Practical Application of Beef Efficiency – A Consultant's Perspective

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Introduction

Understanding the impact of various biologic outcomes on the cost of production and profitability of cattle feeding may allow producers and consultants to make more cost-effective decisions. Simulation models are one way to determine economic importance of outcomes. Some outcomes of interest in feedlots will include average daily gain (ADG), daily dry matter intake (DDMI), the DDMI:ADG ratio (FG), morbidity (MORB), mortality (MORT), and the quality grade (QG) and yield grade (YG) distributions. If economically important biological outcomes are known, computer programs can be used to determine the relative importance of changes in diet composition and diet dry matter cost, as well as the cost effectiveness of performance enhancing products, morbidity treatment programs, and alternative marketing strategies. Hence, we ask the question, "Where does efficiency of gain rank in importance when discussing beef cattle profitability?"

Economic Model

Simple economic models can be effective tools to enhance decision making at the feedlot. A propriety economic model has been developed at Feedlot Health Management Services Ltd. (FHMS) for the primary purpose of evaluating the economic impact of changes in production protocols relative to profitability. Including growth, health, and carcass performance in a single economic model allows the consultant to better understand the full consequences of his/her decisions. Additionally, it allows the consultant to evaluate how positive changes in one outcome can at times have negative changes for other outcomes. The economic model ensures that negative unintended consequences are avoided. Table 1. shows the biological outcome parameter estimates used to calculate relative profitability in the economic model. Additional variables can easily be included. The model for this discussion has been simplified to protect the proprietary design of FHMS' economic model and to better facilitate this discussion.

Table 1. Biological outcome parameter estimate inputs used in the FHMS proprietary economic model.

Parameter	Estimate	10% Change in Estimate
ADG	3.00	3.30
DDMI	20.00	22.00
FG	6.67	6.00
Morbidity	10%	9%
Mortality	2%	1.8%
Prime	2%	2.2%
Choice	50%	55.0%
Select	30%	26.9%
Standard	18%	15.9%
Yield Grade 1	20%	18%
Yield Grade 2	30%	27%
Yield Grade 3	40%	43%
Yield Grade 4	10%	11%
Yield Grade 5	0%	1%

Inputs into the economic model are used to determine the relative importance of the various biological outcomes described above, as well as to assess the economic tradeoffs associated with differences in biological responses. It is important to note that as the economic situation changes, the recommendations of the consultants are likely to change as well. Table 2. lists the economic input values in the model. The numeric value assigned to each variable will undoubtedly change over time; however, the underlying principle of the analysis will remain robust. Economic models incorporating biological outcomes are dynamic, which adds to the flexibility of the tool.

Table 2. Economic inputs used in the FHMS proprietary economic model.

Variable	Unit	$/unit
650 lb Feeder	lbs	1.10
1350 lb Fed	lbs	1.00
Diet Cost	2204 lb	242.44
Yardage	day	0.35
Morbidity	hd	50
Mortality	hd	800
Prime	cwt	10
Choice	cwt	0

Select	cwt	-8
Standard	cwt	-16
Yield Grade 1	cwt	6
Yield Grade 2	cwt	3
Yield Grade 3	cwt	0
Yield Grade 4	cwt	-5
Yield Grade 5	cwt	-15

Sensitivity Analysis

Sensitivity analysis is a useful tool to evaluate the relative contribution of different biological outcomes, and to assess changes related to the overall relative profitability of production system protocols. Additionally, sensitivity analysis based on economic models can help determine where efforts should be focused to optimize profitability of beef feedlot production. For example, if it is determined that a 10% change in one variable has a 1% change in profitability, efforts may be focused on alternate areas with greater potential to improve profitability (e.g. a 10% change in a variable resulting in a 50% change in profitability). In the example below, the relative sensitivity of ADG, DDMI, FG, diet DM cost, MORB, MORT, QG, and YG will be determined by changing each variable by 10% and calculating percent change in relative profitability. A higher percentage change in relative profitability of a variable will therefore equate to a greater profitability contribution. Table 3. shows the sensitivity of the different parameters ranked by most to least sensitive, with relative profitability as the primary outcome variable in the economic model.

Table 3. Relative change in profitability of a 10% improvement in each parameter, and sensitivity of that parameter in the economic model.

Variable	Rank	Change in Profitability from 10% Improvement	Sensitivity
Diet DM Cost	1	51.33/hd	116.9%
FG	1	51.33/hd	116.9%
ADG	3	5.30/hd	12.1%
DDMI	3	5.30/hd	12.1%
QG	5	5.19/hd	11.8%

YG	6	-3.53/hd	-8.0%
MORT	7	1.70/hd	3.9%
MORB	8	0.50/hd	1.1%

Discussion

It is interesting to note that a 10% change in diet DM cost and FG are equally important in the economic model (sensitivity = 116.9%), and have the most influence on profitability. The equal relative importance of diet DM cost and FG suggests that feed cost of gain (FCOG) should be the focus of the consultant if improving profitability of the feedlot is important. FCOG is the product of FG and diet DM cost. A slight change in either FG or diet DM cost can have a significant impact on feedlot profitability. Another example to help illustrate this point is that a 2.5% increase in diet DM cost with a 5% improvement in FG would result in increased profitability of 2.5%. Conversely, if one decreased diet DM cost by 2.5%, resulting in a 5% decrease in FG, profitability would decrease by 2.5%. The important finding here is that one should not try to maximize FG without considering changes in diet DM cost. There are economic scenarios when maximizing FG is not the most cost effective production strategy.

The next most sensitive variables in the economic model include ADG and DDMI. Given the current scenario, a 10% change in ADG and DDMI resulted in an 12.1% change in profitability. Although improvements in ADG and DDMI contribute positively to the overall profitability of beef feedlot production systems, they are much less important when compared with FG, diet DM cost, and ultimately, FCOG. The slight improvement in profitability when ADG and DDMI are improved by 10% is a function of time. More specifically, the increase in profitability comes from shorter DOF in the feedlot, resulting in a lower yardage cost to the livestock owner. If yardage is greater than the estimate used in the current scenario (yardage = $0.35/hd/day), then the relative change in profitability will be greater when ADG or DDMI are improved. Likewise, if the yardage estimate is less than the estimate used in the current scenario then the relative change in profitability will be less when ADG and DDMI are improved.

The fifth and sixth most sensitive variables in the economic model were QG (sensitivity = 11.8%) and YG (sensitivity = -8.0%) distributions. Although this aspect of the analysis will only be relevant to cattle that are grid marketed, there are a couple of interesting findings that should be pointed out. First, given the grid parameters used in the current scenario, carcass quality appears to be almost equally important to profitability when compared with ADG and DDMI.

That is an important finding because it demonstrates that carcass quality should be given the same considerations as ADG and DDMI in grid marketing scenarios. The second interesting point is that QG was slightly more sensitive in the economic model than YG. An economic model is a quick way to determine if a grid marketing program is biased towards QG or YG. In this example, the economic model is suggesting the marketing grid is biased towards QG.

The last two variables in the economic model that need to be discussed include the health parameters of MORT and MORB. MORT and MORB had sensitivity levels of 3.9% and 1.1% respectively. Although the relative contributions of MORT and MORB seem low in this economic analysis, it is simply a function of the low starting contributions. This is another interesting aspect to economic modeling and sensitivity analysis. If the baseline levels of MORT and MORB were initially higher, a 10% improvement in those variables would provide a greater contribution to the economic outcome of overall profitability.

Conclusion

Based on the analyses in this paper, FG and diet DM cost were the two most influential parameters in the economic assessment. Interestingly, FG and diet DM cost were equally sensitive in the model, but one cannot be considered independent from the other when assessing overall feedlot profitability. A second interesting finding from this analysis was that QG and YG were determined to be just as influential as ADG and DDMI relative to the economic impact on overall profitability. These findings demonstrate that economic models and sensitivity analysis can be powerful tools for better decision making.