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# CALF GROWTH AND LIFETIME PERFORMANCE OF BEEF CATTLE

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## SUMMARY

A trial with 21 sets of identical twin steers investigated the effects of poor growth rate of calves on subsequent performance. One member of each set was reared on whole milk *ad libitum* from birth to weaning at 112 days of age. The other member was quantitatively rationed on whole milk so as to grow at a rate of approximately 0.34 kg liveweight gain/day to weaning at 112 days. Twin members grazed together from weaning to 400 days of age.

An average liveweight difference of 42 kg within twin sets at 112 days of age reduced to 35 kg at 400 days of age. Between animals within treatments, the growth rate between 112 and 400 days of age was positively associated with the liveweight at 112 days.

The implications of the results to commercial beef production and to performance testing of beef animals in a genetic selection programme are briefly discussed.

AN earlier communication (Everitt *et al.*, 1969) reported that beef calves poorly reared to weaning at approximately 4 months of age failed to show compensatory growth after weaning and suffered a lifetime growth penalty. The carcass weight of crossbred steers at 620 days of age increased by 1 kg for every 1 kg extra liveweight recorded at 107 days. Genetic and environmental influences could not be partitioned adequately in that work.

This progress report presents data from an experiment with identical twin steers designed to examine the relationships between the early growth of cattle and their subsequent growth performance. The results are discussed in the context of commercial beef production, on the one hand, and the implications for growth performance testing of beef cattle in a genetic selection programme on the other.

## EXPERIMENTAL

### ANIMALS

Twenty-one sets of spring-born identical twin male Jersey and Friesian × Jersey calves were collected.

## MANAGEMENT

Twin pairs were split so that one member (H) was fed *ad libitum* on whole milk up to weaning at 112 days of age. The other member of each set (L) was quantitatively rationed with whole milk so as to grow at 0.34 kg live-weight gain/day up to 112 days of age. Calves were rotationally grazed on high quality pasture with hay offered *ad libitum*.

All calves were castrated at 4 weeks of age. They were drenched against internal parasites at monthly intervals and sprayed periodically against lice.

After weaning off whole milk at 112 days of age all animals grazed together, receiving supplementary hay to appetite during periods of pasture shortage.

Animals were weighed at weekly intervals before weaning and fortnightly thereafter.

## RESULTS

Figure 1 records the mean growth curves of the twins up to 400 days of age. Table 1 summarizes mean live-weights and growth rates for specified periods.

During the 16 weeks of differential feeding, the rationed L animals grew a little faster than the desired rate of 0.34 kg per day. At weaning time (112 days), the mean

TABLE 1: MEAN LIVeweIGHTS, GROWTH RATES AND DIFFERENCES

Character	Group		Difference $\pm$ S.E. (H - L)
	High	Low	
<i>Liveweights (kg)</i>			
Arrival wt	26		—
112-day wt (weaning)	110	68	42 $\pm$ 2 ***
200-day wt	155	115	40 $\pm$ 3 ***
400-day wt	268	233	35 $\pm$ 3 ***
<i>Growth Rates (kg/day)</i>			
Arrival to 112 days (weaning)	0.75	0.38	0.37 $\pm$ 0.02 ***
Arrival to 400 days	0.60	0.53	0.07 $\pm$ 0.01 ***
112 to 400 days	0.55	0.57	-0.02 $\dagger$ $\pm$ 0.01
200 to 400 days	0.57	0.59	-0.02 $\pm$ 0.01

Note: \*\*\*  $P < 0.001$ ;  $\dagger P < 0.10$ ; S.E. = standard error.

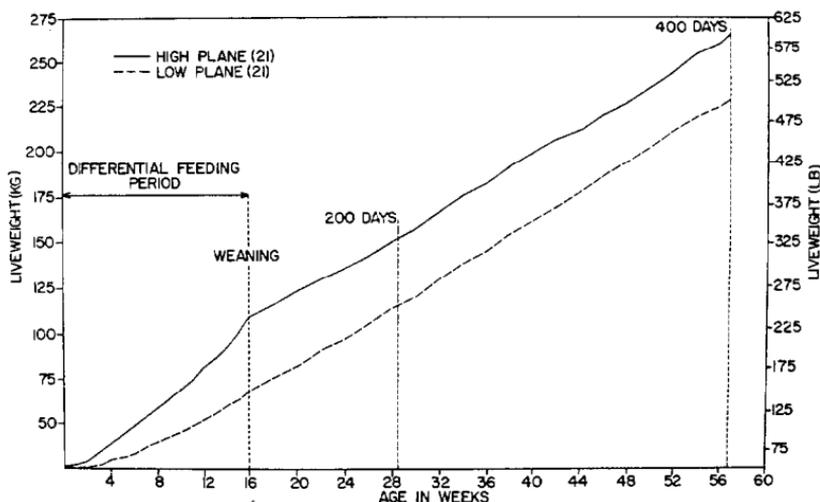


FIG. 1: Mean growth curves of identical twin steers.

liveweight of the poorly fed L animals represented 63% of the weight of the *ad libitum* fed H steers.

L animals grew slightly faster than H after weaning ( $P < 0.10$ ), so that the 42 kg difference at weaning had reduced to 35 kg at 400 days. At 200 and 400 days of age the mean liveweight of L animals represented 72% and 87%, respectively, of the mean weight of H animals.

The regression of the within set liveweight difference at 400 days of age ( $y$ ) on the within set liveweight difference at 112 days ( $x$ ) was

$$y = 1.01 (\pm 0.29) x - 6.24$$

with a correlation coefficient ( $r$ ) of 0.62 ( $P < 0.01$ ). Thus with animals of identical genotype, differences in liveweight at 400 days approximately equalled the differences at 112 days, elicited by nutritional means, less 7 kg due to slight compensatory growth by the L animals.

The regressions of liveweight gain from 112 to 400 days of age ( $y$ ) on the liveweight at 112 days ( $x$ ) for H and L groups separately were

$$\text{High: } y = 1.11 (\pm 0.38) x + 36 : r = 0.61 (P < 0.01)$$

$$\text{Low: } y = 1.42 (\pm 0.50) x + 66 : r = 0.75 (P < 0.01)$$

On a between animal within treatment basis, growth rate from 112 to 400 days of age was significantly related to liveweight at 112 days of age. A difference of 1 kg in 112-day weight was associated with a difference of 1.1 kg in gain over the period 112 to 400 days for the H group, and 1.4 kg for the L group.

#### DISCUSSION

The preliminary results of this experiment illustrate that nutritional restriction of growth from soon after birth and for the first 4 months of life can markedly affect the liveweight achieved at approximately 14 months of age. Using identical twins it has been possible to partition genetic and environmental effects and to clarify the results reported by Everitt *et al.* (1969).

Compensatory growth of L steers after weaning under pasture feeding conditions influenced the position. Reardon and Everitt (1972), in a similar trial, found no evidence of compensation by steers poorly fed for the first 12 weeks of life. The reasons for this difference in results are not clear at this stage.

Other reports suggest that the sensitive period to achieve permanent stunting in cattle may, in fact, be much less than 4 months of age (Everitt, 1967) and may be exerted in the first 2 to 4 weeks of life (Burt and Bell, 1962; Wardrop, 1966; Lonsdale and Tayler, 1969). The British Meat and Livestock Commission (M.L.C., 1971a) has recently reported that the method of rearing dairy-bred Hereford  $\times$  Friesian calves in the first 2 weeks of life influenced subsequent growth performance in large-scale progeny tests.

Results of the present experiment have an important bearing on two facets of beef production. First, the poor rearing treatment accorded the L cattle limited realization of their growth potential which could not be overcome by compensatory growth. At 400 days of age, the mean liveweight of L animals was 35 kg less than that of H animals, representing an appreciable loss of beef production per animal. The degree of growth restriction imposed on the L calves was not unduly severe, their growth rate before weaning being comparable to the rate achieved by many dairy farmers rearing calves for beef (Everitt *et al.*, 1969).

Secondly, the present trial with steers casts doubt upon the methods used in growth performance tests as part of a genetic selection programme. A recent scientific study group on beef improvement in Britain (M.L.C., 1971b)

recognized the need for information on pre-test influences to validate conclusions about the genetic merit of growth-tested bulls. On the basis of liveweight at 400 days of age, after being on test from 200 days of age (Fig. 1), the H steers in all cases would have been selected in preference to the genetically identical L animals. Alternatively, on the basis of the liveweight gained between 200 and 400 days, the L animals in 15 out of 21 pairs would have been selected in preference to their identical twin mates.

In the light of these results, the comparative growth performance of different breeds of bulls used in artificial breeding (Carter, 1969) needs cautious interpretation as the bulls were reared in different environments up to the yearling stage. Further, Carter (1971) concluded that worthwhile genetic gains will be achieved by selection of beef sires on yearling or weaning weight but *not* on weaning to yearling gain. On the other hand, Wood (1970) and Willis *et al.* (1970) have concluded the converse, namely, that liveweight gain on test is more reliable than final weight-for-age because the latter is more susceptible to non-genetic variation.

The present results emphasize the important nutritional influence of the pre-test environment on each of the two selection criteria advocated, providing little confidence in either when the test period commences after 4 months of age. It appears that beef sire performance tests should be conducted with animals reared together from birth. Further studies should aim to determine whether weaning weight, final weight or weight gain on test is the superior genetic selection criterion to use in such a revised programme.

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#### REFERENCES

- Burt, A. W. A.; Bell, E. O., 1962: *J. agric. Sci. Camb.*, 58: 131.  
Carter, A. H., 1969: *Proc. N.Z. Soc. Anim. Prod.*, 29: 54.  
——— 1971: *Proc. N.Z. Soc. Anim. Prod.*, 31: 151.  
Everitt, G. C., 1967: in *Growth and Development of Mammals*, Ed. Lodge, G. A. and Lamming, G. E. Butterworths, London, pp. 131-57.  
Everitt, G. C.; Evans, S. T.; Franks, M. F., 1969: *Proc. N.Z. Soc. Anim. Prod.*, 29: 147.

- Lonsdale, C. R.; Tayler, J. C., 1969: *J. agric. Sci., Camb.*, 73: 483.
- M.L.C., 1971a: *Newsletter*, No. 11. Beef Improvement Services, Meat and Livestock Commission, Bletchley, U.K.
- 1971b: *Beef Improvement: Scientific Study Group Rep.* Meat and Livestock Commission, Bletchley, U.K., p. 63.
- Reardon, T. F.; Everitt, G. C., 1972: *Proc. N.Z. Soc. Anim. Prod.*, 32: 26-38.
- Wardrop, I. D., 1966: *Aust. J. agric. Res.*, 17: 315.
- Willis, M. B.; Rodriguez, L.; Preston, T. R., 1970: *Rev. cubana Cienc. Agric. (Eng. Ed.)*, 4: 37.
- Wood, P. D. P., 1970: *Anim. Prod.*, 12: 585.