AGE AT FIRST CALVING AND ITS EFFECTS ON SUBSEQUENT REPRODUCTIVE PERFORMANCE IN DAIRY COWS IN TANZANIA

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SUMMARY

This study examined the effect of age at first calving on productivity and reproductive performance of dairy cows with above average feeding management in Tanzania. Age at first calving (Mean ± SEM) in the animals studied was 905 ± 24 days. Records of 60 cows, each with three complete lactations, were divided into three groups according to age at their first calving. Group I (n=15) represented cows whose age at first calving was below 900 days. Group II (n=32) included cows whose first calving occurred between the age of 900 and 1100 days, whereas Group III (n=13) comprised cows whose age at first calving was above 1100 days. Corresponding first lactation yields (Mean ± SEM) were 2,838 ± 174, 3,253 ± 114 and 3,425 ± 169 kg of milk, with respective lactation lengths of 341 ± 18, 329 ± 7 and 330 ± 4 days for Groups I, II and III, respectively, Second lactation yields were 3,236 ± 126; 3,505 ± 103 and 3,661 ± 135kg, and lactation lengths were 267 ± 13, 312 ± 9 and 337 ± 2 days for the respective groups. Third lactation yields were 4,175 ± 177; 3,983 ± 166 and 3,898 ± 230kg, and lactation lengths were 326 ± 6,335 ± 7 and 342 ± 9 days for Groups I, II and III, respectively. In the first calving, all lactation yields between the three groups were significantly different (P <0.05) with Group III having the highest yield. In the second calving, lactation yield of Group I differed from those of Group II and III with Group III still having the highest yield; whereas in the third calving, differences in these parameters were noted between Group I and III (P<0.05) with Group I having the highest yield. Animals in group 1, exhibited poor fertility indices with a calving interval of 479 ± 24 days in the first lactation. The same Group, however, had improved fertility in the second and third lactation whereby calving intervals were 403 ± 16 and 386 ± 14 days , respectively. Animals in Group II, had best overall fertility with calving intervals of 384 ± 9, 400 ± 12 and 416 ± 11 days in the first, second and third lactation, respectively. Cows in Group III, showed poor fertility in all three lactations, with calving intervals of 472 ± 32; 468 ± 12 and 423 ± 27 days in the first, second and third lactation, respectively. Fertility indices of this Group in the first and second lactation were different from those of Group II (P< 0.05). They also differed from those of Group I in the second and third lactation. It is concluded that in animals with above average feeding management, age at first calving could be reduced to 900 days without adversely affecting subsequent reproductive performance.

INTRODUCTION

The main reproductive traits responsible for low productivity of dairy herds in tropical countries are advanced age at first calving and long calving intervals (Kiwuwa, 1968). Age at first calving in these countries is 3 - 4 years (Dobson and Kamonpatana, 1986; Galina and Arthur, 1989; Singh and Dave, 1989), but can be reduced by means of improved feeding management. Improved feeding particularly dry season supplementation minimizes weight loss and ensures adequate weight for age growth. This, in heifers, facilitates early start of oestrous cyclicity, timely service and consequently reduces age at first calving (Kayongo-Male *et al.*, 1982). Lower age at first calving is advantageous in as much as it reduces unproductive life and shortens generation interval (El Amin, 1976). This helps in cutting down costs associated with raising replacement heifers (Amir and Kali, 1974; Little and Kay, 1979). Moreover, early first calving age may indicate potential for high lifetime performance.

Experience, however, indicates that too early first calving in dairy heifers, usually result in increased incidence of dystocia, low milk yield and reduced reproductive performance (Arthur *et al.*, 1989). Consideration of these problems in conjuction with the above mentioned advantages, points to the need to determine an optimum age that heifers should reach by their first calving. This age should be consistent with environmental and animal characteristics for a particular geographical area. This study therefore, analyzed breeding and production records with an objective of examining the effect of age at first calving on subsequent milk production and reproductive performance of dairy cows with above average feeding management in Tanzania.

MATERIALS AND METHODS

Location

The study was conducted on a dairy farm belonging to Sokoine University of Agriculture (SUA), Morogoro. The farm is situated at an altitude of 528m above sea level. It receives, on average, 800 mm of rain per year. Rainfall is bimodal with a short and long rainly season. Long rains ocur between February and May while the short rains occur in October and November. The rest of the year forms the dry period. Small temperature variation, between 27°C and 31°C during the day and not less than 14°C at night, are experienced throughout the year. The hottest and coolest months are February and August, respectively.

Animals

Animals comprised Friesian, Ayrshire and Jersey cows that were raised on the farms. Feeding regime for calves was: giving colostrum for the first two days, followed by 2 L of milk per calf per day until the age of three months. Additionally, calves had free access to hay and water. After three months, calves were weaned, grazed on pasture and supplemented with maize silage during the dry season, Heifers were grazed mainly on pasture and supplemented with silage during

the dry season. Lactating cows were on pasture during the day and in paddocks during the night where they were offered green chop or silage. Concentrate feeding was done during milking at 06.00 -07.00 h and between 17.00 and 18.00 h.

Retrospective data

Data on production, breeding and health was obtained from farm records. These data were used to calculate fertility indices, namely, age at first calving, days to first service, number of services per conception, and calving interval. Milk production parameters namely lactation length and lactation yield were also computed from production data recorded on twice-a-day basis. Data on 60 heifers, each with atleast three subsequent lactations, starting with the first, were available for analysis.

Statistical analysis

For analytical purposes, animals were divided into three groups according to age at first calving. Group I included 15 animals whose age at first calving was before 900 days and this was termed the early calving group. Group II comprised 32 cows whose age at first calving was between 900 and 1100 days and this represented the medium calving group; whereas Group III with 13 animals whose age at first calving was after 1100 days represented late first clavers. The effect of age at first calving on lactation yield and lactation length was assessed by analysis of variance using the mathematical model: $Y_{ijkl} = U + C_i + a_j m_k + e_{ijkl}$ where Y_{ijkl} = l^{th} observation on i^{th} cow of j^{th} age in the k^{th} lactation U = population mean and e_{ijkl} = random error. Tests of significance in differences between group means were done using Duncans multiple range test according to Snedecor and Cochran (1980).

RESULTS

Mean age at first claving (± SEM) for the animals studied was 905 ± 24 days. For the first three lactations, overall lactation yields were 3,046 ±86; 3,451 ± 59 and 4,0.28 ± 95kg; and lactation lenghts were 333 ± 6, 319± 5 and 323 ± 3 days respectively. Table 1 shows lactation yields and lactation lengths in the animals grouped according to age at first calving. In the first calving, lactation yields between the three groups were significantly different ($P<0.05$) with Group III (late calvers) having the highest milk yield. In the second calving, however, lactation yield for Group I differed from those for Group II and III still recording high milk yield. In the third calving, however, differences in lactation yields were noted between Group I and III in that Group I exhibited significantly higher milk production in this lactation.
Fertility indices according to age at first calving are shown in Table 2.

Animals in Group I, exhibited poor fertility indices in the first lactation. The same animals, however, showed progressive improvement in fertility in the second and third lactation; fertility

Table 1: Effects of age at first calving on Lactation yield and length

	1ST LACTATION		2ND LACTATION		3RD LACTATION	
Group	Yld Kg	Lngth days	Yld kg	Lngth days	Yld kg	Lngth days
I (n=15)	2838* ±174	341 ±18	3236** ±126	267 ±13	4175*** ±177	326 ±6
II (n=32)	3253* ±114	329 ±7	3505** ±103	312 ±9	3983 ±166	335 ±7
III (n=13)	3425* ±169	330 ±4	3661* ±135	337 ±2	3898*** ±230	342 ±9
Overall	3046 ±86	333 ±6	3451 ±59	319 ±5	4028 ±95	323 ±27

Numbers within column with the same superscript are different ($P<0.05$). Group = First calving age group; I = calving before the age of 900 days, II = calving at an age between 900 and 1100 days, and III = calving at age < 1100 days. Yld = Lactation yield, Lngth = Lactation length.

Table 2: Effects of age at first calving on fertility

	Groups		
	I	II	III
	(n=15) (n=32)	(n=13)	
1ST CALVING			
Calving service	133±16	79±5	83±12
Service index	1.83±0.19	1.55±0.71	2.62±0.31
Calving interval	479±25	384±13	472±33
2ND CALVING			
Calving service	101±18	81±8	124±17
Service index	1.75±0.39	1.63±0.11	2.31±0.28
Calving interval	403±16	400±3	468±20
3RD CALVING			
Calving service	97±12	99±6	122±19
Service index	1.25±0.11	1.78±0.14	1.62±0.26
Calving interval	386±14	416±9	423±27

Calving age groups were: I = calving age of <900 days, II = calving between 900 and 1100 days and III = group calving after 1100 days. Calving service = calving to 1st service, Service index = number of services per conception.

indices in the third lactation in this group were the best of all. Animals in Group II, had best fertility in the first and second lactation. They, however, had moderate fertility indices in the third calving. Cows in Group III, showed poor fertility in all three lactations. Fertility indices of this group in the first and second lactations were different from those of Group II ($P < 0.05$). They also differed from those of Group I in the second and third lactation.

DISCUSSION

Mean ($\pm$SEM) age at first calving of 905 $\pm$24 days observed in this study is lower than that generally claimed for cattle raised in the tropics (Galina and Arthur, 1989; Mbap and Ngere, 1989; Agyemang and Nkhonjera, 1990). This could possibly be explained by the above average feeding management in the farms studied. Significant differences in milk yield and fertility between the groups of this study were observed. Early calving age was associated with both low milk yield and poor fertility in the first lactation. This finding is in agreement with results reported by some researchers (Wickersham and Schultz, 1963; Russel, 1982; Lin *et al.*, 1986). It is however, inconsistent with other studies which recorded non-significant differences in ilk yield according to age at first calving (Nehra *et al.*, 1987; Mrode, 1988; Jezkova *et al.*, 1989). This inconsistency could be due to breed differences or, more likely, age at first calving that was used in those studies. Mrode (1988) in Nigeria, for example, made his observations on animals whose age at first calving was more than three years.

From this study, it seemed that animals with lower age at first calving were less fertile and less productive than the older first calving age groups in the first and second lactation. They were, however, the most fertile and best producers in the third lactation. The third lactation was presumably the time when the effects of premature calving had waned. Lin *et al.* (1988) also observed that the impact of early calving age on subsequent lactations decreased with increasing number of parities. Group II heifers whose age at first calving was between 900 and 1100 days had best overall milk yield and reproductive performance in the three lactations studied. Animals in Group III which were older than 1100 days at first calving, had poorest fertility and lowest overall milk yield. This could mean that failing to conceive at an early age was an indicator of poor fertility as well as low lifetime performance. However, breed differences in the animals used could have influenced the results. Our observations were made on anmals which as heifers were bred upon detection of post pubertal oestrus, irrespective of age. We could therefore not determine the effect of deliberately delaying calving on milk production and fertility during the first two lactations. Nevertheless, since the medium calving age (Group II) had the best overall milk production and fertility, it could be concluded that in animals with above average feeding management, age at first calving could be reduced to 900 days without adversely affecting subsequent reproductive performance. This means, it is possible to breed our animals at an age of 21 months.

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