CURRENT OUTLOOK OF THE MALAYSIAN BEEF CATTLE FARMING PRACTICES

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ABSTRACT. This research aims to examine the beef cattle farming scenario on the ground in Peninsular Malaysia through field visit. The census activities were conducted in 11 states in Peninsular Malaysia between March to November 2021. Malaysia's cattle population was reported at 699,424 head in 2020 with local meat production of 41,379 metric tonnes (mt), contributing to 20.7 % of the total national beef consumption. Over 75 % of the animals are categorised as the KK crossbreed, and it is difficult to trace their breed's perennity and purity. The cattle are mainly raised extensively under integration with oil palm plantations or orchards while some are left grazing freely in paddy fields or agricultural and river reserve areas. The KK crossbred cattle are recorded to have an adult weight between the range of 200-400 kg, with an average male and female weighing 370 kg and 242 kg, respectively. Natural mating is mainly practiced in most farms using a specific breeding bull or with unknown male cattle. The animals are also fed with agriculture farming waste (by-products), in addition to TMR and grasses. In the intensive production system (yards), animal waste is managed as liquid manure. In addition, the Malaysian beef cattle farming are dominated by small farms that operate without Suruhanjaya Syarikat Malaysia (SSM) registration. These findings provide insight into the current beef cattle farming perspective and are useful in future production projection.

Keywords: beef cattle, farming practices, KK cattle, production system

INTRODUCTION

As a key source of protein for human consumption, livestock businesses are gaining ground in the global food supply (Devendra, 2006, 2007; Boland *et al*., 2013). The consumption of meat, dairy products, and eggs has steadily increased over the world in tandem with rising per capita income, particularly in Asia's East and Southeast (Devendra, 2007; Boland *et al*., 2013; Schwarzer *et al*., 2012). This is the case in the livestock industry, where cattle farming is a substantial greenhouse gas (GHG) emitter, resulting from the animal housing, manure storage facility, and the processing of this waste. Over the previous five years duration (from 2016 to 2020), Peninsular Malaysia's beef cattle population has been estimated to be at the average of 582,000 heads annually, based on the number of animals produced annually (NAPA). Simultaneously, the number of dairy cows is between 40,000 and 45,000 heads within the same time period. Both accounted for 19.3 % (13 % and 6.3 %, respectively) of Malaysian agricultural GHG emissions through enteric fermentation and waste management. However, no segregation data on local beef cattle breeds, sex, and age

are available for a more detailed breakdown of the GHG emission measurement. Current GHG emission calculations are based on IPCC's tier-1 methodology, which is by multiplying the total cattle number (population) with the estimated discharge of GHG through emission factor (EF) using country-specific emission factor (CSEF) based on Brakmas breed cattle (Azizi *et al.*, 2017). The use of this CSEF value in the GHG emission calculation may result in over or underestimation of the emission estimates if the actual beef cattle industry scenario is not taken into consideration when the CSEF is developed.

Cattle farming in Malaysia is seen as a challenging venture because of its relatively slow development compared to poultry and swine, coupled with the issues of growing feed sources. The current number of livestock is also not seen to increase aggressively to meet the annual needs of the population. To date, there is no data to show the breed of choice for breeders to meet the country's needs. Breeding and rearing methods are also said to still focus on small groups (< 50 heads) compared to medium or commercial (> 50 heads). It is known that cattle farming is more focused on integrated farming or grazing in the backyard. These practices started over 30 years ago by smallholder or backyard paddy farmers in Kedah and Kelantan states after the paddy-harvesting period (Jalaludin & Halim, 2014). Operation of cattle farming that is integrated with palm oil production is the most favoured system in Malaysia. Grazing beef cattle on oil palm has the potential to provide economic benefits by providing an alternative product, reducing the need for costly plant control, and enriching the soil (Ibragimov *et al.*, 2016; Zayadi, 2021).

The Malaysian palm oil plantation covers over 3.2 million hectares of land, which is suitable for integration with cattle farming at a stocking rate of between 1.9 and 3.7 head ha-1 (Ayob & Hj Kabul, 2009). However, the topography of the plantation may also become a constraining factor especially if the areas are hilly with sloping or uneven surfaces. In addition, many farms are owned by small enterprises, which further hinders the integration process.

Beside integrated system, farmers are also practicing semi and fully intensive systems, feedlots, and special fattening farms. This came as a result of increasing meat demand but low beef self-sufficiency level as Malaysia beef self-sufficiency was reported to be at 20.74 % in 2020. At the same time, there is also insufficient or lack of grazing areas. The number of existing feedlot farm is unknown, but it is estimated that 200 feedlots of various sizes existed in Malaysia in 1998 (Jalaludin & Halim, 2014). The number is likely to be much larger now. Although larger feedlots are capable of producing from 6,000 to 7,000 heads of cattle per year, this is unlikely to happen in Malaysia as most feedlots only hold about 10 to 200 heads at once. It is thought that less than 10 % of large ruminant farms in Malaysia have appropriate infrastructure and facilities (Mohamed *et al.*, 2013). Thus, it is not surprising that more than 60 % of the beef enterprises in Malaysia are small to medium-sized entrepreneurs (Najim *et al.*, 2015).

At present, manure management practices in cattle barns or feedlots are either in liquid (slurry) or solid forms. Cattle manure consists of faeces, urine, and feed waste, which may contain mixed ration concentrate or any agriculture by-products such as chopped oil palm frond, grasses, palm kernel cake (PKC), corn stem silage, essential oil by-product (citronella oil) or rice straw. Meanwhile, slurry handling follows most slurry practices, in which liquid slurry is channelled to multiple holding lagoons comprising anaerobic and aerobic digestion ponds, before being released down to waterways. In some regions of Malaysia, slurry from the holding ponds is pumped out and spread to cropland or grazing areas by gravity discharge or using a mechanical spreader following most practices in the United Kingdom (Chambers *et al.*, 2001). The number of waste ponds are increasing because of the

transition from conventional grazing farming to intensive in-house production systems (Chung *et al.*, 2013).

This research aims to examine the cattle industry perspective on the ground, identify and evaluate each distribution and component for clear view on current beef farming practices nationwide. The census observations include farmers business model, cattle breed ratio, and distribution as well as other fractions/ sub-categories for beef cattle production and management in Peninsular Malaysia.

MATERIALS AND METHODS

The census activity is a collaboration between MARDI, through the Climate Change Programme, Agrobiodiversity and Environmental Research Centre, and Livestock Science Research Centre of MARDI with the Department of Veterinary Services Malaysia (DVS). Two batches of censuses were conducted between March 2021 and November 2021. The number of livestock respondents in each state was determined based on the ratio of 1-3 respondents or livestock holders: 15,000 heads of beef cattle with a logical proportion to each state. The beef cattle farmers were chosen as respondents based on i) pre-census and available contacts through peers, social media network search, communication, and others, and ii) at random from a database obtained through the DVS. Double randomizations were carried out from the farmers' database at the DVS and MARDI levels. The censuses involved qualitative and quantitative data collection, including production systems, animal numbers, and physiological characterisation. These include farming period and types of business practices, types of production system, breed types, age and sex, data on animal weight according to phase (born, grower, mature) for beef cattle production, and feedlot manure management type and processing. A general observation was conducted on feed given, breeding practices as well as selling practices among farmers. All data recorded were analysed using descriptive analysis following scientific research requirements.

RESULTS AND DISCUSSION

Census Limitations

There are about 29,000 beef cattle farmers in Malaysia. However, the actual number may vary due to changes in farming activities, unregistered farms and deceased or change of ownership. The number of respondents in the censuses is too small compared to the actual number of farmers in Malaysia, which may not represent the real scenario. Many farmers lack animal records and consequently cannot provide accurate data. Thus, the data taken is based on personal observations and is non-instrumental. This involves estimating the animal's weight, age, and physical characteristics during the census. There is a possibility of repeated observations on animals or observations in general on the groups of livestock observed. There is a constraint where some of the cattle may not be available to be observed on-site as the cattle may be grazing away from the main yard, reducing the accuracy of the censuses.

General Cattle Farming Overview

The total number of farmers is 75 from both censuses as shown in Table 1. Based on DVS records, Kelantan, Terengganu, Pahang, and Johor have the highest beef cattle population. Based on the farm-scale categories by DVS Malaysia, it has been observed that small-scale farmers dominate beef cattle farming activities at 68.1 % (Figure 1). Small-scale farmers are indicated by the number of cattle less than < 50 heads. Meanwhile, the remaining of 11.6 % and 20.3 % are from medium-scale and large (commercial) farmers, respectively. The censuses also found large-scale on years of experience in

beef cattle farming, ranging from 1 to 40 years (Table 2). However, the average and median experience age are 14.8 and 8 years of experience, respectively. The large range indicates that the censuses covered both new and experienced farmers involved in this activity. In addition, experienced farmers are found to be involved in the industry at an early age by helping their parents keep the stocks in the past. As for the small-scale farmers with small herd sizes, they are typically involved in the industry as a part-time activity compared to larger-scale farmers with higher capital. The censuses recorded that 68 % of farmers fulfil cattle farming as their part-time ventures.

Table 1. Number of beef cattle farmers from Peninsular Malaysia involved in the censuses

No	State	Number of Farmers
1	Kelantan	11
2	Terengganu	10
3	Pahang	11
4	Johor	11
5	Negeri Sembilan	3
6	Melaka	3
7	Selangor	9
8	Perak	5
9	Kedah	8
10	Pulau Pinang	3
11	Perlis	1
Total		**75**

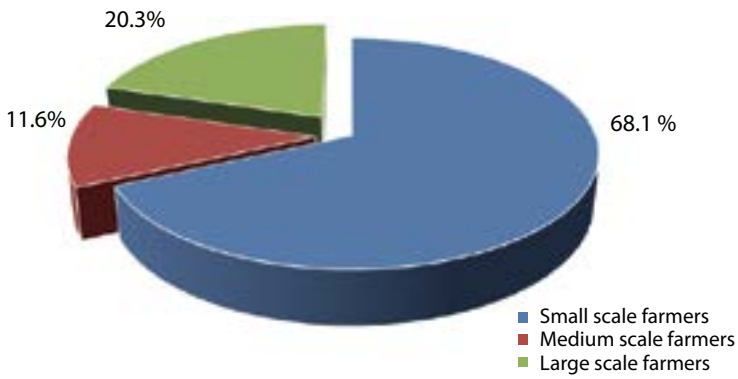

Figure 1. Beef cattle farmers breakdown in a farming scale category observed from censuses (percentages)

Table 2. Breakdown of farmers' farming experiences (years)

Farming experience (years)	Years
Mean	14.8
Median	8
Experience Range	1-40

Main Important Breed

Malaysian beef cattle population are dominated by the Kedah-Kelantan (KK) and its crossbred (later known as KK crossbred). KK crossbred cattle type is one of the indigenous breeds of beef cattle found in Malaysia. The KK cattle are usually found in the northern and eastern regions of Peninsular Malaysia. The census, on the other hand, established that this breed is found in every state in Peninsular Malaysia. KK cows have brown fur, a short but wide head, small ears, small horns of various sizes and a small but compact body with a perfect back-to-body ratio (DVS, 2020). Over 75 % of beef cattle are KK crossbreds (Table 3). The feedlot farmers and commercial farmers may easily rear these on their farms as they are easy to manage, suit the environment well, have high disease resistance, and are highly marketable to consumers. This survey indicated that KK and its crosses remain as the primary breed since it was last reported by Jalaludin and Halim (2014) and Ariff *et al*. (2015). However, it is unlikely to find this pure breed among farmers anymore as they did not practice a good breeding programme, with limited animal numbers to do so. Table 3 shows several breeds found during the censuses. Other important breeds are Local Indian Dairy (LID), Brahman and Charolais and their crosses, which represents 10.1, 8.5 and 2.7 % of the total numbers in the survey, respectively.

The censuses found that farmers raise multiple breeds of cattle simultaneously. There are only seven farmers rearing single-breed cattle. They are either rear KK crosses, Brahman or Charolais breeds with numbers not exceeding 20 heads at times. Farmers claim that Charolais breeds have an adult weight of up to 800 kg and have a higher selling price compared to local hybrid breeds. Young males (calf) and steer have good value, price, and market potential as a bull. Bull also has their niche market for Qurban during the Hajj season although known for its higher price.

Table 3. Beef cattle breed reared by cattle farmers within Peninsular Malaysia; n=75

Cattle breeds	Census 1	Census 2	Total Cattle (head)	Average Percentage (%)
Brangus and crosses	5	0	5	0.1
Bali	10	1	11	0.2
Belgian blue and crosses	4	0	4	0.1
Brahman and crosses	217	134	476	8.5
Brakmas and crosses	0	34	46	0.8
Charolais and crosses	123	22	150	2.7
KK and crosses	2414	1489	4208	75.3
Droughtmaster and crosses	2	70	90	1.6
Limousine and crosses	27	0	27	0.5
Local Indian Dairy (LID) and crosses	560	0	562	10.1
Nellore and crosses, etc	4	3	9	0.2
Subtotal			**5588**	**100**

Cattle Sex Ratio

The proportion of cattle sex ratio is tabulated in Table 4. Overall, the live female cattle have a greater number than male cattle as female cattle are used as breeding cows. The finding indicates the cattle sex ratio as 1:1, probably due to some of the farmers rearing only male cattle for Qurban and higher trade value, while some other farmers only focus on breeding cattle for a certain reason. Meanwhile, the sex ratio of the newly born calves shows a higher percentage of female than the male cattle.

Estimated KK Crossbred Physiological Weight

Animal body weight observed during field visits was estimated according to farmers' and officers' experience. The KK crossbred bodyweight is presented in Table 5. The body weight is higher than the pure KK cattle breed reported by Rosly *et al*. (2021). The higher weight may be due to crossbreeding activities of KK and other breeds, such as Brahman or LID, producing offspring with bigger body frame which increases the body weight. Yet, their physical appearances are more towards to KK breed. This is the transition

Table 4. Cattle field survey sex ratio; n=75

Sex ratio	Live animal (%)	Birth ratio (%)
Male	49.9	46.3
Female	50.1	53.7

of the farming practice from a small size cattle to a bigger size according to the farmers' need and practices. Although the cattle's appearance looks like a KK crossbred, only molecular characterisation methods can be used to predict the breed's composition.

bunds. Such practice is very appropriate if farmers own or have access (permission) to cropland or grazing areas that commensurate with the number of cattle raised. Because of the land use competition, some traditional farmers in the suburbs who use the free-release system

Table 5. KK crossbred liveweight range based on sex and age; n=42

Cattle age	Weight range (kg)	Mean weight (kg)	Maximum weight recorded. (Inclusive of other breeds) (kg)*
Born (calf) weight	10-30	22.8	60
Male			
< 1 year old	20-120	63.3	150
1-2 years old	120-220	147.9	250
> 2 years old	200-400	369.8	800
Female			
< 1 year old	20-120	67.2	150
1-2 years old	120-180	136.5	250
> 2 years old	200-250	242	400

Note: *= animal weight estimations recorded based on other breeds; n=75.

Beef Cattle Production System

Animal production is considered an essential component of an agricultural system. In general, cattle farming is carried out either intensively (in the barn), semi-intensive (being in the barn and grazing) and extensive (grazing in the field or integration). The current finding shows that extensive farming (grazing and integration practices) overrules other production systems by at least 23 % (Table 6). The censuses found that 55.7 % of farmers practice extensive farming with more than 70 % practising the integration under oil palm plantations or orchards. Some of the farmers let these cattle graze in paddy fields, agricultural reserves, riverbanks, or irrigation no longer have access to livestock-friendly areas. This finding contradicts the previous report that the beef industry is primarily based on a semi-intensive production system as practised by many smallholders in the villages (Ariff *et al*., 2015). Integration farming help farmers face the challenges on the rise of animal feed cost to ensure that this field of business provides returns in line with the inputs. It is also a solution to the shortage of local meat supply in Malaysia due to restricted grazing pasture. In Malaysia, the most suitable integrated crop-livestock farming approach that might help to increase the Malaysian beef sector SSL is the integration under oil palm plantations (Ahmad *et al*., 2018).

Semi-intensive reduces animal safety issues such as animal theft outside of grazing time, typically at night-time. Semi-intensive farming involves the cattle getting their feed by grazing within allocated areas in the morning and being kept later in the evening. The cattle may also receive additional feed when they are kept in the yard. Intensive farming, on the other hand, requires high costs, especially for feed materials and human resources. Thus, only 32.9 % of the respondents have taken this path as their farming system. However, this type of farming only requires a small area for the yard but a more comprehensive management system, including manure management. Since the late 1970's, several intensive farms were set up in the country. Most of these farms were involved in the breeding and fattening beef cattle and milk production from dairy. Yet, the farms suffered from recurring negative cash flows, which led to their eventual closure (Ariff *et al*., 2015).

As for the business model term, Table 7 shows that 70.7 % are individually owned farms without any registered business under SSM. This finding aligns with the earlier result on small-scale farming activities (Ariff *et al*., 2015). In addition to this, nearly half of the farmers reported having other livestock activities and beef cattle farming (Table 8) as part of their free time activities and considered backyard farming. They mostly rear small ruminants (goat or sheep) as well as buffaloes and chicken. In addition to horses and poultry, some farmers also kept camels and other small animals, such as rabbits and deer.

Table 6. Beef cattle production system on beef cattle farms in Peninsular Malaysia; n=75

Production system		Sub percentage	Percentage (%)
Intensive			32.9
Semi-intensive			11.4
Extensive	Grazing elsewhere	29.5	55.7
	Intercrop/integration	70.5	100

Table 7. Farming business activity types among beef cattle farmers

Farming Business Types	Number of farmers	Sub percentage (%)
Self-own	53	70.7
Enterprise	18	24.0
Sdn. Bhd.	4	5.3
Total farm observed	75	100

Table 8. Livestock farming involvement with other livestock commodities

Involve in other livestock production	Percentage (%)
Yes	49.3
None	50.7

Feeding Materials

This country's lack of grazing area has not discouraged it from pursuing large-scale cattle production. The integration of cattle farming in oil palm estates is a simple approach to overcome the limitation of land grazing areas. However, farmers practising semi-intensive farming and intensive farming need a large amount of animal feed for their livestock. Animal feed is one of the major costs in cattle farming besides animal infrastructures in intensive cattle farming. Field observation on farmers' farms discovered that the majority of farmers' feeding is not uniform and do not rely on grass sources. Most of the time, local feedstuffs are used to feed ruminants (Ibragimov *et al.*, 2016). In addition to grazing, farmers provide concentrate pellet and supplementary grass to animals, which includes native grass that grows wild along roadsides, ditches, and rivers banks, as well as grass that has been cultivated, such as Napier grass by cut and carry to their barn. Agricultural and industrial by-products are also frequently used. Utilising these by-products addresses the issues of excess waste, among others, of corn planting industry, soybean hull, and waste from the oil palm industry such as palm oil mill effluent (POME) and palm kernel cake. Other components are also given as listed in Table 9, although their levels are not detailed and do not correlate to the feed diet's formulation. In addition, the animals are found to be given unlimited and excessive amounts of POME on a continuous basis in most feedlots' farms.

Table 9. A list of animal feeds used among beef farmers within Peninsular Malaysia.

No	Feed material / types
1	Concentrate / pellet
2	Grasses
3	Napier grasses
4	Palm oil mill effluent
5	Corn plantation waste
6	Palm kernel cake (PKC)
7	Soy bean hull
8	Oil palm frond
9	Rice husk and paddy waste (padi hampa)
10	Corn silage
11	Grass silage
12	Rice straw
13	Potato waste
14	Banana trunk waste
15	Pineapple waste
16	Banana industry farm waste and etc.

Figure 2. Banana waste collected and reused as animal feed material at one feedlot farm in Southern Peninsular Malaysia

Animal Breeding Practices

In general, this survey revealed that both controlled and uncontrolled breeding program have been practiced in beef cattle farm in Malaysia (Table 10). Over 85 % of the farmers bred their cows by natural mating method all year round. This is still the most frequently used as it is cheaper than the artificial insemination method for cattle breeding within the South Asia Pacific region including Thailand, Indonesia, and Malaysia (Herath *et al.*, 2009; Malik *et al.*, 2012). None of the farms have seasonal breeding practice, excluding a farm practising up to four times mating cycles per year for their animals. This is related to the cattle's ability to reproduce at any time of the year, and the recovering period after calving is as short as 60 days. Of the total beef cattle producers interviewed, 26 farms (61.9 %) have a structured breeding programme with specific bulls, either with or without artificial insemination (AI) breeding programme, and ten farmers have random mating breeding system. Only six farmers practise AI on their cows, representing only 14 % of the total number of farmers. A structured breeding programme using a specific bull by natural mating or by AI is often practiced using different sire-breeds to enhance performance, typically the body size, weight, mainly utilising selected breeds such as the Limousin and Charolais (Herath *et al*., 2009). Meanwhile, random mating practices are applied when the stocks have reached its reproductive maturity age (Mohammed *et al.*, 2021).

Table 10. Breeding practices among beef cattle farmers in Peninsular Malaysia; n=42

Breeding (mating) programme	Farm numbers	Percentage (%)
Structured breeding using specific bull	26	61.9
Artificial Insemination (AI)*[1]	6	14.2
Random mating	10	23.8
None*[2]	6	14,2
Total	**42**	**100.0**

*[*1]AI practices is within farmer with structured breeding programme*
*[*2]Farmer practising feedlotting on male cattle, no breeding programme involved*

Cattle Selling Practices

The censuses of the selling trend by beef cattle farmers showed that 67.8 % of adult cattle are sold when the animal reached above 2 years old, while the rest of the farmers sold young cattle (28.7 %) as shown in Table 11. This is likely to cope with the demand during the festive season such as Eid Fitr and Eid Adha. Our finding also indicated that 69.5 % are sold as live animals while the rest as carcasses. Most farmers tend to sell whole carcasses (66.7 %) to wholesaler or butcher compared to retail cut (33.3 %). Selling as a retail cut may yield a higher profit but requires more effort aside to farm routine work. Male cattle (55.7 %) are sold more than the female cattle (22.6 %) (Table 12). Meanwhile, 21.7 % of farmers sold both their male and female cattle. These fractions require consideration on grower male cattle for farmers to focus on production system business model.

Table 11. Beef trade practices among beef farmers in Peninsular Malaysia; n= 67

Beef cattle selling practices	Percentage (%)
Young (any age less than 24 months)	28.7
Adult (> 2 years)	67.8
Live	69.5
Carcass	30.5
Whole carcass	66.7
Retail (fresh meat cut)	33.3

Table 12. Beef cattle sex ratio trade practices among beef farmers in Peninsular Malaysia; n=67

Beef cattle selling practices	A beef cattle sex ratio trade practices among beef farmers in Peninsular Malaysia; n=67
Male	55.7
Female	22.6
Both (Male and Female)	21.7

Manure Management

Since 55.7 % of farmers practice extensive farming, which means they either rear their animals in the backyard or integrates with oil palm trees, and some with orchards, natural or no manure management is considered. Therefore, manure management context was observed only on intensive farming farms during the censuses. Typical manure management in the barn/yard is either solid or liquid as slurry manure. Over half of the intensive farmers choose solid over liquid manure management (Table 13). In addition, slightly over half of these farmers process their solid manure as organic fertiliser.

Compared to solid manure, liquid manure is much easier to handle by waterjet spray and gradually flows to an anaerobic storage pond. Yet it requires a larger volume as compared to solid waste. Less than 50% of farms practise liquid manure storage and this slurry does not have a further treatment process. Cattle slurry can be utilised as organic fertiliser (Eickenscheidt *et al.*, 2014) that contains moisture and typically nitrogen and phosphorus. Yet, no farmers took the advantage to recycle their slurry manure to their crops or pastures although the slurry is an important source for ammonia and GHG emission throughout the entire storage period (Amon *et al.*, 2006).

CONCLUSION

Malaysia beef cattle are dominated by KK crossbreds with over 75 % ratio compared to other breeds. These cattle are mainly reared on integration under oil palm plantations or in the orchards. The adult weight of this breed is ranged between 200-400 kg. This is a presumed native KK crossbred breed with males weighing 370 kg and females 242 kg. The beef cattle physiological measurements can be improved by measuring actual animal body weight gain across their physiological growth at selected farms with an appropriate number of KK crossbred cattle on the field. Most farmers practice simple breeding by natural mating, either using specific bull or unknown male cattle. The animals are fed with TMR and grasses along with other agricultural waste products. Within the intensive farming yard, the animal discharges are treated as liquid manure without further management (unmanaged). The censuses indicated that two-thirds of cattle farmers are smallholders and have no business registration records.

The way forward in improving the beef cattle industry may lay in improving the small-scale farmers to the smallholder dairy-beef enterprises or to medium-scale farmers (greater cattle numbers), re-organise as groupings or teams or "*koperasi*" within the zone area, firm or enterprises, and short-term fattening of feeder cattle.

Table 13. Beef farm manure management from an intensive production system

Manure form	Management	Percentage (%)
Solid	Manage / processed	27.9
	Unmanage / unprocessed	23.0
Liquid	Unmanage / unprocessed	49.2
Subtotal		**100**

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