

SURVIVAL OF IMPORTED HOLSTEIN AND FRIESIAN CATTLE AND THEIR
LOCALLY BORN PROGENY IN VENEZUELA

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The survival rate of 252 American Holstein and 150 Dutch Friesians imported by Venezuela at an age of between 5 and 18 months during 1967, 1971 and 1972 was studied as well as the performance of their progeny born in Venezuela between 1970 and 1981. The animals were owned by institutions and maintained in three herds, two of these at 1200M. above sea level and the others at an altitude of 450 m, in shaded yards and fed high levels of concentrate together with forage of variable quality and availability. 68.1% of the original imported females did not survive until their third calving, losses between their arrival and first calving, between 1st. and 2nd calving and between 2nd and 3rd calving were 15.7%, 31.3%, and 21.1%, respectively. The principal causes of wastage were: Reproductive problems (50%), death (16.3%) and poor physical condition (12.0%). With only 9% of the animals being disposed of voluntarily due to low yield. The mean number of calvings per imported female was $1.8 \pm .07$ and $2.2 \pm .08$ per imported female that calved at least once. With respect to the progenie, prenatal losses (abortion in the imported females) amount to 8.5% and 14.6% of the females, calves born alive, died or culled before reaching a year age. Of these surviving yearling female calves 63.3% left the herd before the third calving with the losses between 12 months and first calving, 1st calving to 2nd calving and 2nd calving to 3rd calving being 10.8%, 33.6% and 18.7% respectively. 86.7% of these losses were involuntary. The principal causes were: Reproductive problems (49.7%), death (15.7%), and low yield (13.3%). The number of calvings per lifetime were $2.3 \pm .11$ per female alive at one year and $2.5 \pm .10$ per female that calved at least once. Although it was not possible to quantify precisely the effects of importation, it was concluded that there were no important differences between the survival rates of imported animals and animals born in the country at either altitude. The magnitude of the losses was that to be expected except in the case of the adult animals, whose useful life was extremely short and questions the profitability of milk production systems using this type of animal in the tropics.

Key words: Tropics, Holstein, Friesian, survival rate, Venezuela, causes of loss.

The use of purebred european breeds of cattle is still proposed as an alternative for milk production in tropical zones. High lactation yields make their use attractive, especially where official policy is committed to solving in an immediate and impressive fashion the deficits of milk products which characterise most tropical countries. The milking and reproductive performance of such cattle in tropical zones is well documented, but there exists relatively little information about their survival, especially as adults. Realistic estimates of herd life are, nevertheless, essential to proper planning, particularly since the initial cost of european cattle tends to be high in tropical countries, especially when they are imported. The purpose of this paper is to contribute to existing information on the survival of imported and locally born european-breed cattle in a tropical environment and to determine the relative importance of the reasons for their leaving the herd.

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Material and Methods

The data used refer to 252 US Holstein and 150 Dutch Friesian females imported into Venezuela and to their 896 females descendants born locally.

The animals were kept in three experiment stations belonging to the Facultad de Agronomía of the Universidad Central de Venezuela. Two of the stations (Bajo Seco and Las Tapias) stand at about 1200 m above sea level in the country's mountainous coastal strip, while the other (Maracay) is located in a valley at 450 m. The mean annual temperature and rainfall are 19°C and 1130 mm at Bajo Seco and Las Tapias, and 25°C and 1000 mm in Maracay, respectively, with a distinct dry period of three months at all locations. The herds were kept in shaded corrals under good conditions of general management and fed on high quantities of concentrates with cut forage of variable quantity and quality. At Bajo Seco and Las Tapias, the extremely steep gradients of the land led to problems of cutting and carting forage and, because of the limited flat space available, to rather overcrowded conditions for the cattle.

Table 1 shows the number of cattle brought into each station, according to their country of origin, year and age at arrival. The Bajo Seco herd was transferred to Las Tapias in 1974.

In the case of the imported cattle, survival was expressed as the proportion of cattle which left the herd with 0, 1 or 2 calvings, using data from all 402 animals which entered the country. In addition, the number of calvings achieved before leaving the herd was calculated using data of 369 of the cows. It was necessary to exclude from this part of the analysis the records of three animals which were still in the herd at the end of 1982, when the data were collected, and of 30 more which were transferred as adults from one of the herds.

Table 1:

Number of females imported into the three experiment stations, according to country of origin, year and age at arrival.

Experiment Station:	Country of origin				
	Holland		USA		
	Bajo Seco	Las Tapias	Bajo Seco	Las Tapias	Maracay
Number imported	50	100	50	100	102
Year of importation	1972	1972	1971	1971	1967
Age (months) at arrival	5-9	5-9	9-12	9-12	11-18

In the case of the progeny of the imported stock, the first aspect of survival studied was the pre-natal loss, expressed as the abortion rate of the dams. An abortion was defined as a positive pregnancy diagnosis by rectal palpation, followed by a diagnosis of not-pregnant, or as an observed abortion. The complete reproductive history of the dams imported

to Bajo Seco and Las Tapias was used, excepting the 3 cows which were still in the herd when the data were collected, giving a total of observations on 544 conceptions of 297 dams.

Calf losses from birth to 12 months of age were calculated on the basis of 896 data, representing all the female progeny of the imported cattle which were born alive up to 1974 (Bajo Seco) and 1981 (Las Tapias, Maracay), except those which were sold or transferred for breeding purposes between birth and a year of age (5.2% of the total born alive).

The percentages of locally-born cattle which left the herd after 0, 1 or 2 calvings were calculated on the basis of the number of females alive at 12 months of age, so that the results should be reasonably comparable with those obtained from the imported animals. All progeny born up to 1977 were included, since those born later had not had the opportunity of calving for the second time when the data were collected. Information was excluded from 85 heifers which were sold or transferred for breeding between 12 months of age and second calving, leaving a total of 452 observations.

The number of calvings achieved before leaving the herd was calculated using data from Maracay, since the information available from the other two stations was insufficient to warrant inclusion. The study included records from all the cattle born in the period 1970-1975, apart from 4 cows which were still in the herd when the data were collected. Thus, the results refer to the complete history of 99.8% of a group born in a specific period and not to animals which left the herd prematurely. The number of observations was 250 when the mean number of calvings was estimated on the basis of the number of females alive at 12 months of age, and 230 when calculated per female which had at least a first calving.

As shown in Table 1, the differences in survival due to importation, country of origin, age at arrival and herd are partly or completely confounded with each other and with year. Therefore, the testing of significance was limited to that between herds (Bajo Seco and Las Tapias) in the case of the imported animals, and between the three herds in the case of the locally born stock, using adjusted Chi-squared (Steel and Torrie, 1960).

Results

Survival of imported females: As shown in Table 1, the animals at Bajo Seco and Las Tapias were similar with regard to their country of origin, year and age at arrival. There was no significant difference due to herds in their survival rates and so, to simplify the presentation of the results, the data of Bajo Seco and Las Tapias were combined according to country of origin of the cattle (Holland, USA). Thus, with the data of the USA imports at Maracay, three separate groups were formed.

Table 2 shows the percentages of females which left the herd with 0, 1 or 2 calvings, according to their country of origin. In general, 15.7% of the imported heifers never calved at all, although this proportion varied from 7.8% to 27.3%, according to group. The chief cause of loss at this stage of life was culling for poor physical condition, which included those heifers which did not reach service weight in the required time (Table 3). This problem was particularly serious in the case of the Dutch heifers,

Table 2:

Percentage of imported females which left the herd after 0, 1 or 2 calvings, according to country of origin

Number of calvings	Country of origin			Total
	Holland ¹	USA ²	USA ³	
0	27.3	9.3	7.8	15.7
1	36.0	34.0	20.6	31.3
2	27.3	22.0	10.8	21.1
Total % which left herd after \leq 2 calvings	90.6	65.3	39.2	68.1

- 1 Imported into Bajo Seco and Las Tapias in 1972 at 5-9 months of age
- 2 Imported into Bajo Seco and Las Tapias in 1971 at 9-12 months of age.
- 3 Imported into Maracay in 1967, at 11-18 months of age.

Table 3:

Relative importance of different causes of removal from the herd of imported females, according to number of calvings achieved before removal

% losses due to:	Number of calvings achieved			Total
	0	1	2	
Involuntary causes:				
Accidents	1.8	3.8	4.1	3.4
Poor physical condition	41.8	2.9	2.7	12.0
Mastitis	0	5.7	2.7	3.4
Death at calving*	0	10.5	2.7	5.6
Death (other)	27.3	5.7	5.4	10.7
Foot problems	0	1.0	5.4	2.1
Reproduction	29.0	53.3	60.8	50.0
Other	0	4.8	5.4	3.8
Voluntary causes:				
Low milk yield	0	12.4	10.8	9.0
Total	100.0	100.0	100.0	100.0

* Death during calving or within 30 days thereof.

but the year 1973, in which they should have been ready for service, coincided with a severe scarcity of forage throughout the region. Apart from poor physical condition, death and reproductive problems explained an important proportion of losses at this stage (Table 3).

Between first and second calving, the losses reached 20.6 to 36.0%, according to a group, with an overall mean of 31.3% (Table 2). Reproductive problems explained 53.3 % of the total removals (Table 3). However,

physical debility which is reflected in the combination of losses due to accidents, poor physical condition and death, accounted for 22.9% of the losses. The relative importance in this age-group of death at, or soon after, calving is noteworthy (10.5% of total losses).

The proportion of removals between the second and third calving (21.1%) was lower than that following first parturition (Table 2). Reproductive problems increased in relative importance, explaining 60.8% of the losses after second calving, while death and accidents were of less importance than before (Table 3).

Overall, 68.1% of the 402 imported heifers left the herd before third calving. Most of the losses occurred between the first and second calving. Reproductive problems caused 50.0% of the overall losses, and increased in importance with the age of the animal. The causes associated with physical debility (accidents, poor physical condition and death) explained 31.7% of the losses up to third calving and were of particular importance in the animals which left the herd with 0 or one calving. In total, 91.0% of the losses were due to involuntary causes, with culling for poor milk yield responsible for only 9.0% of all removals.

Table 4 summarises the number of calving achieved by the imported females before leaving the herd, according to origin. In general, each heifer which arrived in the country completed only $1.8 \pm .07$ calvings during its lifetime. The group which lasted longest, the Holsteins in Maracay, only produced $2.4 \pm .19$ calvings. Expressing herd life on the basis of the number of calvings per female which achieved at least a first calving, the overall mean was $2.2 \pm .08$ calvings (Table 4).

Table 4:

Mean number (\pm S.E.) of calvings achieved by imported females before leaving the herd, according to country of origin.

	Country of origin			Total
	Holland ¹	USA ²	USA ³	
Number of calvings/ female imported	$1.2 \pm .08$	$2.1 \pm .14$	$2.4 \pm .19$	$1.8 \pm .07$
Number of calvings/ female which calved at least once	$1.7 \pm .07$	$2.3 \pm .14$	$2.7 \pm .19$	$2.2 \pm .08$

¹ Imported into Bajo Seco and Las Tapias in 1972 at 5-9 months of age.

² Imported into Bajo Seco and Las Tapias in 1971 at 9-12 months of age.

³ Imported into Maracay in 1967 at 11-18 months of age.

Survival of locally born females: The average rate of pre-natal losses (abortions in the imported dams) was 8.5%, with no significant difference due to herds (Bajo Seco and Las Tapias) or to country of origin of the dam.

Between birth and 12 months of age, the death rate of heifer calves born alive in the three stations was 12.7%, with no significant differences due to herds. Another 1.0% were lost from accidents and 0.9% culled as freemartins, giving a total loss of 14.6% during the first year of life.

Table 5 shows the proportion of females, alive at 12 months of age, which left the herd after 0, 1 or 2 calvings. The loss of animals with 0 calvings was higher at Bajo Seco than at Maracay ($P < .01$), but there were no significant differences between herds in the proportions of animals removed after the first or second calvings. Overall, 10.8% of the heifers alive at 12 months of age did not reach first calving. Reproductive problems explained 57.1% of the removals at this stage (Table 6) and were followed in importance by death (16.3%). Losses between the first and second calving reached, on average, 33.6% (Table 5), with reproductive reasons still the most important cause, followed by culling for production and death within 30 days of calving (Table 6). Between the second and third calving, losses fell to 18.7% (Table 5), and reproductive causes remained principally responsible (Table 6).

Table 5:

Percentage of females born in Venezuela, alive at 12 months of age, which left the herd after 0, 1 or 2 calvings, according to experiment station.

Number of calvings	Experiment Station			Total (n = 452)
	Bajo Seco (n = 30)	Las Tapias (n = 102)	Maracay (n = 320)	
0	30.0 ^{ab}	13.7 ^{ab}	8.1 ^b	10.8
1	33.3	30.4	34.7	33.6
2	16.6	16.7	19.7	18.7
Total % which left herd after \leq 2 calvings	79.9	60.8	62.5	63.3

* Values in the same line accompanied by different letters are significantly different ($P < .01$)

Altogether, 63.3% of the heifers alive at 12 months of age left the herd before third calving. Reproductive problems were consistently the most important reason for removal, explaining 49.7% of the total cases, followed by death (15.7% of the total). Most of the deaths occurred in the first month after calving (Table 6) and, added to accidents and culling for poor condition, this group of causes accounted for an important proportion, 28.9%, of all losses. In general, involuntary causes explained 86.7% of the removals of animals between 12 months of age and third calving, and only 13.3% of losses were due to low production (Table 6).

Table 6:

Relative importance of different causes of removal from the herd of females born in Venezuela, according to number of calvings achieved before removal.

% losses due to:	Number of calvings achieved			Total
	0	1	2	
Involuntary causes:				
Accidents	6.1	6.6	7.1	6.6
Poor physical condition	8.2	4.6	9.4	6.6
Mastitis	0	2.0	1.2	1.4
Death at calving*	0	13.8	8.2	9.8
Death (other)	16.3	2.0	7.1	5.9
Foot problems	0	2.0	3.5	2.1
Reproduction	57.1	48.0	48.2	49.7
Other	12.1	3.3	2.4	4.5
Voluntary causes:				
Low milk yield	0	17.8	12.9	13.3
	100.0	100.0	100.0	100.0

* Death during calving or within 30 days thereof.

The number of calvings achieved by the females born in 1970-1975 at Maracay was $2.3 \pm .11$, on the basis of heifers alive at 12 months of age, and $2.5 \pm .10$ on the basis of the number which achieved at least a first calving.

Discussion

The most important aspects of the results are the similarity between the imported and locally born cattle with regard to survival at different stages and, in general, their very short herd life.

Overall, 68.1 and 63.3% of the imported and local females left the herd before third calving, with 91.0 and 86.7% of the losses due to involuntary causes. If, in the case of the local cattle, the losses due to death and culling up to 12 months of age are added to the above, 77.9% of the females born alive failed to calve for a third time. Besides this, an abortion rate of 8.5% not only affects the number of replacements available, but also the subsequent reproductive efficiency and costs of maintenance of the dams.

The rate of abortions observed, 8.5%, is within the range of up to 29.8% published for european cattle in the topics (Nair, 1973; Vaccaro, 1974; Madsen y Vinther, 1975; Wilkins et al., 1979), with losses above 10% usually associated with the importation of pregnant stock and immunization programmes. In the present case, a certain number of abortions could be traced to specific physical causes such as overcrowding or shortages of water which lasted for up to three days. In addition, high rates of abortion are to be expected in the presence of ana- and piroplasmiasis (Nair, 1973; Hollon and Branton, 1975), both of which diseases were recorded in the herds from time to time. Another contributing factor may have been the age of the cattle. Due to their short herd life, most of the data refer to

animals with first or second conceptions. Hollon and Branton (1975) reported a 7.5% abortion rate in Holstein heifers, compared with 4.2% in second-calf cows and it is noteworthy that the magnitude of losses in subtropical Louisiana was not substantially less than that reported in the present study. In general, the importance of causes associated with physical debility as reasons for leaving the herd suggest that the animals were under considerable physical stress and that high rates of abortion would be expected.

Between birth and 12 months of age, most of the total losses, 14.6%, were due to death. The mean death rate, 12.7%, is reasonable compared with the losses of up to 66.6% in the progeny of imported Holsteins cited by Vaccaro (1974), and is similar to the figures in the range 10 - 23% reported recently for pure and high grade Holstein calves in Latin America (Planas, 1979; Wilkins et al., 1979; Vaccaro and Vaccaro, 1981; Murillo, 1982). The results are also similar to those obtained in large commercial populations of european and crossbred cattle in Zambia (16.6%; Bessel and Daplyn, 1976) and Zimbabwe (12.9%; Higgins, 1978).

The losses of heifers refer to removals between arrival at 5-18 months of age and first calving in the case of the imported animals, and between 12 months of age and first calving in the case of those born in Venezuela. The average loss of imported heifers, 15.7%, is less than that described by Bodisco (1973) for Holsteins brought into Venezuela at 3-5 months old, 20.8% of which did not reach first calving. The difference may possibly be due to age at arrival since, in the present case, the animals imported youngest had the lowest rates of survival, while among those brought in at 11-18 months old, the losses up to first calving were only 7.8%. However, age at arrival was confounded with herd and with year of importation and in the youngest group, which arrived in 1972, service age coincided with a severe shortage of feed throughout the region in 1973. This explains why culling for poor condition accounted for such a high proportion of losses at this stage of life and also why the Dutch animals appear to have suffered particularly. The animals imported to Maracay, on the other hand, arrived in 1967 and did not experience the same stress as heifers. In their case, losses before first calving were principally due to reproductive problems (52.0%), followed by death and accidents (20.0%).

Among the heifers born in Venezuela, the loss from 12 months old to first calving ranged from 8.1 to 30.0%, with a mean of 10.8%. The effect of herds is partly confounded with year of birth, but it is probable that the tendency towards higher losses at Bajo Seco and Las Tapias compared with Maracay was due to the feed supply problems which were always serious in those two herds, since priority would have been given to milking cows, rather than heifers, in the distribution of the forage available. The mean losses reported are within the range 8.9 - 33.8% given for european and high grade cattle between 6-12 months of age and first calving by Amble and Jain (1967), Madsen y Vinther (1975), Higgins (1978) and Vaccaro and Vaccaro (1981). They are also comparable with the losses of 26.3% of Brown Swiss females between birth and two years old reported by Nair (1973) in India, and of 11.7% among Holstein heifers between 15 months old and first calving in Louisiana (Hollon and Branton, 1975). In the present case,

57.1% of the losses of the locally born heifers were due to reproductive problems, a figure similar to that for the heifers imported into Maracay, mentioned above. The importance of reproductive problems as a reason for removal of heifers from temperate zone herds has been pointed out by Hollon and Branton (1975) and by Allaire et al (1977). They found that 39.5 and 26.0 %, respectively, of all losses of Holstein heifers from birth to first calving were due to reproductive causes.

After first calving, losses were very similar in imported and locally born females, reaching 31.3 and 33.6 % between the first and second calving, and 21.1 and 18.7 % between the second and third. Reproductive problems were consistently the chief cause of elimination and, on the whole, the proportion of losses due to reproduction would seem to be high. The overall mean, 49.9%, is similar to the losses reported by Dextre (1961), Salazar (1970), Talavera et al (1973), Katpatal (1977), Echenagucia and Verde (1978) and Fraga (1979) among european and high grade stock in the tropics, with 41.0-58.9 % of total losses due to reproductive problems. However, these values greatly exceed the range, 11.5 to 26.9 % of total losses due to reproduction, published by Narváez (1951), Maltos (1969), Igboeli (1973) and Dextre (1978) for similar animals in the tropics, or referring to commercial herds in Queensland (Amiel and Moodie, 1973) and Florida (Da Silva and Wilcox, 1976; Da Silva, 1977). Part of the difference between the results reported may be due to different definitions of "reproductive problems". In the present case, for example, it was not possible to differentiate the animals which presented specific clinical symptoms from those whose problems were fundamentally due to poor physical condition and which might, under other circumstances, have been culled for other reasons such as poor milk yield. In any case, although the importance of true reproductive problems was perhaps overestimated, the animals were unproductive and had to leave the herd.

Following reproductive problems in importance as reasons for leaving the herd were the causes associated with physical debility. Death was responsible for 16.3% of all losses of imported cattle between arrival and third calving and for 15.7% of the imported ones from 12 months of age up to third calving. These figures are high compared with the loss of 10.75% due to death reported for Brown Swiss and Holsteins in another Venezuelan herd by Echenagucia and Verde (1978) and specially compared with temperate zone figures of 6-8 % losses from death in Holstein heifers and cows in the USA (Parker et al , 1960; Allaire et al , 1977). In the present study, a high incidence of death during the first month after calving was noted in both imported and locally born stock, coinciding with the period of maximum stress in the life of the cow. Taken together, death, accidents and culling for poor condition accounted for 31.7% of the losses of imported females up to third calving, and 28.9% of the losses of local animals between 12 months of age and third calving.

Overall, involuntary causes of removal were so important that culling for production explained only 11.8 and 16.0 % of the losses of imported and locally born stock which reached first calving. This situation is apparently normal in european cattle in the tropics (Narváez, 1951; Talavera et al , 1973; Echenagucia y Verde, 1978; Fraga, 1979), but it con-

trasts markedly with results obtained in temperate zones where culling for low production commonly accounts for 20-35 % of the herd losses and frequently represents the principal reason for removal, even in large populations (Specht and McGilliard, 1960; O'Bleness and Van Vleck, 1962; Da Silva, 1977; Stellingwerf, 1977; Skjervold, 1978; Warwick and Legates, 1979; Fritsche, 1980).

Such high losses of european cattle in the tropics due to involuntary causes have important practical consequences. In the first place, as the results of the present study illustrate, culling for production is reduced. Secondly, losses associated with reproductive problems, accidents and death usually reflect high costs in medicines and labour for treatments. While it was not possible to quantify these aspects in the present case, they evidently constituted an important part of herd maintenance costs. Thirdly, the removal of animals in poor physical condition, from death and accidents, represents a loss of potential income from their carcase value. In many cases, the animals were so thin that it was necessary to give them away before they died or bury them once dead, thus recuperating none of their value for meat. In one of the herds studied, Las Tapias, Benezra (1980) estimated that the residual value of the US Holsteins and Dutch Friesians was US\$ 252 and US\$ 635, respectively. In the same year, a group of non-registered Holstein heifers was imported from the USA into Venezuela at a cost of US\$ 1900 per head.

Apart from these considerations, the high proportion of involuntary cullings makes the very short herd life of the animals studied a matter of even greater concern. Considering the females which achieved at least a first calving, the mean number of calvings obtained was $2.2 \pm .08$ and $2.5 \pm .10$, respectively for all imported females and those born at Maracay. Bodisco (1973) obtained similar results (2.3 ± 1.76 lactations) for Holsteins imported into Venezuela, but the data included records of animals which were still present in the herd. A longer herd life is indicated by the figures in the range 2.96 - 3.95 calvings or lactations reported from other herds of european or high grade cows in the tropics (Carneiro and Lush, 1954; Igboeli, 1973; Talavera et al, 1973; Katpatal, 1977; Fraga, 1979). Other estimates of herd life, expressed in years after first calving, in the range 3.01 - 6.8 years have been published for similar herds by Narváez (1951), Carneiro and Lush (1954), Anderson (1957), Dextre (1961), Joviano et al (1963), Dextre (1978), Echenagucia and Verde (1978), and Muri llo (1982). These values are considerably higher than those obtained in the present case if number of calvings is converted to number of years. Using the information given by Martínez et al (1982) on the intervals between calving and conceptions in the imported and local animals, a mean herd life is obtained of 1.4 and 1.8 years for the two groups. The probably detrimental effect of so short a life on the profitability of a dairy enterprise has been pointed out by Gartner and Herbert (1979).

In conclusion, it is evident that the losses obtained were high, but not abnormally so except in the case of the adult animals, whose useful life was extremely short despite low levels of culling for production. Although the effects of importation and of location could not be estimated precisely, similar results were obtained for the imported and the local

stock and there was no sign of greater problems of survival at 450 m above sea level than in a mountainous zone at 1200 m. The fact that losses of the magnitude reported were obtained in herds supervised by professionals suggests the urgent need to revise carefully the economic aspects of dairy enterprises using similar animals in tropical regions.

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