

AGE AT FIRST CALVING, REPRODUCTION AND PRE-NATAL SURVIVAL IN HOLSTEIN
FRIESIAN AND BROWN SWISS CROSSBREDS IN AN INTENSIVE TROPICAL
MILK PRODUCTION SYSTEM

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The objective of this paper is to describe the reproductive performance of an intensive dairy herd in the western plains of Venezuela. The animals were the offspring of zebu x Holstein Friesian and zebu x Brown Swiss cows, mated to Holstein Friesian and Brown Swiss sires, respectively. The cows were kept in confinement and fed on fresh forage and silage with high levels of concentrate supplements. They were served both by artificial insemination and natural mating. The data available refer to 996 females over the period 1965 to 1980. The effects were studied of years, season (wet and dry) and breed group (Holstein Friesian cross and Brown Swiss cross) on age at first calving, incidence of abortions and stillbirths, services per conception and intervals between the first three calvings. In the case of services per conception, number of pregnancy (first and later ones) was added to the model. The Holstein Friesian crosses calved at between 2 and 5 months of age earlier than the Brown Swiss crossbreds ($P < 0.05$). Heifers born in the rainy season calved for the first time between 1.4 and 1.9 months younger than those born in the dry season ($P < 0.05$). The overall mean number of services per pregnancy was 2.2, with 1.66 and 2.51 services for the first and later conceptions, respectively. The percentage of conceptions to first service was higher in heifers than in cows ($P < 0.01$). A higher proportion of the Holstein Friesian crosses conceived to natural service than the Brown Swiss crossbreds ($P < 0.01$). The rates of abortion and stillbirth were 6.7% and 3.3%, respectively, with significant differences due to years but not to season of the year or to breed group. There was no effect due to year, season or breed group on calving intervals. It is concluded that the Holstein Friesian cross offers advantages over the Brown Swiss cross for use in the semi-humid tropics, due to its better survival, precocity and milk production.

Key words: Age at first calving. Services per conception. Calving intervals. Holstein crosses, Brown Swiss crosses. Abortions. Stillbirths.

The relative performance of dairy breeds and their crosses in terms of production, reproduction and survival, has been shown to be variable in tropical environments. Various authors have studied these traits individually or together in an effort to assess the effects of variation in them on the practical feasibility and profitability of different production systems. In this context, the present study was carried out to evaluate the reproductive performance of Holstein Friesian x zebu and Brown Swiss x zebu cattle, on the basis of age at first calving, services per conception, percentage of abortions and stillbirths, and intervals between the first three calvings.

Materials and Methods

The data used refer to the date, number and type of service used and to the results thereof, based on the individual records of heifers and cows on a dairy farm in the western plains of Venezuela. The cattle were

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the offspring of Holstein Friesian x zebu and Brown Swiss x zebu crossbred cows and Holstein Friesian and Brown Swiss sires. They were kept in corrals with cement floors and beds of sand or rice hulls. Their diet was based on fresh cut forage or silage of maize or sorghum, with high levels of concentrate supplements. Milking was carried out by machine without calves present. Services were both by artificial insemination and natural mating. Generally, cows were inseminated during the first two heats which occurred after 60 days post partum, and heifers at the two first heats once they attained 375 kg body weight. If conception did not occur, controlled natural mating was used in the next two heats, and then, if necessary, the females were run in a corral with a bull. For various reasons, this sequence was not followed in a few cases. The semen used for artificial insemination was frozen and either imported or of local origin. Pregnancy diagnoses were carried out routinely at 45 days after service by a veterinarian. Any female which entered in heat after having a positive pregnancy diagnosis was considered to have had a foetal reabsorption or an abortion. The information on observed cases of abortion was also available. The 16-year period studied was divided into 4 periods of 4 years: 1965-1968; 1969-1972; 1973-1976 and 1977-1980 to simplify the analysis, since these represented periods in which the management of the herd was relatively stable. Two seasons of the year were taken into account: the dry season from December to April and the rainy season from May to November. Details concerning climate have been given by Vaccaro and Vaccaro (1981). Least squares analyses (Anderson and Bancroft, 1952) were used to determine the effect of breed group, year, season of the year and their interactions on age at first calving and intervals between the first three calvings. In the case of services per conception and the rate of conception to first service, the number of the conception (first vs one or more) was added to the model. The rates of abortion and stillbirth were derived from data available from the years 1976-81. The effects of year and season apply to the date of birth in the case of age at first calving and number of services for the first conception, but to the date of the previous calving in the case of number of services for conceptions after the first.

Altogether, individual data were used from 596 Brown Swiss cross and 400 Holstein Friesian crossbred animals, with 1 846 and 839 pregnancies and 3 605 and 1 441 controlled services for the two breed groups, respectively. The information corresponds to animals present in the herd in 1981. It was not possible to obtain data for those cows which had left the herd before that date.

Results and Discussion

Age at first calving: Table 1 shows the mean age at first calving according to breed group and year of birth. On average, the Holstein Friesian crosses calved at between 2 and 5 months younger than the Brown Swiss crossberds ($P < 0.05$) and, in general, age at first calving tended to decrease over the time period studied. The animals born in the rainy season of the year calved 1.4 months (Brown Swiss x) and 1.9 months (Holstein Friesian x) younger than those born in the dry season ($P < 0.05$).

Table 1:

Age at first calving (months), according to years and breed group.

Years	B r e e d g r o u p	
	Holstein Friesian crossbreds	Brown Swiss crossbreds
1965-1968	-	35.7 ± 4.7 ^a
1969-1972	-	33.7 ± 6.7 ^b
1973-1976	34.7 ± 5.0 ^d	39.9 ± 5.9 ^c
1977-1980	30.8 ± 4.0 ^e	32.9 ± 3.6 ^b

Values in the same column with different letters superscript are statistically different ($P < 0.05$).

The average first calving age achieved on the farm in recent years (30.8 months) with the Holstein Friesian crosses is similar to that reported for purebred Holstein Friesians in commercial and experimental herds in Venezuela as well as other parts of Latin America (Alves Netto et al , 1967; Román, 1970; Sarmiento, 1970; Verde et al , 1970; McDowell et al , 1976; Bodisco et al , 1978). However, it is probable that in these cases first service was carried out at weights below 375 kg, which was taken as a minimum for first service on the farm described in this study, and that therefore the animals described here were better developed physically. The difference in favour of the Holstein Friesian crosses is to be expected on the basis of results obtained from zebu or criollo crossbreds as well as from purebred Holsteins as compared with Brown Swiss in the tropics (Bodisco et al., 1969; Rubio, 1976; Katpatal, 1977).

Table 2:

Mean number of services per conception, according to year, season and breed group.

Year	Season	B r e e d g r o u p			
		Holstein Friesian crossbreds		Brown Swiss crossbreds	
Conception number:		1st.	≥ 2nd.	1st.	≥ 2nd.
1969-1972	Dry	-	-	1.33	2.00
	Rainy	-	-	1.38	2.28
1973-1976	Dry	1.88	-	1.80	1.87
	Rainy	1.76	1.50	1.63	1.95
1977-1980	Dry	1.65	2.36	1.65	2.66
	Rainy	1.65	2.76	1.53	2.77

Services per conception: Table 2 shows the mean number of controlled services (A. I. and natural mating) per conception in each sub-class, according to tetraennium, season, number of conception and breed group. The overall mean was 2.2, with 1.66 and 2.51 services per conception for first and later pregnancies, respectively. A difference ($P < 0.06$) was found due to the number of the pregnancy, but not to breed group, year or season of birth or calving, although the number of services tended to increase during the time period studied. A greater proportion of births were noted in the wet season which corresponds to silent heats mostly from the month of August.

A greater percentage of heifers conceived to first service than cows (61.3 Vs 43.1 %; $P < 0.01$), but no difference was found due to year, season or breed group. A higher proportion of the Holstein Friesian crosses conceived to uncontrolled natural mating than Brown Swiss crossbreds (20.7 Vs 12.0 %; $P < 0.01$).

Measured in terms of services per conception and conceptions to first service, the reproductive efficiency of this herd compares favourably with values reported for similar genetic groups in Venezuela (Bodisco et al, 1978; Vásquez et al, 1979; Bermúdez, 1980; González, 1980a) and in other parts of the tropics (Vaccaro, 1973). González and Goicochea (1980) obtained a 67.6% rate of conception to first service in criollo perijanero heifers and 56.6% in adult cows. The level of milk yield has a negative effect on reproduction, independent of age (Bodisco et al, 1975; González, 1980b), which may explain the lower values obtained in the present study. It may also explain why the number of "problem" animals which had to be exposed to free natural mating was greater in the Holstein Friesian crossbred group.

Abortion rate: The overall abortion rate in the time period studied was 6.7%, with differences due to years (Table 3) but with no clear tendency in the changes with time. The effects of breed group, year and season were not important.

The losses from abortion found are within the range reported for genetically similar animals in other parts of the tropics (Vaccaro, 1974). However, since the data included foetal reabsorptions, which are not usually considered in the published literature, as well as patent abortions, the rates obtained on this farm may be considered relatively low for tropical conditions.

Still births: The proportion of calves of both sexes which were born dead was 3.3% (Table 3), with significant differences between years and an increasing tendency throughout the time period studied. The figure obtained for heifer calves in the period 1977-1979 was 2.5% (Vaccaro and Vaccaro, 1981).

This stillbirth rate is relatively low compared with values given for European breed cattle in the tropics (Vaccaro, 1974), and especially in comparison with data from Venezuela which range from 6.9% (Hernández Prado, 1967) to 11.2% (Ríos et al, 1965) for Holstein and Brown Swiss, respectively.

Calving intervals: Information concerning the intervals between the first three calvings is summarised in Table 4. No differences were found due to year, season or breed group. Although the means are higher than

Table 3:

Number of pregnancies (n) and rates of abortion and stillbirth (%) according to years

Year	n	Abortions	Stillbirths
1976	153	10.2 ^a	2.0 ^{abc}
1977	405	3.5 ^c	1.2 ^a
1978	426	7.3 ^{ab}	1.6 ^{ab}
1979	732	8.1 ^{ab}	3.1 ^{ab}
1980	856	6.0 ^b	5.4 ^c
1981	18	11.1 ^a	11.1 ^{bc}
Total/Mean	2 590	6.7	3.3

Values in the same column with different letters superscript are statistically different ($P < 0.05$).

Table 4:

Calving intervals (days), according to calving number and breed group

Interval between calvings	B r e e d g r o u p			
	Holstein Friesian crossbreeds		Brown Swiss crossbreeds	
	n	$\bar{x} \pm S.D.$	n	$\bar{x} \pm S.D.$
1 and 2	190	432 \pm 97	435	439 \pm 102
2 and 3	57	441 \pm 109	240	445 \pm 106

the optimum values obtained for European breeds in temperate climates, they are comparable with the best figures reported for pure and high grade European crossbreeds in Venezuela (Bodisco et al, 1971; Verde, 1979) and other tropical countries (Vaccaro, 1973), most of which are derived from experimental herds with high levels of management.

Conclusions

The results obtained from this farm (Table 5) confirm tendencies observed elsewhere in the tropics (Prada, 1979; Verde, 1979; Pearson de Vaccaro, 1979) which lead to the conclusion that, compared with Brown Swiss crosses, Holstein Friesian crossbreeds have greater advantages for use in the tropics, given their lower death rates ($P < 0.01$, Vaccaro and Vaccaro, 1981) higher growth rates and lower age at first calving ($P < 0.01$) and higher yields of milk per lactation ($P < 0.01$; Cardozo and Vaccaro, 1982, personal communication).

Table 5:

Reproduction, production and survival characteristics of Holstein Friesian and Brown Swiss crossbred groups

Characteristic	Breed Holstein Friesian crossbreds	group Brown Swiss crossbreds	Level of significance
Age at 1st. calving (months)	32.7 ± 4.5	35.6 ± 5.2	0.05
Calving interval (days):			
1st. - 2nd.	432 ± 97	439 ± 102	N.S.
2nd. - 3rd.	441 109	445 ± 106	N.S.
Losses up to 1st. calving (%):			
Stillbirths	2.3	2.8	N.S
Death and culling	24.9	32.1.	0.01
Total losses	27.2	34.9	0.01 ¹
Milk yield (kg) (1979-1980, 305 days, 2x) ³	3 552 ± 1 308	3 167 ± 1 377	0.01 ²
N° lactations considered	382	428	

¹ Source: Vaccaro and Vaccaro (1981)

² Source: Cardozo and Vaccaro (1982, personal communication)

³ Lactations started in 1979-1980, adjusted to 305 days and two milkings daily.

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References

- Alves Netto F, Fang I, Torres J D M, Fonzari W M G y Kvarnstrom O R 1967 Comportamento médio das vacas e rebanhos controlados pelo serviço de controle leiteiro da Associação Paulista de Criadores de Bovinos. Revista Criadores 30:18-108.
- Anderson R L y Bancroft T A 1951 Statistical theory in research. McGraw-Hill, New York. 399 PP.
- Bermudez B 1980 Eficiencia reproductiva en vacas mestizas de 1er. parto - Reporte preliminar. Notas Informativas GIRARZ No. 6, Maracaibo.
- Bodisco V, Fuenmayor C y Cevallos E 1969 Primer parto de vacas Holstein y Pardo Suizas en el Centro de Investigaciones Agronómicas de Maracay. Agronomía Tropical 19:299-308.
- Bodisco V, Rodríguez A, Alfaro E C y Mendoza S 1978 Primera lactación de tres generaciones Holstein y Pardo Suizo en Maracay, Venezuela. Mem. ALPA 13:144 (Res.).
- Bodisco V, Valle A, García E y Mendoza S 1975 Cambios de peso en vacas lecheras durante la lactación y su efecto sobre la reproducción. 5a. Reunión ALPA, Res. G81.
- Bodisco V, Verde O y Wilcox Ch J 1971 Producción y reproducción de un lote de ganado Pardo Suizo. Mem. ALPA 6:81-95.
- González S C 1980a Detección de la baja fertilidad en hatos bovinos. II Congreso Venezolano de Zootecnia, UNELLEZ, Guanare, 126 pp (Res.).
- González S C 1980b Efecto de la producción de leche y amamantamiento sobre la actividad ovárica y comportamiento postparto en bovinos tropicales. Notas Informativas GIRARZ No. 6. Maracaibo.
- González S C y Goicochea H J 1980 Factores que afectan la fertilidad al primer servicio en

- las vacas y su relación con las sucesivas inseminaciones. II Congreso Venezolano de Zootecnia, UNELLEZ, Guanare. 126 pp (abs)
- Hernández Prado A 1967 Patología de la reproducción. Seminario de Reproducción de Ganado Bovino. FONAIAP. Caracas, Venezuela.
- Katpatal B 1977 El cruzamiento del bovino en la India. II. Resultados del proyecto global para la India de investigación bovina coordinada. Rev. Mundial de Zootecnia, 23:2-9.
- McDowell R E, Camoens J K, Van Vleck L D, Christensen E E y Cabello Frías E 1976 Factors affecting performance of Holsteins in subtropical regions of Mexico. J Dairy Sci. 59:722.
- Fearson de Vaccaro L 1979 Resumen de la discusión y comentario. En Seminario sobre cruzamiento de bovinos productores de leche en el trópico: el papel del mestizaje en diferentes sistemas de producción. Mem. ALPA 14:169-177.
- Prada N 1979 Programa de cruzamiento lechero en Cuba. En Seminario sobre cruzamiento de bovinos productores de leche en el trópico: el papel del mestizaje en diferentes sistemas de producción. Mem. ALPA 14:163-167.
- Ríos C E, Bodisco V, Carnevali A, Cevallos E y Mazzarri G 1965 Una década de investigación con ganado lechero. Circular, CENIAP, MAC, Maracay, Venezuela, No. 13, 50 pp.
- Roman J O 1970 Genetics of milk production in Ecuador. Abst. in Dissertation Abstracts International, B 32, 12.
- Rubio R 1976 Ganado costeño con cuernos. En Razas criollas colombianas. Manual de Asistencia Técnica No. 21. I.C.A. Bogotá, Colombia, 83-106.
- Sarmiento D A 1970 Estudio del comportamiento productivo de vacas Holstein nacionales e importadas, registradas en la cuenca lechera de Lima. Tesis Ing. Zootecnista, Univ. Nacional Agraria, Lima, Perú. 94 pp.
- Vaccaro L P de 1973 Some aspects of the performance of European purebred and crossbred cattle in the tropics. Part 1. Reproductive efficiency in females. Animal Breeding Abstracts 41: 571-591.
- Vaccaro L P de 1974 Some aspects of the performance of european purebred and crossbred dairy cattle in the tropics. Part 2. Mortality and culling rates. Animal Breeding Abstracts 42: 93-103.
- Vaccaro L P de y Vaccaro R 1981 Pérdidas hasta el primer parto en hembras Pardo Suizo x cebú y Holstein Friesian x cebú en un sistema intensivo de producción de leche en el trópico. Producción Animal Tropical 6:337-347.
- Vásquez V A, Rodríguez T R y Verde O 1979 Reproducción de un rebaño Holstein en Jusepín - Venezuela. Mem. ALPA 14:122 (abs)
- Verde O 1979 Cruzamiento de bovinos productores de leche en el trópico: resultados en Venezuela. En Seminario sobre cruzamiento de bovinos productores de leche en el trópico: el papel del mestizaje en diferentes sistemas de producción. Mem. ALPA 14:155-161.
- Verde O G, Wilcox C J, Koger M, Plasse D y Martin F G 1970 Estimation of several genetic parameters for milk yield in three Venezuelan Herds. Journal of Dairy Science 53:674 (abs)

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