A COMPARISON BETWEEN BIOLOGICAL AND ECONOMICAL FEEDLOT EFFICIENCY IN BEEF CATTLE

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INTRODUCTION

Livestock recording systems generally endeavor to concentrate on the recording of traits associated with biological efficiency and ultimately, economical efficiency of production. Although it is recognised that the first step in this process needs to be breeding goal definition, the implementation of a proper recording mechanism to identify animals suited for parent stock is a prerequisite (van der Werf, 2000). Economical efficiency can simply be described in terms of only two classes of variables, namely returns and costs (Weller, 2000). Traditionally the only three main functions of costs were recognised as female production, reproduction and growth of young animals (Dickerson, 1970). Growth efficiency and associated quality defined properties have lately gained importance in setting medium to long-term profitability parameters in beef cattle. Normal practice includes some form of finishing phase (mostly intensive) where feedlot efficiency is of prime importance. The objective of this study is to compare some measure of biological efficiency associated with growth and finishing with profitability in the feedlot.

MATERIAL AND METHODS

Two sets of data were used in the investigation. The first set (data set 1) consisted of 674 steers (9 breeds and 99 sires) subjected to feedlot conditions varying from 35 to 232 days. Table 1 indicates the traits measured as well as some basic statistics.

The second date set (data set 2) consists of 10 318 records of young Bonsmara bulls subjected to post weaning growth tests as part of the National (South African) Beef Cattle Improvement Scheme. Table 2 gives a indication of the traits measured and some basic statistics.

Profit was formulated as follows:

Profit = [CCWt x CPr/kg] – [(Iwt x LwtPr/kg) + (TF x FPr/kg) + (((Iwt x LwtPr/kg) x (CBr/365) x Tl)))]

Where:
- CCWt = cold carcass weight
- CPr/kg = price per kg cold carcass weight as determined by fat thickness
- IWt = initial weight
- LwtPr/kg = live weight price based on initial weight
- TF = total feed intake
- FPr/kg = feed price per kg
- CBr = bank rate
- Tl = test length

Table 1. Basic statistics of measured and derived values on the tested animals in data set 1

Variable	N	Min	Max	Mean	Std Dev
Age (days)	674	194	392	282.57	43.842
Initial weight (kg)	674	148	413	238.33	37.899
Final weight (kg)	674	290	547	401.39	40.197
Cold carcass weight (kg)	674	156	303	225.25	24.971
Dressing %	674	46.83	66.9	56.12	0.026
Carcass length (cm)	674	105.9	140.7	119.39	423.148
Subcutaneous fat (mm)	674	0.3	11.6	3.17	1.889
Muscle score	674	1.58	4.44	2.63	0.495
Kidney weight (kg)	539	0.14	5.34	0.46	0.519
Kidney fat (kg)	412	0.29	6.53	2.54	1.070
Marbling score	334	1	6	2.02	1.128
Feed conversion	674	5.55	7.9	6.99	0.325
Test length (days)	674	40	232	124.74	41.475
Weight gain (kg)	674	60	322	163.06	43.969
Average daily gain (Kg:day)	674	0.25	2.25	1.35	0.381
Purchase price (R)	674	925	2581.25	1489.56	236.871
Interest paid (R)	674	25.76	146.18	68.97	19.321
Profit(R)	674	-576.51	630.88	74.63	153.507

Table 2. Basic statistics of measured and derived values on the tested animals in data set 2

Variable	N	Min	Max	Mean	Std Dev
Age (days)	10308	261	513	375.8	32.83
Initial weight (kg)	10308	139	414	265	29.96
Final weight (kg)	10308	232	627	450.4	51.29
Feed conversion	10308	3.67	10.4	6.65	0.81
Test length (days)	10308	82	141	118.6	19.19
Residual feed intake	10308	-3.84	9.5	-0.00583	0.90
Total feed intake	10308	433	1889	1241	246.01
Profit (R)	10308	-342.16	1375	449.53	162.19

As none of the carcass related variables were measured on animals in data set 2, some standardised measures regarding dressing percentage and fat cover were assumed, based on the results from data set 1. Residual feed intake was calculated for all animals in data set 2, as described by Archer *et al* (1997) and Archer and Bergh (2000).

The stepwise procedure of SAS (1996) was used to determine the effects to include in models describing profit.

RESULTS AND DISCUSSION

The results of the stepwise procedure on profit for data set 1 are presented in Table 3.

Table 3. Final multiple regression model for profit (data set 1)

R^2 = 0.92	DF	Sum of squares	Mean squares	F	Pr>F
Model	7	5451167	545116	433.43	0.0001
Error	323	406228	1257		
Total	330	5857395			
Variable	Parameter estimate	Standard error	F	Pr>F	Partial R^2
Intercept	-2291.81	59.87	1464.88	0.0001	
Final weight	-0.92	0.08	108.36	0.0001	0.025
Dressing %	40.50	0.95	1690.28	0.0001	0.591
Subc fat	45.62	3.55	165.08	0.0001	0.044
Test length	-0.83	0.07	124.23	0.0001	0.015
Weight gain	5.96	0.56	110.77	0.0001	0.213
Subc fat^2	-5.03	0.33	222.81	0.0001	0.033

Similar results for data set 2 are presented in Table 4.

Table 4. Final multiple regression model for profit (data set 2)

R^2 = 0.87	DF	Sum of squares	Mean squares	F	Pr>F
Model	4	236217441	59054360	17425.5	0.0001
Error	10303	34916572	3389		
Total	10307	271134013			
Variable	Parameter estimate	Standard error	F	Pr>F	Partial R^2
Intercept	496.01	20.55	24.13	0.0001	
Test length	5.84	0.03	158.09	0.0001	0.254
Feed Conversion	169.18	2.22	-75.91	0.0001	0.160
Average daily gain	0.24	0.00	47.32	0.0001	0.445
Residual feed intake	48.01	1.52	31.56	0.0001	0.012

From Tables 3 and 4 it is clear what different measures for biological efficiency, as measured on animals in a feedlot, influence profit (as a measure of economical efficiency). Partial contributions towards variance in profit showed the importance of dressing percentage (R^2 = 0.59 in data set 1), weight gain (R^2 = 0.213 in data set 1 or ADG, R^2 = 0.445 in data set 2), subcutaneous fat thickness (R^2 = 0.0768 in data set 1), feed conversion (R^2 = 0.160 in data set 2) and residual feed intake (R^2 = 0.012 in data set 2). The lack of carcass data in data set 2 stressed the necessity of inclusion of some measures on live animals that will serve as predictors of dressing percentage (with a partial contribution of 0.591) and subcutaneous fat (combined partial contribution with squared fat value = 0.077 and determining carcass price). The usage of ultrasound measurements for this purpose should warrant further investigation.

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