The effect of farm (herd) and season of calving on the reproductive performance of Sanga cows in smallholder peri-urban dairy farms in the Accra Plains

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Abstract

Reproductive studies were conducted on Sanga cattle which are predominatly used in smallholder peri-urban dairy farms in the Accra Plains for milk production. The interval from calving to first progesterone rise (calving to resumption of cyclic ovarian activity) averaged 101.3 ± 6.2 days and was significantly ($P < 0.05$) different among various farms. Season of calving did not exert any significant ($P > 0.05$) influence on this interval. There was a general delay of about 55 days from first progesterone rise to conception. The interval from calving to conception was 164.2 ± 7.4 days and was significantly ($P < 0.05$) different in the farms studied, with season of calving having no significant ($P > 0.05$) effect. The mean calving interval was 444.3 ± 2.5 days. This was significantly ($P<0.05$) affected by farm and season of calving of cow. Cows that calved the dry season had a shorter calving interval (435.3 ± 9.6 days) than those that calved in the wet season (453.2 ± 11.0 days). The results indicated poor reproductive performance of the animals as evidenced by long post-partum anoestrous period and long calving interval.

(Original Scientific Paper accepted 6 Jun 00.)

Introduction

Milk is regarded as nature's single most complete food (Frei, 1993). Ghana is a net importer of dairy products due to the under development of its dairy industry. In 1995, for instance, 5,171.80 metric tons of dairy products were imported into the country at the cost of US$9,072,061.25 (LPIU, 1995). The dairy industry in Ghana is mostly in the hands of private smallholder farmers who make use of cattle breeds such as Sanga and West African shorthorn.

Milk production in cattle depends on reproductive activity. The more frequently a cow calves, the greater the amount of milk she is likely to produce in her life-time. A recent cross-sectional study by Okantah *et al.* (1999) revealed the broad characteristics of the production system. Although the Sanga breed of cattle constitute 76 per cent of cattle used for milk production in smallholder dairy herds in the Accra Plains (Okantah *et al.*, 1995), there is a paucity of information on their reproductive performance under traditional management conditions. This study was, therefore, conducted to identify the basic constraints to reproduction in Sanga cows under the existing system of management in the Accra Plains. Such informaiton would, hopefully, help evolve strategies for improved reproductive performance and increased and sustainable milk production.

Materials and methods

Location and management of cattle herds

The study was conducted on eight herds of Sanga cattle, in smallholder peri-urban farms located in the Dangbe West District of the Accra Plains of Ghana, betwee February 1995 and July 1996. The Accra Plains has a bimodal rainfall pattern with the major wet season occurring between April and July and the minor season between September and October. The remaining months are dry. Annual rainfall is between 600-1000 mm per annum. The highest mean monthly temperature of 30 °C

occurs between March and April and the lowest of about 26 °C in August. Average relative humidity for the year is about 65 per cent.

The management systems on the smallholder farms were principally agropastoral with a Fulani herdsman in charge of the animals. Cattle were herded and grazed from aproximately 08:00 h to 18:00 h (local time) on natural grasslands which consisted largely of *Panicum maximum, Sporobolus pyramidalis* and *Vertiveria fulvibarbis*. Animals were watered daily from dams and dug-outs on the Plains. Mating was natural with service bulls running freely with females all year round. Calves were weaned between 6-9 months of age. Calves above 1 year old were allowed to follow their dams to pasture. The younger ones were isolated and penned until the return of their dams from grazing when they were allowed access to the dam's residual milk after hand milking (Okantah, 1992). Cattle were vaccinated yearly against rinderpest, and ectoparasites were controlled weekly by handwashing with acaricides (Chlorfenvniphos and Dioxathion combinations or Amitraz). Deworming was generally limited to calves.

Variables studied

Seventy-six cows from eight herds were enlisted and monitored after calving. The average size of herds in the study was 85 with a range of 50-200. The variables studied were calving-to-first progesterone rise interval (calving to resumption of cyclic ovarian activity), interval from first progesterone rise to conception, interval from calving to cenception, and calving interval. Resumption of post-partum ovarian cyclicity was determined by measuring milk progesterone levels of experimental animals. Milk samples were collected from all animlas 14 days after calving and then at 7-day intervals. Milk was collected over ice in the field. The milk samples were then sent immediately to the laboratory, and centrifuged to allow separation and removal of fat. Fat-free milk samples were then frozen at -20 °C until assayed for progesterone with the FAO/IAEA Radioimmunoassay (RIA) kit for milk. A milk progesterone concentration of 2.0 *n*mol/l or more was taken as evidence of ovarian activity. Preganancy was confirmed by elevated milk progesterone levels at 21 and 42 days post-coitus. Once animals became pregnant weekly sampling of milk was stopped.

Statistical procedures

Data were analysed using the GLM procedure of the Statistical Analysis Systems Institute (SAS, 1987). Fixed effects in the model included season of calving. The Model used was as follows:

$$Y_{ij} = \mu + F_i + S_j + e_{ij}$$

where Y_{ij} = interval from calving to first progesterone rise, interval from first progesterone rise to conception, interval from calving to conception and calving interval; μ = overall mean; F_i = effect of *i*th farm; S_j = effect of *j*th season of calving; e_{ij} = a random error associated with each observation. Calving interval was calculted as the number of days between two successive calvings.

Results and discussion

Table 1 shows the effect of farm (herd) and season of calving of cow on the intervals from calving to first progesterone rise and first progesterone rise to conception. The mean interval between calving and initiation of ovarian activity as indicated by first progesterone rise concentration was long (101.3 ± 6.2 days), indicating post-partum anoestrus problem in the Sanga cows. Factors such as inadequate nutrition and suckling (Peters, 1984, Wagenaar *et al.*, 1986; Jolly *et al.*, 1995. Robinson, 1996), involution of the reproductive tract, and time at which the hypothalamo-pituitary-ovarian axis recovers from the inhibition imposed by pregnancy and parturition (Mc Dowell, 1970; Malven, 1984). They have been reported to delay the post-partum resumption of ovarian cyclicity in cattle. According to Sloss & Duffy (1980) and Haresign (1981), bovine uterine involution takes 3-7 weeks to complete. Hansen & Hauser (1984) reported an uterine involution time of 27 ± 3.5 days

TABLE 1

The Effect of Farm and Season of Calving on the Intervals from Calving to First Progesterone Rise and First Progesterone Rise to Conception of Sanga Cattle in the Accra Plains (Mean ± SE)

			Calving to first P rise (days)		*First P rise to conception (days)*
Overall mean		(76)	101.3 ± 6.2	(62)	54.6 ± 6.9
Farm	1	(10)	101.3 ± 8.3^{ab}	(10)	74.7 ± 3.8^{ab}
	2	(5)	118.4 ± 9.6^{ab}	(5)	48.0 ± 6.7^{ab}
	3	(7)	94.7 ± 7.1^{ab}	(6)	26.3 ±10.2^{b}
	4	(11)	68.5 ± 6.2^{b}	(9)	37.5 ± 6.5^{ab}
	5	(7)	102.7 ± 4.4^{ab}	(5)	50.2 ± 4.8^{ab}
	6	(9)	99.3 ± 6.8^{ab}	(9)	93.3 ± 7.6^{a}
	7	(17)	138.1 ± 6.7^{a}	(12)	51.8 ± 3.6^{ab}
	8	(10)	87.5 ± 6.6^{ab}	(6)	48.7 ± 8.8^{ab}
Season	Wet	(54)	108.6 ± 12.2	(46)	54.6 ± 9.6
of calving	Dry	(22)	94.1 ± 8.0	(16)	54.7 ± 9.6

SE = Standard error.
Figures in parentheses indicate number of animals.
Means in the same column with different superscripts (a, b) are significantly ($P < 0.05$) different.
P = progesterone.

post-partum in primiparous cows and 43 ± 0.4 days in multiparous cows.

The natural pastures which the cows depended mainly on as feed resource becomes scarce and also poor in quality during the dry season, thus affecting their nutrition. Cows used in this study suckle their young until they are weaned naturally between 6-9 months. The suckling stimulus combined with low nutritional status of the animals may partly explain the extended interval from calving to resumption of ovarian activity. The interval from calving to the resumption of cyclic ovarian activity was significantly ($P < 0.05$) different in the various farms. Farm 7 recorded the longest interval whilst Farm 4 recorded the shortest (138.1 ± 6.7 *vs* 68.5 ± 6.2 days). The significant effects of farm with respect to all the variables studied may be traced to the fact that herd constitute a major source of variation in the performance of cattle as reported by Okantah & Curran (1982). The herd variation arises from both genetic and environmental sources.

Season of calving did not have any significant ($P > 0.05$) effect on this interval. This could be attributed to the fact that in this study most of the calvings (75%) occured during the late dry season/ early rainy season (March-April). There was generally a delay of about 55 days from first progestrone rise to conception. This might be due to disruptions of cyclic ovarian activities in some cows, short luteal phase, or the occurrence of silent oestrus as reported by some workers (Moller, 1970; Gyawu *et al.*, 1989; Osei *et al.*, 1993).

Farm exerted a significant ($P < 0.05$) influence on the interval from first progesterone rise to conception. The interval was longest in Farm 6 and shortest in Farm 3 (93.3 ± 7.6 *vs* 26.3 ± 10.2 days). Season of calving, however, did not significantly ($P > 0.05$) affect the interval from first progesterone rise to conception. The differences in farms with respect to the interval from first progesterone rise to conception may have been due to differences in management. For example, the number of bulls in the herd in relation to the

TABLE 2

The Effect of Farm and Season of Calving on the Interval from Calving to Conception and Calving Interval of Sanga Cattle in the Accra Plains (Mean ± SE)

			Calving to conception (days)		*Calving interval (days)*
Overall mean		(62)	164.2 ± 7.4	(24)	444.3 ± 2.5
Farm	1	(10)	178.0 ± 8.6^{ab}	(2)	445.5 ± 9.8^{ab}
	2	(5)	159.4 ± 12.2^{ab}	(3)	445.3 ± 10.2^{ab}
	3	(6)	118.0 ± 14.4^{ab}	(2)	456.0 ± 12.2^{b}
	4	(9)	103.9 ± 9.6^{b}	(3)	408.0 ± 6.9^{b}
	5	(5)	172.8 ± 12.4^{ab}	(1)	492.0 ± 8.2^{a}
	6	(9)	196.7 ± 6.8^{ab}	(3)	427.3 ± 12.1^{b}
	7	(12)	213.0 ± 9.4^{a}	(7)	458.7 ± 6.8^{ab}
	8	(6)	171.5 ± 6.6^{ab}	(3)	423.3 ± 8.2^{b}
Season	Wet	(46)	170.3 ± 9.4	(18)	453.2 ± 11.0^{a}
of calving	Dry	(16)	158.2 ± 14.1	(6)	435.3 ± 9.6^{b}

SE = Standard error.
Figures in parentheses indicate number of animals.
Means in the same column with different superscripts (a, b) are significantly ($P < 0.05$) different.

number of females is important. If the cows greatly outnumber the bulls and several cows come on heat at the same time, there is the likelihood that some cows will not be mated. Sexual dysfunction in the bull (low sperm count, lack of libido, etc.) may also be a causal factor.

The effect of farm and season of calving on the interval from calving to conception and calving interval are shown in Table 2. The overall mean interval from calving to conception obtained in this study was 164.2 ± 7.4 days with a high variation between cows (CV = 35. 6%). Calving to conception was significantly ($P < 0.05$) affected by farm but not season of caving of cow. Calving to conception interval was longest in Farm 7 (213.0 ± 9.4 days) and shortest in Farm 4 (103.9 ± 9.6 days). The interval from calving to conception can be considered as being made up of the interval from calving to first progesterone rise and the interval from first progesterone rise to conception. Obviously all factors that affect these two parameters will also affect the interval from calving to conception.

Further, the aggregate effect of a particular factor, e.g. season in this study, though insiginficant on such component traits, could generate a real difference in a trait in which they are in part-whole relationship with as in the case of calving interval observed here. If it is assumed that gestation is fixed, then the interval from calving to conception (days open) is the most important determinant of calving interval. This is particularly important in the dairy industry. A dairy cow has a standard 305-day lactation and, therefore, the number of days open (interval from calving to conception) should not be more than 60 days if the cow is to calve every year. Other factors, particularly diseases which may affect fertility in cows, may also be important.

Calving interval was significantly ($P < 0.05$) affected by farm and season of calving. Calving internal for cows on Farm 5 (492.0 ± 8.2 days) was signifcantly longer ($P < 0.05$) that those for Farm 4 (408.0±6.9 days, Farm 6 (427.3 ± 12.1 days) and Farm 8 (423.3 ± 8.2 days). Cows which calved in the dry season had significantly ($P < 0.05$)

shorter calving interval than those which calved in the wet season (435.3 ± 9.6 *vs* 453.2 ± 11.0 days). The shorter calving interval for cows which calved in the dry season compared to those that calved in the wet season observed in this study colloborates the report of Osei *et al.* (1993) for the same Sanga breed of cattle in the humid forest zone of Ghana.

Cows calving in the dry season may have taken advantage of improved nutritional conditions during the subsequent rainy season to meet their total requirements for maintenance, growth and lactation. The overall mean calving interval, 444.3 ± 6.2 days (CV = 6.8%) obtained in this study was long. Sada (1968) evaluated the fertility of a herd of cattle at the Agricultural Research Station, Legon, and suggested that an interval of 410 days be classified as good; 411-460 days as satisfactory and intervals greater thatn 460 days as poor. In that same study, calving intervals of 15.42 months (462 days), 14.80 months (444 days) and 15.5 months (465 days) were observed for N'dama, West African Shorthorn and Sokoto Gudali, respectively.

The long interval from calving to the resumption of cyclic ovarian activity of the animals may have contributed to the observed extended calving interval. Long post-partum anoestrous entervals have been reported to prolong calving intervals (Eduvie & Oyedipe, 1991). The calving interval value obtained in this study was slightly higher than the value 431 ± 32.8 days reported by Osei *et al.* (1993) for Sanga cattle in the humid forest zone of Ghana. The abundant supply of feed all year round in the humid forest zone may have enhanced the fertility of the animals post-partum, thus decreasing the calving interval.

Conclusion

The reproductive performance of Sanga cows kept on-farm in the Accra Plains is poor due to long post-partum anoestrous period, prolonged calving interval and distruption in cyclic ovarian activity. This situation may be improved by strategic supplementation of cows with protein and energy sources during the dry season and the introduction of early weaning into the production system.

Acknowledgement

The National Agricultural Project (NARP) and the Joint Food and Agricultural Oraginsation and International Atomic Energy Agency Division (FAO/IAEA) are acknowledged for their financial support for this project, the latter as a Coordinated Research Programme Contract. Thanks also go to Messrs Abdulai Mammah and Awudu Mumuni for their help in data collection, as well as Mr F.A. Kwateng for his help in the analysis of milk progesterone assay. The co-operation of smallholder peri-urban dairy farmers is acknowledged.

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