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Estimates of Genetic and Environmental Parameters in Tropical Areas that Influence the Growth Beef Bovine F_1

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Abstract: There are presented the results of bovine cross breading F_1 of seven races of beef cattle with parents of Zebu females taken from a tropical environment. They were handled in a system of rotational shepherding, at night and day. There were confined in corrals and were fed with a kilo of concentrate, molasses 4% (dry matter) and free access urea. The paternal races were: Charolais (Cha), Simmental (Si), Hereford (HE), Brown Swiss (PS), Holstein (Ho), Brahman (BRA) and Indu-Brazil (Id). The parameters were analyzed at birth (PN), weight at weaning (PD), weight at 1 year (PA) and final weight (PF). The statistical model included the fixed effects of weight of the mother, sex of the calf, race of the father, year of birth and the interactions: sex-race of the father, sex at year of birth, race of the father per year of birth and experimental error. The averages for PN, had a range from 29.413-32.655 for the paternal races (Id) and (Si); weight of the mother at birth, weaning, race of father and year of birth had significant effects ($p>0.05$); in case of PD was found a range of 97.391 for (Id) to 112.895 for (PS); finding significant effects in the weight of the mother, race of the father and year of birth ($p<0.05$). In case of PA, there were found 154.813 for (BRA) to 196 for (Ho), having significance ($p>0.05$) for the effects of weight of the mother to weaning, sex of the calf, race of the father, year of birth, father of the calf and for PF were found a range of 243.933 for (BRA) to 243.933 and 295.892 for (Cha), being significant all the effects, only the interactions were not, except with the race of the father for 1 year, which was the expected result. It is confirmed that the climatic and maternal effects are relevant in the tropisc, since in initial parameters of growth the genetic manifestation can get confused due to the fact that the initial parameters are similar. It appears that some races have major sensibility than others at the beginning, but as soon as the genotypes show up with adaptation after weaning, it becomes apparent the capacity of behaviour ($p<0.05$). This itself can be observed by the effect of sex of the calf. The effect of the paternal race is significantly different in all the parameters. The opposite is the case for the effect of weight of the mother where it was found that it was diminished as the calf was growing up.

Key words: Cross breeading, tropical environment, climatic maternal effects, genetic parameters, epistasis, sobredominance

INTRODUCTION

The behaviour of genotypes F_1 in the tropics shows the grade of adjustment and the genetic relation of dominance, epistasis and sobredominance as response of the hybrid vigour. In addition, it generates genetic variability that allows selecting individuals of best production.

In the cattle, it is very important the evaluation of its behaviour in this geographical area, the climatic effect, which determines specific conditions of the nutrition and managing that limit the response of the behaviour of the pure races in production specially beef. Also, it is interesting to note the different responses that these pure races demonstrate in their bearing, when they combine genetically with zebuine races, which will depend on the purity of each and on the conditions of managing.

It is always possible to improve the conditions of managing and nutrition in the sense of efficiency, to use every time better genotypes with better performances (De Dios and Vallejo, 2001).

It is known that for many years one has tried to identify the behaviour of some bovine genotypes. Therefore, evaluations in bovine under tropical conditions in Mexico, estimating the behaviour of some races in crossings F_1 with zebu and valuing the incidence of some environmental and genetic effects, with emphasis principally on the sex of the calf, race of the father

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and the effect of the mother on the weight of the calf, turning out to be significant each of the involved factors.

In the international plane, the conflict is in the identification of the behaviour with given genotypes and the estimation of environmental specific factors for the zones of study. In this way, it would be necessary to mention Riley *et al*. (2004), who has been doing research in this matter.

It is important, also to mention that these kind of studies are been done to identify the response of potentially producing races in crossings between zebuine races and the zeal to increase the obtention of protein from animal origin in the tropical areas.

For this, the aim of the present research is to evaluate the behaviour of seven genotypes F_1 crossing races between *Bos taurus* and *Bos Indicus* in the county of Cardenas, Tabasco, Mexico.

MATERIALS AND METHODS

The variables that measured up were the following ones: I weight at birth (PN), growth pre weaning the (VI), weight to weaning (PD), growth post weaning (V2), weight at one year of age (PA) and final weight (PF). The studied animals were bovine F_1 whose race of the father were Simmental, Charolais, Dun Swiss, Holstein, Indobrazil, Brahman and Herdford, with Zebuine mothers (Table 1).

The evaluation was performed in the facilities of the Top College of Tropical Agriculture (ex-SAT), that it is to 11 msnm, which climate is classified as Am (Kopen) with annual rainfall average of 194.5 mm by annual average temperature of 26.4°C.

The managing of the animals was performed with a system of shepherding in cultivated prairies with African Star (*Sinodon plectostachius*) during 12 and 12 h in dry areas, where cattle were supplemented with a kilogram concentrated, which contented 16% protein per animal per day. Besides, they were offered *ad libitum* molasses with 2.5% of urea. All the animals were weaned between 90 and 105 days.

In the case of statistical analysis PN, PI, PD.V2, PA and PF, were considered like dependent variables on some effects and described in the following general model for each of the dependent variables:

$$Y_{ijmlm} = Y_{ijklm} = M + PMN_i + PMD_j + S_k + R_l + A_m + (SR)k_l + (SA)k_m + (RA)l_m + E_{ijklm}$$

Where,

M = The general average
PMN_i = The i-th weight of the mother at birth
PMD_j = The j-th weight of the mother at weaning
S_k = The k-th sex of the calf
R_l = L-th race of the father and the interactions (SR) sex per race of the father (SA) sex per year at birth and (RA) race of the father per year of birth
E_{ijklm} = The experimental error

The analysis of the database was realized by the method of linear regression of square minimums (Searle, 1996), across the procedure GLM of the system SAS described by Bar and Goodnight (1972).

Table 1: Paternal races and observations

Race	Birth weight	Weaning weight	Weight at year	Final weight
Simmental	84	84	81	75
Holstein	66	66	61	57
Indu-Brazil	46	46	41	37
Brahman	49	50	48	45
Hereford	73	73	69	63
Charolais	70	70	70	65
Brown swiss	68	68	50	45

Variation for a total of observations from 387-457

RESULTS AND DISCUSSION

The values of probability, R^2 and coefficient of variation for the dependent variables as consequence of the analysis of variance, appear in Table 2.

It is possible to observe that the models are explained in a significant way, changing from 0.36 (PN) up to 0.67 (V2), there being a trend to explain better from the weight at weaning up to the final weight and diminishing the coefficients of variation from the same variable.

The values for the effect of the independent variables included in the model appear in Table 3 for the considered races.

It is possible to observe that the effect of the weight of the mother at birth for the subsequent parameters, diminishes sensitively from the growth before the weaning, but clearly it diminishes after the weaning; the opposite thing happens with the sex of the calf, where in the first stages, males and females behave similarly, differing as the growing advances. This is confirmed in Table 4, the race of the father has a consistent effect at all levels. The year of birth is significantly different from the

Table 2: Probability, R^2 and coefficient of variation in the dependent variables

Variables	Probability	R^2	C. variation
Weight at birth	0.0002	0.3605	16.108
Growth pre-weaning	0.0001	0.3995	21.310
Weight at weaning	0.0001	0.6422	15.438
Growth post weaning	0.0001	0.6724	20.112
Weight at 1 year	0.0001	0.4890	18.272
Final weight	0.0001	0.5376	14.086

Table 3: Probability for effects of independent variables with the measured parameters

Effects	Weight at birth	Growing pre-weaning	Weight at weaning	Growing post weaning	Weight at year of birth	Final weight
Weight of the Mother at birth	0.0001	0.0182	0.0007	0.1817	0.1408	0.0962
Weight of the mother at weaning	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Sex of the calf	0.0319	0.6481	0.8284	0.0001	0.0075	0.0001
Race of the father	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Year of birth	0.0858	0.0064	0.004	0.0001	0.0281	0.0002
Father of the calf	0.6651	0.0023	0.0042	0.0161	0.027	0.0703
Interactions						
Sex x Race	0.7366	0.9505	0.974	0.4644	0.1172	0.3084
Sex x year	0.2728	0.5947	0.531	0.2879	0.2317	0.4456
Race of father x year	0.3705	0.5327	0.4881	0.0063	0.0003	0.0036

Table 4: Values of corporal weight (kg) of males and females

Parameters	Males	Females
Weight at birth	31.856	30.608
Growth pre-weaning	74.466	74.968
Weight at weaning	106.322	107.000
Growth post weaning	186.228	158.557
Weight at 1 year	183.612	174.960
Final weight	291.665	264.747

weight of the weaning. With regard to the interactions, the unique variable that is significantly different is the race of the father per year from the growth after weaning.

The difference between the sexes for every independent variable appears in the Table 4.

Comparatively the weights are similar, even females lightly exceed males, as in case of the growth before the weaning and weight at weaning, but from the growth after the weaning the males demonstrate in a way to be superior to the females.

It was observed that in the first phases of the growth there were no clear trends when races were compared, which indicates that the environmental effects affect some races in a more important way than others, but as the animal is developing, the trends are consistent, as it is the case of the races Charolais, Holstein and Brown Swiss, that in the last measurements behave in a better manner than other ones.

It is clear that the climatic and mother effects are influenced in an important way for the animal development in tropical climates, since in the first stages, the response or manifestations of the genotype gets confused easily for being similar values among the races tested. Though significant difference exists (Table 3 and 5), the ranges are of 32.655 kg for Charolais to 29.413 kg for Indobrazil, for example. Also, the results show that some races have more sensibility than other, at the beginning, to environment factors (including the effect of the mother). But, as soon as they demonstrate freely (growth after the weaning) its definitive capacity, which provides a reliable criterion to the structuration of an improvement program. In accordance with Key *et al.* (2004), who found similar effects when they analyzed genetic values of parents in crossed cattle.

Within the environmental factors, also there becomes the important effect of the mother, by means obtention of the weight of the mothers at birth and at weaning, especially this at birth. Its manifestation in the calves is inconsistent (as shown in Table 3), in comparison with it effect at weaning, which appears with major clarity to be considered as an important effect that affects different parameters.

This situation appears with similarity in relation to the effect of the sex of the calf, since in the first stages, the results are alike until it gets to the weight to the weaning. There is demonstrated from the growth after the weaning, that the males have a greater weight than females, which can be observed fully in Table 4. These results make one think that the response is a consequence of the effect of the mother before this level. This situation also was observed by Bohmanova *et al.* (2005).

Certainly, the behaviour of the different races of the father is significantly different, which indicates that the genetic potential has different answers in the tropical environment (Osorio, 1994), which gives the opportunity to carry out selection of genotypes, according to the circumstances that were presented. This situation is confirmed in Table 5. The effect of the mother is determinant, such as the races Brown Swiss and Holstein crosses with Simmental, in the parameter of weight at birth shows greater weight significantly ($p>0.0001$) than the other races. Possibly, this situation is due to the production, quality of milk and character of the mother. Later, until the final weight, the situation is different, since the race Charolais appears with greater weight together with the race Holstein.

It is important to observe that the races Brown Swiss and Simmental though they demonstrated acceptable growths from the birth up to the weaning, seems that they are affected strongly by the environmental conditions of the tropics it major intensity, since these responses decline in the development after the weaning, being Holstein very consistent until the final weight, Perez-Marquez *et al.* (2004) and Herdford in all the stages with intermediate manifestations. The effect of the race of

Table 5: The measures of growth for each of the races of the father

Race	Birth weight	Growth pre-weaning	Weight at weaning	Growth post weaning	Growth at year	Final weight
Simmental	32.655	72.869	105.524	176.813	181.395	281.680
Holstein	31.500	81.636	113.136	180.140	196.754	291.526
Indu-Brazil	29.413	67.978	97.391	156.081	158.707	253.946
Brahman	29.918	67.633	103.960	139.000	154.813	243.933
Hereford	29.754	74.068	103.822	183.000	181.913	288.111
Charolais	32.500	74.186	106.686	188.800	185.129	295.892
Brown swiss	31.853	81.132	112.895	175.915	184.680	282.426

the father in growth before the weaning and weight to the weaning was discussed fully by Van Vleck *et al.* (2007) with similar effects of breed of sire.

It is well known also that the races of the father with origin *bos taurus* in comparison with the control *bos indicus* (Brahaman and Indu-Brazil), from the beginning (weight at birth) have better response (Table 5) and have become the growth untill the final weight. The races perform major differences in the same sense. The previous analysis indicates that the use of the strategies of the hybrid vigour of the breading *bos taurus* crossed with *bos indicus* is a plausible alternative to attempt to increase the production of protein from animal origin in the tropics.

With respect to the year of birth, in the Table 3, it shows significant differences ($p>0.005$) in the years, which indicates that the nutritional managing and possibly the climatic one were not similar in the development of the animals, which could affect the genetic manifestation of some races. This can be also the reason why there was a significant effect in the interaction of the race of the father per year from the growth until the weaning of the calf. This confirms that some races have major sensibility to the climatic conditions and managing than other ones. Though, it seems to be that the mother effect rather confuses the response of the races *Bos taurus* (Herdford and Simmental), even in its hybrid genotype F_1. According with Notter and Cundiff (1991), in their study were analyzed characteristics of growing in tropical conditions for some races and parameters.

CONCLUSION

The environmental effect is determinant in the manifestation of the genotypes in the Tropic, even in the F_1. Some races of origin *B. taurus* have major sensibility to the tropical environment. Races *B. taurus* have major potential of production than those of origin *B. indicus*. The mother effect seems to confuse the response of some genotypes as Brown Swiss. The environment was not similar in the years of study, which could affect the response of some paternal races. The paternal race Charolais has a consistent performance after weaning as does the Holstein. This is a good indication to be considered in managing of double purpose. The weight of the mother at weaning has a greater effect than the weight of the mother at born to the efficiency in the total manifestation of the animal. The explanation of the models could be improved, with the introduction of other variables or excluding others. In this case, interactions could be improved some expressions from other ones. In its definitive behaviour (after weaning) with regard to the sex of the calf, the males have a greater weight than females, though in the first stages the factor of the mother seems to affect the responses. It is important to emphasize the response in growth of that race of the such as Holstein, which confirms that its inclusion in programs of production of meat and milk in bovine in tropical areas could be recommendable.

REFERENCES

Bar, A.J. and J.H. Goodnight, 1972. A user guide to the statistical analysis system. Published by student supply stores, North Carolina State University (manual de procedimientos).

Bohmanova, J., I. Misztal and J.K. Bertrand, 2005. Studies on multiple trait and random regression models for genetic evaluation of beef cattle for growth. J. Anim. Sci., 83: 62-67.

De Dios and O. Vallejo, 2001. Bovine Ecophyisiology in Tropic Production. 1st Edn. UJAT. Tabasco, Mexico, pp: 134-138. ISBN 968-7991-23-2.

Key, K.L. J.O. Sanders and D.K. Lunt, 2004. Heterosis retention in Brahman-Angus and Brahman-Hereford F_2 caws for reproductive traits and maternal effects on survival and weight traits of their calves. J. Anim. Sci., 82 (Supplement 2).

Notter, D.R. and L.V. Cundiff, 1991. Across-bred expected progeny differences use of within-bred expected progeny differences to adjust breed evaluations for sire sampling end genetic trend. J. Anim. Sci., 69: 4763-4776.

Osorio, M.M., 1994. Open Nucleus Crossbreeding Systems for breeding cattle en the tropics. Proc. 5th World Congress of Genetics Applied to Livestock Production, Ghelph Canada, 17: 495-498.

Perez-Marquez, A., A. Correa-Calderon, F. Ponce-Medina and J. Guerrero, 2004. Estimates of genetic parameters of birth weight, weaning weight and calving difficulty in beef cattle. J. Anim. Sci., 82 (Supplement 2).

Riley, D.G., C. Chase Jr., S.W. Coleman and A. Olson, 2004. Evaluation of Romosinuano as staightbreds and crossbreds wit Angus and Brahman: Preweaning Calf traits. J. Anim. Sci., 82 (4).

Searle, S.R., 1966. Matrix Algebra for the Sciences. 1st Edn. Wilex, New York, pp: 147-158. ISBN: 0 471 76930 4.

Van Vleck, L.D., L.V. Cundiff, T.L. Wheeler, S.D. Shackelford and M. Koohmaraie, 2007. Across-Breed adjustment factors for expected progeny differences for carcass traits. J. Anim. Sci., 85: 1369-1376. DOI: 10.2527/jas.2006-658.