Determination of Carcass and Live Body Weight Finishing Cattle from Front Body Weights Taken at a Scale – Electronic Identification Equipped Water Fountain

A.S. Leaflet R2401

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Summary and Implications

Utilizing a platform scale capable of weighing the ”front end” of feedlot cattle coupled with an electronic identification system provided a means by which both live and carcass weights of growing cattle can be monitored daily without disturbing normal routines for both cattle and the farm labor force.

Introduction

The 2008 Animal Industry Report mentions two articles which are precursors to this paper. A.S. Leaflet R2282, “A Water Fountain Orientated Cattle Monitoring System “dealt with the concept and physical equipment necessary to electronically capture the weight and identification number of an animal while drinking along with visibly marking these animals which fall into a defined weight criteria. Paper A.S. Leaflet R2283, “Projecting Weights with Within Lot Scales”, then described the relationship between the weight of the front end of cattle and the whole body weight. This article deals with applying these concepts to obtain weights in a real-time fashion in a feedyard setting. The objective of this monitoring system is to develop an automated means by which cattle can be monitored in terms of weight gain for marketing and management purposes along with water consumption which may infer health status. This system should, theoretically, enhance overall cattle management by providing objective criteria on a daily basis regarding individual animals without a great expenditure of time.

Material and Methods

Two groups of yearling steers of British and Continental influence were tagged with a half duplex, electronic ID tag, weighed and put on a finishing ration of corn, dry ground hay, and supplement. Whole body weights, body condition scores (BCS), hide cleanliness scores (MUD) and cattle disposition scores (DISP) were collected each month while on feed. The weights were compared to the front end weights collected automatically at the water fountain. The first group of 17 head was started on feed in December of 2007 and fed through early spring of 2008. The second group of 19 head was placed on feed in late spring of 2008 and fed until August 2008. At the end of the time on feed, cattle were processed at Tyson Fresh Meats (Denison, IA) where carcass weight, ribeye area, back fat, KPH fat, quality grade and yield grade were collected. While on feed, drinking activity was to be recorded along with individual animal health issues.

PC SAS version 9.1 was utilized to analyze the data using Proc GLM. Sources of variation in predicting whole body weight were front end weights, carcass measurements, and visual assessments at weigh times. Values considered of significance were set at P >t equal or less than 0.05. Table 1 describes the cattle that were used in terms of their physical attributes and variation.

Table 1. Physical attributes and variation of the cattle.

	Average	Standard Deviation
Group 1 Starting Weight	891 lbs.	81 lbs.
Group 2 Starting Weight	981 lbs.	36 lbs.
All Cattle at Finish		
Front Weight (FWt)	887 lbs.	91 lbs.
Actual Live Shrunk Weight	1352 lbs.	107 lbs.
Carcass Weight	810 lbs.	70 lbs.
BCS (1 to 9 scale)	7.5	0.5
MUD (1 to 5 scale)	1.6	0.7
REA	13.3 inches^2	1.2 inches^2
BF	0.4 inches	0.1 inches

Results and Discussion

Estimation of live weight from front end weight measurement in the referenced article A.S. Leaflet R2283 utilized a single front end weight, a gender classification, and age of animal on feed. In this study all cattle were steers of similar age. Therefore, the front end weight would be the only measurement inducing variation that could be carried over from these previous studies. This study did, however, obtain other visual data while cattle were on feed such as DISP, MUD and BCS. The BCS had significant impact in identifying variation between individual animals and improved the R^2 value of estimates. The other measures did not. In the previously mentioned study, BCS was not identified directly but it was taken into account by age designation to a certain degree. The BCS increased with age from calves to yearlings to long yearlings and since the increase in age was also an increase in time on feed and body condition. However, this was confounded with the cow designation since their time on feed was not proportional to the numerical designation representing age. Utilization of the carcass measurement such as the ribeye area, back fat, and others were applied to the equation, but did not improve estimates of live weight while in the feedlot. From the results of this portion of the trial, it was summarized that the relationship of front body weight to whole body weight was quite accurate, especially when BCS was taken into consideration. Equation 1.0 describes the relationship. This relationship would probably require some adjustment to accommodate heifer weights based on previous study observations.

Equation 1.0. Estimation of Actual Weight.
Actual Weight Estimation = -60.02 + 0.84 x FWt + 88.02 x BCS
$R^2 = 0.91$

	Parameter	Std. Error	P> t
Intercept	-60.02	47.04	0.21
FWt	0.84	0.07	< 0.0001
BCS	88.02	10.70	< 0.0001

Estimation of carcass weight from the front end weight measurement is also a possibility with high accuracy. Initially the measures used in estimating actual weight from the front weight were used for determining carcass weight, but unlike the actual weight estimate which improved with the use of BCS, carcass weight estimation did not show an improvement. Utilization of the REA did improve accuracy as shown in Equation 2.1 REA, however, is a measure that is not known until slaughter and the purpose of this exercise was to determine the carcass weight prior to slaughter. Therefore, the only measure that could be used was the front end weight and this weight described the majority of variation observed between individual animal carcass weights (see Equation 2.2). In fact, this measure may be more reliable for estimating carcass weights than use an actual whole body weight since the effects of gut fill are not as extreme with a front end measurement. This is likely since the gut fill load would tend to weigh down the back half of the animal, especially in situations as was done here where the front half is weighed on fixed six inch incline.

The next step was to check these estimates by utilizing the derived equations to calculate a dressing percentage and compare this calculated value to the actual measured dressing percent. Table 2 outlines the measured and calculated values. The results indicate a good fit with the measured "t" value not indicating a significant difference between the value measured and value calculated.

Equation 2.1. Estimation of carcass weight.
Carcass Weight Estimation = 83.21 + 0.70 x FWt + 7.69 x REA
$R^2 = 0.89$

	Parameter	Std. Error	P> t
Intercept	83.21	55.17	0.14
FWt	0.70	0.05	< 0.0001
REA	7.69	3.48	0.03

Equation 2.2. Estimation of carcass weight.
Carcass Weight Estimation = 167.44 + 0.72 x FWt
$R^2 = 0.88$

	Parameter	Std. Error	P> t
Intercept1	67.44	42.20	0.0004
FWt	0.72	0.04	< 0.0001

Table 2. Actual versus calculated dress.

	Measured	Calculated	
Average Dressing %	59.9 %	60.3%	35 samples
Std. Deviation of Dressing %	1.6%	1.2 %	
Minimum Dressing %	57.2 %	58.2%	
Maximum Dressing %	63.5 %	63.0 %	

t< .05, statistically no difference detected

Finally, the question was posed as to whether it would be advantageous to determine an average daily gain value on each animal based on placing a regression line through front weight data. This would then be used in combination with initial weight to calculate live body weight at any point in time. From these preliminary trials, this method did not seem to provide any advantage over what was described above to arrive at a weight estimate. Likewise this methodology requires effort in collecting and recording a whole body weight on each individual animal when started on feed in order to apply the rate of gain to the days on feed when adding up to the current total live weight. In a research setting this is done at the onset of time on feed, but commercially it may not occur. This methodology may be necessary, however, if the system does not allow for screening out extreme outliers. But since the system used in our study does have that capability, the range of weights collected in a given day on a given animal are fairly concentrated and do seem to arrive at a reasonable estimate with the single measurement.

From what was done here, the next step will be to apply an independent data set to test these equations to see whether what was observed thus far continues. Also, when estimating actual weight from the front end weight, an adjustment may be required to more accurately accommodate heifers because previous studies indicated a larger proportion of body weight was in the front quarters of heifers when compared to steers. Likewise, based on the influence REA has on improving carcass weight estimation from a front weight, further adjustment would probably be advantageous when measuring light muscled cattle such as dairy type animals or extremely heavy muscled animals. From the minor differences observed in these tested cattle regarding REA relative to total carcass weight, heavier muscled cattle would have an upward adjustment in carcass weight from the estimate used here since much of this increased muscling, and subsequently extra weight, occurs in the rear quarters.

The study completed here was small and performed on cattle of similar type. Gender could impact the results as would a different biological type of animal such as a Holstein. However there is a repeatable relationship between the front body weight and whole live or carcass weights. Electronic identification and quality control with measurement acquisition are key components to make this system work, but the goal on individual monitoring of group managed cattle is possible.

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