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RESEARCH ARTICLE

PRODUCTIVE AND REPRODUCTIVE PERFORMANCE AND MANAGEMENT PRACTICES OF CROSSBREED DAIRY COWS AT JIMMA COLLEGE OF AGRICULTURE AND VETERINARY MEDICINE DAIRY FARM, ETHIOPIA

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ABSTRACT

The aim of this study was to investigate management system and productive and reproductive performance of crossbred dairy cows reared at Jimma College of Agriculture and Veterinary Medicine dairy farm. The main focus was on identification of reproductive and milk yield performance of crossbred dairy cows including age at first calving, calving-interval, days open, daily and total lactation milk yield, mortality, general management and major constraints to milk production. The study was based on data compiled for 10 years (1996-2005). A total of 63 records out of which 45 data records were used to evaluate reproductive performances. All considered performance traits (age at first calving, calving interval, days open till conception, daily and total lactation yield and lactation length) were analyzed. For the estimation of days open till conception, records with no service date were excluded. Results from the study show that average age at first calving, calving interval and days open till conception were 46.8 ± 1.9 , 15.6 ± 0.6 and 6.65 ± 0.11 months, respectively. The mean daily and lactation milk yield were 5.6 ± 0.8 and 1748.9 ± 228.9 litres per cow, respectively. The average lactation length was 302 days. The major sources of feed were natural pasture, green feed, hay, silage, commercial and on farm formulated concentrate, agro-industrial by-products and milling by-products. Cows are hand milked with twice milking frequency a day. Mortality rate of calves over ten years was 34.26%. The major constraints were feed shortage, disease and parasites, low milk yield of cows, lack of artificial insemination and lack of adequate budget. Prospects for improvement of the performance of the farm include improved management in terms of feeding, disease and parasite control, proper breeding management, improved genotypes and artificial insemination services, as well as allocation of adequate budget.

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INTRODUCTION

Ethiopia, which is one of the tropical countries, has the largest cattle population in Africa, which is estimated at 38.75 million (CSA 2005). In Ethiopia, cattle account for 97% of the country's annual milk production (Tedla et al 1991). It was reported that milk yield of indigenous cows ranged between 500 and 700 liters in less than 100 days of lactation period, under average to good management conditions (EIAR, 1976). Even under a research center management condition, average milk yield did not exceed 500 liters and lactation length was about 150 days (Mukasa-Mugerwa 1989; Yilma 1999). The productivity of the indigenous cattle is low. Usually cows do not produce their first calves earlier than 35-53 months of age and calving interval is about two years (Mukasa, Mugerwa and Azage 1991). Milk production per head per day is very low and this is further affected by relatively short lactation length and extended post-partum anoestrus period resulting in lower productive efficiency (Azage and Alemu 1998).

Even with improved feeding of the indigenous breeds, significant increase in animal output could not be attained without change in the production potential of animals (Sendros and Tesfaye 1997). The low productivity is principally due to poor management practices, poor nutrition, high parasitic and disease incidence, and lack of high genetic potential (Mason and Buvanendran, 1982). One way of improving cattle breed in Ethiopia regarding to milk production is through crossbreeding with exotic dairy breeds. This has been widely used in order to combine the high milk yield potential of exotic breeds with the adaptability of the local ones. Jimma College of Agriculture and Veterinary Medicine (JUCAVM) rear crossbred dairy cattle predominantly for teaching, research and community training. This farm supplies milk to the staff of JUCAVM and to the nearby community. The farm also sells when available young bull calves which are not maintained on farm to the nearby smallholder farmers as one of its community outreach services. However, there is little information published on reproductive and production performance, general management and constraints associated with performance of

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dairy cows kept on the farm. The objective of this study was, therefore, to investigate management practices and the productive and reproductive performance and constraints to performance of dairy cows reared at JUCAVM dairy farm.

MATERIALS AND METHODS

Description of the study area: The study was carried out at Jimma College of Agriculture and Veterinary Medicine (JUCAVM) dairy farm. JUCAVM is located in Oromia Regional State at 355km in southwestern Ethiopia, having a latitude of 7°41'N and longitude of 36°50'E and at an altitude of 1760 masl. The area is characterized by a humid tropical climate of heavy annual rainfall that ranges from 1200 to 2000 mm. About 70% of the total annual rainfall is received during wet season, which lasts from the end of May to early September. The area has a relatively higher temperature of about 25°C to 30°C from January to April, having a minimum temperature of 7°C to 12°C during the months October to December (OPEDJZ, 2002)

Data collection: Both primary and secondary data was used in this study to achieve the intended objectives. A structured questionnaire was designed to generate data collection of both qualitative and quantitative parameters such as feeds and feeding, housing, sources of water and frequency of watering, milking practices, breeding method, diseases and disease control and farm constraints. Secondary data regarding productive and reproductive performance of crossbred dairy cows was gathered from ten production years (1996 to 2005). Personal observation, discussions with farm manager and employees was also used to collect data.

Data analysis: The qualitative and quantitative data collected were described using a descriptive statistic such as mean, standard deviation and percentages.

RESULTS

Herd size and structure: The herd size and structure of the farm during the study time is shown in Table 1. The dairy farm under the study consisted of different types of cattle. It was observed that the percentages of calves, pregnant heifers and lactating cows were 29.17%, 25% and 16.67%, respectively. The local heifers are the Borana breed, which is one of the dominant breed in Ethiopia used for crossbreeding. The four cows produce on average 12 liters of milk per day.

Table 1: Different categories of dairy cattle (%) in the farm during the course of the study (2010)

Type of cattle	Frequency	Percentage
Crossbred cattle		
Lactating cows	4	16.67
Pregnant heifers	6	25.00
Heifers	2	8.33
Female calves	7	29.17
Male calves	2	8.33
Bull	1	4.17
Indigenous cattle		
Heifers	2	8.33
Total	24	100

Productive and reproductive performance

Three measures of reproductive performance, namely age at first calving, calving interval and days open and two measures of production performance, namely lactation length and milk yield per day and per lactation were analyzed. The reproductive and production performances are depicted in (Table 2).

Age at first calving (AFC)

The overall mean age at first calving observed in the present study was 36.8 ± 1.9 months (Table 2). Despite these crossbred cows own high exotic blood level, 62.5% and above, the time gap between the birth and age at first calving is very much longer, the same to local breeds reared by smallholder farmers with low management level. As many studies indicated crossbred dairy heifers owning more than half of exotic blood level in tropics calve earlier than the local breeds under similar management conditions. In the studied farm, low feeding regime, diseases and parasites coupled with inbreeding and back crossing could influence heifers for earlier calving.

Calving interval (CI)

In this study the average length of calving interval of cows was 15.6 ± 0.6 months (Table 2). The long calving interval might be a reflection of the management level, which can be accounted to the available farm input and reproductive management.

Days open

In this study it was found that the average days open was 6.65 ± 0.11 months (Table 2). Days open to conception is the sole variable of calving interval. The main variation in CI is due to variation in days open. Long open periods, hence long calving intervals, generally reflect problems associated with management but may also give some indications of the condition of the cows' reproductive apparatus.

Milk yield traits

The mean milk yield per day and per lactation was 5.6 ± 0.8 and 1738.9 ± 228.9 litres, respectively (Table 2). The amount of milk yield obtained per day or per lactation is relatively low. This might be attributed by feed shortage, poor management level and diseases.

Lactation length

In this study, the average lactation length was 10.07 ± 0.8 months (Table 2). This study indicated that there was no uniform or similar lactation length among the cows. The range of lactation length was found to be from 125 days to 633 days.

Feeding management

Feed resources and feeding practices of the farm is shown in Table 3. The major sources of feed were natural pasture grazing, green feed, hay, silage, agro and milling by-products, commercial and on farm formulated concentrates. The pasture

consists of natural grasses and improved forage species. The cultivated fodder species that are used through cut-and-carry system were alfalfa, Sesbania, desmodium and napier grass.

Table 2: Productive and reproductive performance of dairy cows at JUCAVM dairy farm

Parameters	Mean \pm SD
Age at first calving (months)	36.8 \pm 9.36
Calving interval (months)	15.6 \pm 0.51
Milk yield/cow/day (litres)	5.6 \pm 2.26
Milk yield/lactation (litres)	1738.9 \pm 933.70
Days open (months)	6.65 \pm 0.11
Lactation length (months)	10.07 \pm 0.8

The management system of the farm was semi-intensive. Both grazing and stall-feeding system are practiced. The animals grazed for about 4 hours per day, but kept inside the house the rest of the day. Silage and hay are conserved for dry season supplementation when there is severe shortage of green feed and grazing pasture. Concentrate supplementation was inadequate. Lactating cows were offered about one to two kg of concentrate per day during milking time, but not based on the amount of milk yield per cow. Calves and heifers were also given small amounts of concentrate but not on regular bases. The availability of concentrate was reported to be very severe problem due lack of sufficient budget allocated for feed. To overcome this problem the farm formulate ration on farm from locally available ingredients (Table 3).

Calf rearing

Calves were allowed to suckle colostrum for the first one to five days after birth and then separated from their dams. Thereafter they are given 4 liter of whole milk per day until they are weaned at the age of 180 days. Besides, after 2 months of age the calves are given green forage, hay and concentrate supplement.

Milking procedures and frequency of milking

The sanitary practices and the milking procedures followed by the farm were washing of hands, milking vessels and udder using warm water with detergent. Drying udder was practiced using individual towel. Hand milking was practiced twice a day. As indicated in Table 3, the highest and the lowest milk produced per year were in 1997 and 2005. The highest amount of milk sold was in 1997. The difference in milk production per year was due to difference in number of lactating cows and the availability of feed in adequate quantity and quality, as well as the milk production potential of the cows in that particular year.

Water supply

All animals in the farm had free access to pipe water, with watering frequency of four times a day. The watering trough was constructed outside the barn.

Breeding system

Female calves born at the farm were retained and reared as replacement heifers, with the exception of those which had to be disposed for one reason or another. It was observed that

cows and heifers available for breeding were mated to bull kept at the farm. Heat detection of cows was carried out cattle attendants and behavioral change of the cows in heat. There is no artificial insemination service and inbreeding was reported to be one of the major problems. Thus, introduction of artificial insemination seems very important for training students and improving the breeding efficiency of the cows.

Table 3. Milk production and utilization of the farm (1996-2005)

Year	Amount collected (liter)	Amount sold (liter)	Milk fed to calves (liter)	average milk production per month
1996	25817	17097	8737.5	2151.38
1997	30101	23164	7334.5	2508.42
1998	23440	19149	4368	1953.33
1999	28496	14943.5	13552	2374.63
2000	26233	15474	10760	2186.08
2001	22781	15647	7133.5	1898.42
2002	25266	18690.5	6575	2105.46
2003	24175	18525	5196.5	2014.54
2004	24012	17013	6698.5	2000.96
2005	22086	19023.7	2961.58	2007.84

Disease incidence and control

Disease incidence of economic importance includes mastitis, tick infestation, milk fever, heart water and calf scour in that order of importance. Other diseases such black leg, pasteurellosis, lumpy skin disease, anthrax and foot-and-mouth-diseases are not a major problem and the cattle are vaccinated regularly to control them. Mastitis is the most severe problem of the farm with high incidence, resulting in decreased milk yield, premature culling of cows and high treatment cost. There is regular spraying with acaricide particularly for the control of tick infestation. The other problem for loss of dairy cattle at the farm is ingestion of poisonous foreign bodies like metals and stationery wastes left elsewhere on grazing areas without proper disposal.

Housing management

The animals are housed in modern closed barn with concrete floor. The barn consists of individual stall, milk room, record room, and maternity pen. The roof of the barn is covered with corrugated sheet; the wall is made of bricks. The cattle were housed according to their status, age and sex. The milking cows were housed individually where feeding and milking took place. Young animals are housed in group. The barn also has both isolation and parturition rooms. The attendants indicated that they clean the floor twice a day and wash the animals once per week.

Culling practice

Number of animals culled during 1996-2005 is shown in Table 5. Culling was indicated to be a common and routine management of the farm to regularly dispose cows with severe mastitis infections, old age, and low milk yield, reproductive failure, diseased and physically defected. Male calves unwanted for breeding purpose were the most disposed animals, selling them as bull calves to the community who

rear them as breeding bull. About 70.21% of male calves, 25.53% cows and 2.23% heifers were culled over the 10 years. The small number of heifers culled indicated that the heifers were retained and reared as replacement.

Table 4 General aspects of dairy cattle husbandry and management practices in the study area

Parameter	Parameter
Housing system	Improve fodder grown on the farm
Closed	Napier grass
Feeding system	Sesbania
Stall + grazing	Alfalfa
Stall (calves)	Breeding system
Calf feeding system	Natural (bull)
Bottling	Milking system
Bucket feeding	Manual
Sources of feed	Milking frequency
Natural pasture grazing	Morning and evening
Green feed ("cut-and-carry")	Milking procedure and hygienic practices
Hay	Washing of hand
Silage	Washing of equipments
Agro and milling by-products	Washing of udder by warm water
Commercial concentrate mix	Use of individual towel
Composition of on farm formulated ration	Milk containers
Oil seedcake (35%)	Aluminum
Wheat bran (30%)	Plastic buckets
Maize (29%)	Reasons of cattle disposal
Sesbania leaf/alfalfa (5%)	Performance
Salt (1%)	Fertility
Disease management	Disease
Vaccination	Old age
De-worming	Male calves not required for breeding
Spraying	Physical defects
Treatment by Veterinarian	Manure disposal
Assistant veterinarian	Manual
	Drainage

Table 5. Number of animals culled at JUCAVM dairy farm from 1996-2005

Animal type	Frequency	Percentage
Calves	33	70.21
Heifers	1	2.13
Cows	12	25.53
Bulls	1	2.13
Total	47	100

Mortality of calves

The mortality rate of calves for 10 years is presented in Table 6. Mortality rates were found to vary widely over the ten years. Out of the total 108 calves born alive 37 calves, which is about 34.26% were died due to different reasons. The lowest mortality (10%) and the highest mortality (83.33%) were recorded in 1997 and 2001, respectively. The highest abortion (37.5%) of cows was observed in 2002, whereas in 1997 there was no abortion of pregnant cows.

Recording keeping

Records were available at the dairy farm on milk production, milk sold, services and calving dates, sex, sire and dam used,

mortality, stillbirths, abortions, deaths, feeds purchased, vaccination, culling reasons, diseases and treatments.

Table 6. Mortality of calves and abortion rates (%) between the years 1996-2005

Year	Calves born	Calves died	Mortality rate (%)	Cows Aborted	Abortion (%)
1996	6	1	16.67	1	14.29
1997	10	1	10	-	-
1998	14	6	42.86	1	6.67
1999	16	3	18.75	1	5.88
2000	10	4	40	4	28.57
2001	12	10	83.33	3	20
2002	10	2	20	6	37.5
2003	8	1	12.5	2	20
2004	13	3	23.08	1	7.14
2005	9	6	66.67	1	10

Major constraints

A number of production problems are seriously affecting dairy cows' performance on the dairy farm (Table 7). The major constraints facing the dairy farm feed shortage, diseases and parasites (tick), low milk production of cows, lack of adequate capital, and inbreeding in that order of importance. The major causes for feed shortage were shortage of grazing or pasture land and lack of capital for purchasing concentrate feeds. The interaction of these constraints was a major reason for poor performance of dairy cattle reared at the farm.

Table 7. Rank of major problems encountered in the dairy farm of the college

Constraints	Rank
Feed shortage	*****
Diseases and parasites	****
Low milk production	***
Inadequate budget	**
Lack of AI and inbreeding	*

***** = highly critical problem, **** =critical problem, *** =fairly critical problem, ** =mild problem, * = very mild problem

DISCUSSION

The mean age at first calving was 36.8 ± 1.9 months. The result obtained in this study is slightly higher than the average of 33 ± 0.6 months reported for Frisian Fogera cross bred cows at metekel ranch (Addisu and Prabhakar 2003), but much higher than that reported by (Enyew et al., 1999) for crossbred dairy cattle with different levels of European inheritance (38.8 ± 0.5 months) at Assela livestock farm, in Arsi region and (Mukasa-Mugerwa 1989) for *Bos taurus* X *Bos indicus* crossbred (33 months) in the tropics. Enyew et al. (1999) reported that heifers with high blood levels of 87.5% Frisian inheritance calved at a more advanced age than their herd mates of about 32.2 ± 1.3 months. This could be true in this dairy farm, as indicated by the farm manager the inbreeding effect within the herd which resulted in decreased heterosis effect. In this study the mean calving interval was 15.6 ± 0.6 months. The long calving interval might be a reflection of the management level, which can be accounted to the available farm input and reproductive management. The long calving interval of 15.6 ± 0.6 months observed in this study is attributable to the long days open period of 6.65

months. The CI observed in the present study is in agreement with the findings of Zelalem (1999) for local and crossbred cows (480 and 497 days) and Chernet et al. (1999) for Horro crosses (15.8 ± 0.39 months). However, it was higher than that reported by Mukasa -Mugerwa (1989) for Horro and Arsi crossbred (12.2 and 12.9 months, respectively). It was also higher than that reported by Galal et al. (1981) for crossbred cows in wet zone (322days), but lower than the value reported by Addisu and Prabhakar (2003) for Fogera crossbred cows (559days). The long calving interval might be a reflection of the management level, which can be accounted to the available farm input and reproductive management. In this study it was found that the mean days open was 6.65 ± 0.11 months. The estimated mean DO in this study is higher than the mean DO of 148 ± 1.72 days reported by (Tadesse et al., 2010) at Holeta, Ethiopia. Feed shortage, silent oestrous and lack of proper heat detection might have contributed to the long DO reported in this study. Days open to conception is the sole variable of calving interval. Long open periods, hence long calving intervals, generally reflect problems associated with management but may also give some indications of the condition of the cows' reproductive apparatus. The mean milk production per day and per lactation was 5.6 ± 0.8 and 1738.9 ± 228.9 kg, respectively. The result of this study was comparable to the result reported by (Kiwuwa et al. (1983) for Arsi crossbred dairy cows (5 ± 0.6 kg and 1773 ± 26 kg of mean daily and lactation milk yield, respectively) at Assela, Ethiopia. However, the results were found to be lower than that reported by (Yoseph et al., 2003) for crossbred cows (8.63 kg mean daily yield and 2612 kg mean lactation yield) in urban intensive dairy farms and was also lower compared to the 8.33 kg mean daily yield reported by (Mpairwe, 1998) at the ILRI, Debrezeit Research Center. The estimates for milk traits were also lower than that reported by (Goshu, 1983) for Barka Friesian and Borana Frisian cross cows at Debrezeit dairy farm (1950.92 ± 156.88 and 2367.78 ± 369.91 kg respectively). The amount of milk yield obtained per day or per lactation is relatively low. This might be attributed by feed shortage, poor management level, and diseases. Cattle productivity in terms of milk yield is generally low in Ethiopia under smallholder management conditions. Moreover, the majority of the farmers keep indigenous animals that are generally low producers of milk (Beyene 1984).

In the present study it was found that the overall mean lactation length was 10.07 ± 0.8 months. The result obtained in this study is comparable with the result reported by (Chernet et al., 1999) for Frisian crosses and Borana crosses (313.5 ± 12.8 and 330.2 ± 9.9 days, respectively) at Bako Agricultural Research Center, Ethiopia. It is also comparable with 303 ± 12.67 days reported by (Tesfaye and Gebre-Egziabher, 1995) for crossbred cows at Bako Research Center. The value observed in this study is higher than that reported by (Tesfaye et al., 1995) for Borana Frisian and Horro Frisian crossbred cows (273.3 ± 70.61 and 272.2 ± 26.73 days respectively) at the same site Bako Research Center, but lower than that reported by (Kiwuwa et al., 1983) for Arsi crossbred cows (363 ± 3 days) at Assela, Arsi region. This study indicated that there was no uniform or similar lactation length among the cows. The range of lactation length was found to be from 125 days to 633 days. This shows difficulty of heat detection and problems related to the cow's reproductive performance.

Conclusion and recommendation

The current study had confirmed that productive and reproductive performance of the crossbred cows in the study area was low. The long age at first calving, days open till conception, long calving intervals and low daily and lactation milk yields were attributed to low levels of nutrition, reproductive management and diseases. Feed shortage both in quantity and quality was the major problem limiting performance of the dairy cows in JUCAVM dairy farm. It could be suggested that in order to improve the performance of the dairy cattle adequate feed supply, especially during dry season is very crucial. Feed conservation in the form of silage and hay will increase feed availability during the dry season. On farm improved forage cultivation on large scale needs to be strengthened. The supplementary feeding regime, especially for milking cows, calves and pregnant cows, should be provided according to production level and physiological state of the animal. Disease and parasite infestation can be controlled or prevented through zero-grazing, proper farm sanitation and vaccination. Introduction of artificial insemination and allocation of adequate budget to the farm seems very important to improve the performance of dairy cows

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