THE EFFECT OF SIRE SELECTION FOR HELMINTH EGG COUNTS ON PROGENY HELMINTH EGG COUNTS AND LIVE WEIGHT

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SUMMARY

Progeny of sires selected for low or high helminth egg counts (epg) were compared. A parental selection differential of log 0.69 epg resulted in a difference of log 0.36 epg between the progeny of the two sire lines (log 2.11 vs 2.47 $P<0.005$) which represents a realized heritability of 0.52. There were no significant differences between sires within selection lines.

Sire selection line had no significant effect on live weights at birth, weaning or 18 months of age. There was an effect of sire within the low ($P=0.001$) and high ($P=0.058$) selection lines on 18 month live weights. These differences reflected the sire's own ranking for 18 month live weight.

The results indicate that, at the level of epg counts recorded in this experiment, live weight and helminth resistance as measured by egg counts are not related.

(Key words:- sire selection, helminths, live weight.)

INTRODUCTION

The use of anthelmintics to alleviate the effects of endo-parasite burdens in yearling cattle is widely regarded as a necessary management practice. Seifert (1971b), Turner and Short (1972), Bryan (1976) and others showed that anthelmintic treatment improved liveweight change especially during periods of nutritional stress. The extent of mortality from helminth burdens is not well documented but deaths are known to occur (Seifert 1971b; Bryan 1976). Anthelmintic treatment is a recurring cost, and there is a danger of drug resistance developing in the helminth population (Kelly and Hall 1979).

Genetic manipulation of cattle by choice of breed and by within breed selection can be used to control cattle tick (Seifert 1971a). However, less attention has been given to the genetics of helminth resistance. Repeatabilities of helminth egg counts have been shown to be moderate to high (Seifert 1971b), indicating reasonably consistent ranking of animals according to helminth egg count. Preliminary studies by Seifert (1977) also indicated moderate to high heritabilities for helminth egg counts. These studies imply that selection for helminth resistance may be a feasible alternative to anthelmintic treatment. Preliminary results from a single generation selection experiment in which sires were selected for high or low faecal egg counts are reported in this paper.

MATERIALS AND METHODS

The experimental animals were F2 et seq. generation Africander-Hereford cattle bred and reared at Brigalow Research Station (24°50'S 149°48'E) approximately 190 km south-west from Rockhampton, Queensland. They were the progeny of three bulls selected for low and three bulls selected for high helminth faecal egg counts. These bulls were bred and reared at Mt Eugene, a

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commercial breeding and fattening property located at 24°10'S 150°25'E approximately 70 km south of Rockhampton, Queensland. Selection was based on four epg counts between August 3 and December 10, 1981 when the bulls were c. 8 to 13 months of age. Individual and group epg counts and 560 day (18 month) live weights for the "low" and "high" bulls and for the complete group from which they were selected are shown in Table 1.

Table 1 Helminth egg counts (epg) and 18 month live weights of the sires of the experimental animals and of the unselected group from which they were drawn.

Sire line	Sire	Mean epg count†		Liveweight kg	Liveweight ratio
Low epg	A	0.94	(8)	366	105
	B	1.58	(37)	319	92
	C	1.79	(61)	335	97
	Means	1.44	(27)	340	98
High epg	D	2.60	(401)	362	104
	E	2.63	(421)	310	89
	F	2.80	(696)	347	100
	Means	2.69	(490)	340	98
Whole Group	Means	2.20 ± 0.50††	(157)	347 ± 30††	100
	No. Bulls	68		75	

† transformed as log (count + 1) with back-transformed values in brackets.
†† Standard deviation.

Helminth resistance, based on egg counts was unknown for 107 of the 128 dams of the experimental animals and these dams were allocated to the six sire groups at random within age and lactation status categories. Helminth egg counts from c. 8 to 13 months of age (August to December) were known for the remaining 21 dams and they were allocated to sire groups to give low:low and high:high egg count joinings. The overall mean difference between the dams in the two sire lines was only log 0.12 epg (log 1.64 vs 1.76). By contrast, the selection differential between the two selected sire groups was log 1.25 epg This gives a parental selection differential of log 0.69 epg.

Experimental procedures

The experimental animals were born on November 2 (+20 days SD) 1983. The effect of sire selection for egg counts was based on the mean of four egg counts taken between August 20 and December 7, 1984 using a modification of the McMaster technique (Whitlock 1948) and expressed as eggs per gram (epg) of faeces.

Live weight adjusted for age and epg transformed to log10 (count + 1) were analysed using a standard least squares method for unequal sub-class numbers. In addition to the factors shown in Table 2, dam age, sex of calf and the first order interactions were initially included in the analytical models. None of the interactions was significant and therefore, the final model contained only the four main effects. Correlations between mean log epg counts and the production indices were estimated after removal of the four main effects. Repeatability was estimated by intraclass correlation after removing the effects of selection line and sex.

RESULTS AND DISCUSSION

Table 2 Effect of sire selection on progeny egg counts and live weights to 18 months of age

Class sire line	No.	Epg†		Live weights Birth	Weaning	18 mo.
Low epg	65	2.11a††	(127)	31.3	187	320
High epg	63	2.47b	(296)	30.8	184	316
Sires within						
Low epg line						
A	31	2.13	(133)	33.5a	196a	331a
B	16	2.10	(123)	28.5b	175b	300b
C	18	2.10	(124)	31.8a	191a	329a
High epg line						
D	28	2.47	(297)	31.9	193a	327
E	16	2.56	(360)	30.7	184ab	308
F	19	2.39	(243)	29.9	176b	312
Standard deviation		0.346		4.48	21.3	27.3

† transformed as log10 (count + 1) with back-transformed values in brackets.
†† values within classes and within columns followed by different letters differ significantly ($P<0.05$).

Selection line had a significant effect ($P<0.005$) on log epg but there was no effect of sire within line (Table 2). The lack of effect of sire within line is consistent with egg counts (Table 1). The repeatability of epg was significant ($t=0.20 \pm 0.05$ SE, $P<0.01$).

The difference between sire lines was log 0.36 from a parental selection differential of log 0.69 epg representing a realized heritability of 0.52. Preliminary studies by Seifert (1977) gave a heritabilty of 0.78 based on log epg counts from August to January for animals aged 12 to 18 months, while a heritability estimate of 0.45 ± 0.27 (from the mean of four egg counts) was obtained from paternal half-sib relationships in data from four earlier calf crops of Africander-Hereford heifers bred and reared at Brigalow Research Station (Rudder unpublished data). These estimates indicate that helminth egg counts can be reduced through sire selection.

Selection line had no significant effect on live weight at birth, weaning or 18 months of age. Differences in 18 month live weight between sires within the low ($P=0.001$) and high ($P=0.058$) selection lines reflect the rankings of the sire's own 18 month live weights.

Helminth egg count was not correlated with either live weight at 18 months or liveweight gain from weaning to 18 months, ($r = -0.05$ and 0.10 $P>0.05$, respectively). The relationships of parasitic burdens, as measured by egg counts, and liveweight gain have not been consistent. Turner and Short (1972) and Frisch and Vercoe (1982) found no significant relationship, but Seifert (1971b, 1977) found negative effects of epg counts on liveweight gain. Seifert (1971b) and Turner and Short (1972) indicated that when animals were gaining live weight, parasitic burdens had little or no effect, but became important under nutritional stress.

These results indicate that egg counts can be reduced by selection but this effect may not result in change in live weight for-age. Seifert (1971b) and Turner and Short (1972) showed that reducing egg counts to approximately less than 100 epg by anthelmentic treatment resulted in increased liveweight gain. Perhaps, epg counts need to be reduced to a much lower level than achieved in this experiment before differences in live weight are realised.

ACKNOWLEDGEMENTS

The efforts of our colleagues who contributed to experimental design, maintenance of experimental animals and collection of data and financial support by AMRC are gratefully acknowledged.

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