level of education makes them easier to adopt the technology than lower level of education, such as primary school (Gowda and Dixit, 2015). The average of experience of cattle keeping was more than 14 years (Table 1). The ownership of cattle was about 3 heads consisting of a cow, steer, heifer and calf. The average cropping land was about 1,000 m2. The condition indicated that farmers are categorized as small businesses operation with limited supporting resources. However, farmers were always looking for opportunities to increase income, such as raising beef cattle. They have implemented forage fermentation technology, cultivated grasses, feed concentrates with existing local raw materials and may be purchased from feed factory in accordance with existing capital, as well as the artificial insemination for cattle with special breeds. Instead of buying forages, farmers utilizing crops by-products, cultivating grasses in the edge of the rice field and browsing crop by-products. In this study, the cost of procurement of forage was converted as the opportunity cost of family labour. Table 1 shows the characteristics of the farmers.

Production systems of beef cattle farming

As in other areas in Indonesia, in these study areas, cattle are kept in mixed farming systems and serve many objectives such as saving, producing manure, draught power and social and status (Widiati, 2006; Widiati, 2014). Livestock as a living bank, be indicated that farmers would sell their animals at any time to meet their special needs such as school fees, repair homes, and social needs of the community, so the livestock sold has not yet reached the maximum age for profit (Widiati, 2014). Breeders have a narrow agricultural land was about 1000 m^2 of flat land so that on the season of tilling, then the cattle used to pull plows. Using of tractors on small land will not be efficient or high cost. Beef cattle produce faeces as fertilizer for organic crops was much needed by Indonesian farmers.

Table 1. Characteristics of the farmers in the two study areas (n=210)

No.	Characteristics	Average	Deviation standard
1	Number of family members based on age	3.84	1.79
	• > 50 years (%)	33	
	• 15-49 years (%)	51	
	• 5-14 years (%)	12	
	• 1-5 years (%)	4	
2	Formal education household head (years)	10.01	3.02
3	Experience on keeping cattle (years)	14.2	9.4
4	Agricultural land size (m^2)	1,022.5	1,813.0
5	Beef cattle ownership (head)	2.6	1.6
6	Off farm income (IDR/year)	1,952,000	2,072,000
7	Main occupation (%)		
	• Crop farming (%)	80.5	
	• Farm worker (%)	32.9	
	• Off farm worker (%)	22.4	
	• Trader (%)	10.0	
	• Private business (%)	9.1	
	• Civil servant (%)	12.4	

The production systems were highly depend on the availability of resources, capital and farmers' family labours. They utilised crop by product, due to limitation of land ownership. Despite their capability as a smallholder in a farm scale, farmers adopted technology such as reproduction, good breeding and feeding practices, they tend to concern to particular system, such as breeding and fattening. This is according to research from Huyen et al. (2011). The production systems and the availability of supporting resources will produce technical and economic parameters, as presented in Table 2 and Table 3.

Feeding Practices

All farms, both breeding and fattening systems, used stall-feeding. Table 2 and 3 provide information regarding the forages and concentrates which were offered to the cattle. The average of body weight estimation of the cows and cattle in breeding and fattening system were 349 and 419 kg, respectively. The amount of forages and concentrates which were offered to cattle in breeding and fattening systems seems to be less (8.8% and 8.5 % of body weight, respectively). It is in accordance with a research result in Vietnam that performance of fattening cattle was poor which is due to low supply of concentrate and crude protein supplement in the diet. Furthermore, Syamsu et al. (2014) explained that smallholder farmers have major constraint to provide balanced nutrients in the basal diet.

Management of Reproduction

Farmers in the study areas were familiar with applied artificial insemination, immediately after oestrus was expressed. No natural mating was used. The farmers usually called the inseminators in their areas. However, the number of inseminators was limited (one person / sub-district with 200-500 heads of cow). The service per conception (S/C) was ranging between 1-2 times and calving interval reached 16 months. The farmers reported that they usually wean their calves in the 3rd – 4th of month and sell the calves to get cash money immediately, as cattle serve as saving for them.

Table 2.Technical and economic parameters of the beef cattle breeding

Description	Averages	Deviation Standard
Beef cattle breeding (n=126: Sleman (n= 66) and Bantul (n=60))		
Technical Parameters		
Forage (kg/head/day)	28.7	8.4
Concentrate (kg/head/day)	2.1	2.4
Service per Conception, S/C (time)	1.9	1.4
Calving interval, CI (month)	16.0	1.9
Age of calf weaning (month)	3.5	1.4
Girth of chest (cm)	165.52	14.83
Body weight estimation (kg)	349	
Economic Parameters		
Price of concentrate (IDR/kg)	2,298	265
Price of forages (IDR/kg)	304	91
Price of cow (million IDR)	1.,94	1.01
Price of calf (million IDR)	7.35	1.20

Table 3.Technical and economic parameters of the beef cattle fattening

Description	Averages	Deviation Standard
Beef cattle fattening (n=84: (Sleman (n=54) and Bantul (n=30))		
Technical Parameters		
Forage (kg/head/day)	30.6	6.7
Concentrate (kg/head/day)	5.2	1.7
Fattening period (month)	3.6	1.5
Girth of chest (cm)	176.25	20.19
Body weight estimation (kg)	419	
Economic Parameters		
Price of concentrate (IDR/kg)	2,780	214.16
Price of forage (IDR/kg)	319,5	59.9
Price of feeder cattle (million IDR/head)	11.95	3.56
Price of fattened cattle (million IDR/head)	17.62	3.38
Increase of selling price (million IDR/head)	5.67	2.68
Price of beef (IDR/kg live weight)	40,000	
Price of faeces (IDR/kg)	125	

It is in accordance with Widi et al. (2015) stated that most of farmers selling the progenies immediately after weaning to obtain immediate profit and to avoid further risk. The farmers usually do not retain 'good calves' in their farm, to obtain higher prices with very few inputs and avoiding risks of low growth rates. The weaned calves were usually kept by more commercially oriented farmers who had better access to feed resources. To shorten the calving interval, good cattle keeping management, especially reproduction and breeding must be done. However, external supports such as capable inseminators and good infrastructure from government have to be available.

Enterprise Budget for Beef Cattle Farming

Technical and economic parameters were used as the basis for building the enterprise budgeting. Generally, beef cattle farmer were not specifically commercial business orientation

in a particular purpose. However the output of livestock farming can be divided into breeding that produce calves or growing cattle and feeder cattle for fattening. Furthermore, enterprise budgeting for breeding and fattening cattle is presented in Table 4 and 5. There were 3 types of breeds either for breeding or fattening, namely Ongole, Simmental and Limousine crosses. In this study we took an average of the three breeds, since the breeds have not been identified individually.

Table 4 showed that the costs of health care was allocated very small in value because government provided it in the form of subsidies for all farmers, especially worm medicine. Table 4shows the beef cattle breeding farming generates negative profit, this is in line with previous studies in other locations (Widiati, 2012). Nevertheless, farmers did not realize it because they only consider the return of income derived from management and labour which are positive. Based on enterprise budgeting for breeding, some aspects that can be improved to increase profits are: shortening the calving interval and processing solid and liquid fertilizers in order to obtain value added.

It should be supported by government regulation, such as increasing calf selling price and low interest rate of credit (< 6%), while for fattening the break-even point (BEP) price was Rp 2,282,000 /period. It was resulted from beef cattle fattening in the period of 3.6 months. It must produce cattle with the selling price above Rp 2,282,000.

Table 4. Enterprise budget for beef cattle breeding (per cow/year)

Item	(IDR/th)
Revenue	
Increase of selling price *)	5,690,000
Fertilized since 110 days (3.6 months) : 10 kg/day @ IDR 125,-/kg	137,950
Total revenue (IDR/steer/3.56 months (A)	5,827,950
Cost	
Fixed cost	
Interest rate of capital (2 %/4 months from price of feeder cattle IDR 12,000,000)	240,000
Depreciation of housing/4months	334,000
Variable cost	
Forage feed (30,56 Kg @ IDR 320/kg) (D)	1,075,712
Concentrate (5.24 kg/day @ IDR 2,780)	1,602,392
Equipment (brooms, buckets, shovels)	44,249
Medical	12,000
Labour of keeping outside of grassing (E) (0.5 hour/day/head)	475672
Land charge (IDR/4 month)	50,000
Total cost/feeder/3.6 months (B)	2,282,641
Estimated profit (C) = A-B	3,545,309
Estimated return to management and family labour = D +E +C (IDR/cattle/4 months)	5,096,695

*) Price of feeder cattle IDR 11,910,000, maintained for 3.56 month , selling price of fattening IDR 17,600,000, and 2% mortality.

In the rural areas where job opportunities are limited, therefore, even though the marginal value of labour was low but positive, so that farming activities were remain as a choice (Widiati, 2012). Despite of lack of government policy, resulting on farmers' value exchange was lower than input costs (Stur et al., 2013). Therefore, to increase farmers' wealth and stimulate the production of beef cattle in order to meet self-sufficiency of beef, the Indonesian government should provide support for beef product especially in breeding farm. Penson et al. (2002), states that the government intervention was needed in the agriculture to improve farm economic condition among other things was price and income support payments. In this case needed intervention in the form policy of input price subsidized or determination of the beef floor prices so that their farm activity is profitable. In addition, it also gives loans with subsidized interest rates (<6%/year) so that farmers can pay input of technology to increase farm productivity.

Conclusions

The beef cattle farming was an alternative source of income for the rural communities. In order to generate income in both systems, breeding and fattening, production system in term of feeding practices should be improved and processing of manure has to be done to add value. Calving interval in breeding system has to be improved. For fattening, optimizing the duration of fattening period less than 3.6 months and increase in selling value that was greater than the price of the BEP are the best improvement. It requires government policies, such as determination of beef floor price, input price subsidized and low interest rate of credit especially in breeding farm.

Acknowledgement

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