IMPLEMENTASI SISTEM “KEREMAN” DAN PERTANIAN TERPADU PADA PENGGEMUKAN SAPI POTONG DI DUA KELOMPOK TERNAK DI KABUPATEN SOKARAJA

Implementation of “Kereman” System on Beef Cattle and Integrated Farming System (IFS) at Two Smallholder Farming Systems in Sokaraja District

Ayu Septi Anggraeni¹, Lusty Istiqomah¹, Ema Damayanti¹
¹Research Unit for Natural Product and Technology (BPTBA), Indonesian Institute of Sciences (LIPI) JI Jogja – Wonosari km 31.5 Gading, Playen, Gunungkidul D.I. Yogyakarta, 55861. Telephone/Facsimile: 0274-392570/391168
Email: ayus001@lipi.go.id / ayu.anggraeni07@gmail.com

Submitted 1 Agustus 2019, Accepted 23 September 2019

ABSTRAK


Kata kunci: Sapi potong, system kereman, system pertanian terpadu, manajemen pakan

**ABSTRACT**

Kereman” systems and integrated farming system applied in two smallholder farming systems Berkah Farm and Pondok Pesantren Roudlotul Huda Farm to improve fattening management and increase the cattle performance. Implementation of Integrated Farming System begins with repair pen construction, technical guidance implementation in fattening management and feed technology include: silage processing; rice straw ammoniation as a forage for animal that used agricultural waste; fermented rice bran supplementation as appetite enhancer additive, manure waste processing into organic fertilizer, and also drip irrigation system on agriculture. Technical guidance for Farmer given by transfer technology. The concept of sustainability is an essential element in the development of integrated farming systems because by-product (output) of one system becomes the input for another system. Different management at both smallholder farming systems, especially in feeding management produce different body-weight on beef cattle. Impact of this activity in two smallholder farming systems is higher efficiency production, which reflects on ADG value reached in less period than before. Feeding management, the experience of fattening beef cattle will be the effect on animal productivity — smallholder farming systems which applied better feeding management shown the higher average daily gain.

*Keywords*: Beef cattle, “kereman” system, integrated farming system, feeding management

**INTRODUCTION**

Banyumas region has a total population of beef cattle around 14,845 head (BPS Jateng, 2016). Banyumas region has 27 districts, and there are three districts (Kedung Banteng, Karang Lewas, and Sokaraja) that known as developing the area of beef cattle. More than 90% of beef cattle production in Indonesia derived from smallholder farming systems, often with only 2-3 cattle per farmer (Priyanti et al., 2012). Some of them integrated with crop and livestock production (Agus and Widi, 2018). Farmers in Sokaraja district prefer to fattening beef cattle due to its high selling value. However, the constraints of the society in the fattening management of beef cattle still rely on the feeding roughing irrespective of the amount and nutritional value of the feed (Rahmanto, 2004). Consequently, cattle weight gain are not optimal. To achieve the optimal results from beef cattle fattening management program Sokaraja, we introduce the “kereman” system. “Kereman” system is a simple enclosure system where forage that ready to consume was given daily and an additional feeding of concentrates with crude protein content around 15-16%. In other words, this system requires the provision of adequate feed intensified. With “kereman” system, the average daily gain (ADG) could be achieved by a range of 0.6-1.2 kg/head compared to the regular fattening system, which only reached 0.3 kg/head. Reference (Yusdja et al., 2001) stated that the fattening pattern of kereman system capable of providing the benefit-cost ratio (B/C) between 1.29 to 1.35% for six months to one year of the fattening period. Also, the financial analysis indicates more favorable in kereman system characterized by Asset Turn Overvalue faster (Winarsa, 2004).

The Integrated Farming System (IFS) concept adopted on beef cattle fattening. Beef cattle fattening with the integrated concept between livestock and agriculture should be enriched with the value of the technology. Henceforth, a technology approach of feed, livestock waste treatment, pen systems, and fattening management are crucial to supports the IFS concept. Optimal productivity and profitability can achieve significantly. IFS is an integrated system of agriculture and livestock that involve all the components, which includes agriculture and
livestock in an integrated system of agricultural enterprises (Soni et al., 2014). These systems promote an economy based on eco-friendly technologies and the optimization of all sources of energy produced. The advantages of these systems, are energy efficiency, increase the effectiveness of land, capital continues rotation, and environmentally friendly.

The concept of IFS applied will produce F4 (Food, Feed, Fuel, and Fertilizer). System integration of agriculture and livestock (IFS), resulting in forage for animal feed and livestock manure as fertilizer for crops (Julendra et al., 2013). IFS concept is already widely applied in Indonesia, both in large and small ruminants. Research Unit for Natural Product Technology, Indonesian Institute of Science (BPTBA LIPI) Yogyakarta had been conducting the initiation of IFS since 2006 in several areas such as Belu NTT (Julendra et al., 2007), Yogyakarta (Febrisiantosa et al., 2007; Anggraeni et al., 2015), Kaur Bengkulu (Karimy et al., 2013), Tanah Datar West Sumatra (Damayanti et al., 2013), and Temanggung and Wonosobo Central Java. The objective of this paper describes the concepts of livestock, especially beef cattle through the implementation of “kereman” system and IFS, and also to determine the critical factor that effects on beef cattle performance.

MATERI DAN METODE

Two smallholder farming systems, namely Berkah Farm and Pondok Pesantren (Ponpes) Roudlotul Huda Farm, conducted the fattening program of beef cattle in the Sokaraja district for four months from July to November 2010. Berkah Farm located in Pliken village, Rt.06/01, Sokaraja sub-district, Banyumas district. These smallholder farming systems chaired by Mr. Guntoro.

Berkah Farm has ten beef cattle, one communal pen-type tail to tail and a land area of this smallholder farming systems about 1.500m². Roughage feeder for cattle gets from forage land around the smallholder farming systems. Pondok Pesantren Roudlotul Huda Farm located in Pliken village, Rt.05/03, Sokaraja sub-district, Banyumas district. These smallholder farming systems chaired by Mr. Mujamil.

This smallholder farming systems have 11 beef cattle, two communal pen-type tail to tail and a land area of this smallholder farming systems about 2.100m². Roughage feeder for essential gets from forage land and agricultural waste such as rice straw also industrial waste (waste tofu grain) around the smallholder farming systems.

The activities were as follows:

- Technical guidance about pen construction based on layout design that supports the fattening management of beef cattle in both smallholder farming systems.
- Technical guidance (counseling) about fattening management of beef cattle in both smallholder farming systems.
- Technical guidance about feed processing using agricultural waste into complete feed products such as silage (Pondok Pesantren Roudlotul Huda Farm) and rice straw ammoniation (Berkah Farm).
- Technical guidance (training) about manure waste processing into organic fertilizer by composting technology in both smallholder farming systems, and it utilizations for the drip irrigation system in Berkah Farm.
- Technical guidance about Biogas digester construction and it utilizations in Berkah Farm.
- Application of fermented rice bran as appetite enhancers (feeds additives) to support the cattle immune system (enriched amino acids, vitamins, and minerals). The feed additives were given ±40 g/head/day for four months, and body weight gain was observed. Nutrient contents of fermented rice bran shown in Table 1.
Table 1. Nutrient content in fermented rice bran

<table>
<thead>
<tr>
<th>Composition</th>
<th>Fermented Rice Bran</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Matter</td>
<td>88.78 ± 0.25</td>
</tr>
<tr>
<td>Ash</td>
<td>8.09 ± 0.02</td>
</tr>
<tr>
<td>Crude Protein</td>
<td>15.37 ± 0.07</td>
</tr>
<tr>
<td>Fat</td>
<td>17.62 ± 0.12</td>
</tr>
<tr>
<td>Crude Fiber</td>
<td>9.09 ± 0.21</td>
</tr>
<tr>
<td>Calcium</td>
<td>0.14 ± 0.00</td>
</tr>
<tr>
<td>Phosphor</td>
<td>0.08 ± 0.00</td>
</tr>
</tbody>
</table>

Istiqomah et al., 2010

Monitoring of body weight through the chest circumference measurements was routinely performed every month. Then put the data of chest circumference into Scroll method:

\[ BW = \frac{(CC+22)^2}{100} \]

Table 2. visible Impact through implementation Kereman system in two smallholder farming systems

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Before program</th>
<th>After program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pen construction</td>
<td>* pen capacity was too crowded so cattle crammed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* roof pen was too low, produced bad air circulation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* floor condition is a little bit wet because cattle urine did not flow well into the drain.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* expansion of pen area (3.75 m²/head).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* raising the roof of the pen so make air circulation better.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* floor of pen was designed with 30° slope so cattle urine could flow well into the drain.</td>
<td></td>
</tr>
<tr>
<td>Composting room</td>
<td>* not available, cattle manure flowed directly into drainage (not use)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* created a composting room, so cattle manure could be processed into organic fertilizer without contaminating the environment.</td>
<td></td>
</tr>
<tr>
<td>Fattening and health management</td>
<td>* the average of the fattening period around 7-8 months.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* health management was not controlled yet (not given worm medicine and vitamin).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* fattening period around ± six months and achieved ± 0.446 kg/head of ADG.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* health management was conducted by giving the worm medicine, vitamin, mineral, and feed additive routinely.</td>
<td></td>
</tr>
<tr>
<td>Feed processing management</td>
<td>* rice straw gave without any treatment, so the cattle palatability was low.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* rice straw was processed into silage and rice straw ammoniation to increase the cattle palatability</td>
<td></td>
</tr>
</tbody>
</table>

Smallholder farming systems Berkah Farm

“Kereman” systems have been applied in Berkah Farm. Activities began with the pen construction by design created to support the maintenance of cattle. The construction includes expansion pen area, raised roof of the pen, and also make slope.
in floor pen so urine could flow into the drain. Feed processing technology through feed fermentation become silage has been applied regularly in Berkah Farm (production ± 30 kg for one week) as much as ± 1.5 kg/head/day). Silage technology was used to preserve forage as cattle feed. A composting room built to process cattle manure into organic fertilizer. Organic fertilizer from manure waste has been carried out at both smallholder farming systems (production around 205 kg during four weeks of fermentation and used for forage land belonging to smallholder farming systems. A farmer in Berkah Farm was conducted fattening period more than six months (7-8 months), while during the program they start fattening for 4-6 months. Smallholder farming systems Pondok Pesantren Roudlotul Huda Farm

“Kereman” systems have been applied in smallholder farming systems Pondok Pesantren Roudlotul Huda Farm. Activities began with the pen construction by raised the pen roof enclosure and made the slope of the pen floor to support the maintenance of cattle. The strategic location of smallholder farming systems results in a potential abundance of cattle feed that also supported by the abundant water resources. Also, the region's have wide enough rice field that rice straw could be processed for cattle feed into complete silage and rice straw ammoniation. Moreover, besides feed technology, we also developed manure processing into organic fertilizer by composting. Composting room was built to process the cattle manure into organic fertilizer. Compost can be utilized for agricultural commodities, especially in forage land belonging to smallholder farming systems. A farmer in Pondok Pesantren Roudlotul Huda Farm was conducted fattening period 7-8 month, while during the program they start fattening for 4-6 months.

A cramped pen in both smallholder farming systems did not support animal welfare. This conditions made behavior disorder in fattening cattle, and also decreased cattle productivity — behavior disorder related to inadequate floor space and ventilation (EFSA, 2012). Therefore activities in our program improved and repaired the pen construction, including pen area expansion, raising the roof and made slope in pen. Composting room was built to process cattle manure into organic fertilizer and also to reduce environmental contamination caused by animal waste. Animal manure can help in improving soil fertility and increase production (Walia and Kaur, 2013).

Cattle fattening period depends on rearing and feeding management. In both smallholder farming systems after farmers get guidance about fattening management through “Kereman” system, they obtained a short fattening period with higher ADG compare to previous rearing system. They got more attention in cattle fattening and cattle had better feed than before. Human resources have still relied influence on the sustainability of fattening system it related to ethic work of farmer (Julendra et al., 2013; Anggraeni et al., 2015).

Implementation of feeding management of “kereman” system in two smallholder farming systems

Both smallholder farming systems applied different feeding management during the fattening period. Therefore it influenced the cattle ADG. Comparisons of ADG between smallholder farming systems for 4-months observation shown in Table 3.

**Table 3.** The mean of initial weight, final weight, and body weight gain for four-month

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Berkah Farm</th>
<th>Pondok Pesantren Roudhatul Huda</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial body weight (kg)</td>
<td>334.37</td>
<td>359.33</td>
</tr>
<tr>
<td>Final body weight (kg)</td>
<td>309.79</td>
<td>409.21</td>
</tr>
<tr>
<td>Average Daily Gain (kg)</td>
<td>0.21</td>
<td>0.89</td>
</tr>
</tbody>
</table>
Smallholder farming systems Berkah Farm

Cattle were reared for four months in pen and fed “komboran” (concentrate feed mix with water thus becoming a watery paste) twice a day in the morning and afternoon, as well as an additional form of forage. Cattle were given fermented rice bran as an additive for appetite enhancer to increase consumption, but it was not given routinely. Feed for cattle could be obtained from the environment around the farms so that it could be developed into an integrated farming system. Monitoring of body weight through the chest circumference measurements was routinely performed every month. The result showed that the achievement of ADG in smallholder farming systems Berkah Farm reached 0.21 kg/head at the fourth month of fattening period (Table 3). The ratio of concentrate in smallholder farming systems Berkah Farm decreased (<30%) of the total feed cattle/day due to cost increase of concentrate feed, whereas the concentrate is a source of energy that can enhance the cattle’s ADG.

Furthermore smallholder farming systems Berkah Farm never yet the feedlot management experience so that their knowledge and skills in fattening management still lack and limited. Lack of experience and education of farmer will lead to different management in rearing livestock (Murwanto, 2015; Marhaeniyanto et al., 2019). This condition implicated the unoptimal of body weight gain during the fattening period compare with smallholder farming systems Pondok Pesantren Roudlotul Huda Farm.

Smallholder farming systems Pondok Pesantren Roudlotul Huda Farm

Cattle were reared for four months in pen and fed “komboran” (concentrate feed mix with water thus becoming a watery paste) twice a day in the morning and afternoon, as well as an additional feed rice straw ammoniation. Cattle were given fermented rice bran (40gr/head/day) routinely as an additive for appetite enhancer to increase consumption. Furthermore, in these smallholder farming systems, they also gave nutshell as a fiber source to enriched nutrient for cattle. Monitoring of body weight through the chest circumference measurements was routinely performed every month. The result showed achievement of the ADG in smallholder farming systems Pondok Pesantren Roudlotul Huda Farm reached 0.89 kg/head (Table 3). Smallholder farming systems Pondok Pesantren Roudlotul Huda Farm had ± 1.5 years of experience in the feedlot, so the fattening management was more intensive and produced optimal outcomes. This smallholder farming systems produced better optimal body weight gain during the fattening period compare to smallholder farming systems Berkah Farm.

Figure 1. Comparison of ADG between smallholder farming systems Berkah Farm (BF) and smallholder farming systems Pondok Pesantren Roudlotul Huda Farm (PRH).
The average daily gain in smallholder farming systems Pondok Pesantren Roudhatul Huda was higher than smallholder farming systems Berkah Farm. This condition happens probability due to better rearing and feeding management. Firstly, cattle got enough to feed for their maintenance and growth during the fattening period without any feed input reduction as it happens in Berkah Farm during November 2010 due to higher concentrate price. Second, smallholder farming systems Pondok Pesantren Roudlotul Huda Farm had ± 1.5 years of experience in the feedlot, so their fattening management was more intensive and produced optimal outcomes.

Third, during fattening period smallholder farming systems Pondok Pesantren Roudlotul Huda Farm gave fermented rice bran as appetite enhancer routinely. This is by the opinion of Istiqomah et al.,(2010) which stated that animals that had extra bran fermentation were able to achieve higher body weight. This is reflected in higher ADG than controls. Besides that, protein and fat content in fermented rice bran was highly enough 15.37%; 17.62% (Istiqomah et al., 2010).

This high content of protein and energy could be used for cattle’s growth. It depends on reference (Owens et al., 1993) that higher protein and energy content in feed will produce higher growth rate. The growth of cattle that administered with fermented rice bran routinely for four weeks of observation could produce more efficiently in a conversion rate of feed and significantly improve the average daily gain (Istiqomah et al., 2010). The specific odor of fermented rice bran could increase the appetite of feed, and the minerals and amino acid compounds were useful for cattle performance (Sereewatthanawut et al., 2008).

The specific odor increased the palatability ration. During the fermentation processes, there were changes in nutritional values and also arose appetite due to the formation of one or several chemicals compounds which released by fungi in medium fermentation (rice bran) (Wizna et al., 2000; Zhixiong et al., 2010). Sofyan et al.,(2008) reported that physical quality of fermented rice bran by \textit{Rhizopus sp.} inoculums, and chitosan waste addition produced more fragrant appetite characteristic than the unfermented rice bran.

\textit{Rhizopus oryzae} was capable of producing lipase which able to synthesize \textit{citronellyl esters} compound as appetite forming component in the appetite of food or feed ingredients (Macedo et al., 2003) while \textit{Saccharomyces} produced the alcohol appetite (Thomas et al., 2002) thereby increased the appetite of fermented feed.

**Implementation of the integrated Farming system in both smallholder farming systems**

Both smallholder farming systems were chosen because the territory is suitable for cattle fattening, viewed from the availability of water, forage, and agricultural wastes that could be used as an alternative feed. Suitability of land was main factor in supporting the success of a livestock business, especially ruminants. The use of agricultural crop waste will increase the efficiency of the farm business (Romjali, 2018).

This is related to land uses and potential food crops and forage that will determine the direction of land development for ruminants (Sumanto and Juarni, 2004). Also, Sokaraja is a development area of fattening beef cattle in Banyumas. Rice straw was processed into silage and rice straw ammoniation as cattle feed. Then manure was processed into organic fertilizer that could be applied to forage land in Pondok Pesantren Roudlotul Huda Farm, while in smallholder farming systems Berkah Farm the organic fertilizer was used for vegetable crops with drip irrigation techniques. The concept of sustainability is an important element in the development of
integrated systems. Integrated Farming Systems (IFS) is a system where nothing is wasted, by product (output) of one system becomes the input for another system (Simonne et al., 2008). The drip irrigation system is the right choice in increasing the efficiency of water and fertilizer use to increase productivity through the appropriate irrigation system. According to reference (Simonne et al., 2010), drip irrigation is a method of giving water to the plants directly; the droplets flow continuously and slowly either in the area of plant roots as well as on the surface of the soil.

Efficient use of water for drip irrigation reaches 80-95% (Yanto et al., 2014; Febrisiantosa et al., 2006). An IFS is very good and healthy if it was developed with the concept of biogas. The cattle manure was put directly into the biodigester so it would not pollute the environment and expected to decrease the spread disease. Biogas fuel, it can be methane-fermented, directly combusted, or made into solid fuel (Owens et al., 1993). The capacity of biodigester was 3 m³ and it used to collect manure from ten cattle. Biogas was used in smallholder farming systems Berkah Farm for cooking need daily (the length time of cooking around 4 hours/day). Methane gas production in this program was less optimal than the study of reference (organics, 2014) that used digester with 4.84 m³ capacity with manure input from two cattle. This digester could produce biogas for cooking from one household for one day. This condition happens, might be caused too many cattle manure as input while the biodigester capacity was too small, so it released less biogas. The ideal ratio is obtained from cattle manure (C: N = 10-30), and this is an opportunity to develop appropriate methods and compositions to obtain the C: N ratio ideal which is about 25-30 (Devendra et al., 1997). The concept of IFS applied at both smallholder farming systems in Sokaraja district shown in Figure 2.

![Diagram of IFS in Berkah Farm and Pondok Pesantren Roudlotul Huda Farm](image)

**Figure 2.** Concept of IFS in Berkah Farm and Pondok Pesantren Roudlotul Huda Farm
According to Devendra et al., (1997) there are two types of system integration commonly developed in Southeast Asia, (1) a system that combines livestock and annual crops of rice, maize, cassava, potatoes, soybeans and peanuts, (2) methods that combine livestock with crop annual plants such as rubber, oil palm, coconut and cocoa. Sokaraja area could be categorized in the first type with the integration of rice crops. Interaction between livestock and crops, either seasonal or perennial, will provide positive benefits. It is directly or indirectly will improve productivity, incomes, and sustainability of the business. This is because there is no output from the fields that are not utilized, due to which the output is input to the other fields.

CONCLUSION
Feedlot management with “Kereman” system supporting with Integrated Farming System has been implemented in two smallholder farming systems in Sokaraja. Kereman system that supports with enough nutrient requirement for cattle and also added feed supplement will give better result in fattening beef cattle. Feeding and fattening management as an essential factor that affected cattle growth.

ACKNOWLEDGMENT
The author would like to thank for DIPA BPTBA LIPI 2010 as a source of financial support for this activity and also for Mr. Nana Hidayat, for his help in this activities and data collection.

REFERENCE


