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THE RELATIONSHIP BETWEEN PLASMA CORTICOID AND GROWTH RATE IN CATTLE

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Summary

Plasma corticoid concentrations and post-weaning growth rates were measured in two different herds of Hereford bulls in the South-East of South Australia. Significant ($P < 0.001$ to < 0.05) negative correlations of from $r = -0.78$ to -0.91 in stud bulls and $r = -0.48$ and -0.38 in commercial bulls, were observed between growth rate and plasma corticoid, indicating that bulls with low corticoid concentrations tended to grow faster after weaning than did those with high corticoid concentrations.

The possibility of using plasma corticoid concentrations as a selection criterion for growth is discussed.

I. INTRODUCTION

Current methods of sire selection for production include performance and progeny testing, both of which have disadvantages. Performance testing results are not available until bulls are 9 to 18 months of age and bulls rejected after testing are sold at a price penalty. Results of progeny tests are only obtained when the animals are 3 to 4 years old, so that much of their reproductive life is lost. Progeny testing results, however, are more accurate than those from performance testing.

There is a need to determine a quick, easy and accurate method of screening populations of animals at an early age, for superior sires and dams. This need assumes greater importance since the introduction of semen from exotic breeds.

Selection for productivity includes selection for adaptation to a particular environment. Environmental factors generally cause the greatest variation in production. Therefore, an early predictive parameter needs to be one associated with adaptation and such parameters probably have to be physiological. Blood concentrations of adrenocorticotrophin hormone (ACTH) and the glucocorticoids are two possibilities.

Resistance to environmental stress in pigs is associated with both ACTH and cortisol (Marple, Judge and Aberle 1972) and significant correlations between the concentration of glucocorticoids in blood plasma and growth rate or meat tenderness of Holstein heifers have been reported by Purchas *et al*. (1971) and Hafs, Purchas and Pearson (1971).

This paper reports preliminary results of a study designed to investigate the possibility of using plasma corticoid concentrations and ACTH as a selection criterion for beef production.

II. MATERIALS AND METHODS

(a) Environment

Two herds of Hereford bulls were investigated; one at South Killanoola (Herd A) and the other at Struan (Herd B), both situated near lat. 37°10'S and long. 140°45'E in the South-East of South Australia. This area has a mean annual rainfall of 549 mm with effective rainfall from April to October. The drought frequency is 1 year in 20 years. Mean daily temperatures are 9 and 19°C in

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July and January, respectively, The mean number of frosts per year is 17 with most occurring between June and August.. Soils of the area. have been described by Blackburn (1964).

(b) Animals and management

Animals in both herds were born between February and April, 1971. Calves were weaned onto phalaris--strawberry clover pastures and subjected to routine disease and parasite control measures. Supplementary feeding was practised during winter.

In Herd A, liveweights were recorded in November, 1971 and 1972, while Herd B bulls were weighed at weaning in December, 1971, in April and November, 1972.

Herd A consisted of both stud and commercial bulls. The stud bulls were the progeny of 3 sires called Mainline, Telstar and Lox-ton. The sires of the commercial bulls and the Herd B bulls were unknown.

(c) Blood collection and assay

Bulls in both herds were driven straight from pasture to cattle yards and allowed to rest for about 4 hours prior to blood sampling. Blood samples were collected from 16 stud bulls and 29 commercial bulls in Herd A in November, 1972 and from 31 bulls in Herd B in December, 1972. Samples (10 ml) were taken with heparinized Vacutainers ® (Becton-Dickinson, New Jersey) from the tail vein of Herd A bulls and from the jugular vein of Herd B animals. After centrifugation, plasma was withdrawn and stored at -10°C until assayed.

Plasma corticoid concentrations (PCC) expressed as cortisol equivalents in ng/ml were determined on each plasma sample by the method of Bassett and Hinks (1969).

III. RESULTS

The relationship between PCC measured on November 20, 1972 and the live-weight gain (kg/day) for the period November 16, 1971 to November 21, 1972 of Herd A bulls is shown in Fig. 1.

The correlation coefficients (r) between growth rate post-weaning and PCC were -0.78 ($P<0.01$), -0.82 ($P<0.05$) and -0.91 ($P<0.05$) for the Loxton, Telstsr and Mainline stud bulls, respectively, of Herd A. The r value for the commercial bulls was -0.48 ($P<0.01$) and -0.38 ($P<0.05$) for Herd B bulls. The regression coefficients and intercepts of sire groups and commercial bulls in Herd A were not significantly different. The correlation coefficient of the pooled data from Herd A was -0.50 ($P<0.001$).

The mean $\pm$ SEM., PCC for Herd A bulls was 16.8 ± 0.8 ng/ml (n=45) and for Herd B bulls 11.8 ± 0.9 ng/ml (n=31). Mean $\pm$ SEM post-weaning growth rates were 0.67 ± 0.01 and 0.58 ± 0.02 kg/day for Herds A and B, respectively. Differences in both the mean PCC and growth rates between herds were significant ($P<0.001$). A significant ($P<0.01$) difference in PCC between Telstar (14.2 ± 1.4) and Loxton (20.9 ± 1.1 ng/ml) sire groups was also evident.

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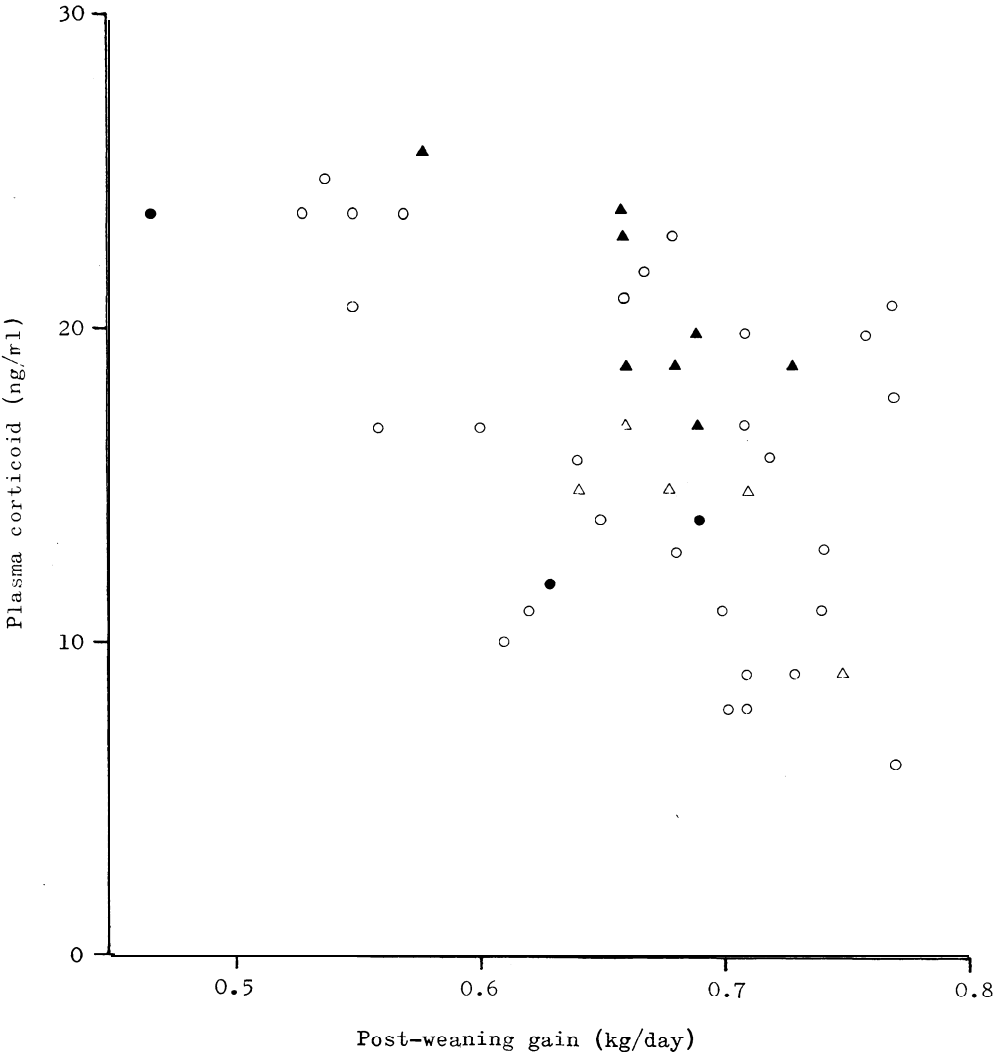

Fig. 1. The relationship between post-weaning gain (kg/day) and plasma corticoid concentrations (ng/ml) for Hereford bulls in Herd A.

O, Commercial bulls; ● , Mainline stud; △ , Telstar stud; ▲, Loxton stud.

IV. DISCUSSION

The moderate to high negative correlation coefficients between growth rate 2nd corticoid concentration indicates that the Hereford bulls with low corticoid tended to grow faster than did those with high corticoid. The existence of this correlation is surprising as PCC in blood plasm2 of cattle are known to vary markedly within a period of 30 minutes (Wagner and Oxenreider 1972; Willett 2nd Erb 1972; Obst unpublished). Significant differences in the mean PCC between the sire groups in Herd A suggest that PCC may be heritable. Breed differences in PCC have also been observed (Obst, Deland and Giles unpublished).

Significant negative correlations ($r = -0.57$ to -0.74) have also been observed between PCC and growth rate of Holstein heifers from 10 to 40 weeks of age (Purchas et al. 1971) and of Friesian cross calves from I8 to 21 weeks (Yates and Ellis personal communication).

If PCC in young animals can be used to predict subsequent growth and if PCC are found to be highly heritable then there is a possibility of using PCC as a selection criterion for growth on pasture or to breed animals with low PCC which may adapt more quickly to the stress of feed-lotting. It would also seem feasible to use PCC to cull animals with poor feed-lot growth potential prior to introduction to a feed-lot.

It is concluded that the results presented should encourage further investigation into the practical application of plasma corticoid measurements as a management tool to increase the efficiency of beef production.

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VI. REFERENCES

BASSETT, J.M. and HINKS, N.T. (1969). J. Endocr. 44:387.
BLACKBURN, G. (1964). C.S.I.R.O. Aust. Soils Land Use Series No. 45.
HAFS, H.D., PURCHAS, R.W. AND PEARSON, A.M. (1971). J. Anim. Sci. 33:64.
MARPLE, D.N., JUDGE, M.D. and ABERLE, E.D. (1972). J. Anim. Sci. 35:995.
PURCHAS, R.W., PEARSON, A.M., HAFS, H.D. and TUCKER, H.A. (1971). J. Anim. Sci. 33:836.
WAGNER, W.C. and OXENREIDER, S.L. (1972). J. Anim. Sci. 34:630.
WILLETT, L.B. and ERB, R.E. (1972). J. Anim. Sci. 34:103.