A BEEF FATTENING DECISION SUPPORT SYSTEM

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ABSTRACT. A beef feedlot production decision support system (DSS) was developed based on Microsoft® Excel. The DSS comprises of three modules i) an ingredient database ii) a least-cost ration formulation module and iii) beef growth simulation module. The program uses empirical equations developed for tropical beef to simulate nutrient requirements and daily body weight gains based on the formulated feed ration. The formulated least cost ration can be pasted automatically into the growth model to evaluate performance and economic viability. The growth model calculates nutrient available and computes body weight gain on a daily basis, summates weight gain and stops at the targeted body weight. The data output include i) days to reach target body weight, ii) cumulative feed consumed, iii) anticipated average daily gain, iv) total cost of feed (concentrates and grass), and v) gross profit per cattle. If a portion of the feed is fed as grass, then the model also computes the pasture land required in hectares, based on the forage species chosen. It is anticipated that the developed model can assist cattle entrepreneurs and farmers in the development of the beef cattle industry in Malaysia.

INTRODUCTION

Beef is an important commodity in Malaysia with a per-capita consumption of 5.6 kg. However, only 28% of this requirement is produced locally (DVS, 2010). The main factor that contributes to the low self sufficiency level is the high cost of local beef production. For example, the average cost of local beef for 2010 was RM15.85 compared to RM9.20 for imported beef from India (DVS, 2010). The lack of cheap feed and the inefficient use of available feed resources contribute significantly to the higher cost of production as feed generally comprises 60-70% to the total production cost. Many local beef producers do not have access to information on nutrient values of available feed resources nor the ability to efficiently utilise the resources. This paper describes a beef fattening decision support system that can help improve the efficiency of a beef production enterprise.

MATERIALS & METHODS

A Microsoft® Excel based software was developed based on cited publications (NRC, 2000; Leonard, 1982) and beef growth data collected from research conducted in MARDI. The model comprises

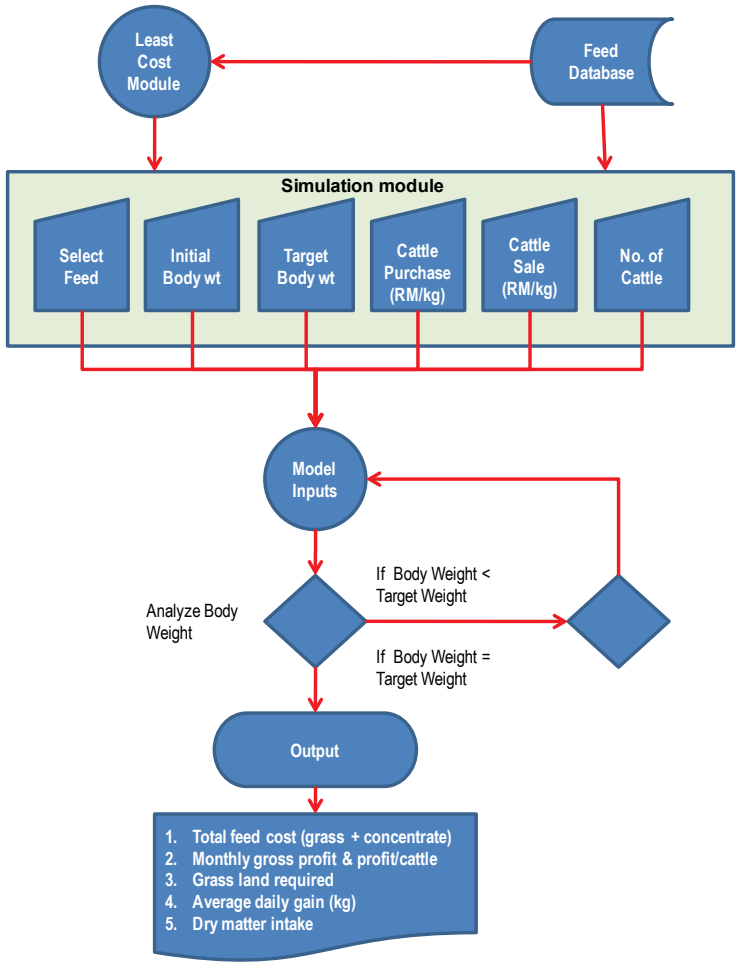


Figure 1. Model algorithm

of three modules i) an ingredient database ii) a least-cost ration formulation module and iii) beef growth simulation module. The ingredient data base comprises of nutrient content information of local feed resources. The least cost module utilizes the linear optimization module inbuilt in Microsoft® Excel 2007 for Windows. The beef growth simulation uses empirical equations developed for tropical beef based on research data to simulate nutrient requirements and daily body weight gains. The nutrient requirements for the beef production module are based on Department of Standards Malaysia (Standards Malaysia) (unpublished). Microsoft® Excel 2007 Visual Basic for Application was employed for the beef daily growth simulation module. The program algorithm is shown in Figure 1.

Other features incorporated into the model include the options to evaluate two different feed formulations and their growth rate predictions.

RESULTS AND DISCUSSION

The captions of the beef fattening decision support system are shown in Figures 2, 3, 4, 5, 6, 7 and 8 with simple user friendly

Figure 2. Main Screen

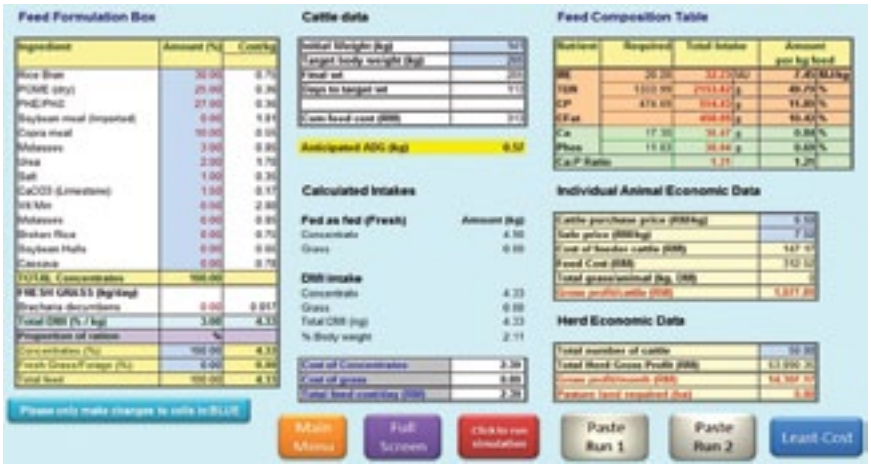


Figure 3. Growth simulation module

modules. The model enables the user to alter feed ingredients and test different feed combinations based on costs and nutrient requirements and allows the comparison of two types of formulations (Figure 5). The user has the option to alter, add and make changes to the feed ingredient database including the use of grass as a proportion

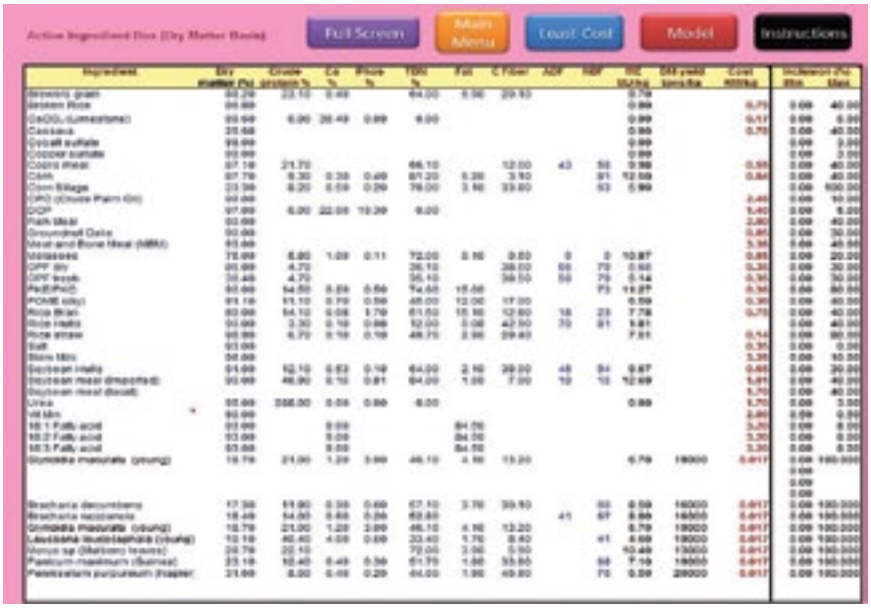


Figure 4. Ingredient database

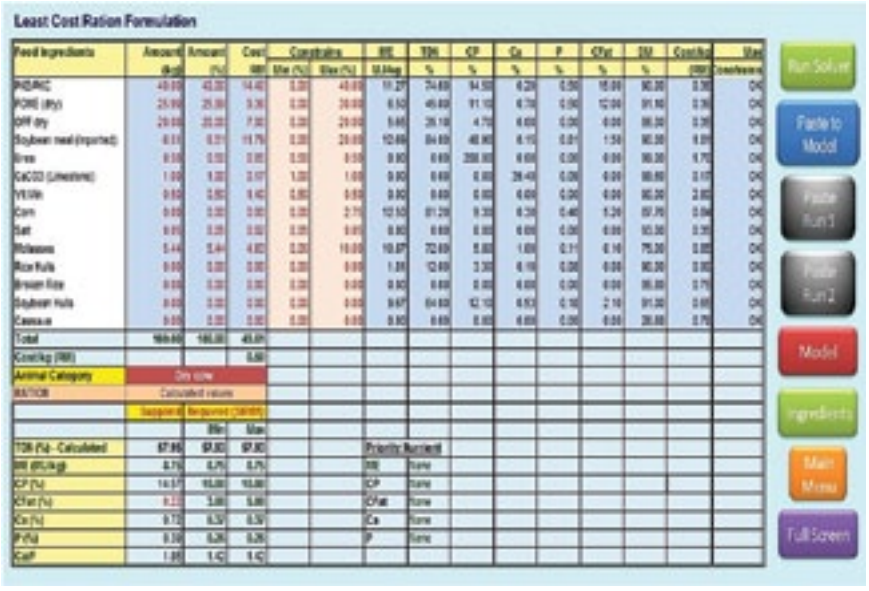


Figure 5. Least cost formulation module

of the diet. If grass is chosen as an option, the model computes the land required to cultivate the grass species chosen. The beef fattening decision support system was verified against actual beef cattle growth from studies conducted in MARDI.

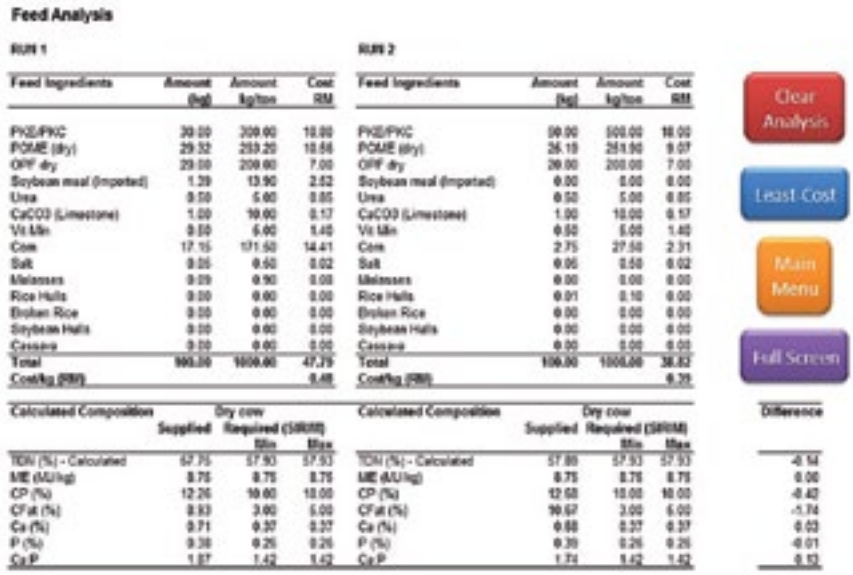


Figure 6. Least cost comparison module

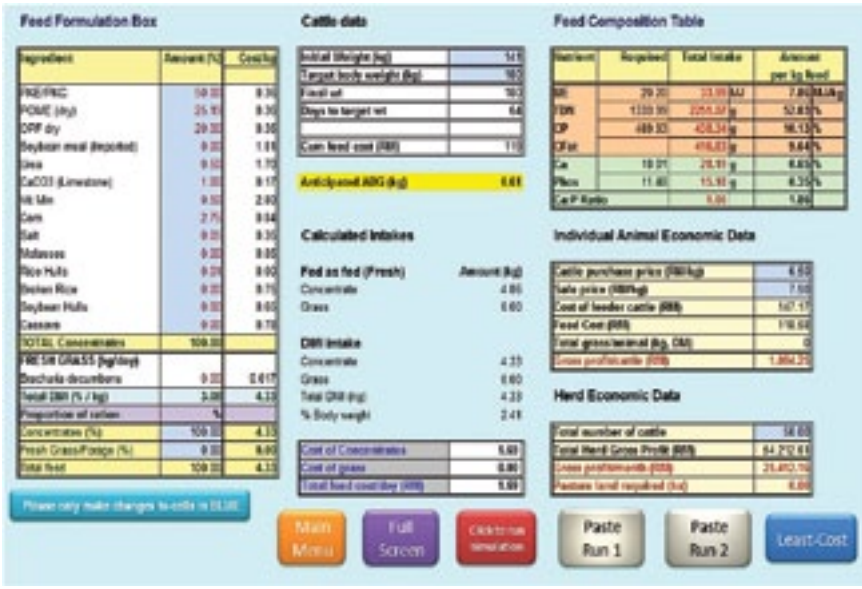
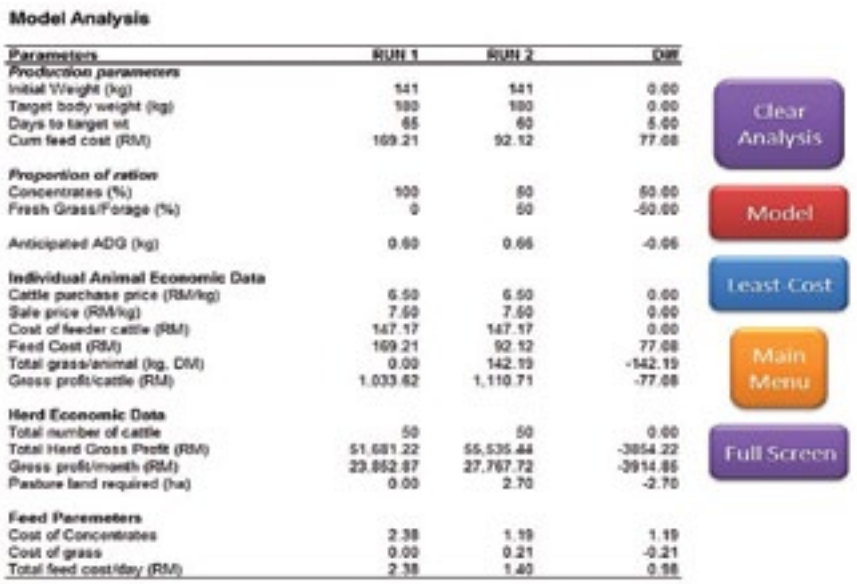


Figure 7. Model evaluation module



Model Analysis

Parameters	RUN 1	RUN 2	Diff
Production parameters			
Initial Weight (kg)	141	141	0.00
Target body weight (kg)	180	180	0.00
Days to target wt	65	60	5.00
Cum feed cost (RM)	169.21	92.12	77.08
Proportion of ration			
Concentrates (%)	100	50	50.00
Fresh Grass/Forage (%)	0	50	-50.00
Anticipated ADG (kg)	0.60	0.66	-0.06
Individual Animal Economic Data			
Cattle purchase price (RM/kg)	6.50	6.50	0.00
Sale price (RM/kg)	7.50	7.50	0.00
Cost of feeder cattle (RM)	147.17	147.17	0.00
Feed Cost (RM)	169.21	92.12	77.08
Total grass/animal (kg. DM)	0.00	142.19	-142.19
Gross profit/cattle (RM)	1,033.62	1,110.71	-77.08
Herd Economic Data			
Total number of cattle	50	50	0.00
Total Herd Gross Profit (RM)	51,681.22	55,535.44	-3854.22
Gross profit/month (RM)	23,852.87	27,767.72	-3914.85
Pasture land required (ha)	0.00	2.70	-2.70
Feed Parameters			
Cost of Concentrates	2.38	1.19	1.19
Cost of grass	0.00	0.21	-0.21
Total feed cost/day (RM)	2.38	1.40	0.98

Clear Analysis

Model

Least Cost

Main Menu

Full Screen

Figure 8. Model analysis and economic evaluation module

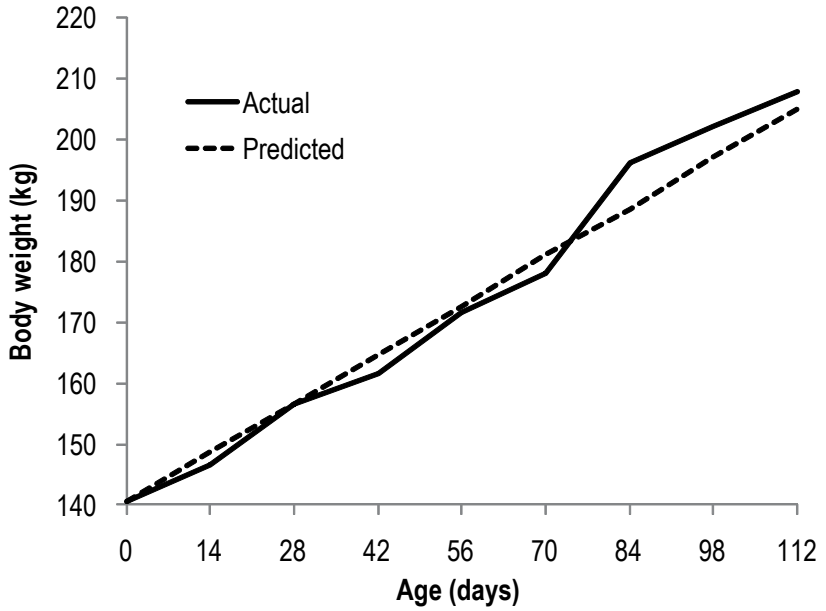


Figure 9. Actual vs Predicted body weight

A sample data of predicted against actual growth rate based on the feed formulated is shown in Figure 9 with an average prediction error of 0.8 kg. The model developed can be used by the beef feedlot industry to make intelligent decisions and avoid losses in feedlot operations. It can also be used by extension agents and as a teaching tool especially in universities.

CONCLUSION

A beef feedlot production decision support system (DSS) developed based on Microsoft® Excel was observed to predict beef growth under Malaysian conditions within reasonable limits. Beef feedlot is a challenging enterprise especially with the high cost of feed ingredients and this DSS software can be utilised to optimise returns. The model can be used by feedlot operators, beef nutritionists, and also in universities as a teaching tool. However, it is emphasised that as with most DSS systems, there can be variations in any biological system. Nevertheless this software can be used as an intelligent tool to assess feedlot operations and improve economic returns.

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