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Improving Beef Cattle Production System for Sustainable Rural Development in Central Java

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Abstract. This study was designed to identify beef cattle production system, feeding system and also discuss the possibility for improving their system. Data on livestock production and feeding system under 48 farmer group of beef cattle in rural areas of Central Java was recorded. Beef cattle production in rural areas area is mainly conducted in a traditional system with small numbers of animals (ranged 2-8 head) with low in productivity (daily gain 0.6 kg/day, calving interval 20.6 months). Types of feeds offered to beef cattle could be classified into four major groups: legume, grasses other shrubs trees, concentrate, an agricultural by-product. In middle and upland areas, grass and rice straw in fresh is still considered the best feed for cattle. In low-land, farmer provides rice straw in fresh and also practice ammoniation. Low performances for Ongole Cross, Sumba Ongole Cross, Simmental Cross, and Brahman Crosses were found. Findings of this study should be accounted for in strengthening feeding and management, especially in maintaining body weight during mating and pregnancy periods in order to improve their productivity. Proven applied technology in term of breeding, feeding, housing, health and daily practice management aspects as well as empowering farmer and group dynamics is needed for increasing the sustainability of beef cattle production in rural areas.

INTRODUCTION

In Indonesia, the last ten years period, demand for beef consumption keep increasing and exceeding the domestic production [1], and it expected to increase by 2.7% during 2010-2014 [2]. Therefore, the government in 2000 started a program to attain beef self-sufficiency by the year 2005 and moving around 2010 and 2014. This policy is based on the consideration that Indonesia has natural resources and cattle population that relatively can be expanded to produce adequate beef for domestic consumption or even for export. To achieve that objective the government has launched a thrust policy program stipulated in animal husbandry development policy [3]. Development of beef cattle in the future should be carried out through sustainable agribusiness approach. Beef cattle farming system should be more

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professionally managed through the application of technology innovation focusing on the aspect of business efficiency [4]. One of the visions in achieving the self-sufficiency is based on local resources. The development of a feeding system which is based on the local resources is the milestone in supporting sustainable and competitive beef cattle production systems in rural areas. The purpose of this paper is to identify beef cattle production system, feeding system and also discuss the possibility for improving their system in rural areas of Central Java.

MATERIALS AND METHODS

The current study was conducted by Livestock On-Farm Trials located at 12 regencies of Central Java province. Data on livestock production and feeding system involved 48 farmer group of beef cattle was recorded. The productivity of fattening (Ongole Cross, Sumba Ongole Cross, Simental Cross) and breeding (Local and Brahman Cross) were evaluated. Quantitative and qualitative descriptive analysis was applied in this study.

RESULTS AND DISCUSSION

Livestock Production Systems

Animal production involves both large and small ruminants and a variety of systems integrated with crops. The systems vary as a function of the agro-ecological zone and intensity of farming operations. The development of these systems has considerable potential, the benefits being associated with the complementary interactions of the subsystems in which the products are additive [5]. The prevailing animal production systems in Indonesia could be classified fall into one of three categories (i). landless, (ii). crop-based; and (iii). rangeland-based. The characteristic of system and subsystem animal production in term of beef cattle production under farmer group of beef cattle development program are summarized in Table 1.

In animal production systems, the value of species increases in relation to its adaptation, capacity to make socioeconomic contributions, capacity to fill market opportunities and potential for increasing productivity. Present on-farm research has shown that small scale farmers in the location of study and in many parts of Central Java continue to work with local breeds because of their good adaptation to the prevailing conditions. Ongole Crosses (Peranakan Ongole) are the predominant of the native cattle and are widely distributed over the Central Java regions. Especially in Kebumen regency found that most of the farmer raising Sumba Ongole cattle. Beef cattle are raised within the traditional system, characterized by small-scale production (mostly 2-3 animals per flock in various physiological age). They use of animal as a function including subsistence, cash-income, security, and investment. The beef cattle houses were built with available materials and generally permanent form. Communal housing located mostly located out of the farm family house but it near the village. Cattle for fattening and breeding purposes were raised at separated flocks. This study demonstrates that the appropriate use of local feed resources and local livestock breeds requires close integration between crops and livestock within the system. The excreta (dung) was used on the farm to produce fertilizer. Ruminants will continue to serve a valuable role in sustainable agricultural systems [6]. They are particularly useful in converting vast renewable resources from rangeland, pasture, and crop residues or other by-products into humanly edible food. With ruminants, land that is too poor or too erodable to cultivate becomes productive. Also, nutrients in byproducts are utilized and do not become a waste disposal problem.

Beef cattle prices vary and depend on a number of factors like season of festival days, age, sex and size of the beef cattle, whether the buyer. Management of the beef cattle was based on primary experiences, and transfer technology was not fully applied resulting in low productivity especially in breeding purposes. In order to increase cattle population based on liable production cost, an approach of animal integrated system with food crops, estate crops, forestry and others has feasible to develop [7]. Introducing appropriate feed technologies have changed agricultural byproducts to be a valuable feed for cattle. Through an approach of LEISA (low external input sustainable agriculture), for every hectare of paddy or corn field has yield feed for 2-3 adult cattle. The role of the cattle in the systems to be a compost machine with agricultural by-products as feed resources and its use for organic fertilizer.

TABLE 1. Characteristics of system and subsystem animal production under farmer group of beef cattle in rural areas

a. Characteristics of system	
Type (classification)	Mixed farming, minimum land
Sub-type	Traditional, landless, smallholders,
Availability of factors land, labor, capital	Land (integrated), tenant (household), capital (low-input, LEISA).
Orientation of production	Business, subsistence, Calf-crop, dung
Crop production, fertilizer	Rice, Maize, Compost (dung).
b. Subsystem animal production	
Animal species/Breeds	Ongole Cross, Sumba Ongole Cross, Simental Cross, Brahman Cross
Adaptation	Local and imported breeds
Productivity	Low productivity in 2nd partus for imported breed
Function in system	Subsistence, cash-income, security, investment
Management	Feeding (cut-and-carry, integration into crop). Communal, integrated with forage
Housing	
Interaction with crop	Complementary (dung field)
Constraints nutrition, disease	Nutrition quality and sustainability, Prolapsus uteri, bloat and parasite.

Feeding System and Improvement

Currently, the serious problem in livestock production in Java is limited land areas for forage production. Increasing ruminant population in Java will be possible by introducing the integrated cultivation of local and introduced grass and legume cultivars in various non-pasture lands and plantations [8]. Ruminants livestock production in the study area is mainly conducted in the traditional system with small numbers of animals (ranged 2-8 head). In these systems, farmers generally feed livestock with fresh forage. Under lowland with the rice base, farmer provides rice straw in fresh and also practice ammoniation technology. Native grasses and leguminous tree leaves mostly found in the upland are especially at forest margin. The animals are also fed a small amount of locally available supplements, such as rice barn, tofu ware, and cassava waste. The preference of many farmers for native grass as ruminants feeds can be justified by the generally high nutritive value of these grasses [9]. During the dry season, when fresh forage is scarce, farmers utilize peanut straw, banana leaves and trunk or coconut leaves as alternative feeds. Leguminous tree leaves, rice barn and palm pith are the most common fed supplements for ruminants in the traditional system.

The present study revealed that types of feeds offered to beef cattle could be classified into four major groups: legume, grasses other shrubs trees, concentrate, agricultural by-product (Tabel 2). A number of local resources and by-products of agriculture and agro-industry were make the most of feeding practice [10] and found the estimated proportion of grasses in diets ranged from 42% to 93% while crop residues and three legumes were 2% to 30% and 1% to 14% respectively [9].

TABLE 2. Some common fodder species fed to beef cattle

Legumes	Gliricidia, Calliandra, Leucaena, Sesbania, Acacia, Albizia
Grasses other shrubs trees	Elephant grass, Guinea grass, King grass, Mixed grass, Sugar cane, Setaria, Cassava, Sweet potato, Blandy grass, Jackfruit
Concentrates	Kapok, Coconut meal, Soybean, Cassava rubber, Rice bran, Cor meal, Maize bran
Agricultural by-products	Soybean leaf, Sweet potato leaf, Cassava leaf, Cassava peelings, Banana leaves, Rice straw, Sugar cane top, Maize stover

Most of the farmer in middle and upland areas, the grass is still considered the best feed for cattle. In the low land with rice base, rice straw in fresh considered the best feed for cattle. At the dry season, when native grasses are scarce, some group of a farmer from dry areas prefers to collectively hire a truck and travel long distance to obtain native grasses and rice straw from wet or irrigated areas. A native grass has high nutritive values and that native grass-fed village cattle are generally in very good condition justifies farmers preferring native grass to other feeds [9]. For grazing livestock, however, caution must be exercised during the dry season because the contents of crude protein and some essential minerals decline to bellow maintenance requirement [11]. As a result, cattle lose up to 25% of body weight during dry season. Strategic supplementation must be undertaken to improve cattle productivity. Due to most crop residues condition in poor nutritive values and digestibility, feed technology such as ammoniation and the use of feed supplements have been practiced by all of the group farmers of beef cattle development program.

Result of this study shows that rice bran was practiced as a supplement fed to cattle by all of the group farmers of beef cattle development program. In the area of the tofu industry, farmer used tofu waste as a supplement feed. Especially in fattening program, farmers use some proprietary concentrate supplements because they realize the advantage of these to improve live weight gain. However, these supplements are considered very expensive and farmers prefer to make their own from a mixture of rice bran, maize bra, tofu waste, cassava waste, and molasses. Few farmers used urea molasses multi-nutrient block and vitamin supplements.

Beef Cattle Productivity

It was difficult to quantify growth rate of the calves and fattening cattle in the villages because of a general lack of records and limited infrastructure (such as balance for measuring animal weight) kept by the farmers. However, most of the farmers interviewed, and discussions with the key persons, indicated that growth rates of Peranakan Ongole, Sumba Ongole, and Simental Cross for fattening purposes were moderate till high, and low reproductive for Brahman Cross.

BCS is an important management practice used by producers as a tool to help optimize production, evaluate health, and assess nutritional status. This practice helps evaluate their herd or flock as to the amount of body reserves, particularly fat and muscle, an animal possesses [12]. BCS is a subjective measurement used to classify animals by the amount of muscle and fat in their bodies. BCS of beef cattle can be an effective management tool for evaluating the energy reserves of cows and the whole nutritional program throughout the year. Adjusting the nutritional program to obtain desired body condition at different stages of production is necessary to enhance production efficiency. Females that are too thin or too fat can be an expensive investment. Thin cows can have difficulty rebreeding, while fat cows are prone to calving problems and excessive feed costs. BCS allows producers, extension personnel, and researchers to communicate more effectively regarding the herd's nutritional status [13].

In overall, low productivity of daily gain of beef cattle in this study (0,63 kg/day, and calving interval 20.6 months). Body Condition Score from the farm visit evaluation was 3-8 at the Ongole Cross, Sumba Ongole Cross, Simental Cross (Table 3) for fattening purposes. BCS for breeding of Local breed ranged 3-7 (Table 4) better than Brahman Cross ranged 3-5 (Table 5). BCS 4 is a borderline condition, and the optimum BCS ranged from 5-7 [14]. These findings on Brahman Cross tend to low in BSC. This low performance could be attributed to poor nutrition and the suboptimal management practices observed in most visits. If this situation is improved, productivity could also be improved. It was observed that small amounts of concentrate and rice straw fermentation were introduced and accepted by the beef cattle.

Beef cattle farmers were aware of the importance of feeding concentrate and they were mixing local resources (crop and agro-industry waste) such as rice bran, tofu waste and common salt in various proportions. In some location, rice bran and tofu waste were fed alone as the concentrate. The proportions of the ingredients and the quantities offered seemed to be a matter of availability and resource allocation rather than a need to supply quality feed to the animal.

TABLE 3. BCS of beef cattle for fattening purposes

BCS	Number of respondents	Percentage (%)
1-2	0	0
3-4	5	10.4
5	16	33.3
6-7	24	50
8-9	3	6.3

TABLE 4. BCS of local beef cattle for breeding purposes

BCS	Number of respondents	Percentage (%)
1-2	0	0
3-4	11	22.9
5	24	50
6-7	13	27.08
8-9	0	0

TABLE 5. BCS of Brahman cross for breeding purposes

BCS	Number of respondents	Percentage (%)
1-2	0	0
3-4	34	75.56
5	11	24.45
6-7	0	0
8-9	0	0

TABLE 6. Calving interval for breeding purposes

Calving Interval (months)	Number of respondents	Percentage (%)
< 13	2	4.2
13 – 18	36	75
18.1 – 24	10	20.8
24.1 – 30	0	0
> 30	0	0

This research is finding that mostly calving interval ranged 13-24 months (Table 6). One of the main goals of beef cattle production system is to optimize the annual fertility rate. To achieve this, the majority of the cows suckling calves should conceive before 90 days postpartum [15]. The results of a previous study [16] revealed that breeding program of Brahman Cross under village production system was unsuccessful in terms of low reproductive rate for the second pregnancy and calving as well as a high rate of calf and dam mortality. The rate of the second calving was 2.89%.

Numerous research studies have indicated that under-nutrition due to limited feed availability or poor-quality feed sources during late gestation (prepartum) and/or early lactation (postpartum) has detrimental effects on subsequent reproductive efficiency [17]. Reproductive performance is closely linked to the amount of available energy reserves a cow has which is reflected by her amount of body fat. Body condition score at calving for a two-year-old, first-calf heifer is BCS 6 (scale 1-9) was recommended [13]. First-calf heifers are more likely than mature cows to fail to rebreed. Additional body condition provides some insurance against reproductive failure. However, excessive fleshing beyond BCS 6 prior to calving in first-calf heifers may result in an increased incidence of dystocia (calving difficulty). For optimal reproductive performance, mature cows should be a BCS of 5 to 5.5 and first-calf heifers should have a BCS of 5.5 to 6 at calving and through the breeding season. Thin cows (BCS 3 and 4) have reduced pregnancy rates, increased calving intervals, wean a younger/lighter calf, and provide considerably less yearly income compared to cows that are in good condition (BCS 5 and 6) at calving [17]. Ovarian activity during the early postpartum period showed that the reestablishment of reproductive activity coincides with the recovery of body condition of cows. Results indicated that only cows comprising a BCS 3 (1 to 5 scale) around the first month postpartum could be used in an artificial insemination program with possibilities of becoming pregnant [15].

Feeding strategy to improve reproductive efficiency in cows have been studied [18]. Long calving interval is one of the major factors in reproductive wastage in Indonesia. This is mainly due to a delay in the first post-partum estrous (PPE). Low energy body reserved reduces both milk production and delays first estrous after parturition. Body condition score (BCS) is closed related to the status of the energy body reserves that are affected by feeds consumed prior to both pregnancy period and parturition. The interaction between dietary nutrients and body energy reserves which is reflected in body weight (BW) and BCS, affects the first PPE. Feed supplementation at pre and post-partum is necessary to meet the minimal requirement for particular live body weight with appropriate BCS. It is expected that there should be a conception within a maximum 90 days after parturition. It means one cow will produce one calf annually. Currently, national calving rate is reported around 22% only. It is concluded that post-partum estrous is influenced by the correct strategy of feeding supplementation.

Livestock Production System Improvement Program

Livestock Production System could be distinguished two main groups: those solely based on animal production and those where cropping and livestock rearing are associated [19]. Accelerating the contribution from animal production systems in Asia stems from the inability of the component industries to supply the projected human demand for animal products. The implications are the need for improved systems and also increased efficiency in Natural Resources Management [5]. Implementation of the improved system at the extension services program by introducing proven applied technology in term of breeding, feeding, housing, health and daily practice management aspects as well as empowering individual farmer potential and farmer group dynamic. The extension services program is conducted to transfer knowledge, technology and skills to rural farmers so that ultimately farmers will improve their productivity and efficiency, hence increasing their income through farming and improving their standard of living.

Faculty of Animal Science Jenderal Soedirman University have designed the improving livestock production system program. Most of the staff members of the faculty are involved and committed to supporting the goal of extension services. Individual farmers and farmer groups are invited to consult with the faculty, and also joint at some activities such as (i) Seminars and workshops, (ii) General stadium, (iii) exhibitions, demonstrations, forum and expo, (iv) field days and university open days. Centre of Research and Teaching Farm of faculty is also providing for a farmer such as study, demonstration and internship. In order to accelerate the improved livestock system and agribusiness process, faculty joint collaboration with other institution and partner, namely (i) Alumnus of the university, (ii) Local Government, (iii) Directorate Livestock Services Ministry of Agriculture, (iv) Livestock and Farmer Association, and (v) Bank.

CONCLUSION

Beef cattle production under farmer groups in rural areas is mainly conducted in a traditional system with small numbers in the flock (ranged 2-8 head) and low in productivity (daily gain 0.6 kg/day, calving interval 20.6 months). The appropriate use of local feed resources and local livestock breeds requires close integration between crops and livestock within the system. Types of feeds offered to beef cattle could be classified into four major groups: legume, grasses other shrubs trees, concentrate, an agricultural by-product. Most of the farmer provide rice straw in fresh and also practice ammoniation. Findings of this study should be accounted for in strengthen feeding and management, especially in maintaining the body weight during mating and pregnancy periods in order to improve their productivity. Introducing proven applied technology in term of breeding, feeding, housing, health and daily practice management aspects as well as empowering farmer and the group dynamic is needed for increasing the sustainability of beef cattle production in rural areas.

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