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EVALUATION OF FLIGHT TIME AND CRUSH SCORE AS MEASURES OF TEMPERAMENT IN ANGUS CATTLE

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SUMMARY

Data from four hundred and seventy-eight mixed sex Angus weaners of known pedigree were used to examine the relationship between two measures of temperament, visual crush score and electronically measured flight time. Weaners were measured in four Angus seedstock herds in NSW. At each property animals were assessed for both crush score and flight time on two separate occasions (on average 73 days apart) with temperament being measured twice on each occasion. A significant relationship bet ween crush score and flight time existed both within and across measurement time. The results showed significant differences in both flight time and crush score between herds, but the repeatability of the traits was high, ranging from 58 to 65% within a measurement time and 31 and 44% across measurement times. Both traits were lowly heritable but all estimates had large standard errors. The study has shown both traits could be used as measures of temperament in Angus cattle and may able to be changed by selection.

Keywords: Flight time, temperament, repeatability

INTRODUCTION

The economic importance of temperament in relation to production traits such as daily weight gain, meat quality and fertility is now commonly accepted by beef producers (Elder *et al.* 1980). Further, animals with poor temperament can be responsible for increased costs associated with management problems and handler safety (Fordyce *et al.* 1988). Estimates for the heritability of temperament range between 0.28 and 0.71 indicating it is a moderately heritable trait (Hearnshaw *et al.* 1984). These heritability estimates confirm that temperament can be improved by selection but it is important to find a reliable and accurate measure that can be recorded on large numbers of animals in seedstock beef herds. The majority of earlier studies used subjective measurement systems, such as crush score, to assess temperament during a handling procedure. There is now a trend towards the adoption of objective measures (e.g. flight time) that have been shown to be repeatable over time (Burrow & Dillon 1997).

The aim of this experiment was to investigate the value of visual crush score (CS) (currently adopted by the Australian Limousin Society) and flight time (FT) to measure temperament in Angus cattle, by estimating repeatabilities and correlations of each measure both within and across time along with heritability estimates.

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Meat Breeding Objectives

MATERIALS AND METHODS

Animals. A total of 494 mixed sex Angus 2001 spring-born weaners were sourced from four different herds for use in the study. 478 had known sire and dam. They were aged between 4 and 9 months (an average age of 224 days), and sired by 42 different sires with progeny number ranging from 1102. An additional group of 40 yearling bulls (12-16 months) were also included in the study. Two of the sires had progeny measured in every herd, and a further six sires had progeny measured in at least two of the four herds. The regions represented by these herds located in NSW included the NW slopes, the SE slopes, the Northern Tablelands, and the Central Tablelands (with 129, 128, 131 and 106 weaners from each herd respectively). The groups measured at each herd where subjected to minor changes with the addition and removal of animals, as management practices dictated between the two measurement times. All animals were managed under normal paddock conditions.

Measurements. Each animal's temperament was measured twice on two separate occasions, (on average 73 days apart) giving a total of four individual temperament scores. At each assessment a single scorer (the senior author), using a 1 to 5 numeric scale (1 being docile and 5 wild) scored animals for their response to isolation and restraint in a single-animal crush (Grandin et al. 1993). In conjunction with crush score, each individual animal's flight time was recorded. Flight time was an electronically recorded time required for an animal to cover 1.5 m following release from a crush. Both measures were simple and safe to record, requiring no contact with the animal. Crush score is a measure that can be done by breeders (at no additional cost) using the 5-point scale. Similarly FT can also be recorded by breeders using flight time recording equipment. The equipment is very simple to install in most existing yards and a unit can currently be purchased for around \$900. FT is an objective measurement of an animal's temperament, with faster times indicating animals with poorer temperaments, as described by Burrow et al. (1999). On average the calves had been weaned for approximately 28 days and had an average weight of 254 kg. Although each herd was weaned at different times, on each day of assessment no animals were involved in other husbandry procedures. Further, at each separate round of testing the animals were handled in an identical fashion and the assessor maintained a set routine when scoring each animal.

Statistical methods. The crush score and flight time data were analysed separately with each being fitted as the dependent variable in a mixed model using the Mixed procedure of SAS (SAS Institute Inc, 1989). Initial models were constructed for each trait to determine significant fixed effects. Each measure of crush score (i.e. CS 1, CS 2, CS 3 and CS 4) and flight time (FT 1, FT 2, FT 3 and FT 4) was analysed separately. For both the flight time and crush score initial models the fixed effects included herd, age at measurement, contemporary group (CG) within herd, and all first order interactions. Sire was fitted as a random variable. CG included the effects of weaning dte (if known), weaning group, embryo transfer status, calves raised on heifers or cows and sex. Variables with a probability value greater than 5% were sequentially removed to yield the final model. For all traits the final models included herd and within herd CG as significant fixed effects. Additional analyses were performed using the above base model with the addition of some covariates. Firstly, in the analysis of FT as the dependent variable crush score was included in the model as a covariate. This was done to determine the relationship between crush score and flight time. Secondly, weight was included to investigate the effect of the animal's weight on flight time and crush score.

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To determine the repeatability of FT and CS a mixed model was run using ASREML (Gilmour 1999) where the fixed effects in the model were those determined previously and animal was included as a random effect. For each trait the analysis included measures taken at time 1 and 2; times 3 and 4 to test repeatability within a day, as well as time 1 and time 3 to test repeatability across time. Genetic variances for crush score and flight time traits were estimated using the same model but included with a relationship matrix constructed using three generations of pedigree records. Herd and contemporary group within herd were fitted as fixed effects.

RESULTS AND DISCUSSION

Least square means for FT and CS at the 4 measurements times are presented in Table 1. Higher flight times are associated with slower exiting from the crush, whereas lower crush scores indicate more docile animals. Within measurement day 1, FT was observed to either decrease (i.e. animals became faster) or did not change. However, within measurement day 2 (times 3 and 4), FT was observed to increase (i.e. animals became slower) or did not change. Across test days (i.e. 1 versus 3) the effect was not consistent across herds. Herd C and D both showed increases in FT, whereas Herd A decreased and Herd B showed no change in flight time. The changes in CS showed similartrends to FT.

Table 1. Least square means for flight time and crush score by herd across the 4 measurement times.

Trait	Herd	Time 1	Time 2	Time 3	Time 4
Flight time (sec)	А	1.04	1.08	0.88	0.97
	В	0.81	0.70	0.77	0.78
	С	0.67	0.64	0.73	0.81
	D	0.74	0.60	0.68	0.68
Crush score (score)	А	2.1	2.1	2.3	2.2
	В	2.3	2.4	2.3	2.3
	С	2.8	2.9	2.5	2.4
	D	2.6	2.9	2.6	2.7

Additional covariates. The effect of animal weight on flight time (FT 1 and FT 3) or crush score from a subset of animals with a weight recorded (n=231) was found to be not significant. The results from models that included crush score as a covariate for the dependent variable of flight time, demonstrated that crush score was a significant covariate for flight time (P<0.05) and a significant CS x herd interaction was observed. The regression coefficients for flight time on crush score for the four herds, ranged from -0.14 to -0.48 sec/score. In Herd A, for each decrease in crush score animals were estimated to have exited the crush 0.47 seconds slower, whereas in Herd D the relationship was -0.14 sec/score.

Repeatability. The results indicate that both crush score and flight time were moderately to highly repeatable, particularly within a measurement time but also across time. The repeatability within a measurement day were 61 and 65 % for FT, and 60 and 58 % for CS. Repeatabilities across time (i.e.

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measurement 73 days apart) were 31 and 44 % for FT and CS, respectively.

Heritability and phenotypic correlations. Results for the genetic analyses are presented in Table 2. Although the dataset is extremely small for estimating variance components and genetic parameters, it does suggest the presence of genetic variation for both traits at both measurement times.

Table 2. Variance components for Flight Time (FT1 and FT3) and Crush Score (CS1 and CS3).

Measure	No. records	Mean	Additive Variance	Residual Variance	Heritability (se)
FT 1	405	0.849	0.010	0.109	8.6 (9.0)
FT 3	423	0.778	0.006	0.044	13.1 (11.6)
CS 1	405	2.384	0.046	0.443	9.6 (8.8)
CS 3	424	2.408	0.087	0.424	17.1 (12.8)

Phenotypic correlations between the two traits both within a measurement time (i.e. the same day) were moderate to high (FT1 and CS1 = -0.70 and FT 3 and CS 3 = -0.79). Phenotypic correlations of the same trait, across time, were moderate (FT1 and FT3 = 0.49 and CS1 and CS3 = 0.50) and between the traits across time i.e. FT1 and CS3 = -0.45 and CS1 and FT3 = -0.47.

CONCLUSIONS

This study has shown both crush score and flight time were repeatable and correlated measures of temperament. Flight time shows potential as an easy to measure objective measure of temperament in *Bos Taurus* cattle. Further data and research will now be required to obtain a more accurate estimate of the heritabilities of FT and CS, prior to any development of an estimated breeding value (EBV) for temperament (docility) using one or both measures.

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