

INVENTORY ANALYSIS OF SMALLHOLDER BEEF CATTLE IN EAST JAVA

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ABSTRACT

Smallholder cattle production in East Java makes a major contribution to the supply of beef in Indonesia. A research project is underway to investigate the potential to increase the productivity and incomes of Ongole Cross (PO) cattle producers based on existing feed supplies. However, little is known about the structure and dynamics of the smallholder cattle herd in different agro-ecological zones. As part of the project, monthly monitoring was undertaken throughout 2010 with 184 farmer-collaborators in two agro-ecological zones – the irrigated lowlands and the rainfed uplands. The lowland zone (50-150 m asl) was represented by 76 farmers in three adjacent villages in Probolinggo and Pasuruan Districts. The upland zone was represented by 108 farmers in one village in Malang District (500 m asl). For each breed, sex, and age-class of cattle, records were kept of the number of births, deaths, purchases, and sales, the number transferred from owners to keepers and vice versa, and the number moving between age-classes. The weight of cattle sold, the price received, and other data relating to sales were also recorded. The data were aggregated for all farmer-collaborators to provide an inventory of the cattle herd in each site, enabling an analysis of herd dynamics over the year. The number of cattle increased by 7% in the lowland site and decreased by 2% in the upland site. The calf crop was 62% and 54% in the lowland and upland sites, respectively, reflecting a generally low calving interval. Most of the cattle sold in the lowland site were calves (55%) due to insufficient feed for growing large numbers of cattle, while most sold in the upland site were adults (54%). European-cross calves dominated – 62% in the lowland site and 99% in the upland site – reflecting farmers' and traders' strong preference for the heavier calves resulting from these crosses. In addition, 37% of Ongole Cross heifers and cows in the lowland site and 27% in the upland site were sold during the year. Hence there was a trend away from Ongole Cross breeders within the aggregate herd to European crosses.

Key words: cattle inventory, smallholders, lowland, upland, East Java

INTRODUCTION

East Java is the province with the highest density of beef cattle in Indonesia, with about 4.7 million head or 32% of the nation's beef cattle population (Direktorat Jenderal Peternakan dan Kesehatan Hewan, 2011). Productive cows aged 1-6 years account for 54% of the provincial herd, or 2.6 million head (Kementan-BPS, 2011). To help achieve the target of beef self-sufficiency by 2014, the Provincial Government of East Java has launched the "Sapi Berlian" program with the aim of producing 5 million calves within five years. This program is an acceleration of a previous program that aimed for artificial insemination (AI)

of one million cows. The program is based on a targeted growth of 2.7% in beef production, requiring extraordinary actions to be realised (Kadir, 2009).

As is the general condition for beef cattle farming in Indonesia, smallholder operations in East Java commonly raise 2-3 cattle per household. A total of 1.6 million farmers in East Java are engaged in livestock farming, formed into a total of 1,422 farmer groups (Dinas Peternakan Provinsi Jawa Timur, 2011). The main reason for raising beef cattle is to generate household income to meet current farm-household needs, such as repaying consumption credit and buying production inputs (seed, fertilizer), or intermittent needs, such as school fees, health costs, and motorcycles. That is, cattle production is a regular source of cash income for the household (Priyanti, *et al.*, 2012). In a small number of cases the sale of cattle is used to acquire an asset (land, house) or pay for a major event.

To understand better the capacity of cattle smallholders in East Java to increase production and income in line with the government's targets, a study was undertaken of the herd dynamics in lowland and upland sites in East Java. As an individual household's herd is too small to capture these dynamics, an inventory analysis was carried out on the aggregated herds of groups of farmers in two contrasting sites. This analysis was related to farmers' access to resources to for beef cattle production, particularly feed and labour.

MATERIALS AND METHODS

A research project was initiated in East Java in 2010 to explore ways of increasing calf production and cattle growth rates utilising locally available feeds (ACIAR Project LPS/2008/038). A total of 184 farmers participated in the study in the first year (2010) within the two major agro-ecosystems, lowland and upland. The lowland site is represented by the villages of Klampok and Nguling in the districts of Probolinggo and Pasuruan, which encompass fertile irrigated plains about 25-150 masl (BPS Pasuruan, 2009; BPS Probolinggo, 2009). The upland site is represented by the village of Bantur, Srigonco, in the district of Malang, which is in a rainfed agricultural area about 550 masl with a seasonally dry climate (BPS Kabupaten Malang, 2009).

Monthly monitoring of all participants' cattle during 2010 included the cattle breed, sex, age, births, deaths, purchases, sales, cattle transferred from owners to keepers and vice versa, the price of any animals sold or bought, the reason for selling, the use of money from the sale, and the type of cattle buyer. Farmers owned cattle of several breeds, mostly local cattle (Ongole Cross, PO) and PO crossed with Simmental or Limousin.

RESULTS AND DISCUSSION

Characteristics of Farmers

During 2010, a total of 184 farmer-collaborators were involved in the study – 76 in the lowland site and 108 in the upland site. A preliminary household survey found no obvious differences between lowland and upland sites in the characteristics of farm-households (Hanifah *et al.* 2010). On average, farmers were in their 40s, and had small families (4-5 members), limited education (not completing elementary school), but around 20 years of experience in agriculture and cattle production. While most respondents in both sites indicated that farming was their major occupation, over a quarter of lowland farmers (28%) relied mainly on farm or non-farm wage work for their livelihood because the land they managed was not sufficient to support them. Hence, for them, own-account crop and livestock activities were necessarily a secondary source of income.

Trends in Cattle Numbers

Table 1 presents monthly cattle numbers in the two groups by breed. It can be seen that, although the average number of cattle owned was just over 3 in both sites, farmers in the upland site managed more crossbred cattle (1.6 per household) than in the lowland site (0.8 per household). It is interesting that the number of PO cattle decreased throughout the year by 3.2% and 17.8% in the lowland and upland sites, respectively, while the number of crossbred cattle increased by 29.8% and 10.8%. Mahendri *et al.* (2010) found that the price of crossbred cattle was generally higher than for PO cattle (20-30% higher for crossbred calves and up to 50% higher for crossbred adults).

Table 1. Monthly cattle numbers by site and breed, 2010

Month	Lowland (n=76)		Upland (n=108)	
	Local (PO)	Cross-bred	Local (PO)	Cross-bred
January	188	54	151	164
February	183	50	149	163
March	189	54	148	169
April	191	57	148	174
May	185	56	145	176
June	185	51	139	176
July	180	51	136	183
August	183	52	133	181
September	182	61	131	175
October	189	63	131	175
November	186	74	127	183
December	182	77	124	184
Monthly mean	185	58	139	175

Household mean	2.43	0.76	1.29	1.62
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Herd Structure

The cattle were categorized in three groups according to age – calves (< 1 year), young (1-2 years) and adult (>2 years). Table 2 shows the age structure of the herd averaged over the 2 years. Adult females accounted for 74% of PO cattle in the lowland site and 86% in the upland site, indicating that PO cattle still formed the basis of the breeding herd. However, in the upland site, crossbreds predominated in the female calves and young female categories, indicating that the breeding herd was rapidly moving away from pure PO stock. On average, calves accounted for 67% and 54% of the herds in the lowland and upland sites, respectively. The predominance of crossbred calves, especially in the upland site, again indicates the preference for using artificial insemination (AI) with European breeds. The table also confirms that the use of natural mating was very rare in the villages since only a small number of adult male cattle were retained.

Table 2. Mean number of cattle by age class, sex, breed, and site, 2010

Age	Lowland		Upland	
	PO	Crossbred	PO	Crossbred
Adult male (> 2 year)	2.3	0.2	3.1	7.7
Adult female (> 2 year)	136.2	8.0	118.6	25.2
Young male (1-2 year)	4.8	3.0	2.4	14.3
Young female (1-2)	21.4	8.2	2.4	34.0
Calves male (< 1 year)	10.3	18.8	3.6	40.8
Calves female (< 1 year)	10.2	20.4	8.4	53.7
Total	185.2	58.5	138.5	175.6

Births and Deaths

There were 94 calves born during 2010 in the lowland site and 83 in the upland site (Table 3). This indicated an estimated calf crop of 65% and 58%, respectively, indicating that the calving interval is likely to be well below the target of one calf per year. Most of the calves born were crossbred – 62% in the lowland site and 99% in the upland site – again reflecting the high use of AI, especially in the upland site, and the strong preference for breeding crossbred cattle. Calving occurred throughout the year, with an apparent peak during August-November in the lowland site (whereas the wet season is from October to April). This indicated that there was little attempt to manage mating based on the availability of feed; AI was available throughout the year as long as the cows had estrous. Calves born in

the wet season when feed is abundant would have lower risk of mortality due to insufficient feed. Poppi *et al.* (2010) report that seasonal controlled mating aims to achieve timely calving to ensure the calf drop matches the supply of feed from pasture growth, crop residues, and other available feeds to meet cow-calf requirements during early lactation and to enable the cow to produce sufficient milk and calves to get access to good green feed. Controlled mating can be achieved by natural mating using a good quality bull according to the availability of feed.

Table 3. Number of calves born monthly, 2010

Month	Lowland				Total	Upland				Total
	PO		Crossbred			PO		Crossbred		
	Male	Female	Male	Female		Male	Female	Male	Female	
January	0	0	0	0	0	0	0	0	0	0
February	0	0	1	1	2	0	0	1	0	1
March	4	2	1	3	10	0	0	4	5	9
April	1	2	2	3	8	0	0	6	5	11
May	1	2	0	2	5	0	0	4	3	7
June	2	0	0	3	5	0	0	2	4	6
July	1	2	1	1	5	0	0	6	5	11
August	3	3	2	3	11	0	0	4	2	6
September	1	2	4	6	13	0	0	4	3	7
October	3	5	2	3	13	0	0	4	2	6
November	1	0	5	8	14	1	0	6	5	12
December	1	0	5	2	8	0	0	5	2	7
Total	18	18	23	35	94	1	0	46	36	83

Only a small number of cattle died during 2010, accounting for 0.8% of the starting population in the lowland site and 1.9% in the upland site. Mortality was mostly due to calves being unable to suckle. In general, farmers looked after their cattle very carefully and managed cattle sheds and enclosures daily.

Purchases and Sales

During 2010, 17% of farmers in the lowland site and 5% of farmers in the upland site purchased cattle. The reasons for purchasing cattle were to increase the breeding herd for cow-calf operations (58%), followed by acquiring cattle for growing (23%) and fattening (16%). Therefore, the cattle purchased were mostly young and adult females for cow-calf and growing operations, followed by adult males for fattening.

During 2010, 79% of farmers in the lowland site and 49% in the upland site sold cattle of various ages. In gross terms, lowland farmers sold 91 head, or 38% of opening herd

numbers, while upland farmers sold 70 head, or 22%. This reflects the higher percentage of calves sold in the lowland site. Table 4 shows the pattern of sales over the year. Sales tended to increase in the second half of the year when the major Islamic festivals occurred. This was also the period of increased calving in the lowland site.

In the lowland site, cattle sold were fairly evenly distributed between PO (56%) and crossbred (44%), while in the upland site sales were dominated by crossbred animals (72%). A surprising number of adult female PO cattle were sold (26% of the total number sold in the lowland site and 24% in the upland site). This was partly due to culling infertile or otherwise less productive cows, but may also reflect a strategy of moving away from pure PO herds.

Table 4 also shows that farmers in the lowland site sold mostly calves (55%). This reflects the fact that this site is more intensively farmed so farmers have cropping activities all year round, hence limited time for cattle and insufficient feed and space to grow cattle. The calves are presumably bought by traders and shipped to other districts with better resources for growing and fattening. Upland farmers were able to grow more animals to adults before selling them.

The main reasons given for selling cattle were to meet farmers' needs (68% of farmers), to cull animals due to infertility, sickness or injury (18%), or due to difficulties with the supply of feed or extending the cattle shed (13%). This finding is similar to that reported by Mahendri *et al.* (2010). The decision to sell was mainly taken by the husband (85% of farmers in the lowland site and 94% in the upland site). Culturally in East Java the husband is regarded as the head of the household and the owner of household assets, including livestock.

The average selling price is shown in Table 5. In general, the price for crossbred cattle was higher than for PO cattle, except for adult PO cattle in the lowland site. This may have been due to the time of sale during Idul Adha or Haj (Islamic holidays) when PO cattle get a higher price. The selling price was related to traders' visual estimate of body weight, based on the conformation, body condition, and breed of the cattle.

Table 4. Number of cattle sold monthly, 2010

Month	Lowland (n=60)												Tot	Upland (n=53)												Tot	
	PO						Crossbred							PO						Crossbred							
	Adults		Young		Calves		Adults		Young		Calves			Adults		Young		Calves		Adults		Young		Calves			
	M	F	M	F	M	F	M	F	M	F	M	F		M	F	M	F	M	F	M	F	M	F	M	F		
Jan	0	1	0	1	1	0	0	0	0	0	0	2	2	7	0	1	0	0	0	0	0	1	0	0	0	0	2
Feb	0	2	1	0	0	0	0	0	0	0	0	1	1	5	0	0	0	0	0	0	1	0	0	2	0	0	3
Mar	0	0	0	0	0	0	0	0	0	0	0	1	1	2	0	0	0	0	0	0	1	0	1	0	1	0	3
Apr	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	1	0	3
May	0	2	1	1	3	0	0	1	0	0	0	0	0	8	0	3	0	0	0	0	1	0	1	0	1	0	6
Jun	0	1	0	1	0	2	0	0	0	0	0	4	1	9	0	3	0	0	0	0	1	0	0	0	0	0	4
Jul	0	3	1	1	2	0	0	0	0	0	0	2	0	9	0	1	0	0	0	0	2	1	1	0	1	1	7
Aug	0	1	0	0	0	1	0	0	0	0	0	2	3	7	0	1	0	0	0	0	0	2	1	1	1	2	8
Sep	0	3	0	0	1	0	1	0	0	0	0	1	0	6	0	2	0	0	0	0	3	0	3	0	3	1	12
Oct	0	1	0	0	2	0	0	0	1	1	3	2	10	0	1	0	0	0	0	3	2	0	0	0	0	0	6
Nov	1	6	0	0	0	1	0	0	0	0	0	2	5	15	2	2	0	1	0	0	1	0	0	0	0	0	6
Dec	1	2	2	1	1	2	0	0	1	1	0	1	12	12	0	3	0	0	0	0	0	0	2	0	2	3	10
Total	2	23	5	5	10	6	1	1	2	2	18	16	91	2	18	0	1	0	0	13	6	10	3	10	7	70	

Table 5. Average selling price (IDR thousand)

Cattle age	Lowland (n=60)		Upland (n=53)	
	PO	Crossbred	PO	Crossbred
Adult males (> 2 years)	7,650	6,500	8,800	10,703
Adult females (> 2 years)	4,785	na	4,430	5,450
Young males (1-2 years)	4,900	3,875	na	7,595
Young females (1-2 years)	4,670	4,550	4,500	4,333
Calves male (< 1 year)	2,500	3,063	na	3,125
Calves female (< 1 year)	2,100	2,546	na	3,435

na = no cattle sold

Inventory Analysis

Table 6 and Table 7 show the change in the cattle inventory during 2010 in the lowland and upland sites, respectively. The number of cattle in each category was recorded at the start of the year, and all births, deaths, purchases, and sales were recorded, month by month. Besides raising their own animals, some farmers also managed cattle as keepers under a sharing system. The most common sharing practice was that one cow would be raised by a keeper for a given time period, with the first calf belonging to the keeper and the second calf to the owner. The movement of cattle between owners and keepers was also accounted for as this influenced the number of cattle inventory throughout the year, which may have increased or decreased cattle population herd in the village.

The total number of cattle increased by 7% in the lowland site. This was mainly due to a net increase in the number of both PO and crossbred calves. This increase in calf numbers more than offset the decline in adult PO females, which was mainly due to sales, as noted above.

In contrast, the total number of cattle decreased marginally by 2% in the upland site. In this case the increase in calf numbers was more or less offset by the sale of adult PO females and the sale of crossbred animals in all age classes. In both sites there was a small but significant movement of cattle from owners to keepers and keepers to owners across age categories and breeds.

Table 6. Inventory analysis for the lowland site, 2010

Cattle breed and age	No. at start	No. born (+)	No. purch -ased (+)	No. died (-)	No. sold (-)	Owners (O)		Keepers (K)		No. at end
						O to K (-)	K to O (+)	O to K (+)	K to O (-)	
PO										
Adult male	2	-	1	-	2	-	-	1	-	2
Adult female	143	-	-	-	23	3	2	8	3	127
Young male	6	-	-	-	5	-	-	-	-	3
Young female	24	-	5	-	5	1	-	1	-	24
Calves male	7	18	2	-	10	2	-	-	-	13
Calves female	6	18	-	1	6	1	-	-	-	13
Crossbred										
Adult male	-	-	1	-	1	-	-	-	-	0
Adult female	8	-	1	-	1	-	-	1	-	10
Young male	3	-	1	-	2	-	-	1	-	3
Young female	7	-	-	-	2	-	-	-	-	8
Calves male	20	23	-	-	18	3	-	2	-	24
Calves female	16	35	2	1	16	1	-	1	-	32
Total	242	94	13	2	91	11	2	15	3	259

Table 7. Inventory analysis for the upland site, 2010

Cattle breed and age	No. at start	No. born (+)	No. purch -ased (+)	No. died (-)	No. sold (-)	Owners (O)		Keepers (K)		No. at end
						O to K (-)	K to O (+)	O to K (+)	K to O (-)	
PO										
Adult male	3	-	-	-	2	-	-	-	-	2
Adult female	129	-	-	1	18	5	2	-	3	106
Young male	3	-	-	-	0	-	-	-	-	2
Young female	2	-	1	-	1	-	-	1	-	2
Calves male	4	1	-	-	0	-	-	-	1	4
Calves female	10	0	-	-	0	1	-	-	-	8
Crossbred										
Adult male	14	-	-	1	13	4	2	1	2	-1
Adult female	24	-	3	-	6	1	3	3	1	27
Young male	17	-	1	-	12	-	2	-	-	10
Young female	38	-	1	2	3	3	-	1	2	33
Calves male	30	46	-	1	10	4	-	1	-	55
Calves female	41	36	-	1	7	3	1	-	2	60
Total	315	83	6	6	72	21	10	7	14	308

CONCLUSION

Policy targets for East Java imply a rapid increase in beef cattle numbers and productivity. This analysis of inventory change in two smallholder “herds” during 2010 has shown that, while change is occurring, it is not necessarily supporting the growth targets. Total numbers of cattle increased slightly in the lowland site and decreased slightly in the upland site, indicating that in neither site is there a steady build-up of the breeding herd. In both sites there was a tendency to sell PO cows, beyond the expected culling rate, leading to an overall decline in the total number of adult females rather than a build-up. The number of young females was steady or declining. This, combined with a clear preference for the use of AI with European semen, was leading to a change in the breed composition of the herds towards crossbred animals, reflecting the higher returns to selling crossbred calves and adults. The limited spare capacity in the lowland site was seen in the high incidence of selling calves, to be grown in other districts, whereas farmers in the upland site grew more animals for sale at older ages. In both sites, reproduction rates remained low, with a calf crop of around 65% in the lowland site and 58% in the upland site, well below the target of one calf per cow per year, though cattle mortality was low at 1-2%. Greater use of natural mating, better coordination of mating with available feed supplies, and targeted use of legume-feeds may help to improve reproductive performance and increase cattle numbers and growth rates, but achieving these productivity gains may be difficult given the resource constraints and market signals experienced by farmers.

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