

USE OF FEEDER STEER DESCRIPTORS TO PREDICT FEEDLOT AND CARCASS PERFORMANCE

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SUMMARY

Feeder steer descriptors at feedlot entry were examined for their ability to predict determinants of final value as assessed by feedlot and carcass performance. Data analysed were on 460 animals from four groups of differing breed, sex, management history and end market weight. Variables analysed were feedlot daily gain, final liveweight, carcass weight, dressing %, carcass eye muscle area (EMA), carcass P8 fat depth, retail beef yield % and marbling score. Steer descriptors were most useful for predicting final weight and carcass weight, and potentially useful in helping to predict carcass P8 fat depth and beef yield %. Associations with feedlot and carcass traits often differed between data sets, limiting the usefulness of descriptors. Steer weight at entry was notable for the constancy of its association with final weight (regression coefficient approximately 1.0) and carcass weight over diverse data groups. The most useful steer descriptors were considered to be liveweight, age (in months), fatness (a scan or score), hip height, and muscle thickness (a score or scan).

Keywords: Store, beef cattle, value, marketing, assessment

INTRODUCTION

Effective market signals are critical to both breeders and managers of beef cattle. One way value-based trading at feedlot entry might develop is to use, for valuation at entry, predictions of factors that decide ultimate value of the finished slaughter animal. These factors include those that specify market suitability (age, weight, fat depth, marbling score, etc.), the weight on which final payment is based, and the feed required per day in the feedlot. Useful predictors could also be utilised in a store steer description system. Research on live animal descriptors has concentrated on descriptors of the finished animal. Studies on feeder or store animals have been few (eg. Butts *et al.* 1980). The objectives of this study were i) to examine a range of descriptors of feeder steers for their ability to predict feedlot and carcass performance traits that affect ultimate value of the animal, and ii) to consider the transportability of predictions across data groups.

MATERIALS AND METHODS

Four data sets were available, comprising 460 animals from different breeds, sexes, vendors and nutritional histories, and which were managed for different production-market system end-points. Animals were fed for 102 to 332 days and marketed at average liveweights of 519, 547, 603 and 750 kg for lighter and heavier Korean, and shorter- and longer-fed Japanese markets. Cattle within a group were slaughtered at the same time. Descriptors evaluated were: age (in months), weight, height at the hip, a subjective fat score (as per a market report), ultrasonic P8 fat depth, 12/13 rib fat depth

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and eye muscle area (EMA), hip and stifle width, a visual muscle score (15-point scale) and a maturity type score (9-point scale), where these were all taken at or near feedlot entry. Dependent variables considered were feedlot daily gain, final liveweight, carcass weight, dressing %, carcass EMA, carcass P8 fat depth, retail beef yield % and marbling score.

Data from the four groups were initially analysed within groups, ignoring interactions, using the SAS REG Stepwise procedure (SAS Institute Inc. 1989). Models included management group and breed. Descriptors that accounted for less than one percent of variation in all data sets were excluded from further analyses. Data were then pooled for analysis, allowing assessment of changes to relationships between data groups and pre-entry managements.

Pooled analyses used the SAS Mixed procedure (SAS Institute Inc. 1997). Analyses assessed the ability of descriptors to explain variation when animals were of known breed and pre-entry nutrition level (ie. 'history known'), and whether relationships differed from one group to another. Account was taken of heterogeneous residuals where these occurred as a consequence of the pooling. Models included data set, prior nutrition level during pre-feedlot backgrounding (nested within data set), a random effect for breed-management group within data set, and all first-order interactions among fixed main effects and between these and the descriptors. Vendor (ie. herd of origin) was not included in the definition of management group since relationships in practice have to be applicable across vendors. Non significant ($P < 0.1$) terms were systematically dropped to yield the final model.

The ability of descriptors to explain variation when the steer's history was completely unknown was also assessed. For this, all levels of effects for terms involving pre-feedlot variables were dropped from the above final models for pooled analyses. Data set was retained in these models.

Results are described in terms of the percentage variation explained. This was assessed for successive models as $1 - (\text{residual variance} / \text{observed variance}) \times 100$.

RESULTS AND DISCUSSION

Selected results from the pooled analyses are presented in Table 1. Differences between data sets were a large contributor to variation in all traits. This is reflected in the percentage of variation explained by the base model when other history of the steer was unknown (Table 1). Known steer history included knowledge of breed and, in two of the four data sets, of the nutritional regime experienced prior to feedlot entry. When these aspects were known, models generally gave improved predictions, with the steer descriptors contributing relatively less. The steer descriptors considered most useful for prediction, for the range of traits analysed, were weight, age, hip height, a measure of fatness, and a measure of muscling. These accounted for an extra 2 to 20 percent of the total variation in feedlot and carcass performance traits (Table 1), or 7 to 64 percent of the variation unexplained by base models. Use of a subjective fat score in place of a scanned fat depth, or of a muscle score in place of scanned eye muscle area, generally resulted in only a small loss of accuracy.

Table 1. Percent variation in feedlot and carcass variables explained by base models and prediction models for feeder steers with histories either known or unknown. Numbers of steers in parentheses

	% variation explained					
	Steer history known			Steer history unknown		
	base model	prediction model	difference	base model	prediction model	difference
Feedlot daily gain	57.0 (456)	61.0 (436)	4.0	40.4 (458)	47.8 (436)	7.4
Feedlot final weight	82.5 (458)	92.7 (436)	10.2	79.2 (458)	92.5 (436)	13.3
Carcass dressing %	44.6 (458)	48.4 (452)	3.8	34.6 (458)	42.7 (452)	8.1
Carcass weight	83.6 (458)	93.0 (452)	9.4	81.5 (458)	92.7 (452)	11.2
Carcass EMA	88.8 (272)	90.6 (266)	1.8	81.0 (272)	90.4 (266)	9.4
Carcass P8 fat depth	60.7 (458)	75.2 (436)	14.5	53.5 (458)	73.1 (436)	19.6
Retail beef yield %	12.1 (176)	28.4 (163)	16.3	10.3 (176)	27.2 (163)	16.9
Marbling	56.7 (357)	61.3 (357)	4.6	58.4 (357)	62.2 (357)	3.8

Feedlot daily gain. Steer descriptors explained only 4 or 7 % extra variation in feedlot daily gain (Table 1), emphasising the difficulty in predicting this trait without other knowledge. Comparison of the base models showed knowledge of pre-entry nutrition level and breed was more useful than the steer descriptors. Partial regression coefficients indicated younger steers and those with greater hip height had greater rates of gain. The association with entry P8 fat depth varied between data sets. Leaner steers at entry had greater rates of gain in all but one data set of very diverse genotype.

Feedlot final weight. Feedlot entry descriptors accounted for an extra 10 or 13% of variation in final liveweight (58 or 64% of that unexplained by base models), this being mostly due to entry liveweight. Heavier, younger and taller steers had greater final weights. The association with entry P8 fat depth was generally negative, differing between data sets as for feedlot daily gain. The partial regression relating final weight to entry weight was consistently close to 1.0 across data sets.

Carcass dressing %. Steer descriptors accounted for only 4 or 8 % of variation in dressing %. Partial regressions suggested steers with greater muscle score and taller steers had greater dressing %. The association with 12/13 rib fat depth differed between data sets, and was of inconsistent sign.

Carcass weight. As with final weight, steer descriptors explained much of the remaining variation in hot carcass weight. Heavier, taller and generally leaner steers at entry had greater carcass weights. The association with weight of steers at intake was similar across diverse data groups. The association with entry P8 fat depth differed between data sets as for feedlot daily gain.

Carcass EMA. Steer descriptors explained an extra 9% of variation in steers of unknown history but only 2% when breed and pre-entry nutrition level were known. Steers with greater scanned EMAs, and which were leaner at entry, had larger carcass EMAs. Associations in each case differed between data sets, but were of consistent sign.

Carcass P8 fat depth. Table 1 suggests steer descriptors at entry can help predict carcass P8 fat depth. However, usefulness of the descriptors was limited by the fact that associations differed between data sets. Averaged over data sets, fatter and older steers at entry had fatter carcasses, and taller steers at entry had leaner carcasses.

Retail beef yield %. Steer descriptors accounted for about an extra 19% of variation in beef yield %. The ability to predict yield, however, remained low (Table 1). Partial regressions suggested steers with greater EMA, and which were also leaner and lighter at entry, had a greater beef yield %.

Marbling score. Differences in marbling occurred mostly between the data sets, these also reflecting post-entry management differences for different market end-points. The association of marbling with steer age became more positive as time on feed increased.

CONCLUSIONS

Results showed steer descriptors at feedlot entry are highly valuable for predicting final liveweight and carcass weight, potentially a help in predicting carcass P8 fatness and retail beef yield, and only broad indicators of feedlot daily gain, dressing %, carcass EMA and marbling. Associations with feedlot and carcass performance traits often differed between data sets, limiting the usefulness of descriptors. Separate predictions may be feasible for some differing circumstances. Partial regressions of final weight and carcass weight on weight of steers at feedlot entry were notable for their constancy across diverse breeds and managements. Feeder steer descriptors can add to the accuracy of predicting feedlot and carcass performance traits that affect value. However, alone, they are of limited use.

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