Characteristics of cattle production around teak forest in Bojonegoro, East Java

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Abstract. East Java has a large number of cattle and also a wide area of teak forest. It is believed that the existence of teak forest influences cattle production by smallholders. The objective of the study was to get insight into characteristics of cattle production which are kept by smallholders who living near to teak forests. We interviewed 33 and 27 respondents in Napis and Windu hamlets, Bojonegoro Regency, East Java. The cattle production system was still traditional in the study area. The average herd size was 2.07±0.9 head per household with breeding as the most production type (80%). Peranakan Ongole (PO) cattle were the common cattle breed kept by respondents (90%) with about 86.7% of cattle were their ownership. Cut and carry system was the common feeding practice. Forest land is the major source of fodder. The teak forest also provided land for crop production for respondents. Artificial insemination was started used by cattle smallholders to mate their cattle since rarely bull kept by respondents. Saving was the common motivation of smallholders to keep cattle. Government programs to improve cattle reproduction performance are strongly needed.

1. Introduction

In Indonesia, the national demand for beef has an increasing trend. National consumption for beef in 2014 was 0.261 kg per capita per year. It increased to 0.417 kg per capita per year in 2017 [1]. Increasing purchasing power and human population might drive increasing in beef demand [2-4]. East Java province is one of the provinces in Indonesia which has the highest population of cattle [1] and about 95% of cattle were kept by smallholders [5]. Income is one of the several reasons farmers keep cattle in Java, besides other reasons such as capital savings for unexpected expenditure, manure for crops, social status, hobby, utilization of crop by-products, and draught animal [3].

Besides cattle, East Java also has a large area of teak forest whereas cattle smallholders are living around there. Teak tree is a high-value tree in Indonesia [6-8]. Napis village in Bojonegoro Regency is one of the villages in East Java Province which consists of a high number of cattle and a large area of teak forest. The existence of teak forest may influence the cattle production system. Better knowledge of cattle production system may give alternatives solutions to improve the productivity of cattle. Therefore, the present study had the objective to get insight into characteristics of cattle production which are kept by smallholders who living near to teak forests. We also studied the different
characteristics of beef cattle production by smallholders who living at different distances to the teak forest and market.

2. Method
We conducted a survey with four stages to achieve the study objectives. First, we selected one village which had the highest population of cattle and the largest area of the teak forest. We used secondary data from BPS [9] to select the village. In this first step, we selected Napis village, Tambakrejo sub-regency, Bojonegoro Regency. Then, to get a general knowledge about cattle smallholders in Napis village, we selected key informants to conduct a rapid rural appraisal. The rapid rural appraisal method is used to get insight into rural general conditions because of the quickness, robustness, and cost-effectiveness of this method in understanding the rural in a short time [10].

In the third step, we selected two hamlets (Napis and Windu hamlets) which have a different distance to market and teak forest. Napis hamlet represents a hamlet which is relatively close to the market and far from the teak forest. While Windu hamlet represents a hamlet which relatively far from the market and close to the teak forest. In the four step, we selected and interviewed respondents. The respondents were selected randomly. We interviewed 33 and 27 respondents in Napis and Windu hamlets, respectively. A structured questionnaire was used to interview respondents to get insight into the characteristics of smallholder cattle production. The respondents were asked about household characteristics, cattle production systems, and motivation to keep cattle. The interview was conducted in 2017.

The qualitative data were analyzed descriptively. The quantitative data were analyzed using a non-parametric test (Mann-Whitney test) to test the differences between the two hamlets. The collected data were analyzed using the Statistical Package for Social Science (SPSS) version 24.

3. Result and discussion

3.1. Respondent characteristics
The characteristics of respondents in study areas are shown in Table 1.

Table 1. The characteristics of respondents in Napis and Windu hamlets.

|                          | Napis Average ± SD | Windu Average ± SD | Mixed Average ± SD |
|--------------------------|--------------------|--------------------|--------------------|
| Number of respondent (n) | 33                 | 27                 | 60                 |
| Age (years)              | 47.6±9.5           | 46.7±12.2          | 47.2±10.72         |
| Household size (person)  | 3.4±1.32           | 3.6±1.15           | 3.5±1.24           |
| Education (% of household head in class) |                |                    |                    |
| No school                | 15.2               | 29.6               | 21.7               |
| Elementary school (6 years) | 60.6             | 55.6               | 58.3               |
| Junior high school (3 years) | 15.2             | 14.8               | 15                 |
| Senior high school (3 years) | 9.1              | -                  | 5                  |
| Higher education         | -                  | -                  | -                  |
| The main occupation of household head (%) |                |                    |                    |
| Farming                  | 66.7               | 77.8               | 71.7               |
| Labour/worker            | 18.2               | 7.4                | 13.3               |
| Trader/private business  | 9.1                | 11.1               | 10                 |
| Village officer/civil servant | 3.0            | 3.7                | 3.3                |
| Carpenter                | 3.0                | 0                  | 1.7                |
| Marital status           | 100% married       | 100 % married      | 100 % married      |
| Total farm size (m²)     | 6,280.3±4,330.9    | 6,458.1±4,484.8    | 6,360.3±4,364.0    |
| Farm in non-forest land (m²) | 5,977.3±4,490.6   | 3,628.5±4,09.3     | 4,920.3±4,570.9    |
| Farm in forest land (m²) | 303.0±428.6        | 2,829.6±1,797.2    | 1,440.0±1,844.6    |

*different superscripts in the same row indicate significant differences between Napis and Windu hamlets. Source: Komarudin et al. [11].
The average of age and household size of respondents did not differ between the two hamlets. The age and household size of respondents in both hamlets were similar. The average age and household size were 47.2 years old and 3.5 persons, respectively. The majority of respondents were farmers with education levels at elementary school. On average, respondents in the two hamlets used more than 5,000 m$^2$ land for farming.

The farming activities in the study area were mixed farming and there was a strong interaction between crops and cattle. Respondents used cattle manure as organic fertilizer for their land and used crop-by-products as feed for their cattle. Respondents were already aware that manure is better for their land than artificial fertilizer. As described by Devendra and Thomas [12], the implementation of mixed farming systems can improve soil fertility, soil structure, moisture absorption and can reduce run-off through providing manure from livestock as an organic fertilizer to farmland.

3.2. Cattle production system

The characteristics of cattle production by smallholders in Napis and Windu hamlets are shown in Table 2. More than 90% of respondents had experience keeping cattle for more than ten years. The number of cattle per household varied from one to five heads, with an average of 2.1 heads per household. The average number of cattle kept by respondents between Napis and Windu hamlets was not significantly different (P<0.05). The cattle production system was still traditional and crop oriented. The average herd size was 2.2 heads for respondents in Napis and 1.9 heads for respondents in Windu hamlet. This result was similar to the study of [13,14].

Peranakan Ongole (PO) cattle was the common breed of cattle kept by respondents in both hamlets. It constituted 74% of total cattle in Napis and 71% in Windu hamlet. To sell their cattle, all respondents in study areas depended on local traders. A similar result was observed [15]. However, the percentage of respondents who sell their cattle to local traders in the present study was higher than the study reported [15]. Difficult access to market, transportation, and lack of vehicle ownership suitable for livestock might make respondents prefer to sell their cattle to local traders. Selling cattle to local traders was easier than going themselves to the animal market and selling it there. However, in this way, respondents did not have good options for good bargaining to get a good price. Local traders visited farmers’ cattle stable and estimated the price of farmers’ cattle based on their estimation. Local traders also had a major role in providing cattle for respondents in both hamlets.

Artificial insemination (AI) was the primary mating method used by respondents in both hamlets. It was in line with other studies that found farmers, especially in Java island has already familiar with AI [16,17]. Furthermore, the application of this method was getting common in study areas since bull became rare kept by farmers. The application of AI will generate more profit for farmers compare to if they raised male cattle and did natural mating [18]. Moreover, in terms of price, AI is also one of the important factors affecting the profitability of cattle production [19]. Table 2 shows that only one bull was kept by respondents in study areas and it was kept by the respondent with a growing production type. Farmers usually sold their males calf as soon as it became young bulls. A lack of bull kept by farmers suggested a reason why cattle smallholders using AI to mate their cattle. The majority of respondents in study areas were breeders. It was in accordance with the study reported by Priyanti et al. [13] and Hanifah et al. [20]. It was also reflected in the high number of the cow which is kept by respondents. It accounted for 53% of total cattle among the respondents in Napis and 46% in Windu hamlets.

In the study area, there were no grazing lands. Teak forest area is not allowed for grazing cattle. Therefore, respondents collected grasses for their cattle in non-forest and also in forest areas, and brought it to their cattle (cut and carry system). Grass and crop by-products were the main feed in the respondents’ farm. They only used rice bran as supplementary feeds in small amounts. There was no feed with nutritional value feed such as commercial feed or concentrate used by respondents to feed their cattle. The main factor limiting the purchase of commercial feed was limited purchasing power. Respondents with growing or intermediate fattening usually bought calves or young bulls to keep it for less than one year. It was difficult to categorize them as a true feedlot. Unlike feedlot, they did not
give concentrate or any high nutritious feed to their cattle. However, they gave rice bran as supplementary feed at a much higher level than respondents with breeding purpose.

Table 2. The characteristics of the cattle production system in Napis and Windu hamlets.

|                                | Napis Average±SD | Windu Average±SD | Mixed Average±SD |
|--------------------------------|------------------|------------------|------------------|
| Experience in cattle keeping (%) |                  |                  |                  |
| > 10 years                      | 90.9             | 92.6             | 91.7             |
| ≤ 10 years                      | 9.1              | 7.4              | 8.3              |
| Number of cattle (head)         | 2.18±1.0         | 1.93±0.8         | 2.07±0.9         |
| Cattle ownership status (%) *   |                  |                  |                  |
| Owning                          | 87.9             | 85.2             | 86.7             |
| Sharing                         | 3.0              | 3.7              | 3.3              |
| Both                            | 9.1              | 11.1             | 10.0             |
| Production type (%) *           |                  |                  |                  |
| Breeding                        | 87.9             | 70.4             | 80.0             |
| Growing                         | 3.0              | 7.4              | 5.0              |
| Both                            | 9.1              | 22.2             | 15.0             |
| Cattle breed (%) **             |                  |                  |                  |
| Peranakan Ongole (PO) cattle    | 53 (74 %)        | 37 (71 %)        | 90 (72.6 %)      |
| Crossbred                       | 19 (26 %)        | 15 (29 %)        | 34 (27.4 %)      |
| Cattle (head)                   |                  |                  |                  |
| Bull (> 2 years)                | 1 (1 %)          | 0 (0 %)          | 1 (0.8 %)        |
| Cow (> 2 years)                 | 38 (53 %)        | 24 (46 %)        | 62 (50 %)        |
| Young bull (1-2 years)          | 4 (6 %)          | 10 (19 %)        | 14 (11.3 %)      |
| Heifer (1-2 years)              | 5 (7 %)          | 5 (10 %)         | 10 (8.1 %)       |
| Male calf (< 1 year)            | 11 (15 %)        | 5 (10 %)         | 16 (12.9 %)      |
| Female calf (< 1 year)          | 13 (18 %)        | 8 (15 %)         | 21 (16.9 %)      |
| Feeding practice                | cut and carry    | cut and carry    | cut and carry    |
| The main source of grass (%) *  |                  |                  |                  |
| Non- forest land                | 75.8             | 7.4              | 45.0             |
| Forest land                     | 9.1              | 81.5             | 41.7             |
| Both                            | 15.2             | 11.1             | 13.3             |
| Shelter for manure storage      | No               | No               | No               |
| Main cage material (%)          |                  |                  |                  |
| Wood                            | 97               | 100              | 98.3             |
| Bamboo                          | 0                | 0                | 0                |
| Brick                           | 3                | 0                | 1.7              |
| Main floor material of cage (%) |                  |                  |                  |
| Soil                            | 66.7             | 96.3             | 80               |
| Concrete floor                  | 24.2             | 0                | 13.3             |
| Stone                           | 9.1              | 3.7              | 6.7              |
| Recent mating method (%)        |                  |                  |                  |
| Artificial insemination         | 53.1             | 72.0             | 61.4             |
| Natural                         | 18.8             | 16.0             | 17.5             |
| Both                            | 28.1             | 12.0             | 21.1             |
| Selling cattle                  | 100 % to local traders | 100 % to local traders | 100 % to local traders |
| Buying cattle (%)               |                  |                  |                  |
| Local trader                    | 39.4             | 25.9             | 33.3             |
| Animal market                   | 15.2             | 37.0             | 25.0             |
| Another farmer                  | 18.2             | 3.7              | 11.7             |
| Never***                        | 27.3             | 33.3             | 30.0             |
| General opinion keeping cattle  | 2.36±0.1         | 2.52±0.1         | 2.43±0.1         |

* Calculated from total respondents.  
** Calculated from the total number of cattle.  
*** Cattle from their parents or result from sharing practice.

Distance to the teak forest influenced cattle feeding strategies in the study area. The main source of grass for respondents in Windu hamlet was forest land, while for respondents in Napis hamlet this was
non-forest land. Respondents in Windu hamlets relied more on the teak forest than respondents in Napis hamlet. Of the total respondents in Windu hamlets, 81.5% relied on forest land to collect grass for their cattle, while in Napis this was only 9.1%.

3.3. The motivation of respondents keeping cattle
Cattle are the most important livestock for villagers in the study area. Saving was the most common motivation of respondents to keep cattle (table 3). It was followed by income, manure, hobby, and utilization of crop by-product. Saving or financial security was the main objective of respondents keeping cattle. This result was in accordance with previous studies held in Java [3, 15, 17]. However, the term of saving was more than saving as usual. Cattle converted and accumulated uneconomic sources in the study areas such as grass and paddy straw to become a valuable asset in the form of cattle and calves. These assets grow along with the growth of cattle and calf production. The lowest respondent’s motivation for keeping cattle was social status.

Table 3. The motivation of respondents keeping cattle.

| No | Motivation       | Napis (n=21) | Windu (n=6) | Mixed          |
|----|------------------|--------------|-------------|----------------|
|    | Average±SD       | Rank*        | Average±SD  | Rank*          | Average±SD  | Rank*          |
| 1  | Saving           | 1.19±0.51    | 1           | 1.17±0.41      | 1            | 1.19±0.48      | 1            |
| 2  | Income           | 2.38±0.74    | 2           | 1.83±0.41      | 2            | 2.26±0.71      | 2            |
| 3  | Manure           | 3.38±0.97    | 3           | 3.17±0.41      | 3            | 3.33±0.89      | 3            |
| 4  | Utilization crop by-product | 4.71±0.64 | 5 | 4.5±0.55 | 5 | 4.67±0.62 | 5 |
| 5  | Hobby            | 3.48±1.25    | 4           | 4.33±0.82      | 4            | 3.67±1.21      | 4            |
| 6  | Social status    | 5.90±0.44    | 6           | 6.00±0.00      | 6            | 5.93±0.36      | 6            |

* The lowest score (1) indicates the most important reason.

The reason for respondents to sell their cattle can be categorized into two categories. First, they sell cattle to meet large, unexpected household needs. These could be hospital costs or house renovation. In this way, cattle production has a function as a safety net for respondents. Second, respondents sell their cattle to buy expensive farming assets and equipment such as additional land for crop farming, hand tractor, and motorcycle. A motorcycle is an important vehicle to improve the accessibility to the market to sell crops since limited public transportation. By having a hand tractor, respondents can minimize their crop farming variable cost sharply and also have the opportunity to get additional income through rent out their hand tractor to other farmers. Since livelihood options, including job opportunities, were limited in the study areas, keeping cattle seems an important livelihood strategy for respondents to enhance their household welfare.

3.4. Strategies to improve cattle production in study areas
In the present study, the majority of respondents was breeder, therefore the government programs to evaluate and improve reproduction performance are very important. As breeders, the income from cattle production is mainly driven by how many calves they can produce in a certain period. Age at first calving, number of services per conception, and calving interval are the three most important reproduction parameters. Therefore, intensive and continuous veterinary inspection is strongly needed. The use of superior cattle semen is also essential to ensure fattening quality and consequently prices of calves.

In addition, even though fodder is available throughout the year, an attempt to improve the nutritional value of cattle feed should be made. The use of commercial feeds seems not appropriate for smallholders in the study area since they have limited purchasing power and since there are also infrastructural constraints to get the commercial feeds at low costs at the farms. The implementation of simple local feed processing technology using local feed resources seems an appropriate alternative way to improve the feed quality in the study areas.
4. Conclusion
The cattle production system in the study area was still crop oriented and traditional. There seems however scope for expansion of cattle production. The existence of teak forest supported cattle production by providing feed for cattle in the form of grass and crop by-products from crop farming in the forest land. Saving was the common motivation of smallholders for keeping cattle. Keeping cattle had a function as a safety net for smallholders. Since the majority of smallholders in the study area was breeder, government programs to improve the reproduction performance of cattle are strongly needed.

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