AN ECONOMIC EVALUATION OF FOUR FINISHING STRATEGIES FOR CULL DAIRY COWS

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Abstract

An experiment was conducted to economically evaluate four finishing strategies for cull dairy cows based on grass silage and concentrate. Sixty-eight multiparous Holstein-Friesian cull spring calving dairy cows were randomised and assigned to a four treatment (n= 17) finishing experiment. The four treatments were: ad-lib grass silage (GS); GS + 3 kg concentrate (GS+3C); GS + 6 kg concentrate (GS+6C); GS + 9 kg concentrate (GS+9C). Finishing targets were set to ensure cows reached the carcass classification required by the abattoir. These were: cold carcass weight > 272 kgs, fat score 3 or 4L and carcass classification P+ or O. The economics of the study were modelled for two scenarios: (A) 3 purchase price variations with 3 housing costs (B) Selling price sensitivity with fixed purchase price and housing cost. At low housing costs the slower finishing systems are most profitable, while with high housing costs faster finishing systems should be adopted. Farm circumstances will dictate the best suited feeding system for this enterprise

Introduction

Cull cow sales are a major potential source of income on dairy farms, especially with the present downward pressures on milk prices, fattening of cull dairy cows offers a considerable possibility of improving dairy farm profits. Milk production systems in Ireland are predominantly pasture-based and involve seasonal calving (Dillon et al., 1995). In a typical seasonal herd in Ireland, breeding starts on a fixed calendar date in spring and a percentage of animals in each herd will fail to conceive. Dairy farmers have three main options with empty cows: to cull the cows from the herd and finish them, to sell empty cows directly to the slaughter house at the end of lactation, or to milk the cows through the winter and rebreed the following spring (extended lactation). This study focuses on different regimes to fatten cull cows using grass silage and concentrate. Cull cows comprise about 38% of all cattle slaughtered at Irish meat factories. In Ireland, the average for all cull cow carcass weights is 282kg. This is considerably less than the average for other EU countries. It is especially low when compared to values in major cull cow markets such as France (343kg) (DAF 2006). As feed costs represent 66% of beef production costs, a more efficient conversion of feed should be prioritised. Cows with a higher body condition score, and thus weight, optimize the economic return having both a higher carcass value and a higher live value. Although published literature addresses many individual aspects of beef production, there is insufficient research completed on the possibilities of cow beef systems. The objective of this study was to determine the most economic fattening strategy for cull dairy cows.

Materials and methods

The experiment was undertaken at Teagasc, Moorepark Dairy Production Research Centre, Fermoy, Co. Cork, Ireland (50^{o}07’ N, 8^{o}16’ W; 46). The experimental treatments were imposed from 17 December 2005 to 27 June 2006 (27 weeks).

Experimental design and animals

Sixty-eight multiparous Holstein-Friesian cull spring calving dairy cows were randomised and assigned to a four treatment (n = 17) finishing experiment. Mean lactation number was 3.3 (s.d. 1.93), pre-experimental live weight and pre-experimental body condition score were 597 kg (s.d. 68.9) and 266 (s.d 28.3), respectively. The four treatments were; ad libitum grass silage (GS); GS + 3 kg concentrate (GS+3C); GS + 6 kg concentrate (GS+6C); GS + 9 kg concentrate (GS+9C).

Feed offered and analysis

Concentrate composition, on a fresh weight basis, was: 0.33 barley (rolled), 0.32 corn gluten, 0.32 citrus pulp and 0.03 dry cow minerals. Silage composition was 29.6g dry matter (DM) kg^{-1} and pH 3.9. Cows were group-housed according to treatment in a lime dusted concrete cubicle house in four individual groups (n=17). Cows were offered the grass silage and concentrate as a TMR. Prior to feeding, the previous day’s feed refusals were removed, weighed and subsampled. The two ingredients (grass silage and concentrate) of the TMR were sampled individually three times weekly.

Individual dry matter intakes (DMI) were estimated once during the study, (week 5), using the n-alkane technique (Mayes et al., 1986) as modified by Dillon and Stakelum (1989). Cows were dosed twice daily for 12 consecutive days with a paper filter or bung (Carl Roth, GmbH and Co. KG, Karlsruhe, Germany) containing 500mg of dotriacontane (C_{32}-alkane). From the seventh day of dosing, faecal grab samples were collected from each cow twice daily for the remaining six days. The faecal grab samples were then bulked (10 g of each collected sample) dried for 48 h at 40 ^{o}C and chemically analysed. During the period of intake estimation a fresh sample of the offered TMR was collected daily, immediately after the mix had been offered. Additionally, individual grass silage and concentrate samples were collected separately on three occasions during the period of intake estimation. The n-alkane concentration in the feed and faeces was determined as described by Dillon (1993). The ratio of herbage C_{33}-alkane (tritriacontane) to dosed C_{32}-alkane was used to estimate feed intake.

Residual feed intake (RFI) was calculated based on daily measurements of DMI before and during the alkane intake run on week 5. Calculation of RFI, was completed as reported in several recent studies (e.g., Archer et al., 1997; Arthur et al., 2001; Crews et al., 2003).

Animal measurements

Cows were weighed twice weekly, on consecutive days, prior to feeding. The mean weekly liveweight was used to calculate average daily gain (ADG). Body condition score (BCS) was recorded every 2 weeks as described by Lowman et al., (1976). Subcutaneous back fat depth was recorded once every 3 weeks for each cow at three different points, the 12th-13th rib, loin and rump (Doyle E. Wilson et al., 1998). Skeletal measurements (Buvanendran et al., 1980) girth, wither height, wither to pin and pin to pin distance were measured at the beginning of the study and every three weeks thereafter. All cows were subjectively carcass classified on four occasions (weeks 4, 8, 12 and preslaughter). Carcasses were graded for conformation on the scale (E, U, R, O, P) and fatness score (1 to 5) according to the European Union Beef Carcass Classification Scheme (Commission of the European Communities, 1982) similar to that described by Drennan and McGee (2004).

Finishing Criteria

Finishing criteria were based on the animal achieving (1) carcass cold weight > 272 kg (liveweight > 620kg); (2) carcass confirmation > P+; (3) Fat score 3 or greater (BCS > 350). These criteria were set to ensure that the animals achieved the minimum criteria to be eligible for bonus payments paid for such carcasses i.e. to optimise the carcass value. These targets were established based on an analysis of an existing dataset which included liveweight and slaughter records for three thousand cull cows obtained from (Dawn Meats Charleville, Co. Cork, Ireland) over a three month period from October to December of 2005 (Minchin et al., 2006, unpublished). When each individual cow achieved all three criteria she was deemed fit for slaughter, thus determining the days to finish of each individual group.

Slaughter measurements

Post-slaughter measurements included kidney channel fat, carcass classification and carcass fabrication data. Meat samples from a subset of 10 cows from each treatment were analysed for the following quality associated variables: composition analysis, tenderness, fat and muscle colour (Cooke et al., 2004).

Statistic analysis

All statistical analyses were performed using appropriate procedures in SAS. All individual animal variables were analyzed (n=68) using analysis of variance. Treatment and block were included in the model. The linear and quadratic responses to concentrate were also tested.

Economic analysis

The fixed parameters used in the economic analysis are shown in Table 1. The economics of the study were modelled for two scenarios: (A) 3 purchase price variations with 3 housing costs (B) Selling price sensitivity with fixed purchase price and housing cost. The model has a margin per cow to show for each scenario. The 3 purchase prices used in the analysis were calculated from the average price offered by the slaughter house for a cow in P1 carcass classification in November 2003(L); 2005 - 2004(M); and 2006(H). Selling price was calculated from previous year averages of 2003 to 2005. The average selling price achieved by farmers from 21 slaughter houses reported in (DAF 2006) were averaged for 2003 (L); 2004 - 2005 (M); and 2006 (H). Housing costs were calculated for high cost housing (H) with costs included for full conventional housing and slurry storage, Medium cost housing (M) with costs for full conventional housing and slurry storage but receiving grant aid for 60% of the construction costs and low cost housing (L) with costs for slurry storage only.

Table 1: Fixed Parameters

Variables	High	Medium	Low
Silage (€/t DM)	120	-	-
Concentrate (€/t DM)	200	-	-
Housing (€/wk)	8.9	3.5	1.4
Purchase price (€/kg)	1.54	1.26	0.98
Sell price (€/kg)	2.42	2.04	1.53
Labour (€/wk)	2.8	-	-

Results and Discussion

Table 2 shows the effect of feeding system on physical performance of the cows. As the slaughter criteria were pre determined, there was no significant treatment effect on slaughter liveweight or BCS. As concentrate proportion in the diet increased, the days to slaughter decreased linearly ($P<0.001$). There was a linear increase in ADG up to 6 kg concentrate/cow/day. Mean kill out for each treatment was 0.46. The finishing criteria set out in this study were designed for each animal to achieve its optimum selling value. Carcass value was not affected by the dietary treatments which agree with Carter et al., (2006). Cold carcass weight, carcass grades and carcass yields did not differ between treatments when the carcases were fabricated.

Table 2: Effect of feeding regime on mean values for growth and carcass characteristics.

	Treatment							
Variable	GS	GS+3	GS+6	GS+9	Sed	Sig	Lin	Quad
Initial Liveweight (kg)	612.7	603.8	600.6	601.5	6.65			
Slaughter Liveweight (kg)	699.3	703.1	708.2	697.8	10.92	NS	NS	NS
Weight gain (kg/day)	0.75^{a}	0.91^{a}	1.14^{b}	1.15^{b}	0.094	***	***	NS
Period on trial (days)	121.5^{a}	108.1^{ac}	95.2^{bc}	83.5^{b}	7.49	***	***	NS
Carcass cold weight (kg)	315.4	324.6	322.1	322.9	8.66	NS	NS	NS
Kill Out %	0.45	0.46	0.46	0.46	0.0056	NS	NS	NS
Kidney Channel fat (% of carcass)	0.037	0.040	0.039	0.039	0.0033	NS	NS	NS
Initial BCS	266	265	263	268	8.69			
Slaughter BCS	349.1	352.9	352.9	351.5	4.49	NS	NS	NS
BCS Inc	0.83	0.88	0.90	0.84	9.54	NS	NS	NS
BCS Inc/day	0.007^{a}	0.008^{ac}	0.01^{bc}	0.01^{bc}	0.001	*	***	NS
[1]Carcass Classification (Initial)	2.50	2.29	2.59	2.94	0.27	0.13	NS	NS
[1]Carcass Classification (Slaughter)	3.06	3.12	3.00	3.59	0.32	NS	NS	NS
[2]Carcass Fat Score (Initial)	4.49	3.59	3.71	4.18	0.52	NS	NS	NS
[2]Carcass Fat Score (Slaughter)	8.13	8.41	7.82	7.88	0.49	NS	NS	NS

As concentrate level increased there was a linear ($P<0.001$) increase in DM intake (DMI) across treatments. As concentrate DM offered increased the total silage DM intake linearly ($P < 0.001$) decreased. Silage substitution for concentrate was highest at the first increment of concentrate (0.68 kg silage/kg conc), this declined with each additional concentrate increment (0.56 and 0.49 kg silage/kg conc). The actual measured proportion of concentrate in diets GS, GS+3, GS+6 and GS+9 was 0, 0.22, 0.41 and 0.52, respectively, with the remaining proportion constituted of grass silage. The residual feed intake (kg) DMI values for the GS, GS+3, GS+6 and GS+9 treatments were -2.7, -2.3, -2.0 and -1.6 which approached significance ($P<0.05$).

The total feed budget for each treatment was 1.45 tonnes DM and did not differ amongst treatments. As feeding costs and capital cost of the cull cow account for greater than half of the overall cost of the enterprise, achieving the carcass criteria set out by the slaughterhouse is of paramount importance. This has large implications for Irish dairy farmers as greater than 40% of animals entering Irish slaughterhouses don't reach the required BCS. (Minchin, unpublished)

Table 3 shows the results of economic scenario (A): Static selling price with three purchase prices and three housing costs. With the high purchase price, irrespective of feeding system the enterprise is unprofitable given the assumptions used with high housing costs. As housing costs decrease, the GS feeding system increases in profitability, although the relative differences between feeding systems are minimal. At the high housing cost the high concentrate feeding systems are most profitable. With medium housing cost all systems are equally profitable. All treatments increase profitability with low cost housing from €161 to €150, respectively. At the lowest purchase price and high housing costs all feeding systems increase margin/cow to > €100/cow, at the medium housing cost margin/cow was insensitive to feeding system, but at the low housing cost the GS feeding system had highest margin/cow.

Table 3: Scenario A: Three varying purchase price with three housing costs

Purchase Price €/cow	Selling Price €/cow	Housing Cost €/wk	Margin €/cow			
			GS	GS+3	GS+6	GS+9
370	778	8.9 (H)	-45	-34	-23	-13
(H)	(H)	3.5 (M)	49	49	50	52
(1.54)	(2.42)	1.4 (L)	85	82	79	77
308	778	8.9 (H)	31	40	51	61
(M)	(H)	3.5 (M)	124	123	124	125
(1.26)	(2.42)	1.4 (L)	161	156	153	150
240	778	8.9 (H)	106	114	124	134
(L)	(H)	3.5 (M)	200	198	198	199
(0.98)	(2.42)	1.4 (L)	236	230	226	224

Table 4 shows the results of economic scenario B, at the highest selling price there was a mean margin/cow of €124, which was similar across feeding system. However at medium selling price the profitability of the enterprise is minimal, €2/cow and at the low selling price the enterprise is loss making. The economic benefit of finishing Holstein-Friesian cull spring calving dairy cows is very much dependent on individual farm circumstances. One of the main findings of this study is, for animals to achieve optimum selling price, they must fulfil the criteria set out by the slaughterhouse. All systems produced similar carcass grades, so profitability differences resulted from the differences in feed costs and finishing times. Ainslie (1992) found differences in profit between systems were due to overall efficiency, however in the present study; there were no differences in efficiency between treatments over the entire trial. This was due to same finishing targets reached by the four systems. This led to the same deposition of lean meat and similar feed consumption in terms of UFL. Comparative profitability of the systems depended on the opportunity cost of the cow at the beginning of the trial and the market selling price when the cow was finished. Seasonality of market price wasn't factored into these calculations.

Table 4: Scenario (B): Selling price sensitivity for cull dairy cows

Purchase price €/cow	Selling price €/kg	Housing cost (€/wk)	Margin €/cow			
			GS	GS+3	GS+6	GS+9
308	€778	3.5	124	123	124	125
308	€656	3.5	4	-0.2	1	2
308	€492	3.5	-157	-166	-163	-162

Conclusions

The main objective of a cull cow finishing enterprise is to optimise the value of the carcass. This study clearly sets out the finishing criteria required to achieve this objective. Farm circumstances will dictate the best suited feeding system for this enterprise. The main findings of this work suggest at low housing costs the slower finishing systems are most profitable, while with high housing costs faster finishing systems should be adopted.

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