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Evaluation of Artificial Insemination Services Performance in a Smallholder Dairy Herd Under Extensive Management: A Case Study of KALRO- Lanet Herd, Kenya

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Abstract

In dairy cattle fertility management, the rule of the thumb is one calf per cow per year. In a smallholder dairy herd managed by Kenya Agricultural and Livestock Research Organization (KALRO)-Lanet under extensive production system, the rule has not been applicable. The cause of the problem mainly is poor reproductive fertility in the herd. The effects due to the problem are low calf crop, milk production and income. A study was conducted in (KALRO)-Lanet to evaluate performance of AI services, in herd of about 100 heads of cattle where use of AI service had been introduced. The objective of the study was to evaluate the performance of AI and recommend ways of improving and up scaling of the service. A herd of 72 cows comprising of various breeds; Friesian, Sahiwal and Crosses (Friesian/ Boran) were investigated for 16 months. The cows were in different ages and parities. The cows were artificially inseminated after exhibiting heat signs. The cows were served by either one of two AI technicians contracted. After the service AI set was duly completed. Data was extracted from AI set and analyzed using Genstat Discovery Third Edition computer package. Cows were divided into groups according to the number AI service(s) before a successful delivery. Average AI services per delivery were 1.9. There was significant difference ($P<0.05$) in the number of cows allocated to each group, calves delivered, and calving percentages. In group R0, calving was 39%. On the other hand, there was no significant difference ($P>0.05$) in time of insemination within the four groups. The quality of semen, breed of the donor bull and the kind of technicians were not significant ($P>0.05$), neither. The performance AI breeding program however, was evaluated according to calving percentages. From the evaluation, it was recommended bulling cows and heifers to be flushed. It was also recommended that estrus of the cows to be synchronized, so as to harmonize herd fertility management. Besides that, other forms of diagnosing pregnancy should be used, a part from non-repeat. Further to that, cows that are non-repeaters and conceptors should be culled while repeaters should be treated before being taken to the breeding program. Also operating AI services by the Organization can be one way to reduce the cost of AI services.

Keywords: Artificial insemination, Smallholder, dairy herd, Kenya

Introduction

Profitability in livestock production is linked to reproductive success (Newton, 2014). Reproductive efficiency of the dairy herd is important to the economic success of the dairy operation. One of the most important reproductive technologies implemented by the dairy industry is artificial insemination (AI). Artificial insemination reduces the incidences of sexually transmitted diseases among cattle. It also as increases the use of genetically superior sires to improve performance of the herd as well (Looper, 2015).

In order to benefit from the advantages of AI however, farmers must detect cows on oestrus. The detection is supposed to be accurate and on time to ensure a successful insemination. The same is also recommended for any cow that returns to oestrus. Apart from this, good quality semen is important for optimum conception rates (CRs). Conception rates will also be enhanced by well trained and experienced AI technicians.

The technicians are vital in handling semen and performing inseminations (Boettcher and Perera, 2007). Artificial insemination service when done appropriately improves pregnancy rate in a dairy herd. Dairy producers strive to achieve this by improving the AI service delivery in their herd (Fricke, 1999)

Objectives

Kenya Agriculture and Livestock Research Organisation (KALRO) - Lanet has a dairy herd of about 100 heads of cattle. The herd comprises of cows of various breeds of different age and parities. Breeding bulls have been used to serve cows which have been on heat until recently when AI has been introduced. To improve and up scale the AI service in KALRO-Lanet, a study was conducted on AI performance for 16 months to establish the calving percentages as a measure of success.

Materials and Methods

Herd management

The study was conducted in KALRO - Lanet in Nakuru County in Rift Valley region, Kenya using AI records for 16 months. Within the period, 72 cows comprising breeds of Friesian, Sahiwal and Crosses (Friesian/ Boran) was studied. The cows grazed extensively in established rye grass pastures for 12 hours in a 24-hours day. The cows were milked at 0500 and 1600 hrs for duration of one hour. Live-body weight of the cows was recorded on monthly basis.

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Insemination

Cows on estrous were identified by the stockmen. The stockmen were able to identify cows on estrous after the following observations, decline in day's milk yield, mounting on other cow, bellowing, aggressiveness, restlessness, sniffing and rubbing against others and standing while being mounted by others. After the display of estrous signs either of the two Artificial Inseminator (AI) technicians was informed. The technician inseminated cow between eight and18 hours after the display of first estrus signs. Cow was inseminated using semen from Kenya Animal Genetic Resource Centre (KAGRC) - Kabete. The semen was deposited in the uterus using recommended AI apparatus (one dose per insemination technique).

After the insemination a duly completed AI set was issued. The process was repeated as cows displayed estrous appeared. Semen from 13 different bulls was used to inseminate different cows. Pregnancy diagnosis was done based on a non-return method. Non-return method is whereby if the cow does not display a repeat of estrous signs after 18 days it is diagnosed as in-calf. If the estrous signs are displayed however, the cow did not conceive and the insemination is repeated.

Cows were divided into various groups depending on the number of AI service(s) for a successful delivery. All cows inseminated for the first time were grouped as R0. Cows in group R0, displaying a repeat of signs were grouped as R1 and re-inseminated. Cows in group R1, displaying a repeat of signs were grouped as R2 and re-inseminated. Cows in group R2, displaying a repeat of signs were grouped as R3 and re-inseminated. The cost of each AI service was recorded. Data was collected and analyzed using Genstat Discovery Third Edition computer package.

Results

During the period of 16 months, 72 cows had been inseminated, completed at least one gestation period and calved down, table 1.

Table 1. Number of cows, calves delivered and conception rate in various groups of cows

Groups	R0	R1	R2	R3
No. of cows with at least one gestation period	72^a	44^b	34^c	29^d
No. of calves delivered	28^a	10^b	5^c	2^d
Calving %	39^a	23^b	15^c	6^d

Means followed by different superscripts in the same row are significantly different (P<0.05)

There was significant difference (P<0.05) in the number of cows per group, calves delivered and calving percentages, table 1. There was also no significant difference (P>0.05) in time of insemination in the four groups. The quality of semen, breed of the donor bull and the kind of technicians were neither significant (P>0.05). Of the inseminated cows, 74% that had a body live-weight of between 310 to 360 kg and maintained a constant weight for two months prior to the estrus, conceived and successfully delivered with one AI service. The total number of AI service used within the herd were 137, average inseminations per cow being 1.9. Each AI service was costing KES. 700.00 (Seven hundred). Total money spent on the AI service was KES 95,900.00. The average cost of AI service per calf delivered was KES 1,330.00

Discussion

After the cows were artificially inseminated, they could either return on heat signs or not. Return of signs meant there was no conception mostly between days 15 to 18 after AI [Peters 1995). Failure to conceive could be caused by several factors among them, wrong insemination time, poor semen quality and inadequate skills of the AI technicians. Conception could still take place however, due to early embryonic death; there is failure of normal embryonic development (Ball, 1977). In cattle, early embryonic losses occur in about 38 % (Humblot et al., 1996, Karunakaran, et al., 2012). In such cases it is possible for cows to display a repeat of heat signs.

In some cows about 37%, this could be subsequently followed by anoestrus or a cyclicity. This is where cows do not display heat signs and yet do not deliver. One possible cause for this is cystic ovaries. Here is interplay of progesterone and estrogen based on the estrus cycles yet there is no ovulation taking place. Such animals need treatment or culling.

The calving percentages of 39 % in group R0 was within the acceptable range of a developing country (Senger, et al 1984). In Senegal, a developing country, the success rate of AI was taken as the calving rate, was 38.8% (Sawadogo 2006).

The success could be attributed accurate heat signs observation by experienced stockmen. Besides the accurate heat signs, inseminations were done within the recommended time. According, Karunakaran, et al., (2012) the duration of estrum in cow is 15 to 20 hours. The ovulation occurs approximately 12 hours after the end of estrum. Apart from the animal factors, the nature of the AI technicians attributed to the success rate. This is in agreement as reported by Peters (1995) and Karunakaran, et al., (2012) that handling of semen during storage, thawing, AI technique, training and experience is recommended for successful AI program.

Technicians with less than 10 years of experience however, tended to have lower overall CR (Senger et al 1984). Due to this, some trained inseminators have lower than normal conception rates even though they are able to deposit the semen at the right place (Karunakaran, et al., 2012).

Besides that, good body condition of the cows was an important factor towards a successful AI program.

High calving percentages was observed in cows with good body condition. Good body condition was as a result of accidental flushing since in extensive management there was no flushing program that had been put in place. Accidental flushing could have contributed to higher cow fertility (Karunakaran, et al., 2012). Cows on adequate nutrition usually maintained satisfactory body condition and positive energy balance which has a favorable influence on fertility (Than, et al. 1999). Low CR was observed in animals when energy in the diet was reduced prior to AI service (Diskin, 1996). Lacking supply of the right nutrition requirements was perceived to be the cause of failure to achieve the recommended conception rate(Than, et al. 1999).

The calving percentages in other groups however, gradually reduced. This implied, cows became more difficult to conceive as the number of repeats increased , in a healthy herd the average number AI services per delivery is 1.6 to 1.7. (Than, et al. 1999). It is always possible that certain portion of cattle population either fails to conceive with a single or more number of inseminations (Karunakaran, et al., 2012). The repeats of AI services however, in such groups made the cost of it relatively high, almost double.

Conclusion and Recommendations

Calving percentages were used as the criteria of measuring performance of AI breeding program in the Centre. Bulling cows and heifers should be given proper nutrition that is able to supply reproductive requirements. It is necessary to synchronize estrus so as to harmonize management in the herd. Other forms of diagnosing pregnancy a part from non-return method such as rectal palpation, ultra sound and early non pregnancy diagnosis should be made use of in the program. Cows that are non repeaters and conceptors should be culled. Repeater breeders should be given treatments and taken back to the breeding program. The cost of providing AI services can be cut down if the Center could purchase AI facilities and use the AI trained members of staff to carry out the inseminations.

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