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Productivity of Ongole Cows and Calves under an Integrated Village Management System (IVMS) in East Java

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Abstract. The objective of this study was to assess the productivity of ongole crossbed (PO) cows and calves managed by the Integrated Village Management System (IVMS). Key principles of the IVMS are weaning of calves at 5-6 months and strategic supplementation of breeding cows and early weaned calf using locally available feeds. In this study, village cows were fed a diet based on untreated rice straw, with supplementation using green feed and concentrates. Calf productivity was recorded by measuring birth weight, weaning weight, and calf mortality. Implementation of IVMS management with rice straw-based feed strategically supplemented with concentrate and tree legume produced good PO cow and calf productivity. Calving percentage was 61%, calf birth weight 25.1-26.1 kg, calf weaning weight 116 kg, calf mortality <3% and body condition score (BCS) of cow maintained at 3.2/5.

Keywords: management, calves, rice straw, legume

Abstrak. Penelitian bertujuan mengkaji produktivitas pedet sapi PO dengan manajemen Integrated Village Management System (IVMS). Pemeliharaan pedet secara umum mengikuti pola induk. Prinsip manajemen IVMS diantaranya penyapihan 5-6 bulan dan strategi suplementasi pada induk dan pertumbuhan ternak dengan menggunakan pakan potensi lokal. Pakan induk berbasis jerami dengan suplementasi menggunakan greenfeed dan konsentrat. Recording produktivitas pedet diantaranya: kelahiran, penyapihan, bobot badan, dan kematian pedet. Penimbangan bobot badan dilakukan saat kelahiran, dan penyapihan. Penerapan manajemen IVMS dengan pakan berbasis jerami padi menghasilkan produktivitas induk dan pedet sapi PO yang baik. Persentasi kelahiran pedet mencapai 61%, bobot lahir pedet 25,1-26,1 kg, bobot sapih pedet 116 kg, kematian pedet <3% dan skor kondisi tubuh (SKT) induk 3,2/5.

Kata kunci*:* manajemen, pedet, jerami padi, legume

Introduction

East Java province has the largest population of beef cattle in Indonesia, supporting 27.5% of the national herd (Ditjennak, 2018). Ongole Crossbreed (PO) cattle are an Indonesian local cattle breed valued by local farmers for their feed efficiency, tick resistance and adaptation to tropical environments, including poor feed, high temperature and humidity (Hartati et al., 2006). Ongole cattle are the most common breed of cattle in Indonesia, comprising 21% of the total cattle population.

Typically in East Java, village cattle are managed by an intensive cut and carry system. Cattle are kept in small yards within the village, each individually managed by a household. Many of these cattle are raised by landless households in which the main income sources are from agricultural labor wage and raising cattle on low quality feeds such as native grasses, rice straw, and other crop residues. Application of this management system contributes to low reproductive performance (calving interval 16 months) and high mortality (8%) (Hanifah et al., 2010).

Most cattle in East Java are fed diets based on crop residues and agricultural byproducts such as rice straw (Hanifah et al., 2010). Rice straw is low in organic matter digestibility (OMD, 51%) and crude protein (CP, 5% DM), but can be used to maintain cow liveweight (Syahniar et al., 2012). However, the feeding

value of rice straw is not high enough to meet the requirements of animals with high nutritive demands (such as lactating or rapidly growing cattle) (Ahmed et al. 2002; Akter et al. 2004). In these situations, small amounts of high-quality supplements, such as rice bran or tree legumes, can be used to supply shortfalls in energy and/or CP from rice straw. Syahniar et al. (2012) found that untreated rice straw can maintain weight and Body Condition Score (BCS) of Ongole cows when supplemented with tree legumes at the level of 2.8 g DM/kg W/d.

The Integrated Village Management System (IVMS) is designed to improve the efficiency of cow reproduction and calf survival. Key features of the IVMS are improved mating management (effective detection of estrous and timely access to bull or artificial insemination), improved feeding of cows during late pregnancy and early lactation, and weaning calves at 5-6 months old or earlier if required to maintain BCS (Dahlaludin et al., 2016). Panjaitan et al. (2008) have reviewed the IVMS management system in Bali cattle and shown that the IVMS can increase cow reproduction, reduce calf mortality, reduce labor requirements and increase the cash flow of farmers.

In this study, we evaluated the impact of applying the IVMS on Ongole cow reproduction and calf production (calving rate, birth weight, calf mortality, weaning age, weaning weight and daily gain) in East Java.

Materials and Methods

This research was conducted in Srigonco village, Bantur district, Malang regency (elevation 550 m, average temperature 20-34^{0}C) between 2010 and 2013. An initial cohort of 108 households was enrolled in the study. Households were free to leave or join the project, so the number of households varied throughout the project period (Table 1).

Most small holder farmers in Srigonco village keep 1-3 cattle per household (Hanifah et al., 2010) and manage their own small herd independently. Cattle are kept in simple cages with dirt floors, wooden walls and clay tile roofs, and are fed by a cut and carry system.

Implementation of the IVMS

The IVMS system was first introduced to farmers at the village site in 2010, including: mating, weaning, and feeding (supplementation) management. The majority of cattle calving in the first year of the project were conceived prior to the introduction of the IVMS. Management of the cows and calves followed the suggested IVMS scheme whereby calves were weaned at 5-6 months old of age. Weaning was done directly or preceded by suckling restrictions. The calves were weaned early if cows were in poor condition (low BCS).

Calves remained with the cow until weaning and had access to the feed provided to the cow. Cows were fed mainly crop residues such as rice straw and corn stover plus small amounts of legumes and concentrates as supplements. A higher level of supplementation was provided two months before and after calving.

Calves were given anthelminthics firstly at 1-2 weeks old (liquid or bollus) and again at 3 months o. Mating management was improved by training provided to farmers in estrous detection and mating in timely manner. If any cows returned to estrus after AI mating, then farmers were recommended to mate the cow naturally with a bull.

Table 1. Number of cows and farmers involved in the research

Year of Research	Number of households	Number of cows (head)
2010	108	120
2011	124	141
2012	103	116
2013	99	102

Data collection and analysis

In this research, we sited a junior scientist in the village who will record all parameters. We recorded the dates of calf birth and weaning, and liveweight of calves on the day of birth and the day of weaning. We also recorded incidences of calf disease, any treatment provided, and date and cause of any mortalities by interview with the household.

Feed consumption of cows (feed offered and refused) was measured and recorded by the junior scientist on one day of every month for a subsample of 30 cows. Every type of feed available on site on these observation days was sampled. Sampled feeds were analyzed for a dry matter, CP and ash content at the Nutrition Laboratorium of the beef Cattle Research Institute (Grati). Dry matter and ash were measured by gravimetric method (AOAC) and crude protein by a semi micro Kjeldahl method. Feeds offered to cattle were categorized as basal diet, green feed, or high-quality feeds. Basal diet included rice straw and corn stover. Green feed included native grass, elephant grass, tree legumes and sugarcane tops. High quality feed included rice bran, cassava, onggok (cassava bagasse) and concentrates (grain and meals).

Data collected during the study was used to calculate inter-calving interval (days between two consecutive calvings), calving rate (the percentage of calves born from total number of cows in each year), average liveweight gain during suckling (the difference in calf weight at birth and weaning, divided by number of day between calf birth and weaning) and calf mortality rate (the percentage of dead calves divided by total number of calves). The data are presented descriptively.

Results and Discussions

Feeding of cows and calves

Farmers in Malang utilized a large variety of feeds for their cattle. Feed included crop residues (rice straw, corn stover), crop byproducts (rice bran), green feed (elephant grass, native grass, sugarcane top), tree legume (Moringa oliefera leaf) and other feeds (such as sugarcane leaf) (Table 2). The types of feed offered each month depended on the availability of local feed sources. Crop residues such as rice straw were fed throughout the year, and comprised the bulk of the diet of cattle, since they can be dried after harvest and stored for later use. Green feed and high-quality crop by-products were offered in smaller amounts. Farmers fed their cattle average fresh weight of 13.81 kg basal diet; 13.53 green feed and 0.38 kg high-quality feed. There were differences in diet composition between the wet and dry season. The availability and digestibility of green feed in the wet season is higher than in the dry season (Ratnawati et al., 2016). Forage grasses in the dry season produce only one third the yield of the wet season (Hanifah et al., 2010).

Table 3 shows the chemical composition of the feedstuffs. In general the CP content was adequate for ruminants (CSIRO, 2007) with the exception of the straws and stovers as would be expected.

The calving rate of cows varied throughout the study (Table 5), and was related to the inter-calving interval. For example, the low calving rate in 2012 (36%) followed a long inter-calving interval in 2011 (543 days), while the high calving rate in 2013 (61%) followed a shorter inter-calving interval (486 days). Increasing experience with the IVMS as indicated by years in the project, and by comparison of 2010 results with subsequent years, did not markedly increase calving rate until the end of the research period (2013).

The IVMS can maintain BCS of PO cows (Table 5). Previous study by Dahlaludin et al. (2016) and Panjaitan et al. (2008) showed that Bali cattle under the IVMS increased calving rate under the IVMS to reach values of approximately 80-90%. Indonesian Ministry of Agricultural (2015) stated that calving rate and

calving interval of PO Kebumen cows were 70% and 13.43-15.25 months. Also, calving rate and calving interval of Bali cows were 40-85% and 330-550 days (Indonesian Ministry of Agriculture, 2010).

Table 2. Types of feed offered to Ongole cows in Srigonco village, Malang. X indicates which month each feed was fed, ND indicates months where no data was collected, blank cells indicate the feed type was not fed. Grey shading indicates months with more than 60 mm rainfall.

Feed ingredient	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Corn stover		ND	ND	ND				X		X	X		
Elephant grass		ND	ND	ND		X	X	X	X	X	X	X	X
Native grass		ND	ND	ND		X	X	X	X	X	X	X	X
Other feed	2010	ND	ND	ND		X	X	X	X	X	X	X	X
Rice bran		ND	ND	ND				X	X	X	X	X	X
Rice straw		ND	ND	ND	X	X	X	X	X	X	X	X	X
Sugarcane tops		ND	ND	ND								X	X
Corn stover			X		X	X		X	X	X	X	X	X
Elephant grass		X	X	X	X	X	X	X	X	X	X	X	X
Native grass		X	X	X	X	X	X	X	X	X	X	X	X
Other feed	2011	X	X	X	X	X	X	X	X	X	X	X	X
Rice bran		X	X	X	X	X	X	X	X		X	X	X
Rice straw		X	X	X	X	X	X	X	X	X	X	X	X
Sugarcane tops		X	X	X	X	X	X	X	X	X	X	X	
Corn stover		X	X										
Elephant grass		X	X	X	X	X	X	X	X	X	X	X	
Native grass		X	X	X	X	X	X	X		X	X	X	X
Other feed	2012	X	X	X	X	X	X	X	X	X	X	X	X
Rice bran		X	X	X	X	X	X	X	X	X	X	X	X
Rice straw		X	X	X	X	X	X	X	X	X	X	X	X
Sugarcane tops		X	X	X		X	X	X		X		X	X
Corn stover						X		X	X				
Elephant grass		X	X	X	X	X	X	X	X	X	X	X	X
Native grass		X	X	X	X	X	X	X	X		X	X	
Other feed	2013	X	X	X	X	X	X	X	X	X	X	X	X
Rice bran		X	X	X	X	X	X	X	X	X	X	X	X
Rice straw		X	X	X	X	X	X	X	X	X	X	X	X
Sugarcane tops		X			X	X	X	X	X	X	X	X	X

Calf birth weight was between 25.4 and 26.7 kg (Table 5) which was within the expected range for PO cattle (Astuti, 2003). The daily weight gain of calves before weaning reached 0.48 kg/day at the beginning of the study and stabilized in the following year at 0.51 kg/day. These results were higher than 0.36 kg/day by Hartati et al. (2006). The daily weight gain during suckling is influenced by several factors, including calf sex (Wiyatna et al., 2012), calf birth weight, weaning age and calf birth month (Mayberry et al., 2016). Luthfi et al. (2016) reported that the forage consumption of cows can affect the daily weight gain of unweaned calves. The daily weight gain of calves before weaning in the PO breed appears higher than Bali cattle and lower than that of Brahman cattle (Mayberry et al., 2016).

Table 3. Dry matter and crude protein content of feed.

	Feed type						
	Native Grass	Elephant Grass	Rice Straw	Corn Stover	Rice Bran	Moringa Oleifera Leaf*	Sugarcane Leaf*
Dry matter (%)	21.5	12.2	80.3	17.9	93.9	6.0	30.0
Crude Protein (% dry matter)	15.4	11.4	4.5	9.3	7.1	22.7	4.0
Ash (% dry matter)	14.8	13.6	20.7	6.7	15.3	-	-

Note: * from literature

Table 4. Consumption of dry matter and crude protein (kg/head/day) during research (wet and dry).

Year	Dry Matter	Crude Protein
2010	15.36	0.85
2011	14.30	0.75
2012	9.24	0.55
2013	16.34	0.81
Mean total Consumption (kg/head/day)	13.81	0.74
Standard Deviation	3.70	0.14

Note: The estimated total DM intake of cows (wet and dry season) was 13,81 ± 3,70 kg/head/day, with an average crude protein content of 5,4% for the total diet.

Productivity of PO cows and calves

Table 5. Annual productivity of PO Cow and Calves (Average ± Standard Deviation)

	2010	2011	2012	2013
Indicators of reproductive success				
Calving Rate (%)	50.8	48.9	36.2	60.7
Inter Calving Interval (days since previous calving)	-	507 ±117	543 ± 110	486 ±70
BCS of cows at calving (1-5 scale)	3.2 ±0.6	3.1 ±0.5	3.2 ±0.4	3.2 ±0.3
Calf productivity				
Birth weight (kg)	26.7 ±3.5	25.9 ±3.7	26.0 ±3.2	25.4 ±1.7
Weaning weight (kg)	107 ±24	110 ±24	110 ±17	117 ±14
Weaning age (days)	171 ±21	165 ±26	164 ±13	182 ±21
Liveweight gain during suckling (kg/day)	0.5 ±0.1	0.5 ±0.1	0.5 ±0.1	0.5 ±0.1
Calf mortality rate (%)	2	0	3	0

Health of PO calves

The mortality of calves was relatively low (<3%) and reflects the good husbandry employed in this village (Table 3). Calf mortality was caused by failure to defecate (potential failure to suckle) or unspecified reasons without any information from the farmers. PO cattle have relatively good adaptability to the environment and are more resistant to diseases compared to Bali or Brahman cattle (Mayberry et al., 2016).

Disease and health disorders that occured during the study included wounds/itching of the skin, diarrhea, abscesses, omphalitis (umbilical inflamation), trauma and decreased appetite. The occurence of health problems in PO calves during the research period is shown in Figure 1. Treatment was applied according to the probable cause of calf health history. Diarrhea is a symptom of many diseases with many causes, including internal parasites, viruses and bacteria.

Faecal egg counts could not be performed to confirm the presence or absence of internal parasites. Abscesses and omphalitis are inflammatory process and can be accompanied by accumulation of pus. It usually begins with an open wound on the skin and umbilical cord, accompanied by a bacterial infection. Livestock environments are highly conductive for pathogenic infections (bacteria, viruses, parasites). Decreased appetite is an early symptom of livestock health problems, which could be treated with supportive therapy (vitamins and minerals) and alternative treatments with herbal remedies by farmers.

Weaning calves

Calves were weaned at about 5 months old in 2010-2012 and 6 month old in 2013 (Table 5). The differences in weaning weight (Table 5) were related to age at weaning. IVMS recommends that calf weaning occur during times of feed surplus or during the wet season (Table 2) to ensure the availability of higher quality feed for the weaned calf.

The decision to wean at certain time was affected by cow BCS. When cows presented with a poor BCS, calves were weaned early at around 3 months to induce cow cycling (Mayberry et al., 2016). Cows with good BCS showed early oestrous whilst still suckling a calf.

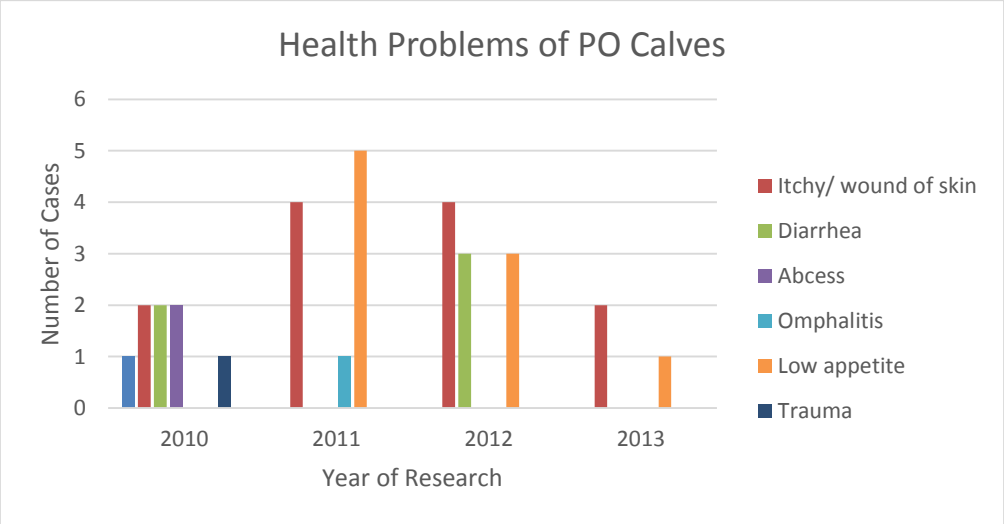

Figure 1. Health problems of PO calves

The critical point of cow reproduction is during the last 2 months of pregnancy and the first 2 months of lactation. At this critical point, the cow's body condition score should maintain >3/5 for cycle and future calving. It is difficult to

increase body condition score rapidly under these village feed resources.

Conclusion

IVMS for PO cows together with a rice straw-based feeding system can support reproduction and productivity of preweaned calves. Calf weaning weight reached 116 kg and calf mortality was under 3%. A small amount of a high protein feed source (concentrate and tree legume) can meet the maintenance requirement of the cow and enable good growth of the suckling calf. The system thus saves high quality feed resources to feed weaned calves and fattening bulls.

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