LOSSES UP TO FIRST CALVING IN BROWN SWISS x ZEBU AND HOLSTEIN FRIESIAN x ZEBU HEIFERS IN AN INTENSIVE SYSTEM OF MILK PRODUCTION IN THE TROPICS

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The purpose of this study was to determine the magnitude of losses of heifers up to first calving in an intensive milk production system in the tropics, as well as the effects on losses of the genotype of the heifer and its year and season of birth. The data were obtained from a commercial farm in the western llanos of Venezuela and covered births in the period 1976-79. The heifers were daughters of 23 Brown Swiss bulls and 16 Holstein Friesian sires out of Brown Swiss x zebu and Holstein Friesian x zebu cows of three different grades. They were reared in individual calf pens and then in corrals with high levels of feeding and management. Stillbirths accounted for 2.5% of all births (n = 1350) with no differences due to genotype, year or season of birth. Altogether, 15.6% of the heifers born alive (n = 1656) died or were culled before 9 months of age. The losses were consistently higher in the daughters of Brown Swiss compared to Holstein sires (18.4% versus 13.4% $P < 0.01$), with an especially marked difference (8.8%) in the case of the Holstein Friesian x zebu dams. The effects of year and season of birth were important: losses of calves born in August - November reached 21.9% compared with 11.5% (December - march) and 12.6% (April- July). Pneumonia and diarrhoea caused 57.7% of all losses, 64.3% of which occurred in the first month of life In the period 9 months to first calving, the overall lose from death and culling was 9.9%, with no differences due to genotype or season, although year of birth had an important effect ($P < 0.01$). Altogether, 31.2% and 24.9% respectively, of the daughters of Brown Swiss and Holstein Friesian sires failed to reach first calving. It was concluded that simi- lar results might commonly be expected in systems of this type and attention was drawn to the implications of this finding both with respect to the accurate planning of future milk development schemes as well as to the limited selection for production which inevitably results.

Key words: Death and culling rates to first calving, Brown Swiss crossbreds, Holstein crossbreds, semi-humid tropics.

Death and culling rates in youngstock are fundamental aspects of any milk production system, The losses which occur not only have direct economic consequences but also affect the intensity of selection which can be applied to the milking herd. Because of the unusually high variability of milk yields under tropical conditions, the success of a given system depends to a large extent on the availability of heifers to replace poor-yielding cows. There is little evidence available in the tropics about the rates of losses up to first calving under different production systems, even though it is essential to the correct planning of development programmes, The objective of this study is to determine the rate of loss in heifers up to first calving in an intensive milk production system and to examine the effects on death and culling incidence due to breed group, year and season of birth. The study forms part of an overall evaluation of a production system based on high grade European crossbred cattle kept in confinement in a semi-humid area of the tropics.

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Material and methods

The data were collected from "El Choro", a commercial farm in Acarigua, Portuguese State, located at 9.35°N, 69.14°W and approximately 220 metres above sea level. The mean temperature is 27.2°C and the average rainfall 1570 mm per year, but there are marked fluctuations between seasons in precipitation as shown in Table 1.

The study refers exclusively to female animals and losses during the following stages of life, these being calculated separately:

i) Stillbirths (%)
ii) Losses due to death and culling (%) between birth ant 9 months of age
ii Losses due to death and culling (%) between 9 months and first calving

The still births were calculated from the data of all female calves (n =1350) born during the period 1977-79. Information from earlier years was not included because it was not considered to be fully reliable. The percentage of losses from birth to 9 months of age was determined on the basis of 1656 observations which included all the heifer calves born alive in the period 1976-79, with the exception of 15 animals which were sold or donated to institutions and were excluded from the study. The losses from 9 months of age to first calving were calculated from the records of 665 heifers, representing all the females born alive in 1976 and 1977 which survived the first 9 months of life. The sample included data from 83 animals (12.5% of the total) which had a positive diagnosis of pregnancy and were either sold for breeding or were still on the farm, but had not calved, when the data were collected in September, 1980. It was assumed that these animals would have calved normally and they were regarded as survivors.

Table 1:
Climate data of the area studied

Season of the year	Mean Temperature (°C)	Mean Rainfall/ month(mm)
December-March	28.1	21.6
April-July	26.7	208.5
August-November	26.7	107.7

Source: MARNR. Meteorological Station, Acarigua Airport (Years 1975-1979).

The animals studied were daughters of 23 Brown Swiss and 16 Holstein Friesian sires, Their dams were Brown Swiss x zebu and Holstein x zebu crossbred cows, classified by the official milk recording service of the Ministry of Agriculture and Livestock as either low, medium or high grade European crosses.

Calves were reared in individual wooden pens with slatted, raised floors. They were fed 4 litres of milk each per day and a concentrate of 20% protein ad libitum up to the fifth week of age. Thereafter, they were kept in corrals with concrete floors and

received 3 kg of concentrate (20% protein) per head per day and hay ad libitum. They were served for the first time when they reached 18 months of age and 375 kg liveweight so that first calving occurred from 27 months of age onwards. The animals were vaccinated routinely against foot and mouth disease, brucellosis, blackleg, hemorrhagic septicaemia, pleuro-neumonia and anthrax.

The significance of the difference due to the factors studied in the proportions of calves which survived was determined by a Chi-square test for cases of one degree of freedom (Steel & Torrie, 1960).

Results

Stillbirths. The overall rate of losses due to stillbirths was 2.5% The results given in Table 2 show that differences due to breed group were not statistically significant. However, the figure obtained for the calves of Brown Swiss bulls and Holstein x zebu cows (4.5%) was approximately double that obtained for the other groups.

Table 2:
Stillbirths (%) in heifer calves, according to the genotype of sire and dam (years 1977-79)

GENOTYPE OF DAM	GENOTYPE OF SIRE				SIGNIFICANCE OF DIFFERENCE
	Brown Swiss		Holstein Friesian		
	n*	%	n	%	
Brown Swiss x Zebu:					
High grade	17	0	4	0	
Medium grade	430	2.1	536	2.2	
Low grade	8	12.5	15	6.7	
Sub-Total:	455	2.2	555	2.3	N.S.
Holstein Friesian x Zebu:					
Medium grade	46	8.7	23	0	
Low grade	111	2.7	140	2.9	
Sub-Total:	157	4.5	163	2.5	N.S.
Others	7	0	13	0	
T O T A L :	619	2.8	731	2.3	N.S.

* Number of calvings.

Differences due to year and season of birth were not statistically significant either but losses tended to increase from 1977 (1.8%) to 1979 (3.2%). The mean figures for the dry season (December-March), first part of the rainy season (April-July) and second part of the rainy season (August-November) were, 2.0%, 2.7% and 3.1% respectively.

Death and culling rates from birth to 9 months of age. Overall, 15.6% of the heifers born alive did not survive until 9 months of age. Tables 3 and 4 show that losses during this stage of life were affected to an important extent by the breed group of the sire and of the dam of the calf. With respect to the sire, heavier losses occurred among the calves of the Brown Swiss bulls than among the progeny of the Holsteins (Table3). This difference due to sire breed was evident with dams of each breed group but was especially marked in the case of the Holstein x zebu cows (21.4% vs 12.6X). Taken altogether, the data show a difference of 5% between Brown Swiss and Holstein sires in the losses of their progeny which is of considerable statistical and economic importance.

Table 3:
Death and culling rates (%) between birth and 9 months of age in heifer calves, according to the genotype of sire and dam (years 1976-79)

GENOTYPE OF DAM	GENOTYPE OF SIRE				SIGNIFICANCE OF DIFFERENCE
	Brown Swiss		Holstein Friesian		
	n*	%	n	%	
Brown Swiss x Zebu:					
High grade	18	16.7	4	0	
Medium grade	521	16.7	731	13.5	
Low grade	8	62.5	18	16.7	
Sub-Total:	547	17.4	753	13.6	$P \leq 0.075$
Holstein Friesian x Zebu:					
Medium grade	43	11.6	26	23.1	
Low grade	111	25.2	156	10.9	
Sub-Total:	154	21.4	182	12.6	$P \leq 0.05$
Others	7	28.6	13	15.4	
T O T A L :	708	18.4	948	13.4	$P \leq 0.01$

* Number of heifers born alive.

Table 4:
Death and culling rates (%) between birth and 9 months of age in heifer calves, according to the genotype of sire and dam (years 1976-79).

GENOTYPE OF DAM	GENOTYPE OF SIRE			
	Brown Swiss		Holstein Friesian	
	n*	%	n	%
Brown Swiss/Holstein Friesian x Zebu				
Medium grade	564	16.3	757	13.9
Low grade	119	27.7	174	11.5
Significance of difference	$P \leq 0.01$		N.S.	

* Number of heifers born alive.

Table 4 shows the results grouped according to level of crossbreeding of calves' dam The losses in calves from low grade cross cows and Brown Swiss bulls were very high (27.7%) compared with the results from medium grade cows (16.3%). This difference was not apparent in the cows mated to Holstein bulls. Since the majority of the medium grade cows were Brown Swiss crosses while the majority of the low grades were Holstein crosses (Table 3), it was impossible to clarify whether the higher losses from the latter group were due to their Holstein breeding or to the fact that they were low grade crossbreds.

The effects of year and season on losses between birth and 9 months of age are shown in Table 5. The frequency of death and culling tended to rise over the time period studied, with a considerable increase between 1976 (13.2%) and 1979 (19.0%). Approximately double the losses occurred among calves born in the season August-November (21.9%) compared with the two others (DecemberMarch and April-July), a difference which is of statistical and practical importance. It is noteworthy that the frequency of carvings was slightly greater in August-November (34.7% of the total) than in the other seasons of the year.

Table 5:
Death and culling rates (%) between birth and 9 months of age in heifers calves, according to year and season of birth.

YEAR OF BIRTH	n*	%
1976	340	13.2^{a**}
1977	489	15.1^{ab}
1978	374	14.4^{ab}
1979	453	19.0^{b}
SEASON		
December - March	565	11.5^{a}
April - July	517	12.6^{a}
August - November	574	21.9^{b}

* Number of heifers born alive.

** Within years and seasons of birth, percentages with different superscript letters are different ($P \leq 0.05$ between years; $P \leq 0.01$ between seasons).

An analysis of the causes of losses at this stage of life showed that 94.2% of the total were due to death and the rest to curling for abnormalities, accidents etc. Pneumonia and diarrhoea were the principal causes of death, accounting for 30.6% and 27.1%, respectively, of the total losses. Another 19.4% of all losses were due to a joint infection caused by faulty calf housing which occurred in the first years of the study and was later corrected.

Most of the losses occurred early in life: 28.3% in the first week, 64.3% in the first month and 18.2% in the second month after birth, leaving 17.4% to occur in the period between three and nine months of age.

Death and culling rates between 9 months and 1st calving. The percentage of heifers alive at 9 months which did not survive to first calving or abortion was 9.9. Differences between breed groups did not reach statistical significance but the progeny of Brown Swiss sires suffered greater losses whatever the type of dam (Table 6). It was not possible to ascertain whether the very high losses observed in the case of the daughters of Holstein x zebu dams (17.3%) and Brown Swiss sires was due to a real biological tendency, because of the small number of observations involved,

Table 6:
Death and culling rates (%) between 9 months of age and first calving in heifers, according to genotype of sire and dam.

GENOTYPE OF DAM	GENOTYPE OF SIRE Brown Swiss n*	Brown Swiss %	Holstein Friesian n	Holstein Friesian %	SIGNIFICANCE OF DIFFERENCE
Brown Swiss x Zebu:	271	10.3	339	9.1	N.S.
Holstein Friesian x Zebu	23	17.3	32	9.4	N.S.
T O T A L :	294	10.9	371	9.2	N.S.

* Number of heifers alive at 9 months of age.

Year of birth affected losses at this stage to an important extent, a much higher figure being obtained for the year 1976 (14.5%) than for the year 1977 (6.9%). This was not due to the distribution of carvings of the Holstein x zebu dams since most of these calved in 1977. Season of birth was an unimportant source of variation in losses at this stage.

Of the total losses which occurred between 9 months and first calving, 30.2% were due to death and 69.8% to culling. The chief identified cause of death was blood parasitic diseases, which accounted for 11.1% of the total losses, while reproductive problems explained most of the losses due to culling

Total losses up to 1st calving. The best estimate of total losses up to first calving which may be derived from this study is the sum of those occurring at each stage of life although this has the limitation that the sample considered in each case differed somewhat with respect to year of birth. The results are shown in Table 7 for the four main breed groups.

Table 7:
Total losses of heifers up to first calving, according to genotype of sire and dam (sum of tables 2, 3 and 6)

GENOTYPE OF DAM	GENOTYPE OF SIRE Brown Swiss %	Holstein Friesian %
Brown Swiss x Zebu	29.9	25.0
Holstein Friesian x Zebu	43.2	24.5
T O T A L :	32.1	24.9

Overall, 28% of the females born did not survive until first calving or abortion, The losses at all stages of life were heavier in the progeny of Brown Swiss bulls compared with the Holstein, with totals of 32.1% and 24.9%, respectively, giving a difference between sire breeds of 7.2%. The losses due to death and culling in the progeny of Brown Swiss bulls and Holstein x zebu dams was relatively high at all stages, but the total loss of 43.2% may not be a reliable estimate because of the small number of observations in animals of between 9 months of age and first calving.

Discussion

The stillbirth rate observed in this study, 2.5%, is not high compared with results published for high grade European crossbreds in other parts of the tropics, the majority of which fall in the range 3-6%(Amble & Jain, 1967; Yaccaro, 1974; Nadsen & Vinther, 1975). There is relatively little information about the effect of breed of sire on stillbirth rates, but the present results agree with those of Hollon & Branton (1975) who found no difference between Brown Swiss and Holstein sires in the stillbirth rates of crossbred calves. Although the differences due to season of birth did not reach statistical significance in the present study, 55% more calves were born dead in the period August-November than in the dry season (December-March). Differences due to season in the incidence of stillbirths as well es abortions have been reported in various cases, with the majority of the losses occurring during the rainy season of the year (Afifi & Barrada, 1972; Higgins, 1978).

The overall rate of losses between birth and 9 months of age, 15.6% is within the range reported elsewhere for high grade crosses under tropical conditions, While losses of 7.4% - 9.2% were observed in calves of 5/8-15/16 Red Dane breeding in the first six months of life in Thailand (Madsen & Vinther, 1975), the death rates of 5/8 and 3/4 Holstein calves at five centres in Cuba were higher, 18.97% and 18.74%, respectively (Planes, 1979) and the losses due to death and culling in calves up to one year of age in the Indian military farms rose from 4% in the case of the 5/8 european crosses to between 14% and 30% in the groups with between 3/4 and 31/32 european inheritance (Amble & Jain, 1967). Even in subtropical Louisiana, losses of 13.1% were reported for high grade european crossbred calves up to three months of age (Hollon & Branton, 1975).

The difference in losses up to 9 months of age due to breed of sire of the calf observed in the present study, contributes to evidence on this point which in accumulating in other parts of the tropics. In the present case, the difference in losses between progeny of Brown Swiss sires (18.4%) and Holstein bulls (13.4%) was 5%. This agrees closely with the figures of 19.0% and 11.9% obtained for first cross calves of Brown Swiss and Holstein sire" from zebu dams in Haringhata, India (Katpatal, 1977). In other centres in India, comparisons between Brown Swiss x zebu and Red Dane x zebu at Hissar (Tomar, 1973) and between Brown Swiss x zebu and Jersey x zebu calves at Allahabad (Srivastava & Agawala , 1973) showed heavier losses in the offspring of the Brown Swiss sires. The relatively poor survival of the crossbred offspring of Brown Swiss bulls was originally observed by McDowell & NcDaniel (1968) in their study of crosses between european breeds at Beltsville. Crossbreds, including zebu crosses, studied in Louisiana showed the same tendency with losses of 16.1% in

daughters of Brown Swiss sires up to 15 months of age, compared with 9% in the case of the progeny of Holstein bulls (Hollon & Branton, 1975), The difference was even more marked in the later study of Gilson & Koonce (1977) of animals up to first calving in which losses of 42.9% compared with 16.7% were found in the progeny of the Brown Swiss and Holstein sires, respectively.

The large difference in losses from birth to 9 months between Brown Swiss to genotype of the dam (Tables 3 and 4) is difficult cross of the dam is confounded with Holstein be that dams with more zebu inheritance had and Holstein sires due to explain because the grade of breeding in this study. It may be greater difficulty at calving and that the poorer survival rates of their calves was related to weakness at birth, but is not supported by the normal stillbirth rates found in the low grade Holstein x zebu cross dams (Table 2), neither does it explain the high rates of loss apparent in the period from 9 months to first calving, In any case, the results seem to indicate that the survival rates of progeny of Brown Swiss bulls may be especially poor with certain genotypes of dam.

In other respects, the information presented agrees with results obtained in other studies of losses in young calves. Significant differences due to year and season of birth are to be expected, with higher losses in the wet or winter seasons (Joviano et al., 1963; Matta, 1973; Tomar, 1973; Sharma & Jain 1976; Higgins, 1978). Pneumonia and enteritis have generally been reported as the principal causes of death and the majority of losses have usually occurred within the first month of life (Srivastava & Agarwala, 1973; Tomar, 1973; Vaccaro, 1974; Sharma & Jain, 1976), Since these diseases are largely controllable through appropriate management, the present results show that priority should be given to the management of young calves on the farm studied, especially during the first month of life. It is also recommended that the proportion of carvings which occur at the critical time of the year (August-November) should be reduced, provided that this does not, for other reasons, interfere with the efficient running of the farm. The gradual rise in combined losses from stillbirths, death and culling up to 9 months on this farm from 16.9% in 1977 to 22.2% shows that special precautions and care should be taken.

Relatively little information exists in the literature about losses in the period between 6-9 months and first calving in crossbred animals in the tropics. The overall figure obtained in the present case (9.9%) is very close to the figures of 9.6% and 9.1% obtained in Thailand for heifers of 5/8 and 3/4 Red Dane Breeding (Madsen & Vinter, 1975). Similar results were reported by Hollon & Branton (1975) from Louisiana where 8.1% of the high grade crossbred heifers left the herd between 15 months of age and first calving. On the other hand, much heavier losses (24% to 51%) due to death and culling between one year and first calving were observed in the Indian military farms for heifers of 3/4 to 31/32 european inheritance and only the figure for the 5/8 group (11%) approximates to that found in the present study (Amble & Jain, 1967).

Taken together, the evidence available, including that of the present study, shows that losses of about 30% are to be expected in the period from birth to first calving in high grade european crossbreds in the tropics. It is also significant that a similar estimate, 31.6%, was obtained from a study of 509 milk producing farms with extensive systems of management in Barinas State, Venezuela (Cardozo et al., 1980).

. The consequences of this information are of great practical significance, In the first place, the figures usually assumed for calf mortality in dairy development projects are 10% losses in calves and 5% in older cattle. It seems likely that these values under-estimate by about 100% the true losses which will occur and, consequently, overestimate the returns from the planned projects. Secondly, the estimates of productive life of european type animals in the tropics are usually in the order of 3 carvings or 4 years and the majority of cows leave the herd for reasons not associated with their level of milk production (Salazar, 1970; Talavera et al., 1973; Vaccaro, 1974; Dextre, 1978). If 30% of the heifers born do not survive to first calving, the herds will be unable to provide their own replacements unless birth rates exceed 72% annually, which is not always the case. Even if replacements are covered, it will be impossible to apply the intensity of selection for production which is urgently required unless the rates of loss are reduced.

Fortunately, the most serious losses, which occur in the period between birth and 9 months of age, should be controllable to some extent by management and by seasonal calving practices. It also seems justifiable to conclude that the use of Brown Swiss bulls in crossbreeding programmes may lead to relative! high rates of loss in youngstock. Since Brown Swiss crosses have not demonstrated advantages with respect to reproductive efficiency, growth or milk production (Rubio, 1976; Katpatal, 1977), it seems unlikely that the heavier loss of calves will be compensated for by other productive advantages.

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