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Effect of Artificial Insemination on production performance of dairy cattle in Case of Sayo District West Wollega Zone, Ethiopia

Mohammed Yousuf ^{1,*}

¹ College of Agriculture and Veterinary Medicine, Mizan Tepi University, Ethiopia

* Corresponding author:

mahammedyousuf1@gmail.com

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Abstract

The study was conducted in Sayo district with the objective of assessing challenges and opportunities of artificial insemination on dairy cattle, to document potential opportunities of artificial insemination, to identify the challenges of artificial insemination and to assess the perception of farmers on the AI technology in the study area. Three kebeles, three were taken purposively and 20 households from each kebele were randomly selected. The data were collected using semi structured questionnaires, interview and direct observation. The reproductive and productive data were analysed statistical software (SAS version 9.3.1 where as other data were analysed by simple descriptive statistics. The result of this finding shows that the overall mean of daily milk and lactation length of dairy cows in the Sayo distinct were 5.83±0.82L and 240±18.43 days respectively whereas the overall mean of age at first calving, calving interval and number of services in the study area were 968.42±269.83, 449±22.09 days and 1.93±0.71times respectively.

Keywords

Artificial insemination, Reproductive, Productive Performance.

1. Introduction

Ethiopia is home for a large and diverse livestock resource and good production environments. The vast majority of the rural livestock production. However production and productivity and producers benefits from livestock production are far below expectation. The livestock sector accounts for approximately 30% of the total agricultural GDP and 16% of national economy. The

total cattle population for the rural sedentary areas of Ethiopia is estimated to be 43.12 million, of which 55.41% are females (Livestock, 2017). Out of the total female cattle population, only 151,344 (0.35%) and 19,263 (0.04%) heads are hybrid and exotic breeds, respectively (De Vries, 2006). In spite of the presence of large and diverse animal genetic resources, the productivity (i.e., meat and milk) of livestock remains low in many developing countries including Ethiopia for numerous reasons such as inadequate nutrition, poor genetic potential, inadequate animal health services, and other management related problems (Lobago, 2007). Holstein Friesian and their crosses in central Ethiopia and found out that the highest milk yield 3083 kg for total lactation milk yield and 2678 kg for annual milk yield (Tadesse & Dessie, 2003).

The total number of both exotic and hybrid female cattle produced through the crossbreeding work for many decades in the country are quite insignificant indicating unsuccessful crossbreeding work. It is widely believed that AI (Artificial Insemination) service has not been successful to improve production and reproductive performance of dairy industry (Sinshaw, 2005). The problem is more aggravated by lack of recording scheme, wrong selection procedures, and poor management of AI bulls associated with poor motivations and skills of inseminators (Hulsen, 2005). Selective breeding has been considered as one of the highly effective and sustainable approaches for increasing animal productivity in the long-term. In this regard, Artificial insemination allows a single animal to have multiple progeny, reducing the number of parent animals required and allowing for significant increases in the intensity of selection, and proportional increases in genetic improvement (Zumbach & Peters, 2000; López-Gatiús, 2011). The percentage of pregnancies resulting from AI is the product of cows detected in heat and inseminated fertility level of the herd, semen fertility level and inseminator efficiency (Risco 1996). Whereas tools of molecular genetics, growing demands for reliable services and quality semen and diversified genetic resource were the good opportunities to use AI widely (Leakey et al., 2009).

2. Research methods

2.1 Description of the Study Area

The study was conducted in Sayo woreda of Kellem Wollega Zone, Oromia Regional state. The study area is was located in altitude range from 1575 m to 2075 m to 2014 as.l. It has suitable topography for agricultural activities and classified as Dega.Weinadega and Kola. The annual rain fall varies from 1450 to 1775 mm. The mean temperature varies from 170C to 240C the woreda consists of 26 rural and 2 urban kebeles .The total human population of the woreda is 186320 bottom about 15% among this land area about 35, hectare communal grazing and about 98 hectare is individual grazing land of the woreda people ,land use of the woreda shows communal grazing 26.03% private grazing 73.6% .Altitude vegetation and soil of the woreda are slightly different and the woreda categories under mixed farming system agricultural the major crop type cultivated in the woreda are teff, maize, sorghum, wheat, barley, bean etc and considerable size of animal are kept by small holder farmer proving drought power, in come food, manure, saving and socio economic functions. According to the Sayo woreda office of agricultural census report there are 23250 cattle, 36845 sheep, 20450 goats, 2500 horse, 6520 donkeys, 2301 mule and 398, 120 poultry in the woredas (Livestock, 2017).

2.2 Sampling procedures

One district, namely Sayo district was purposely selected based on accessibility, potential whereas for selection of peasant associations (PAs), availability of high crossbred cattle, agro ecology, and secondary data from agricultural office and accessibility were considered. Thus based on the above criteria, three PAs were taken strategically for this study. While a total 60 households, (20 households from each Pas) who were interviewed for the survey study were randomly taken by using lottery system.

2.3 Methods of data collection

Both primary and secondary data sources were used. The primary data were collected from the farmers through semi structured questionnaires, interview and direct observation. Secondary data such as cattle population, human population, and climatic condition was obtained from published and unpublished available sources, agricultural experts, DA's and administrative office of the PAs. Focus group discussion (FGD) was used to collect data. To this end PA chairman, DAs, model farmers and elders were participated in the FGD.

2.4 Data analysis methods

The collected data were analysed statistically using SPSS (version 20) for Windows. The quantitative data were analysed by using compare means method; express in mean such as livestock numbers. While the qualitative data (nominal) were analysed using descriptive statistics, represented in percentage.

3. Results and Discussion

3.1 Management system in the study area

3.1.1 Feed and water

The major source of feed for cattle in the study area is presented in Table 3. Among those hay accounts (43.33%), crop residues (20%), green forage (18.33%), concentrate (13.33%) and few respondent was used Atela (5%). This showed that AI service, production and reproductive performance of dairy cattle were mainly affected by feed source that means when there was good feed source, the AI delivery, production and reproduction system also improved. Several factors related to management play roles in successful pregnancy among which nutritional management contribute the largest proportion (Dinka, 2012). The main reason related to lack of improved forage availability in the study area were lack of land and also there was not expansion of improved forage seed from agricultural office. According to the respondent the water use were river source (45%) and pipe water (55%). The use of river source was mainly when there was water shortage. So that, the use of river source causes the cows faced in health problems which directly affect production and reproduction performance of the cows and increase challenges of AI. Most of the respondent gave water to cows two times per day (Gebremedhin, 2011).

Table 1. Feed and Water sources in the study area

| Type of feed | N | % | Rank |
|---------------------|----------|----------|-------------|
| Hay | 26 | 43.34 | 1 |

| | | | |
|------------------------------------|----|-------|---|
| Crop residues | 12 | 20 | 2 |
| Green forage | 11 | 18.33 | 4 |
| Concentrate (frushica, wheat bran) | 8 | 13.33 | 3 |
| Atela | 3 | 5 | 5 |
| Water source | | | |
| River | 27 | 45 | |
| Pipe water | 33 | 55 | |

N= number of households %= Percent

3.1.2 Housing system

Most of the respondent (65 %) used separate house with roof from main house and 35% of the respondent use local barn without roof. The purpose of local barn housing in the study area was to protect cattle from theft, hyena and extreme weather conditions. Some of milk producers reported that they keep their cattle breed in not partition of the main building, they keep their cattle breed together with family and others due to lack of capital and land. So this causes disease and which in turn increase challenges on AI.

Table 2. Housing system of dairy cattle in the study area

| Type of house | N | % |
|--|----|-----|
| Separate house with roof from main House | 39 | 65 |
| Local barn without roof | 21 | 35 |
| Total | 60 | 100 |

N= number of households %= Percent

3.2 Common disease in the study area

According to the respondents, the cattle diseases prevailing in the study area were listed in Table 3. In the study area, the prevention method was low because the housing system was very poor, that means there was no separate house between individual animals. So that improving the housing system, supplementing of good water and improved feed is important in preventing disease and decreasing the challenges of AI.

Table 3. Common disease of dairy cows in the study area

| Common disease | Local name | Scientific name | Symptoms |
|--------------------|---------------|------------------------|--|
| LSD | citto | - | - Point spot on the hide/skin - Edema on the limp |
| Bovine Brucellosis | Rima gataa | Brucella abortus | - Abortion - Retail placenta - VaginadischARGE |
| Mastitis | Dhukuba harma | Streptococcal mastitis | - Inflammation of udder - Blood mixed milk |
| Milk fever | - | - | - Opening of the teat |
| Pasteurolosis | maramartoo | Pasteurellamultocida | - High respiration rate - High salivation |

3.3 Cross breeding in the study area

Crossbreeding of local breeds with European dairy breeds has been widely used as a tool to improve milk production potential in tropical cattle (Duguma et al., 2012). In the study area cross breeding was done by selection of superior bulls (Natural mating) and by using AI so as to increase milk production and genetic improvement. For genetic improvement semen of HF, Fogera x HF cross bred bulls were selected for natural mating when there is no availability of AI.

3.4 Selection parameter of bull and cows for crossbreeding

The selection criteria of bulls for mating in the study area were depending on conformation, growth, libido, size and arrangement of testicles, adaptability and color (red) of the animals. The growth trait and color was the most preferred trait of other entire trait because the size and color of the animal determines the market value. While, selection criteria of cows were depending on conformation, calf growth, calf survival, size of teats, age at sexual maturity, calving interval, milk yield, mothering ability, adaptability and color (red) of the cow.

3.5 Breeding system in the study area

The present result shows that 45% of the respondent used AI, 43.33% of the respondent used natural mating and 11.67% of respondent used both AI and natural mating. There was no more difference between both AI and Natural mating, because some respondent believed that the exotic breed consumed high amount of feed, requires high management, high cost and AI service gives high male to female ratio calves, but the free of paid cost and availability of infrastructure and its potential for milk production were facilitate (initiates) the peoples to use AI service in the study area. Artificial insemination has become one of the most important techniques for increase milk production and genetic improvement of farm animals (Mohammed, 2018)

Table 4. Breeding system

| Mating system | N | % |
|---------------|----|-------|
| AI | 27 | 45 |
| Natural | 26 | 43.33 |
| Both | 7 | 11.67 |

N = number of respondents, % = percent

3.6 Effect of AI on production performance of dairy cattle in the study area

3.6.1 Milk production

According to the survey, the milk production of local breed was less than cross breed this was due to the cross breed receives the good trait from exotic breed. The Local breed in the Sayo district gave 316.2 l of milk / per lactation length. But, the indigenous zebu breed produced about 400-680 L of milk/ per lactation period (Ahmed et al., 2004), and also the, F1, F2 and F3 cross breed in the Sayo distinct were 1661.6 L, 2029.4 and 3600 l of milk / per lactation length. This result of F1 and F2 lower than the finding of (Tadesse & Dessie, 2003) the Holstein x Boran crosses which was 2369.95±26.04L. The variation was due to breed type and management system. The below table shows that the average DMY of local breed 1.7 + 0.41l. This result lower than Tadesse & Dessie (2003), which was 1.76±0.8 of Boran breed , it was due to poor management and breed type ,while the average DMY of F1 ,F2 and F3 breed in Sayo district was,

6.7+0.95, 7.93+0.83 and 12.0+0 L, respectively. Also the DMY of F1 is lower than, the Tadesse & Dessie (2003) DMY of HF X Boran breed which is 7.14±0.06 L, but the DMY of F2 and F3 is higher than the Tadesse & Dessie (2003) which was 5.70±0.12 and 5.05±0.31 of HF X Boran breed, respectively. This was due to breed type and level of management. Generally, as the effect of AI increase the daily milk from 1.7 to 6.7 and as the blood level increases the DMY increase from 6.7 to 7.93 in the study area.

The average LL of local breeds in Sayo district was 186+12.42 days. This result was lower than the Tadesse & Dessie (2003) LL of Boran breed which was 246.22±3.46 days. But the average LL of F1 breed and F2 breed in Sayo district was, 248+22.19, 278.6+14.06 and 300+0, respectively. This result shows the LL of F1 and F2 was lower than, the LL of Tadesse & Dessie (2003) which was 332.54±2.82, 298.68±5.17days of HF X Boran respectively. The reason was due to breed type and level of management. But the F3 is higher than LL of Tadesse & Dessie (2003) which was 299.90±6.46 days. This was also due to management and breed type. According to the study the lactation length and daily milk yield of the local cows and cross breed cows was highly vary, this was due to the effect of AI by transfer of good trait from exotic breed to local breed and the blood level increases from F1 to F2 and F3 the LL also increase when there was good management and production system.

Table 5. Milk yield performance of indigenous cows at different level of HF cross breed cows

| | N | Mean ±SD | |
|----------------------|----|-----------|-------------|
| | | DMY(L) | LL(d) |
| Over all | 60 | 5.83±0.82 | 240±18.43 |
| R² | | 0.91 | 0.79 |
| Breed | | | |
| Local | 15 | 1.7+0.41 | 186+12.42 |
| F1 | 30 | 6.7+0.95 | 248+22.19 |
| F2 | 14 | 7.93+0.83 | 278.6+14.06 |
| F3 | 1 | 12.0±0 | 300±0 |

DMY (L) = Daily Milk Yield, (LL) = lactation length, SD= standard deviation, N= number of respondents

3.7 Reproductive performance of dairy cattle in the study area

3.7.1 Age at first calving

According to the respondent like production performance the age at first calving of local, cross and exotic) breeds was affected by management system (feed, housing. Health condition) mainly by feed. That means when the management system become poor the AFC is long and when the management system is good the AFC is short. The above table shows that the average AFC of local breed in Syo distinct was 1200+70.52 days. This result is higher than the AFC of (Ibrahim et al., 2011), which was 1,164 day of Fogera breed; it was due to poor management and breed type in the study area. And the average AFC of F1 breed and F2 breed in Sayo distinct was 971+97.5, 773.13+41.2 day respectively. This result is found to be higher than, the (Ibrahim et al., 2011). AFC of HF X Zebu breed which was 1041 day, but the AFC of F2 was lower than the Nuradis findings, this was also management, breed type and environmental condition. This finding indicated that the blood level increase AFC decrease and the effect of AI decreases the AFC of 1200+70.52 to 971+97.5 days in the study area.

3.7.2 Calving interval

According to the respondent, the calving interval of local, cross and exotic breed like AFC similarly affected by management system. The average CI of local breed in Sayo district was 501+24.76 day, this result was higher than the CI of Effa et al. (2011) which was 474 days of Fogera breed. This was also due to poor management and breed type. But the average CI of F1 breed and F2 breed, Sayo district was, 426.25+22.52 and 417.5+17.32 days, respectively. This result shows the CI of F1 was higher than, the (Ibrahim et al., 2011). CI of HF X Zebu breed which was 419 day, but the CI of F2 lower than the Nuradis findings, this difference between the two breed was due to climatic condition, production system and also management system. Generally, when there was good management and production system and the blood level increase the calving interval becomes short.

3.7.3 Number of services per conception

Like the other reproductive performance the number of service per conception was affected by management system, production system and also semen quality. The above table shows that the average NSC local breeds in Sayo district was 2.15+0.74. So it contradicts to the NSC of (Kebede et al., 2011) which was 2 times of Horro breed. This was due to breed type and poor management in the study area. But the average number of service per conception of F1 and F2 was 2+0.78 and 1.56+0.5 times respectively. The NSC of F1 was higher than the NSC of (Kebede et al., 2011) which was 1.97 times of FH X Horro and the NSC of F2 was lower than (Kebede et al., 2011) findings. This difference was due to nutrition factor, AI technical and poor semen quality. Among those factor nutrition was highly influenced the NSC in the study area. Because in the stud area hay was the dominant feed. Animals fed well balanced feed has high rate of conception rate (Anzar et al., 2003).

4. Conclusion

The more production system becomes the better opportunity of AI and the more production and reproduction performance of the dairy cow. AI service, production and reproductive performance of dairy cattle were affected by feed source. Cross breeding was done by selection of superior bulls (Natural mating) and by using AI helps to increase milk production and genetic improvement. The overall mean of daily milk yield and lactation length of dairy cows in the Sayo district were 5.83+0.82 L and 240+18.43 days respectively whereas the overall mean of AFC, CI and NSC in the study area were 968.42+269.83, 449+22.09 days and 1.93+0.71 times, respectively.

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