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Cattle behaviour: comparison of measures of temperament in beef cattle.

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ABSTRACT

The aim of the study was to evaluate three measures of cattle temperament which incorporate tests of human presence and separation from herdmates. The study utilised 134 heifers and 137 steers which were grazed as two single-sex herds. The cattle were rising 2-year-old, and were of either 3/4 Limousin x 1/4 Jersey or 3/4 Jersey x 1/4 Limousin breed-type. Flight distance was measured for each animal in the paddock and in the handling yards. A test of animal sociability measured the time taken by an animal to move to a pen containing herdmates. Each test was conducted on three occasions at intervals of one month. In contrast to the other two measurements, yard flight distance was highly repeatable with a repeatability coefficient of 0.51 between separate tests for heifers and steers. The repeatabilities for the paddock flight distance and sociability test were 0.36 and 0.34, respectively. In conclusion, the yard flight distance test represented an effective and repeatable measure of cattle response to humans.

Keywords: cattle; behaviour; temperament; repeatability.

INTRODUCTION

The temperament of cattle has profound effects on the way they respond to management practices such as handling and transport. Calm animal responses to these events are beneficial for animal welfare and product quality (especially meat quality), as well as human safety. The way cattle react to handling events is believed to be influenced by genetic components and environmental factors, such as rearing management and previous handling.

Studies conducted in France and Australia have indicated a genetic potential for selecting beef cattle for calm temperament (Le Neindre *et al.*, 1995; Burrow and Corbet, 2000). However, a previous study recorded a low heritability for temperament in New Zealand beef cattle (Morris *et al.*, 1994). The authors concluded that the measures of temperament used were not particularly heritable in New Zealand beef cattle. It is desirable to have cattle that are docile, but selection for this requires measures of cattle temperament that are meaningful, practical and repeatable.

Previous studies examining temperament testing in beef cattle have often used subjective scoring of animal behaviour (Tulloh, 1961; Grandin, 1993). Although such measures can be useful to discriminate between grossly different temperaments, or when a single observer conducts all measurements, their subjectivity may render them less useful under other circumstances. Objective measures such as the docility test (Le Neindre *et al.*, 1995) and crush exit speed (Burrow *et al.*, 1988) have been developed, but these require specialised electronic equipment and/or software.

The aim of this study was to evaluate the repeatability of three potential measures of cattle temperament which would be practicable to conduct under most farming environments. The tests - paddock flight distance, yard flight distance and sociability score, incorporate elements of human presence and separation from herdmates, which are two principal components of most cattle handling events.

MATERIALS AND METHODS

Animals

The study utilised 134 heifers and 137 steers, which were grazed as two single-sex herds at the AgResearch farm at Tokanui near Te Awamutu. The cattle were 20 months of age at the start of testing, and were of either 3/4 Limousin x 1/4 Jersey (54 heifers, 46 steers) or 3/4 Jersey x 1/4 Limousin (80 heifers, 91 steers) breed-type. The steers had been castrated at 7 months of age. The 3/4 Jersey animals had been born to pure-bred Jersey cows on dairy farms and artificially reared as dairy calves on one Waikato farm, and were then brought to Tokanui at approximately 7 months of age. The 3/4 Limousin cattle were born as embryo transfer calves to cows at the AgResearch farm at Whatawhata and run with the recipient cows until weaning at 6 months of age when they were moved to Tokanui. From the time of arrival at Tokanui, the cattle were handled regularly, including weighing every month and occasional blood or tissue sample collection.

Temperament tests

The temperament tests were adapted from those used by Matthews *et al.* (1997). The flight distance of an animal is the distance to which the animal will allow a person to approach before it moves. The paddock flight distance was recorded from 0900 h on the days of measurement, commencing 30 min after the animals had been moved to a fresh paddock, and when the cattle were relatively dispersed and grazing. A person walked slowly towards a particular animal, ensuring that the animal was aware of their presence. At the point when the animal began to turn and move away, the distance between the human and the animal was defined as the flight distance and was measured. For ease of measurement, paddock flight distances greater than approximately 5 m were recorded instantaneously using laser rangefinder binoculars (Leica, Heerbrugg, Switzerland). Lesser distances were recorded using a measuring tape. Following a measurement, the human moved towards an undisturbed animal in an adjacent area of the paddock to conduct the next recording. The paddock

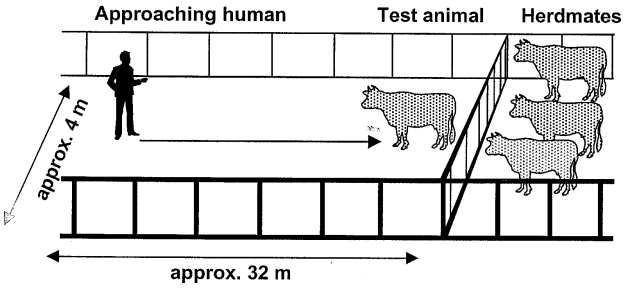
flight distance procedure measured approximately 40 to 45 animals/h.

The sociability test was conducted in the handling yards and was designed to measure the motivation of an animal to be with its herdmates if separated. A group of six or more cattle from the test group were held in a pen at the bottom of the yards. The remaining animals were released one at a time at the top of the yards 30 m away, and time taken for each animal to move down the yard to join its conspecifics was recorded. If an animal did not join its herdmates within 120 sec, the test was terminated at this point and a value of 120 was recorded. The sociability test procedure was able to measure 16 to 18 animals/h.

The yard flight distance was recorded in the same handling yards, approximately 30 sec after the completion of the sociability test, when an animal was placed at the bottom of the handling yards, close to the pen containing its herdmates. A person would walk slowly towards the stationary animal from a distance of 32 m, ensuring that the animal was aware of their presence (Figure 1). At the point when the animal took two paces with its front feet (in any direction) in response to the approach of the human, the distance between the human and the location of the animal was defined as the flight distance, and was read off the fence running along the yard, which was marked at 0.5 m intervals. The yard flight distance procedure, if conducted separately, measured 22 to 24 animals/h.

Each test was conducted on three occasions, separated by one month. Each same-sex group was measured on separate days and the paddock flight distance was measured on a different day to the sociability and yard flight distance.

FIGURE 1: Plan of the yard flight distance test. The human slowly approaches the stationary animal until it takes two paces with its front feet in any direction in response. The distance between the human at that point and the animal's stationary position is recorded as the flight distance.



Statistical analyses

For each test, the repeatability coefficient was calculated across the three occasions of measurement, using the ASREML procedure (Gilmour, 1997). In addition, correlations were calculated between the results of the three different types of test (yard flight distance, paddock flight distance and sociability score).

FIGURE 2: Plots of yard flight distance, paddock flight distance and sociability temperament tests for each of three separate test occasions, 1 month apart, together with trendlines.

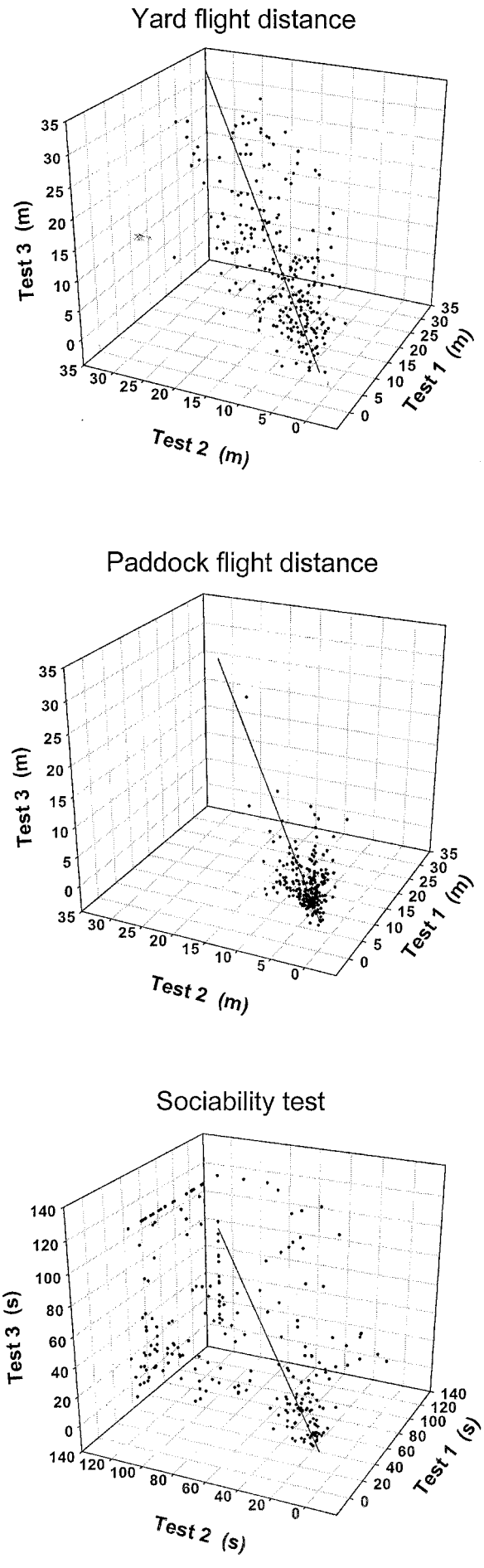


TABLE 1: Ranges, means and repeatability estimates for yard flight distance, paddock flight distance and sociability tests of temperament in cattle (n = 271). Each temperament measure was repeated three times, at intervals of 1 month. Data are presented for each temperament test type across all three measurement occasions combined, and for each separate measurement occasion.

Test	Yard Flight Distance (m)	Paddock Flight Distance (m)	Sociability Score (s)
Overall			
Minimum	1.0	0.1	5.1
Maximum	31.0	31.0	120
Mean	11.1	3.6	57.9
sd	5.4	2.4	38.5
Repeatability ± se	0.51 ± 0.03	0.36 ± 0.04	0.34 ± 0.04
Individual tests			
Mean (test 1)	11.3	3.7	53.5
Mean (test 2)	11.1	3.3	72.7
Mean (test 3)	10.8	4.0	48.7
sd (test 1)	7.1	2.4	38.7
sd (test 2)	7.0	2.4	46.4
sd (test 3)	7.4	3.0	42.1

RESULTS

The use of cattle of differing breed types, sex and rearing histories produced a wide range of flight distances and sociability scores (Figure 2). The repeatability of the yard flight distance test was higher to that of the paddock flight distance and sociability tests (Table 1). In addition, the yard flight distance test was quicker and easier to conduct than the sociability test.

Yard flight distance was correlated with paddock flight distance ($r = 0.22$; $P<0.001$). Sociability was negatively correlated with yard flight distance ($r = -0.44$; $P<0.001$), but was only weakly related to paddock flight distance ($r = -0.11$; $P<0.01$).

DISCUSSION

The higher repeatability of the yard flight distance test compared with the other tests examined in this study may be due to a number of factors. It was noted during the conduct of the study that the paddock flight response of animals appeared to be influenced by the proximity of herdmates and by the weather. Within the paddock flight distance test, animals appeared to tolerate a closer approach when herdmates were nearby, or on very cold mornings (when inter-animal distances appeared reduced in general). The physical separation of the test animal from its herdmates in the yard flight distance test may have contributed to its greater repeatability, by ensuring that each animal was tested under similar social conditions on each occasion. The additional reasoning underlying the placement of the test animal next to a pen containing herdmates was to ensure the precise placement and stillness of an animal at the start of human approach, and to ensure that when the animal did move, it was in response to the approaching person. In order to better measure the behavioural response of cattle to handling events, it is probably desirable to conduct such measurements within handling yards and associated facilities, rather than at pasture. When at pasture, cattle can easily move away, and, thus, an animal that may be strongly agitated by human presence in a confined environment may not display agitation to human approach in an extensive situation.

The failure of the sociability test to be highly repeatable may be due to the test procedure used, rather than an indication that a measure of the motivation of cattle to rejoin herdmates is not useful. Matthews *et al.* (1997) recorded the willingness of cattle to cross a rope of varying heights to rejoin herdmates as a measure of sociability. The study demonstrated an effect of previous intensive handling on the attraction of herdmates, although the measure was not tested for repeatability. Although separation from herdmates is an important component of many handling practices such as weighing, recent studies suggest that the presence of humans is the critical factor influencing cattle behavioural responses to handling events (Grignard *et al.*, 1999).

The advantage of the yard flight distance test as a measure of temperament is that it generates a number than can be measured and recorded, rather than relying on a subjective assessment of an animal's behaviour. Yard flight distance has previously been measured in studies examining differences in temperament between breeds. Murphey *et al.* (1981) demonstrated differences in flight distances between dairy and beef breeds of cattle. In contrast, no differences were detected in flight distance between Afrikander, Brahman and Hereford-Shorthorn cattle in a study where subjective movement scores for restrained animals indicated breed differences (Fordyce *et al.*, 1982). Given that yard flight distance in the current study was measured in a yard of 32 x 4 m compared with 30 x 20 m used by Fordyce *et al.* (1982), a narrower area may be better for the measurement of flight distance in yards. It is conceivable that yard flight distance, while repeatable, is not a good indicator of how cattle respond to handling events; although the results of Matthews *et al.* (1997), in which repeated gentle handling experience significantly reduced flight distance, would tend to refute this.

Although the yard flight distance test is relatively simple to measure, and can be conducted in many typical farm handling yards, the procedure is more time-consuming than most standard handling practices. Attempts to automate measurement of temperament and ease of handling have included placing load cells on the head gate of crushes and scales (Schwartzkopf-Genswein *et al.*, 1997) and automatically recording flight speed from the crush (Burrows *et al.*, 1988). By comparison, yard flight distance is more time- and labour-intensive to measure, but does not require the use or fitting of specialised equipment. As with any handling event with cattle, there is an element of risk involved for the operator, and so far we have not conducted the test with cattle which are inherently aggressive toward humans.

It is desirable when conducting the yard flight distance test (and similar measures of temperament) to utilise a test person who is not the animals' usual handler. Previous negative experiences with a particular person have been shown to negatively affect subsequent cattle responses to that individual (Munksgaard *et al.*, 1997), although such effects can be hard to control in any on-farm temperament measurement, as cattle also generalise such negative treatment to the handling environment in which it occurred (Rushen *et al.*, 1988).

In conclusion, the yard flight distance procedure used in this study yielded highly repeatable results for a behavioural assay, whereas paddock flight distance and the sociability test were less repeatable. Future research will test for a genetic basis for differences in cattle temperament as measured by yard flight distance.

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