

PRELIMINARY RESULTS ON THE COMPARATIVE DAIRY PERFORMANCE
OF SIX HOLSTEIN-FRIESIAN : GUZERA GRADES IN BRAZIL

Resultados preliminares sobre la producción de leche
comparativa de seis tipos de cruzamientos Holandés:Guzera
en Brazil

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Crossbreeding of *Bos indicus* (mainly Holstein-Friesian) and *Bos taurus* (mainly Gir and Guzera) has been practiced by dairy farmers in the SE REGION of Brazil for some fifty years, thus substituting the original crioulo cattle population. Intermediate European:Zebu grades are generally maintained by periodically switching the breed of bull, which results in a wide range of cattle types in the same farm. To obtain information about the suitability of alternative breeding strategies, a trial was set up to measure the performance of six Holstein-Friesian:Guzera grades in commercial cooperator farms. The background and rationale of this trial have been previously described (Madalena, 1981). In this paper, preliminary results on first lactation traits are presented.

MATERIAL AND METHODS

Animals Heifers of six red and white Holstein-Friesian (HF): Guzera (G) grades were produced at Sta. Mônica Exp. Sta., State of Rio de Janeiro and reared up to approximately 22 months of age, when they were distributed to commercial cooperator farms. Throughout this paper, grade means the expected fraction of HF genes, the implicit complementary fraction adding to 1 coming from the G breed. The six grades studied were: 1/4, 1/2, 5/8, 3/4, 7/8 and HFs. The latter were registered grades ($\geq 15/16$ HF). The half bred were F₁s out of G dams. The 1/4s and 3/4s were first backcrosses of F₁ dams to G or HF bulls, respectively. The 7/8s were second backcrosses to HF, and 5/8s were out of 5/8 bulls and 5/8 dams. Further information on the genetic background of these groups was given by Lemos *et al.* (1982). The HF and G sires of the heifers studied were purebred registered from commercial local AI studs. The same set of HF bulls sired the HF, 7/8, 3/4 and 1/2 grades. The sample of heifers included in this report had 13 HF and 7 G sires represented, sire effective number (Robertson, 1953) being respectively 7.9 and 6.9. The 5/8 sires were from the same herd as the 5/8 dams. Only one 5/8 sire was represented in the present data.

Farms Climate and heifer rearing practices at Sta. Mônica were described by Teodoro *et al.* (1982).

In general, each cooperator farm received a group of six heifers, one of each grade, chosen so as to make their age as uniform as possible. Cooperator farms were located in the main milk producing areas of the States of Minas Gerais, São Paulo and Rio de Janeiro, within 17°42' and 22°25' S and 40°46' and 47°53' W. The climate of this region corresponds to Cw of Koeppen's classification (mild, dry winter, hot summer). At the areas where farms were located, mean annual temperature varied between 19 and 23° C, annual rainfall between 1210 and 1704 mm, and mean relative humidity between 73 and 83%. A description of milk production

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in the region was given by Joviano and Costa (1965). Farms of high and low levels of management were chosen, with the help of extension agents and other local contacts. Farmers were instructed to manage the experimental heifers in the same way as their own. All farms practiced twice a day milking, using the calf to stimulate milk let down, as is usual in the region. Eighty one per cent of the heifers in this study were hand milked.

Ninety one heifers were kept at Sta. Mónica Exp. Sta. to provide better nutrition, management and health conditions than commercial farms. These animals were fed 2 kg per head daily of commercial concentrate (23% crude protein) during 30 days before calving, 7.5 kg per head daily during the first 60 days of lactation, and according to NRC requirements thereafter. Maize silage (6.2% crude protein in the dry matter) was fed during the dry season, and chopped elephant grass during the rainy season, when pasture of *Brachiaria decumbens*, Stapf. was also available. The animals were drenched twice, at calving and after 90 days of it, with a broad spectrum product (fembendazol), and kept practically free of ticks by frequent spraying. Concentrate feeding according to production was practiced only at Sta. Mónica and at one cooperator farm.

Records and statistical analyses Distribution of heifers to cooperator farms started in March 1979. In this report, only farms receiving heifers up to February 1981 were included. Calvings occurred all year round, between May 1980 and February 1982. Lactations were considered only if initiated at least one year before this study was undertaken, i.e. up to March 1981. Lactations interrupted because of disease, death or other abnormal cause were excluded.

Milk production was recorded monthly. Milk samples were sent to this Centre, where fat and protein content were measured using Foss Electric Milko Tester and Pro Milk equipment.

The following traits were studied: age at first calving, first lactation milk, fat and protein yields, and fat and protein percentage. Farms were classed into high (H) or low (L) level of management groups according to a subjective assessment of husbandry practices (considering concentrate feeding, pasture quality and availability, roughage supplementation, milking facilities, control of external parasites, managerial ability and herd yield and condition). There were 6 farms in the high and 22 farms in the low management group. Numbers of records are shown in Table 1. It may be seen that most heifers in the high management group were at Sta. Mónica Exp. Sta. One farm in the low management group received two sets of heifers.

Records were grouped into dry (April to September) or rainy (October to March) season of calving. There were four year-seasons for age at first calving and two for dairy traits.

Harvey's (1972) computer programme was used to adjust the following fixed effects least squares model:

$$Y_{ijkl} = m + g_i + l_j + s_k + gl_{ij} + gs_{ik} + ls_{jk} + e_{ijkl}$$

where Y represents one of the above traits; m a general mean; g the effect of the i-th grade (i = 1, ..., 6); l_j the effect of the j-th level of management (j = 1, 2); s_k the effect of the k-th year-season (k = 1, ..., 4 for age at calving and k = 1, 2 for dairy traits); gl, gs and ls the second order interactions of these effects; and e_{ijkl} a residual error. The usual analysis of variance assumptions were made about the distribution of residuals.

RESULTS AND DISCUSSION

Mean age of heifer sets when sent to cooperator farms ranged from 15.6 to 28.0 months, averaging 23.4 months.

Age at first calving was highly significantly (P < 0.01) affected by grade and year-season, but not by level of management, perhaps due to the age at which heifers were split into the H and L level of management farm groups. Interactions

TABLE 1. Number of heifers distributed, calving and completing their first lactation according to grade and level of management.

	Level of management	Holstein-Friesian grade						Total
		HF	7/8	3/4	5/8	1/2	1/4	
Kept at Exp. Sta.	High	11	19	12	10	17	22	91
Sent to farms	High	5	5	5	5	5	5	30
Total	High	16	24	17	15	22	27	121
Total	Low	23	24	23	22	23	23	138
Calved	High	10	23	14	14	22	26	109
	Low	12	15	16	12	21	11	87
Completed lactation	High	7	15	9	13	16	19	79
	Low	6	4	8	6	8	5	37

were not significant ($P > 0.05$). Halfbreeds calved $3.5 + 1.2$ months earlier than HFs and $4.3 + 1.0$ months earlier than 1/4s (Table 2). Teodoro *et al.* (1982) reported that both heterosis and HF additive gene effects reduced age at first conception of the heifers kept at Sta. Mônica. Under poorer management, Freitas, Madalena and Martinez (1980) reported that F1 HF:Gir heifers calved 5.5 months earlier than purebred HFs and 3.3 months earlier than 3/4s.

Grade, management level and grade x management interaction significantly affected ($P < 0.05$) all dairy traits, with the exception of protein percentage, which was significantly influenced by grade only. None of the dairy traits was significantly affected ($P > 0.05$) by season effects nor by interactions involving this factor.

As may be seen in Table 2, at the H farms, HFs had longer lactations than the other grades, and showed a somewhat higher milk yield. However, milk yield in the first 305 days of lactation was $3052 + 216$ and $3155 + 202$ for HFs and 1/2s, respectively. There were non significant differences in lactation length and milk yield between the 1/2, 3/4 and 7/8 grades, while 1/4s and 5/8s had shorter lactations and poorer yields.

At the L farms lactation length of HFs was greatly reduced (Table 2). In fact, three of the six lactations in this subclass were very short (less than 120 days) thus causing the low mean yield observed. One 3/4 grade heifer under low management had a short lactation, and none of the 7/8 or 1/2s. Madalena, Freitas and Martinez (1980) reported 35, 25 and 13% lactations shorter than 120 days, respectively, for HF, 3/4 HF:1/4 Gir and F1 HF:Gir cows under poor management conditions. Short lactations were also shown by four 5/8 heifers (all at H farms), and by five 1/4s (three at H and two at L farms), indicating that short lactations of these grades were not caused by poor management.

Grade effects on fat percentage were different for each level of management. All grades showed higher fat percentage at the L farms, with the exception of 1/2s and 3/4s, which had higher fat percentages at E type farms (Table 2). At the H farms, 1/2s and 3/4s had higher fat percentages than the other grades, whereas at the L farms fat percentage was higher for the 1/4s, and declined consistently as HF grade increased. Protein percentage also tended to decline with increased HF grade, under both levels of management.

F1s showed the higher fat and protein yield, both at the H and at the L farms (Table 2). However, at the H farms the differences between the 1/2, 3/4, 7/8 and HF grades were rather small, whereas at the L farms there was a marked reduction in these traits as grade departed from 1/2.

TABLE 2. Least squares means \pm standard error, for first lactation traits of heifers of six Holstein-Friesian : Guzera grades in farms of high and low level of management.

Trait	Level of management	Holstein-Friesian grades						Total
		HF	7/8	3/4	5/8	1/2	1/4	
Age at calving, mo.	All	40.2 <u>+1.1</u>	39.9 <u>+0.8</u>	39.1 <u>+0.8</u>	40.4 <u>+0.9</u>	36.7 <u>+0.7</u>	41.0 <u>+0.8</u>	39.5 <u>+0.4</u>
	High	404 <u>+37</u>	318 <u>+20</u>	315 <u>+26</u>	203 <u>+23</u>	322 <u>+20</u>	225 <u>+21</u>	298 <u>+10</u>
Lactation length, days	Low	154 <u>+38</u>	289 <u>+41</u>	275 <u>+30</u>	260 <u>+33</u>	307 <u>+28</u>	155 <u>+38</u>	240 <u>+15</u>
	High	3438 <u>+379</u>	3076 <u>+207</u>	3322 <u>+267</u>	1622 <u>+235</u>	3235 <u>+205</u>	1443 <u>+218</u>	2689 <u>+105</u>
Milk yield, kg	Low	772 <u>+390</u>	1959 <u>+418</u>	1717 <u>+306</u>	1474 <u>+335</u>	2322 <u>+287</u>	859 <u>+387</u>	1517 <u>+152</u>
	High	126.6 <u>+15.4</u>	118.0 <u>+ 8.4</u>	133.5 <u>+10.1</u>	53.3 <u>+ 9.5</u>	141.7 <u>+ 8.3</u>	60.4 <u>+ 8.9</u>	105.6 <u>+ 4.3</u>
Fat yield, kg	Low	28.4 <u>+15.8</u>	77.8 <u>+16.9</u>	68.0 <u>+12.4</u>	60.6 <u>+13.6</u>	96.1 <u>+11.7</u>	38.5 <u>+15.7</u>	61.6 <u>+ 6.2</u>
	High	102.3 <u>+12.0</u>	93.2 <u>+ 6.6</u>	102.9 <u>+ 8.5</u>	48.8 <u>+ 7.5</u>	109.4 <u>+ 6.5</u>	50.6 <u>+ 6.9</u>	84.5 <u>+ 3.3</u>
Protein yield, kg	Low	22.4 <u>+12.4</u>	63.5 <u>+13.2</u>	53.5 <u>+ 9.7</u>	45.2 <u>+10.6</u>	75.0 <u>+ 9.1</u>	28.6 <u>+12.3</u>	48.0 <u>+ 4.8</u>
	High	3.52 <u>+0.31</u>	3.84 <u>+0.17</u>	4.05 <u>+0.22</u>	3.14 <u>+0.19</u>	4.38 <u>+0.18</u>	3.97 <u>+0.18</u>	3.82 <u>+0.19</u>
Fat Percent	Low	3.93 <u>+0.32</u>	3.92 <u>+0.36</u>	3.94 <u>+0.25</u>	4.12 <u>+0.28</u>	4.18 <u>+0.24</u>	4.83 <u>+0.32</u>	4.15 <u>+0.13</u>
	High	2.91 <u>+0.18</u>	3.03 <u>+0.10</u>	3.12 <u>+0.13</u>	2.83 <u>+0.11</u>	3.38 <u>+0.10</u>	3.41 <u>+0.11</u>	3.11 <u>+0.05</u>
Protein Percent	Low	2.97 <u>+0.19</u>	3.16 <u>+0.20</u>	3.07 <u>+0.15</u>	3.07 <u>+0.17</u>	3.27 <u>+0.14</u>	3.50 <u>+0.19</u>	3.17 <u>+0.07</u>

The grade means for lactation length, and milk, fat and protein yields, appear to be consistent with the presence of positive additive effects of HF (vs. G) genes, and with heterosis effects causing the departures from linearity observed for the relation between those traits and HF grade.

The present results are indeed of a very preliminary nature, given the small number of farms and lactations involved. However, substantial heterosis effects for dairy traits have been previously reported in European:Zebu crosses (Wijertane, 1970, Vencovsky, Dias and Ricardo, 1970). Also, the superiority of intermediate grades under poor management situations have been reported by Buvadendran and Mahadevan (1975), Katpatal (1977) and Wilkins *et al.* (1979). Brazilian results (reviewed by Madalena, 1981) are in agreement with present findings for both management levels. Kimenyé and Russel (1975) and Trail and Gregory (1981) also found small differences in dairy performance between grades, sired by pure-bred bulls, in the 1/2 to pure European range, for farms under good management in Kenya. However, Branton, McDowell and Brown (1966) and Alberro (1980) reported a decline in production with increased Zebu grade. It is difficult to assess whether these contradictory results are due to genetic differences in the European or Zebu breeds sampled, or to differential adaptation to climate and production system.

ACKNOWLEDGMENTS

The authors would like to acknowledge Mssrs. J.B.N. Monteiro, D.P. Moreira, J.D. Nogueira, A.T. Campos, D.A. Barrios, M.S. Tavares and P.C. Reis, for their technical assistance in the collection of data and supervision of field work.

SUMMARY

Age at first calving and first lactation performance of heifers of six Holstein-Friesian (HF):Guzera (G) grades were compared at farms of high and low level of management in SE Brazil. Heifers (259) of 1/4, 1/2, 5/8, 3/4, 7/8 and $\geq 15/16$ HF grade were reared and distributed to 28 cooperator farms at ages 16 to 28 mo.

Mean ages at calving for the six grades, in the above order, were, respectively, 41.0, 36.7, 40.4, 39.1, 39.9 and 40.2 mo. At farms with high level of management, lactation fat yields were, respectively for the six grades, in the same order: 60.4, 141.7, 53.3, 133.5, 118.0 and 126.6 kg; whereas corresponding values at the farms with low level of management were, respectively, 38.5, 96.5, 60.6, 68.0, 77.8 and 28.4 kg. Protein yield followed similar trends.

RESUMEN

La edad al primer parto y características de la primera lactancia de seis tipos de cruzamiento de Holandés (HF):Guzerá (G) fueron comparadas en fincas con alto o bajo nivel de manejo en el SE de Brasil. Vaquillonas (259) con 1/4, 1/2, 5/8, 3/4, 7/8 y $\geq 15/16$ de sangre de Holandés fueron criadas en una estación experimental y luego distribuidas a 28 fincas de cooperadores con 16 a 28 meses de edad.

Las edades medias al parto para los seis cruzamientos, fueron, respectivamente, 41.0, 36.7, 40.4, 39.1, 39.9 y 40.2 meses. En las fincas de alto nivel de manejo, las medias de producción de grasa, fueron respectivamente (en el mismo orden): 60.4, 141.7, 53.3, 133.5, 118.0 y 126.6 kg, mientras que los valores correspondientes en fincas con bajo nivel de manejo fueron, respectivamente, 38.5, 96.1, 60.6, 68.0, 77.8 y 28.4 kg. La producción de proteína siguió tendencias similares.

REFERENCES

- ALBERRO, M. 1980. *Anim. Prod.* 31: 43-49.
- BRANTON, C., McDOWELL, R.E. and BROWN, M.A. Southern Co-operative Series Bull. Nº 114, La Agric. Exp. Sta., Baton Rouge, LA. 39 pp.
- BUVADENDRAN, V. and MAHADEVAN, P. 1975. *World Anim. Rev. (FAO)*, 1966 15: 7-13.
- FREITAS, A.F., MADALENA, F.E. and MARTINEZ, M.L. 1980. *Pesq. Agrop. Bras.* 15: 101-105.
- HARVEY, W.R. 1972. Least squares and maximum likelihood general purpose programme. Ohio Sta. Univ. Mimeo.
- JOVIANO, R. and COSTA, R.V. 1965, in Proc. IX Int. Grassland Congr., Vol I, pp. 61-80. Secretaria da Agricultura, São Paulo
- KATPATAL, B.G. 1977. *World Anim. Rev. (FAO)*: 22: 15-21.
- KIMENYE, D. and RUSSEL, W.S. 1975. *E.A. Agric. For. J.* 40: 416-421.
- LE MOS, A.M., TEODORO, R.L., BARBOSA, R.T. and MADALENA, F.E. 1982. Holstein - Friesian:Guzera crosses in Brazil. 1. Birth weight and gestation length (in preparation)
- MADALENA, F.E. 1981. *World Anim. Rev. (FAO)* 38: 23-30.
- MADALENA, F.E., FREITAS, A.F. and MARTINEZ, M.L. 1980 in Proc. IV World Conf. Anim. Prod., Vol II, pp. 650-656, L.S. Verde and A. Fernandez, eds., AAPA, Buenos Aires.
- ROBERTSON, A. 1953. *J. agric. Sci.* 43: 334-336.
- TEODORO, R.L., LEMOS, A.M., BARBOSA, R.T. and MADALENA, F.E. 1982. Holstein - Friesian:Guzera crosses in Brazil. 2. Traits related to the onset of sexual function. (in preparation).
- TRAIL, J.C.M. and GREGORY, K.E. 1981. *Span*, 24: 28-30
- VENCOVSKY, R., DIAS, D.J. and RICARDO, Y. 1970. in Ann. Report, mimeo. Dept. Genet., ESALQ, Piracicaba, São Paulo, pp. 130-136
- WIJERTANE, W.V.S. 1970. *Anim. Prod.* 12: 473-484.
- WILKINS, J.V., PEREIRA, G. ALI, A. and AYOLA, S. 1979. *World Anim. Rev. (FAO)*, 32: 25-32.