ASSESSING THE REPRODUCTIVE PERFORMANCE OF A TANZANIAN DAIRY HERD: THE IMPORTANCE OF PROPER RECORD KEEPING

KANUYA[1] N. L., AGGER[2] J. F. and PEDERSEN[3] K. M., [1]Department of Veterinary Surgery, Obstetrics & Reproduction, Faculty of Veterinary Medicine, Sokoine University of Agriculture, Tanzania and Departments of [2]Animal Science, Health & Ethology and [3]Clinical Studies, Reproduction, The Royal Veterinary and Agricultural University, Denmark.

SUMMARY

Before attempting to evaluate the fertility of a dairy herd, it is necessary to have accurate reproductive data of all cows. A retrospective longitudinal study was conducted to assess the reproductive performance by analyzing records of cows in one conveniently selected dairy herd in Tanzania. The records covered the period between February 1989 and June 1993. The cows in this herd were of Ayrshire and Friesian breeds. Both natural service and AI were utilized for breeding. The average interval (mean$\pm$SD) from calving to first service, first service to conception and calving to conception intervals were 94.85$\pm$42.88, 31.8$\pm$55.1 and 121.69$\pm$60.65 days, respectively. The conception rate to first service was 60.1 %. The overall pregnancy rate in the herd over the study period was not determined due to missing records or variation in the interval from first service to confirmation of pregnancy. Friesian (n=24) and Ayrshire (n=17) cows had an average gestation lengths of 275.8$\pm$4.8 and 277.1$\pm$4.0 days, respectively. The average calving interval in the herd was 407.0$\pm$66.0 days. The data set had several recording errors. Underrecording of events was also common. This paper recommends to use the results of the study as a basis of discussion with the farm management team to set targets for several reproductive parameters, compare the targets to the current situation and when necessary implement intervention strategies to improve the reproductive performance in the herd. Attainment of the set targets should benefit the farm by optimizing the number of replacement heifers available and milk production per lifetime of individual cows in the herd.

INTRODUCTION

The success of a commercial dairy farm depends on the efficiency of milk and calf production. Efficiency of production of the two products normally governs the net income and therefore the profit to a farm (Spreicher and Meadows, 1967). However, efficiency of milk and calf production depends on fertility (Bulman and Lamming, 1978; Janson, 1980). A fertile cow produces a viable calf regularly within a specified calving interval. Regular calvings normally result in more calves being born and an increase of the amount of milk produced per cow per lifetime (Salisbury *et al.*, 1978). In addition, regular calving indirectly improves efficiency of management through increase in the rate of herd replacement and also determines to what extent culling can be carried out efficiently in a farm. Due to the above mentioned significance, fertility and regular calving are regarded as factors of paramount importance in commercial dairy farming enterprises (Peters and Ball, 1987).

Fertility, as an indicator of reproductive performance, has been a subject of several studies in many countries (De Kruif, 1978; Roine and Saloniemi, 1978; Claus *et al.*, 1983). These studies have shown that fertility is best estimated by the use of a set of reproductive parameters or indices. Commonly used reproductive parameters include the intervals from calving to first service, first service to conception, calving to conception and that between successive calvings or calving interval.

For a dairy operation to maintain a profitable calving interval, it is necessary to prevent and control herd reproductive problems. This can be accomplished by conducting regularly scheduled reproductive health examinations. Proper record keeping and updating for the intended use is paramount in the establishment and efficient running of a reproduction control programme. The use of computers in record keeping and retrieval will greatly facilitate and add efficiency to the whole programme.

The objective of the present study was to analyze breeding and calf records as presently kept in one dairy farm in Tanzania in order to identify problems in record keeping and retrieval system and suggest solutions required to effect improvement to increase reproductive efficiency in the farm.

MATERIALS AND METHODS

Study area, design and animals

The data for this retrospective longitudinal study was obtained from breeding and calf register books in one herd which belong to the Department of Animal Science at the Sokoine University of Agriculture, Morogoro, Tanzania. The records analyzed cover the period between February 1989 and June 1993. The data has continuously been collected as part of the routine farm management practice. At the farm the records are normally utilized whenever information on breeding, pregnancy status or calving dates of individual cows are required. The study sample was conveniently selected, i.e. not at random and the data has never been formally critically evaluated and analyzed to establish reproductive indices on a berd basis.

All the animals in the herd were adapted *Bos taurus* dairy breeds (Friesian and Ayrshire) except a few cross breeds. In this herd, both natural service and artificial insemination are used. However, bulls are always separated from cows except at the time of breeding after a cow has been detected in heat. According to farm management policy in this herd, there is a voluntary waiting period of 60 days after calving before subsequent breeding is started. Cows graze out on established pasture during the day and are kept in paddocks at night. They are let out to graze after the morning milking but in order to avoid the effects of excessive environmental temperature, animals are put under a roofed shed at around midday. During this period they have free access to drinking water and are also provided with either silage or green chop. Supplementary feeding of cows is carried out according to standard nutrient requirements and control of endemic diseases is regularly carried out.

RESULTS

General

Recorded information on herd size, number and birth weight of calves born, frequency of abortions and dystocia in the herd over the study period is shown in Table 1.

Breeding methods and pregnancy check results

Information on dates of heat that were not utilized for breeding was missing in the records. During the period of study, a total of 249 natural services and 37 AI events were recorded. Of the 11 bulls used for breeding during this period, six were utilized through AI and five by natural service. Each of the five bulls used for natural service, performed 54.61, 12.55, 12.18, 8.49 and 1.85 % of all the breeding events, respectively. The remaining proportion of the breeding events was performed through AI. Also there were 113 pregnancy checks carried out, of which 104 had positive and 9 negative findings. There were therefore an average of 2.75 breeding performed per pregnancy. When 11 cows which required four or more services to conceive are excluded, the average number of services per pregnancy was reduced to 2.2.

Of the 95 cows with a calving event recorded, 10 did not have a record of prior pregnancy check performed on them. Therefore, of the 104 positive pregnancy checks, only 85 were later followed by a calving event. Of the remaining 19 cows, that were previously confirmed to be pregnant but without a calving event indicated later in the records, 14 cows had no further records, three had an abortion, one had a diagnosis of dystocia only and one had no record of calving or abortion or dystocia but rather confirmation of pregnancy was followed by a natural service. This defies normal biological sequence of events.

The average interval between calving and first service was 94.85±42.88 (mean±SD) days

Abortions

There was a storm of abortions (n=-15) in 1989 and based on clinical signs presented by the affected cows and later laboratory confirmation this was caused by Rift Valley Fever Virus infection. The majority (n=13) of the cows which aborted were reserviced at an average of 79.1±18.7 (mean±SD) with a range between 50 and 114 days after the abortion. However, two cows were bred again at 194 and 197 days post abortion. Of the 15 cows that aborted, 11 subsequently calved after an average of 392.-1±57.7 (mean±SD) days with range between 323 and 493 days from the date of abortion. These cows required an average of 1.5 services or inseminations per pregnancy. The dates of calving of four cows were not shown in the records.

Gestation length

The gestation length was obtained by counting the number of days between last recorded breeding event and the next calving event. Based on the gestation lengths of 41 cows (Table 5) each of which had 1 to 4 gestation periods recorded, the majority of animals exhibited a gestation length of 270 to 290 days, but 12.2% of cows had a gestation length of more than 290 days. Friesian cows (n=24) had an average gestation length of 275.8±4.8 days whereas Ayrshire cows (n=17) had an average gestation length of 277.1 ±4.0 (mean±SD) days. The difference in average gestation length between the two breeds was non significant (P> 0.05). When both breeds are considered together, the average gestation length was 276.3±4.5 (mean±SD) days.

Calving interval

The calving interval for an individual cow (Table 2) was determined by counting the number of days between two consecutive dates of calving. There were 10, 7, 6, and 2 cows each with 1, 2, 3, and 4 calving intervals respectively. The average calving interval was 407.0±66 (mean±SD) with a range between 320 and 585 days.

First service to conception

The interval from first service to conception (Table 2) was calculated by counting the number of days from the first recorded service or insemination after calving to the last similar event before the cow was declared to be pregnant. There were 7, 10, 6, 4 and 1 cows each with 1, 2, 3,4 and 5 records available for this calculation, respectively. The average interval from first service to conception was 31.8±55.1 (mean±SD) days. The range was 0 to 237 days. The pregnancy rate to first service was 60.1 %. Pregnancy rate to first service was calculated as the percentage of first services given to all cows over the study period, which resulted into a diagnosed pregnancy or were followed by a calving event. However, the overall pregnancy rate which is another important measure of fertility in a herd was not determined due to missing records and/or variations in the interval from first service to confirmation of pregnancy.

Table 1. Herd size, number and weight of calves born, frequency of abortions and dystocia in the herd between February 1989 and June 1993

	1989	1990	1991	1992	1993	Total
Herd size	39	33	31	25	43	-
Ayrshire	16	12	18	9	18	-
Friesian	23	19	13	12	20	-
Crossbred	0	2	0	4	5	-
Positive preg. check	2	29	33	18	22	104
Negative preg. check		5	4			9
Calves born	13	21	31	22	15	102
Males	8	15	14	13	7	57
Females	5	6	17	9	8	45
Average birth weight	29.7	29.6	29.9	29.5	27.8	-
(± SD)	±5.7	±5.9	±5.2	±3.9	±5.7	
Males	31.9	30.1	31.9	29.1	29.2	-
	±5.9	±4.5	±4.6	±3.6	±3.4	
Females	26.2	28.3	28.2	30.0	26.6	-
	±3.7	±7.3	±5.1	±4.7	±7.1	
Abortions	15	3	2	1		21
Dystocia				1		1

Table 2: Frequency of records available for determination of reproductive parameters

	Records available				
	1	2	3	4	5
Parameter					
Calving to first service	11	11	8	4	2
First service to conception	7	10	6	4	1
Calving to conception	5	13	6	4	0
Calving interval	10	7	6	2	0

Calving to first service

The interval from calving to first service (Table 2) was calculated by counting the number of days from calving to the first breeding event recorded following the calving. There were 11, 11, 8, 4 and 2 cows each of which had respectively 1, 2, 3, 4 and 5 intervals available.

Calving to conception interval

The interval from calving to conception (Table 2) was calculated by counting the

number of days from calving to the last recorded date of service or insemination event immediately preceding a positive pregnancy diagnosis or calving. There were 5, 13, 6, and 4 cows each with 1, 2, 3 and 4 calving to conception intervals respectively, available. The average calving to conception interval was 121.69±60.65 (mean±SD) days with a range between 30 and 283 days. with a range from 30 to 201 days. The distribution of cows in the herd according to interval from calving to conception is shown in Table 3.

Calving season

The calf register book showed that 102 calves were born whereas only 95 calving events were recorded. Most calves (79.4 %) were born between March and September as shown in Table 4. For all the years covered during the present study, there was only one calving event which occurred in the month of October. From the calving pattern shown in Table 4, it can retrospectively be inferred that the period of highest fertility (highest conception rate) was between July and December when most cows became pregnant. This coincides with the dry season which is usually followed by the short rains.

Table 3: Distribution of cows in the interval between calving and conception in days

Calving to conception interval	Frequency	Cumulative %
<60	10	12.05
61-80	10	24.1
81-100	16	43.38
101-120	4	48.2
121-140	7	56.63
141-160	8	66.27
161-180	6	73.5
181-200	4	78.32
>201	18	100.00
TOTAL	83	100.00

Table 4. Calving distribution over months (M) from January to December (J to D) and the total (Tt) in 1989 to 1993.

M	89	90	91	92	93	Tt
J	0	0	3	0	0	3
F	3	0	0	0	0	3
M	2	2	1	1	4	10
A	0	5	2	6	3	16
M	3	1	4	3	2	13
J	2	2	2	0	6	12
J	0	4	5	1	0	10
A	1	3	5	2	0	11
S	1	3	3	2	0	9
O	0	1	0	0	0	1
N	1	0	1	4	0	6
D	0	0	5	3	0	8
Tt	13	21	31	22	15	102

Table 5: Frequency distribution of gestation length (days) of 41 cows with 1 to 4 gestation periods

Gestation length (days)	Frequency	%
< 270	6	7.3
270-290	6	80.5
> 290	10	12.2

Calf birth weight

For calculation of calf birth weight averages (Table 1), one male calf of those born in 1992 was omitted due to the recorded birth weight being more than 5 SD units below average which makes the record to be suspected of having a recording error. The birth weights of two calves born in 1993, one male and one female, were unrecorded and therefore the average birth weight for that year was based on 13 calves only. According

to year of birth, the average birth weight (Table 1) varied from 27.8±5.7 to 29.9±5.2 kg with no significant difference ($P > 0.05$) between male and female calves.

DISCUSSION

Monitoring and maintaining good fertility in a dairy herd can be achieved through regular, routine examination of all cows in a herd. All relevant data gathered in the course of each examination of individual cow should be accurately and permanently recorded. Routine examination and recording of cow data facilitates early identification of cows which are infertile. Before attempting to evaluate the fertility of a herd, it is therefore necessary to have accurate reproductive data of all the cows.

The data utilized in this report contained a framework which could potentially provide most of this vital information. The main missing information is on dates of heat not utilized for service. With the management decision only to breed cows coming to heat more than 60 days post calving, there must have been cows that showed heat earlier than that time and went unrecorded. Overall such a practice would not help to improve the efficiency or increase the herdsmen vigilance to observe and recognize animals in heat. Another negative impact of the practice would be to delay early identification of cows that remain anoestrous for a longer than normal duration after calving i.e. the proportion of cows which were in heat before 60 days postpartum would remain unknown. The data also showed that pregnancy diagnosis was not carried out at a specified period after breeding. This makes it impossible to calculate the herd pregnancy rate at a particular time post breeding. Non pregnant cows that are not detected in heat would therefore remain in the herd for a long time before detailed examination and treatment (if indicated) are carried out which prolongs the herd calving interval.

The main problem shown by the reproductive parameters (calving to first service, first service to conception and calving to conception intervals) in the present study lies with the great variability of these intervals among individual cows as shown by the standard deviation values (Table 2). The greatest variation in performance of individual cows is observed in the interval between the first service and conception where the SD was greater than the mean.

The gestation length of Ayrshire and Holstein-Friesian cattle is 277-279 and 278-288 days respectively (Morrow 1986). With 7.3% of gestation lengths being < 270 days in the present study, this is most likely a reflection of errors in the initial recording or transfer of data. The 12.2% gestation lengths of > 290 days could either indicate cows conceiving to a later service or insemination, which went unrecorded or represent a finding which requires further investigation.

There was missing as well as incorrectly recorded information. In some instances a service or AI was recorded but without indication of bull number or breed. A few of the recorded calf birth weights were far below average. This could either be an error in recording or assuming the weight of an abnormally terminated pregnancy to be a birth weight. While the herd size changed over the years (Table 1) not all challenges (and reason for) were recorded. This data also showed that either peri- and postpartum reproductive diseases (dystocia, retained fetal membranes, metritis, etc.) occur very infrequently or they were under recorded. The problem of underrecording was also shown by the registration of two consecutive calvings and a positive pregnancy diagnosis in one cow but without either natural service or AI event between them.

Only a small proportion of breeding events (37 out of 286) were carried out artificially. Of the five bulls used for natural service, one of them was preferentially utilized and performed 54.6% of all the breeding events. In future, semen from several bulls with comparable breeding values should be used equally frequently at any one time to

avoid problems of inbreeding which might result from the extensive use of one bull.

The calving to conception interval in the present study was longer than that of dairy cows in temperate countries (Larsson *et al.*, 1984, Laitnen *et al.*, 1985, Eldon, 1988 and Lemire *et al.*, 1991) or other Tanzanian dairy herds in which cows are always mixed with breeding bulls (Kanuya, 1992). But this interval was shorter than that reported in studies conducted among dairy cows in two other parts of Tanzania (Shekimweri, 1982; Katyega, 1988).

The pregnancy rate to first service of 60.1 % obtained in the present study is on the higher side of similar previous studies (Pelisier, 1972, Janson, 1980, Eldon *et al.*, 1985, Reimers, 1985). This apparently high pregnancy rate to first service could probably be explained by differences in sample sizes, misreading or lack of recording. The average calving interval of 13.6±2.2 months was similar to that reported by Lemire *et al.*, (1991). Cows in the present study required more services per conception than reported by Lemire *et al.* (1991). With the apparently good pregnancy rate to first service, the average number of services per pregnancy was mainly influenced by the few cows that required more than four services before conception.

The observation that most conceptions occurred during the period of the year when environmental temperatures and humidity were relatively low is probably an adaptation phenomenon to circumvent the adverse effects of high temperatures and humidity. In addition, conception during this period of the year ensures that calving would take place during the long rains or immediately after when there is plenty of grass to ensure calf survival. However, such a seasonal calving pattern leads to uneven milk supply over the year. Since liquid milk is the most desirable dairy product in Tanzania, an even supply over the year is preferred. This can be achieved by adopting a sound feed conservation policy to even out supply over the year. Animal housing and management routine can be aimed at alleviating heat stress to animals and allow conception to occur equally well at all seasons of the year. When this is achieved, it should then be possible to have an all year round calving pattern as one of the targets in this farm.

It is being recommendation before intervention to improve both the recording efficiency and reproductive performance of the herd is attempted, a number of targets for the farm must be set up and agreed upon after discussion with the farm manager and the herdsmen. After scrutinizing the present system of recording, methods of improvement should be suggested and agreed upon. For example events should be registered in the farm's record book on the day of occurrence. There should also be a routine system of reviewing and updating of records. This can for instance be done through writing of monthly reports by the farm manager to the head of the department. Existing records should be transferred and stored in a computer. These computer records should also be constantly updated as new events occur.

Reasonable and achievable targets on pregnancy rates among cows desired to become pregnant, calving to conception interval and the number of breeding per cow per pregnancy need to be agreed upon. Other targets should involve policy on calving pattern over the year, the interval from the last insemination to pregnancy check as well as a policy on genetic improvement by use of AI, bulls or embryo transfer. For heifers, a target age at first calving should be set. To be able to reach the targets and to make proper allocation of available resources, a priority list showing the order of implementation of these targets must be made. It can not be overemphasized that success of the programme will very much depend on proper record keeping of all events occurring in the herd. In fact, a certain record keeping accuracy and efficiency should be agreed upon as one of the targets to be achieved in the herd. The need for this is clearly shown by the various shortcomings, as

pointed out earlier, in the records utilized in the present study.

Targets that if achieved would improve the reproductive performance in this herd are as follows:

(a) 80 to 90% of cows desired to be kept in the herd should achieve pregnancy again after calving;

(b) A calving to conception interval of 100 to 110 days;

(c) An average of two inseminations or natural matings per cow per pregnancy;

(d) Age at first calving should range from 24 to 30 months;

(e) An all year round calving pattern and

(f) For genetic improvement in this herd, the exclusive use of AI using semen collected from bulls with high genetic merit for milk production should be emphasized. Enthusiastic use of AI in a farm requires keenness in oestrus detection as well as good record keeping.

The discussions with the management team and herdsmen education will not add extra monetary cost to the farm except for the time utilized. If deemed necessary, a package of incentives to the herdsmen who reach a particular target should be worked out by the farm management team. Attainment of the set of targets would benefit the farm by improving the reproductive performance in the herd leading to more replacement calves being born and an increase in milk production per lifetime of a cow.

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