HERITABILITY INDICES OF POST WEANING PERFORMANCE IN BRAHMAN CATTLE

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Data on post weaning daily gain and final live weight, at an average of 414 days post weaning, were analysed for 174 male and female progeny of 8 sires in a Brahman herd in Yucatan State. The animals were weaned at a mean age ant weight of 254 ± 8.7 d ant ZOO + 33 kg. The data were analysed by multiple regression. The least squares means for post weaning daily gain and final live weight were 0.495 ± 0.15 kg/t ant 345 + 2.9 kg respectively. There were highly significant effects (P <.01) of se% on the two variables and of sire on final live weight. The heritability estimates for final live weight and post weaning tally gain were 0.51± 0.31 and 0.08 ± 0.14 respectively.

Key words: Cattle, heritability, post weaning performance

Selection and mating system are the principal ways available to the cattleman for changing the genetic structure of his herd. To determine the expected progress in genetic improvement through selection, it is necessary to know the extent to which the characteristics we wish to improve are transmitted from parents to progeny, that is, their index of inheritance or heritability. Final postweaning weight in a beef herd is a measure of the herds productivity and is the result of the daily increases in weight which measure the rate of growth. Heritability indices reported in the literature for these parameters show great variation (see Preston & Willis 1974) although the preferred values given by these authors are 0.52 and 0.70 for daily gain on test and final liveweight on test, respectively, The objective of the study was to estimate the heritability of: final live weight (at an average of 414 d post weaning) and post weaning daily gain in a Brahman herd.

Materials and Methods

Records for post weaning daily gain and final live weight (at average 414 d post weaning) for 174 male and female progeny of a Brahman breed were used. The progeny were sired by eight bulls (Table 1) in a herd situated in the municipality of Tizimin, Yucatan State. This area has a mean rainfall and annual temperature of 1105 mm and 25.8^{o} (Garcia 1973).

The animals were born from November 1969 to January 1970 and weaned at a mean age of 254 ± 8.7 d and a mean live weight of 200 ± 3.3 kg. Weaning was in three stages at intervals of 1 month with 56 to 60 individuals in each group. After weaning the calves grazed guinea grass (Panicum maximum). Subsequently the groups were divided according to sex into paddocks in the same pasture. The final post weaning live weight was recorded on the same day for all animals which gave an average period of 414 ± 36 d in that system.

Table 1 :
Distribution of animals by sire and sex

Sire	Sex		Total
	Males	Females	
A	12	13	25
B	10	8	18
C	12	9	21
D	10	11	21
E	12	13	25
F	5	10	15
G	16	13	29
H	13	7	20
Total			
8	90	84	174

The analysis was done by regression (Barr & Goodnight 1972), the following models were used.

For the analysis of the post weaning daily gain:

$Y_{ijk} = U + T_i + S_j + bN_{ijk} + dE_{ijk} + e_{ijk}$

In which Y_{ijk} = the post weaning daily gain of the k-th calf of the j-th sex of the i-th sire.

U = general mean

T_i = Effect of the i-th sire

S_j = Effect of the j-th sex

b = partial regression coefficient of the post weaning daily gain on the weight at weaning.

N_{ijk} = Weight at weaning of the 'k' calf as a continuous co-variable.

d = partial regression coefficient of the post weaning daily gain on the age at weaning.

E_{ijk} = age at weaning of the 'k' calf as a continuous co-variable

e_{ijk} = random error

For the analysis of post weaning final live weight:

$Y_{ijk} = U + T_i + S_j + e_{ijk}$

where:

Y_{ijk} = the post weaning final live weight (adjusted to 414 d) of the k-th calf in the j-th sex of the i-th sire.

U = general mean

T_i = effect of the i-th sire

S_j = effect of the j-th sex

e_{ijk} = random error

In the preliminary analyses, the sire X sex interaction was not significant and it was excluded from the model in the final analysis.

Post weaning daily gain was calculated using the formula given by Bogart (1966). Post weaning final live weight was adjusted to 414 d by multiplying the post weaning daily gain by 414 and adding to this value the weight at weaning.

The correlation method between parental half sibs, described by Falconer (1970) was used to calculate the heritabilities (h^2). The variance components, the average numbers of progeny per sire (k) and the standard errors of the heritability were estimated according to Turner and Young (1969).

Results and Discussion

The results for post weaning daily gain and adjusted final live weight are presented in Table 2. The overall means were 0.495 ± 0.15 kg/d and 345 ± 2.9 kg respectively.

Table 2:
Analysis of variance of post weaning daily gain and post weaning final live weight (adjusted to 414 d)

Source of variation	df	Mean squares	
		Daily gain	Final live weight
Sire	7	0.0085	5751.25**
Sex	1	0.0681	36888.6**
Weight at weaning	1	0.0644**	
Age at weaning	1	0.0000	
Error	163	0.0060	
	165		1390.61
Coefficient of variation, %		22.36	10.82
Standard deviation		0.077	37.29

** P<. 0 1

The effects of sire on post weaning find live weight and of sex on both variables were highly significant (P <.01). The males weighed 359.9 kg and gained 0.516 kg daily in comparison with 330.4 kg and 0.474 kg for females. The literature on the effect of sex on post weaning performance is large (see Preston & Willis 1974).

Compensatory growth is a phenomenon which may give errors in the estimation of the true potential of the growth of individuals when the performance test fellows immediately after weaning, that is to say, there will be a proportionally greater set back at weaning in the suckling calf of an exceptional dam than in a calf of a mediocre dam (De Alba 1970).The highly significant (P <.01) regression of -0.0007 of post weaning daily gain on weight at weaning seems to confirm this situation. Nevertheless, the regression of -0.00001 of post weaning daily gain on the age at weaning was not significant possibly because the animals were weaned in various groups, standardising to a large extent their age at the start of the test, and consequently eliminating the effect of this factor.

The heritability estimate for post weaning daily gain was 0.08 ~ 0.14 which is lower than the median value, 0.54 of 56 reports reviewed by Preston & Willis (1974). The smaller number of observations and the exclusive use L of pasture for feeding are possible causes of this result. On the other hand the heritability estimate for post weaning final weight, 0.51 ~.31, while showing the relative importance of additive

gene effects on this character, is similar to the preferred estimate of 0.65 reported by Preston & Willis (1974) from 30 reports in the literature. Nevertheless, it is important to remember that in this study the animals were fed only on pasture and not with cereals as was the case in most of the reported estimates.

From a genetic point of view, the principal importance for the cattleman of the size of these heritability estimates is in the selection of individuals.

Genetic progress in populations through selection basically depends on the heritability of the character under improvement and on the selection differential (Falconer 1970). The heritability index in addition to being an important factor in the prediction of genetic progress, determinates the reliability of the phenotypic value as an indicator of the individual's breeding value (Falconer 1970). Taking this into account and under the specified management conditions of this herd it would be more appropriate in a genetic improvement programme to select animals for post weaning final live weight, rather than the-mean daily gain in the same period.

References

Barr A J 6 Goodnight B 1972 S A 5 A user's guide to the statistical analysis system. North Carolina State University, Raleigh

Bogart R 1966 Crianza y mejora del ganado Herrero: Mexico D F

De Alba J 1970 Reproduccion y Genetica Animal IICA, OEA, Mexico D F

Falconer D S 1970 Introduccion a la genetica cusotitativa CECSA: Mexico D F

Garcia e 1973 Modifaciones al sistema de clasificacicon climatica de Koeppen UNAM Instituto de Geografia: Mexico

Preston T R & Willis M B 1974 Produccion intensiva de carne Diana: Mexico D F

Turner B & Young S 1969 Quantitative genetics in sheep breeding Cornell University Press: Ithaca, New York

Received June 10, 1979