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EARLY WEANING THEORY AND ENTERPRISE BENEFITS FOR BEEF CATTLE

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SUMMARY

Early weaning (EW) beef calves at 3 months of age represents a modification of current on-farm beef production that decreases the metabolic energy requirement of the entire herd, maximises the number of cows for a given area and increases land use efficiency. The EW calves are then grown and finished using an intensive production system. This study has modelled the potential impact of EW in terms of economic return and optimal land use for beef production. The modelling procedure used a linear programming model of a pasture and livestock system to analyse the whole farm impact after changing to EW. The economic analysis has shown an unexpected and dramatic increase in the gross margin from beef production for a virtual 1,000 ha beef enterprise in NE Victoria, from $54,459 to $262,935. This corresponded to an increase in the number of cows in the herd from 574 to 851 (48%). Sensitivity analysis suggested that further benefits could be achieved if calving occurred in October, rather than in August. Profitability of EW was sensitive to market price and finished weight. Weaning a calf at 3 months and finishing it in a feedlot decreased the metabolic energy requirement of the cow from 15 to 13 dse per year. The economic benefit from EW arose from increased stocking rate, higher carcass weight and improved product value. The productivity and quality of beef from the EW system need to be evaluated before the full benefits to the beef industry can be realised.

Keywords: cattle, feed budgeting, economic model, stocking rate, early weaning

INTRODUCTION

Economic pressure to sustainably improve production efficiency combined with variation in the pasture growing season continue to stimulate the investigation of new or modified beef production systems. Weaning is a major event in the life of a calf and usually impacts on growth and, for this reason, generally occurs at 8 to 10 months of age when the calf is actively ruminating and growing. Weaning is thus a physiological control point that restricts growth and can be considered as an animal based nutritional deficit. Furthermore, a reduction in the metabolic energy requirement of the cow to produce an early weaned calf provides an opportunity to increase production efficiency. Early weaning (EW) provides benefits to the cow-calf producer, the feedlot operator, and enhances beef quality (Myers *et al*. 1999c). Early weaning is not a new concept, but has been used when pasture is of poor quality, the growing season is short, cows have a poor milk supply, and for first calving heifers (Myers *et al*. 1999b). Early weaning has the potential to be used under normal conditions to increase productivity and meat quality, provide a range of land use options and decrease on-farm production costs (Schoonmaker *et al*. 1998). Also, the use of intensive finishing systems for EW cattle take advantage of an active reticulum to gain increased feed efficiency, maximise the growth potential of the calf and produce high quality beef. Little research has investigated EW under favourable conditions, and there has been no evaluation of its impact in southern Australia for current or future market specifications.

Early weaning followed by intensive finishing of cattle increases average daily gain (ADG) and decreases total feed intake for finishing without any change in carcass weight or red meat yield. Changes in the cow herd have shown that EW increases condition score and pregnancy rate. Compared with pasture finishing of EW cattle, feedlot finished EW cattle had a higher ADG, better feed conversion efficiency (FCE) and lower visceral weight, without any change in carcass or sensory attributes. Feedlot finished EW cattle also had a higher marble score and USDA grade (Myers *et al*. 1999b). Although most of these benefits are consistent with any concentrate finishing system, the benefits are also realised in the comparison of creep feeding and EW with a feedlot finishing phase (Myers *et al*. 1999a).

This study follows an industry pilot and used whole farm modelling to define the benefits of EW in southern Australia under assumed conditions. Early weaning provides the potential to increase land use options and expand the area of inland Australia that is capable of producing high quality beef by decreasing the metabolic energy requirements from pasture for the cow-calf unit. The study provides scientists and producers with new options to stimulate quantum changes to beef production. The EW model still requires validation to determine its technical feasibility in southern Australia.

MATERIALS AND METHODS

The Victorian Department of Primary Industries' (VDPI) grazing industries complex activity budget model

The complex activity budgets (CAB) used in this study are an extension of gross margins (GM) that allow for the analysis of input and output substitution possibilities. Unlike a GM, the CAB model accounted for the biological and technical limitations of the production system. This information was used to seek out the feasible combination of inputs and outputs that resulted in the highest whole farm gross margin. Since the technical relationships were taken into account, the CAB was able to estimate the change in farm GM that resulted from a change in a component of the production system (eg. pasture quality). The CAB model was not designed to replicate every detail of farming systems, but to examine the potential for a farming system to change its input or output mix (NRE 1998).

The CAB model uses a linear programming framework. The key feature of this framework is that it accounts for any on-farm adjustments (eg. stocking rate) that may be necessary to accommodate a particular change or improvement. It does so by imposing the change only after modifying the production system to incorporate the change and maximise the whole-farm GM. This provides a better indication of the true economic value of a particular change or improvement.

The CAB model is based on a monthly feed budget. The model chooses the least-cost feed mix to run the optimal stocking rate for the year that maximises farm GM. The model considers pasture and livestock as the major components of a grazing system. Since the amount of pasture produced can vary greatly between years due to differences in rainfall and weather conditions, highly complex and detailed simulation modelling is required. The CAB model uses the outputs from existing pasture simulation models as inputs. As a result, the livestock CAB model accounts for the effects of seasonal variation within a year on pasture production and quality. For livestock, the variations in the feed requirement of the herd throughout the year are also included in the CAB model.

The CAB model has been extensively reviewed with the assistance of VDPI experts in beef, lamb and pasture. More information about the CAB model, including a description of assumptions and data, can be found in Economics Branch (2002).

Procedures and assumptions

The VDPI grazing industries CAB model was first run for normal weaner production as the base and then for EW with calving in spring and autumn as scenarios using the following assumptions that were based on an industry pilot: (1) all steer and heifer calves were weaned and lot-fed from 3 months of age, (2) replacement heifers were purchased at $600 per head, (3) the feedlot cost was $425 per calf assuming 300 days on feed, with consumption of 2.125 t of feed at $200/t, (4) the EW system market liveweight was 550 kg, (5) the control store weaner system market liveweight was 300 kg, (6) the EW system market price was 180 c/kg liveweight, (7) the normal store weaner market price was 130 c/kg liveweight, (8) no EW calves grazed pasture after 3 months of age, and (9) no EW cows were lactating after 3 months from calving. Other assumptions included: (10) autumn calving occurred with 70% of calves born in March and 30% in April, and for spring calving, 70% of calves were born in August and 30% in September, (11) no capital costs for feedlotting were considered, (12) the pasture area considered was based on NE Victoria and comprised 70% perennial, 20% annual and 10% native pasture species, (13) pasture utilisation was considered to be 50% in all months, (14) perennial pasture yielded 9 t dry matter/ha/year with an average metabolisable energy of 10.3 MJ/kg DM.

RESULTS AND DISCUSSION

Early weaning provides the potential to change beef production systems in Australia and provide options for land use that include increased productivity, alternative enterprises such as cropping and agroforestry or land deferral to facilitate biodiversity and reduce overgrazing. In this study, the use of a linear programming model enabled the analysis of the impact on the whole farm of implementing EW. The economic analysis of EW compared to a traditional breeder and store weaner production system showed dramatic and unexpected benefits (Table 1). There was an increased GM from $54.46/ha for normal weaner production to $262.94/ha for spring calved EW production. This corresponded to a decreased rating per cow from 15 dse to 13 dse. When combined with the removal of the EW cattle, this allowed an increase in stocking rate from 8.6 to 11.1 dse/ha.

Table 1. Economic analysis of standard weaning compared with autumn and spring early weaning.

	Standard store weaner production	Autumn calved early weaner production	Spring calved early weaner production
Total gross margin	$54,459	$235,329	$262,935
Pasture area (ha)	1,000	1,000	1,000
Cow herd size (hd)	574	780	851
Total dse per cow	15	13	13
Gross margin ($/ha)	$54.46	$235.33	$262.94
Gross margin ($/cow)	$94.91	$301.56	$309.12
Gross margin ($/dse)	$6.33	$23.20	$23.78
Stocking rate (cows/ha)	0.6	0.8	0.9
Stocking rate (dse/ha)	8.6	10.1	11.1

Sensitivity analysis showed that October was the optimal calving time when the cow herd would comprise 879 head, and the farm gross margin per ha was $361.05 (Figure 1). Of market price, market weight and feedlot cost assumptions used in analysing EW, the profitability of EW showed the highest sensitivity to market weight. At least 400 kg liveweight should be achieved after feedlotting for EW to be profitable.

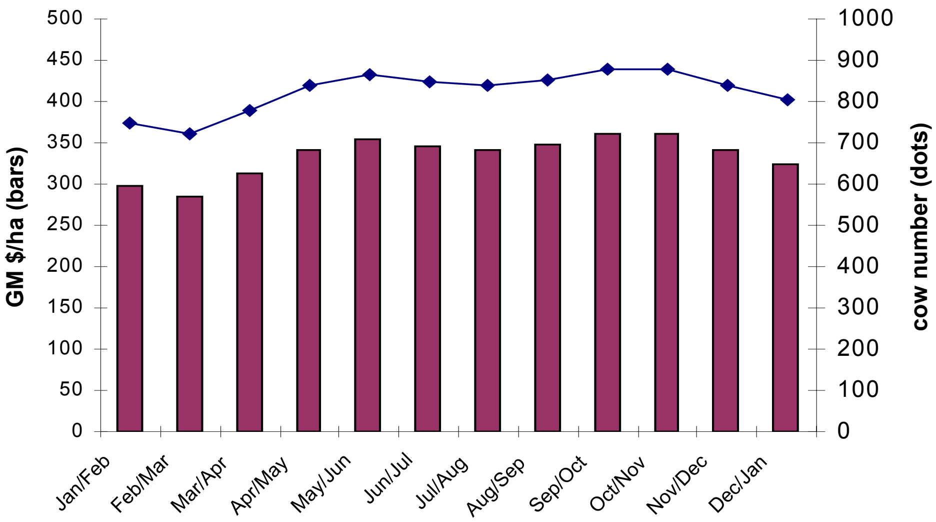

Figure 1. Sensitivity of early weaning after calving in different months.

The animal analyses showed that implementation of EW resulted in a lower energy demand per cow during all months of the year (Table 2). This is achieved by the removal of the milk production and calf growth energy requirements from 3 months after calving. The EW cattle require an intensive production system to realise the physiological FCE benefit that results in increased carcass weight and beef product value. The reduction in energy demand from pasture per cow-calf unit increased the carrying capacity of the pasture area, resulting in a 48% increase in the cow herd number.

While these increases appear dramatic, extreme caution must be taken with the implementation of EW due to the implicit nature of the assumptions behind the model and the assumptions on production targets and cost of finishing EW cattle in a feedlot. Although profitability has been modelled to show a quantum increase, the EW system has increased risk when compared with the traditional production system. Early weaning uses an intensive growing and finishing period for beef production, and uses the cow herd only for its reproductive potential, and for the minimum period that a calf must be supported until it can be weaned. Analogous to EW is the artificial rearing of calves and weaning at 8 to 12 weeks of age. However, EW overcomes the high labour cost of calf rearing by allowing the cow to raise its calf until 3 months. The earliest time for weaning has not yet been defined and the 3-month time has been used as a precedent from previous reports (Myers *et al*. 1999c).

Table 2. Animal energy demands for standard weaning and savings from autumn and spring early weaning.

Month	Standard store weaner energy demand (MJ ME/cow)	Autumn calved early weaner energy demand (MJ ME/cow)		Spring calved early weaner energy demand (MJ ME/cow)	
			Saving (%)		Saving (%)
Jan	3051	2331	720 (24)	2344	707 (23)
Feb	2689	2115	573 (21)	2281	408 (15)
Mar	3641	2903	738 (20)	2583	1058 (29)
Apr	4008	3264	744 (19)	2650	1358 (34)
May	4056	3461	595 (15)	2562	1494 (37)
June	3979	2021	1958 (49)	2256	1723 (43)
July	4148	1863	2285 (55)	2342	1806 (44)
Aug	4548	2344	2204 (48)	2903	1645 (36)
Sept	4646	2443	2203 (47)	3264	1382 (30)
Oct	4941	2583	2358 (48)	3461	1479 (30)
Nov	5051	2650	2401 (48)	2021	3030 (60)
Dec	4270	2562	1708 (40)	1863	2407 (56)
Total	49027	30541	**18486 (38)**	30530	**18498 (38)**

The assumptions made for the feedlot phase of beef production were that EW cattle entered the feedlot at 100 kg liveweight and were slaughtered at 550 kg liveweight for a feedlot cost of $425 and a market price of 180 c/kg liveweight. These assumptions have been extrapolated from an uncontrolled industry pilot and require confirmation before further implementation or design of experiments to refine EW.

The interaction of energy demand of the animal and that available from the pasture has been calculated from theoretical values. These results require confirmation from defined grazing systems before extrapolation can be attempted to the enterprise level. The implementation of EW in the wider industry will require the consideration of many other external influences and risks such as market security, land use, cropping enterprise opportunities and capital availability for expansion. However, given the potential risks and limitations of EW, this modelling study shows that considerable benefits exist from EW in terms of productivity, economic return and land use capability.

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