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CROSSBREEDING SYSTEMS UTILIZING NATURALIZED BREEDS OF BEEF CATTLE IN LATIN AMERICA

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Summary

A large number of beef cattle breeds are available to producers in Latin America. The objectives of this paper are to review and summarize the results obtained with respect to crossbreeding systems utilizing naturalized *Bos taurus* breeds of beef cattle. The results available are presented according to the components of beef production: reproduction (increase in numbers), production (increase in size), and product (increase in quality of beef), for the following breeds: Brazilian Polled, Caracu, Criollo, Crioulo Lageano, Curraleiro and Pantaneiro. It should be pointed out that some of the naturalized breeds of beef cattle have a very high potential for use in crossbreeding systems and in the development of composites in Latin America, such as the Caracu and the Criollo, but others were not evaluated for such alternative utilization of the genetic resources.

Introduction

A large number of beef cattle breeds are available to producers in Latin America, including those of the *Bos taurus* species, the naturalized breeds of *Bos taurus*, the *Bos indicus* breeds (Zebu cattle), the African breeds (Sanga type) and the composite breeds of one or more of these species in different proportions. The differences in both physiological, morphological and adaptation characters among them can be attributed to the varying natural and artificial selection pressures and directions to which they have been subjected. Thus, it would be expected that each of these breeds should be endowed with a different hereditary make-up and probably should have different performance levels under varying management practices and environmental conditions.

The objectives of this paper are to review and to summarize the results obtained in Latin America with respect to crossbreeding systems utilizing naturalized breeds of beef cattle. Since in most cases comparative results are lacking, emphasis will be given to the biological characterization of crossbred animals. The results available are presented according to the components of beef production: reproduction (increase in numbers), production (increase in size), and product (increase in quality of beef). The names of the breeds, types and varieties follow the world dictionary of MASON (1988).

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Crossbreeding results with naturalized breeds

COTRIM (1913) listed the national breeds existing in Brazil at the beginning of the 20 th century in the following order of importance: Caracu, Crioulo, Junqueira, Curraleiro, China, Mocho, Sertanejo, and Franqueiro. DE ALBA (1987) described the naturalized Bos taurus breeds of cattle in Latin America . This review includes a summary of the results obtained with the utilization of the following breeds in Latin America: Brazilian Polled, Caracu, Criollo, Crioulo Lageano, Curraleiro and Pantaneiro. Results obtained up to 1988 were summarized by BARBOSA and DUARTE (1989) and are included in this paper.

1.1 – Brazilian Polled

The history, phenotypic characterization, performance evaluation and conservation of the Brazilian Polled were described by MAGNABOSCO et al. (1993). These authors suggested the implementation of crossbreeding Brazilian Polled bulls with Zebu females in order to increase the numbers of animals for evaluation and conservation purposes.

A crossbreeding experiment was carried out from 1934 to 1942 at Sertãozinho, São Paulo state, to evaluate the potential of *Bos taurus* (Aberdeen Angus, Brown-Swiss, Charolais, Devon, Hereford and Limousine) and *Bos indicus* (Gir, Guzerá and Nelore), as paternal breeds, in a continuous crossbreeding system with Brazilian Polled and Caracu females as maternal breeds. The results were summarized by JORDÃO and ASSIS (1942) in an institutional report, as described by SANTIAGO (1975), and are shown in Table 1. Total losses were higher for *Bos taurus* (47.1%) than for *Bos indicus* x *Bos taurus* crosses (18.8%) indicating that, under the management practices and environmental conditions prevailing at Sertãozinho, the crossbred Zebu cattle were more resistant than European crosses. Crossbred Zebu steers were also superior to the *Bos taurus* crossbreds in terms of liveweight, carcass weight and dressing percentage (Table 1). JORDÃO and ASSIS (1942), after taking into account the results obtained in the experiment, suggested its discontinuation and recommended the evaluation and selection of Zebu cattle for beef production. Results on reproduction efficiency of crossbred females and on carcass characteristics of crossbred Brazilian Polled males were not found in the literature.

Table 1 – Total losses from birth to 3 years of age, liveweight, carcass weight and dressing percentage of different breedtypes raised on pastures at Sertãozinho, SP, Brazil (adapted from JORDÃO and ASSIS, 1942 and SANTIAGO, 1975).

Breedtypes*	Total losses, %	Liveweight, kg	Carcass weight, kg	Dressing percentage, %
½ *Bos taurus* + ½ *Bos taurus*	41.0	508.0	296.2	58.3
¾ *Bos taurus* + ¼ *Bos taurus*	60.0	504.8	293.1	58.1
½ *Bos indicus* + ½ *Bos taurus*	17.0	554.4	343.5	61.9
¾ *Bos indicus* + ¼ *Bos taurus*	20.8	490.2	304.1	62.0

* The second fraction refers to the genetic composition from Caracu and Brazilian Polled.

1.2 – Caracu

Information about Caracu cattle, a double purpose breed, along with their historical development in Brazil, were given by LIMA et al. (1992). The Caracu cattle have been evaluated in several crossbreeding experiments in Brazil and the results are summarized in this review.

In terms of age and weight at first calving, ROJAS-VIDAL et al. (1988) in Bolivia observed that ½ Caracu + ½ Criollo crossbred females were superior to the Criollo ones. Calving rates of crossbred Caracu females from a crossbreeding experiment involving Caracu, Canchim, Brown-Swiss, Holstein, Santa Gertrudis and Nelore bulls mated to Nelore cows were higher (P. R. LEME, personal communication) than those obtained for Nelore cows (88% vs. 62%).

A crossbreeding trial was carried out at the Experiment Station in Andradina, São Paulo state, with the objective of evaluating Guzerá, Nelore, Brown-Swiss, Chianina and Caracu, as paternal breeds, crossed with Guzerá and Brown-Swiss x Guzerá females. The results on growth from birth to weaning were reported by TROVO et al. (1982) and are summarized in Table 2. Crossbred Caracu were similar at weaning to Brown-Swiss, Guzerá and Nelore crossbred calves, but had lower birth weights, which is an advantage in crossbreeding systems using young heifers.

Table 2 – Birth weight (BW), weaning weight (WW) and weight gain from birth to weaning (GAIN) of various breedtypes at Andradina, SP (adapted from TROVO et al., 1982).

Breedtypes (sire x dam)	BW, kg	WW, kg	GAIN, kg
Guzerá	27.3	169	141.7
Brown-Swiss x Guzerá	29.1	189	159.9
Caracu x Guzerá	26.2	189	162.8
Guzerá x (Brown-Swiss x Guzerá)	34.2	217	182.8
Nelore x (Brown-Swiss x Guzerá)	34.9	219	184.1
Chianina x (Brown-Swiss x Guzerá)	40.2	236	195.8
Caracu x (Brown-Swiss x Guzerá)	31.6	218	186.4

Another crossbreeding project was carried out at the same Experiment Station in Andradina to evaluate progenies of Brown-Swiss, Canchim (a composite of 5/8 Charolais + 3/8 Zebu), Caracu, Holstein and Santa Gertrudis sires bred to Nelore females and compared to contemporary purebred Nelore progeny. Results were reported by RAZOOK et al. (1985) and are summarized in Table 3. In terms of a productivity index (weaning rate x weight at 18 months) the paternal breeds ranked in the following order: Canchim (220.6 kg), Caracu 196.3 kg), Nelore (174.9 kg), Holstein 136.7 kg), Brown-Swiss (135.5 kg) and Santa Gertrudis (116.7 kg), indicating the good results obtained with the Canchim and the Caracu breeds.

Table 3 – Mortality rate (MR), birth weight (BW), weaning weight (WW), weight at 13 (W13) and 18 months (W18) of various *Bos taurus* x *Bos indicus* breedtypes in Andradina (adapted from RAZOOK et al., 1985)

Breedtypes (sire x dam)	MR, %	BW, kg	WW, kg	W13, kg	W18, kg
Nelore x Nelore	7.8	27.7	168.9	164.2	242.9
Brown-Swiss x Nelore	11.2	30.6	189.2	191.3	288.3
Canchim x Nelore	4.9	29.0	188.9	183.9	275.7
Caracu x Nelore	6.4	26.0	182.9	183.1	280.4
Holstein x Nelore	5.2	29.8	195.2	202.9	303.7
Santa Gertrudis x Nelore	13.4	28.3	187.5	185.0	271.3

A crossbreeding experiment in a 3 x 3 diallel, including the Caracu, Gir and Nelore breeds, was carried out at Pirassununga, São Paulo state, with the objectives of evaluating breed and heterosis effects on reproduction, growth and maternal ability under two management procedures (grazing on pastures with and without supplementary feeding during the dry season). Results are available only for grazing on pastures without supplementary feeding. LÔBO (1989) reported the results obtained from this experiment (Table 4) with respect to growth of 496 purebred and crossbred calves from birth to two years of age. The superiority of crossbred animals, in liveweight for age, ranged from 8.5% to 21.9% and the heaviest calves were from the Nelore x Caracu and Gir x Caracu breedtypes, suggesting that Caracu cattle are recommended as a maternal breed in crossbreeding systems with Nelore and Gir bulls. Additional results are discussed by BARBOSA and DUARTE (1989).

Table 4 – Least square means for birth weight (BW), weaning weight (WW), 12-mo. (W12), 18-mo. (W18) and 24-mo. weights (W24) of purebred and crossbred Caracu, Gir and Nelore cattle at Pirassununga, SP, Brazil (adapted from LOBO, 1989)

Breedtypes (sire x dam)	BW, kg	WW, kg	W12, kg	W18, kg	W24, kg
Caracu x Caracu	29.5	128.9	167	228	303
Gir x Gir	26.2	124.1	161	203	286
Nelore x Nelore	29.3	133.6	174	230	291
Caracu x Gir	27.4	139.3	187	249	300
Gir x Caracu	32.6	139.4	198	273	319
Caracu x Nelore	29.2	143.3	191	262	324
Nelore x Caracu	34.8	158.3	207	277	327
Gir x Nelore	30.4	138.2	176	235	300
Nelore x Gir	28.4	144.4	185	239	293

PEROTTO et al. (1994) reported the results obtained in a crossbreeding experiment between Charolais and Caracu carried out at the Estação Experimental Fazenda Modelo, in Ponta Grossa-PR, Brazil, from 1981 to 1992. A breed group model was fitted to the data and yielded significant estimates of heterosis for birth weight (2.3 kg), yearling weight (11.9 kg) and daily gain from weaning to yearling (87 grams per day). Backcross heterosis was significant for birth weight (3.7 kg), yearling weight (15 kg) and daily gain from weaning to yearling (83 g/d). Heterosis retained by the rotational crossbreeding system was 3.1 kg for birth weight, 12.8 kg for yearling weight and 93 g/d for weight gain from weaning to yearling. Heterosis for weaning weight was not significant. The results showed that the rotational crossbreeding system between Caracu and Charolais could retain a considerable amount of heterosis for post-weaning gain up to yearling age.

Several results for carcass traits of crossbred Caracu animals are available in the literature (Table 5) and indicate their potential both in crossbreeding systems and in the development of composites for beef production in Brazil.

1.3 – Criollo

Crossbreeding experiments with Criollo cattle have been carried out in Argentina (MIQUEL, 1987; GONZALO-RUIZ, 1992; MEZZADRA, 1993; CORVA et al., 1995; MOLINUEVO, 1995), Bolivia (BAUER et al., 1997; PLASSE et al., 1997; PLASSE, 2000), Colombia (RIVERA et al., 1989; CORREAL, 1992; 1999) and Venezuela (MARTINEZ and GABALDON, 1990; PLASSE, 2000). A summary of the results will be presented at the Conference.

Table 5 – Carcass characteristics of crossbred Caracu animals compared to other breeds

Breedtypes	System of finishing	Carcass weight, kg	Fat thickness, mm	Authors
Nelore	Pastures	229.8	4.4	Luchiari Fº et al. (1989b)
Caracu x Nelore	Pastures	246.8	3.8	
Nelore	Feedlot	243.4	4.7	Luchiari Fº et al. (1989a)
Caracu x Nelore	Feedlot	260.2	3.1	
Nelore	Feedlot	222.1	3.0	Margarido et al. (1991)
Caracu x Nelore	Feedlot	242.8	3.7	
Charolais	Feedlot	256.5	0.8	Moletta et al. (1993)
Caracu	Feedlot	247.3	1.5	
Caracu x Charolais	Feedlot	250.7	0.9	
Nelore	Feedlot	274.0	4.0	Leme (1998)
Caracu x Nelore	Feedlot	309.0	2.6	
Charolais	Feedlot	250.0	1.6	Perotto et al. (2000)
Caracu	Feedlot	260.0	2.2	
Charolais x Caracu	Feedlot	281.5	2.1	
Caracu x Charolais	Feedlot	281.0	2.2	

1.4 Crioulo Lageano

Crioulo Lageano cattle are dealed with separately from other Criollo because they are genetically different (POLI, 1985). Results on crossbreeding were reported by RIBEIRO (1993) and RIBEIRO et al. (1994). The main conclusions from these papers are: 1) crossbred animals have better performance in terms of growth than the purebreds; 2) the crossbreeding Nelore x Charolais justified its popularity and together with the Crioulo Lageano x Charolais have shown to be an excellent alternative to increase the growth rate of beef cattle in the high plains of Santa Catarina; and 3) the small birth weights with little negative impact on weaning weights, high survival ability and good milk production are traits that the Crioulo Lageano cattle could contribute in crossbreeding plans to increase beef production in a sustainable way in regions similar to the Southern Brazilian High Plains.

1.4 – Curraleiro

CARVALHO and GIRÃO (1999) reported that this breed of cattle is threatened of extinction and, for this reason, Embrapa is maintaining a herd of approximately 326 heads, at São João do Piauí in the northeast region of Brazil. Semen, embryos and DNA samples are also being preserved for future uses. No results on crossbreeding Curraleiro cattle were found in the literature reviewed.

1.5 – Pantaneiro

MAZZA (1993) reviewed the situation of Pantaneiro cattle as far as their conservation is concerned. SERENO et al. (2000) reported that crossbred Pantaneiro x Nelore heifers were younger (1033 days) and heavier (241 kg) at first breeding than either Nelore (1223 days and 233 kg) and Pantaneiro (1135 days and 213 kg).

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