The University of Reading

FINISHING CULL DAIRY COWS FOR BEEF PRODUCTION

Project No. 7278

For

English Beef and Lamb Executive (EBLEX)
HCC (Meat Promotion Wales)
QMS (Quality Meat Scotland)

Conducted by

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Executive Summary

1. A study to determine performance benchmarks of modern dairy cull cows fed autumn/winter forage-based feeding systems was undertaken at the Animal Production Research Unit, Centre for Dairy Research (CEDAR), The University of Reading.

2. A total of 24 cull cows (equal numbers of Holstein Friesian and Friesians) born between November 1996 and November 2003 were enrolled onto the study having met predetermined health criteria.

3. The study was of a randomised complete block design. At enrolment animals were weighed and condition scored and subsequently blocked by breed, live weight and condition score and randomly allocated to one of three dietary treatments, namely grass silage only (G), grass silage plus 3 kg cracked wheat (GW) or maize silage total mixed ration (M) which consisted of maize silage and a small supplement of soyabean and rapeseed meal to produced a 12% dietary CP% content.

4. Animals received their respective diets individually through Calan Broadbent electronic gates throughout the duration of the study (63 days). Diets were offered fresh daily following the removal of the previous days feed. Feed was offered *ad-libitum* with refusals maintained at approximately 100g/kg intake).

5. Live weight was recorded on two consecutive days at the start of the study, weekly throughout the study period and on two consecutive days prior to slaughter. Body condition scoring was performed weekly at the same time as weighing by the same personnel throughout the study.

6. With the exception of three animals all other cattle remained healthy and completed the study. Of the three animals that were treated, two were removed from the gated area due to chronic lameness (diet G) and the third due to recurrent mastitis (diet GW).

7. Dry matter intakes were significantly ($P < 0.001$) greater in diet M. Similarly rates of gain were higher in diet M ($P = 0.085$) when compared to diets G and GW. However, although feed conversion efficiency was numerically better in diet M it failed to reach statistical significance

8. There was no effect of dietary treatment on either body condition score or change in body condition score, although on average animals gained 0.4 of a condition score. Similarly there were no effects of dietary treatment on carcass characteristics, all animals having similar carcass weights, killing out percentages, fat and conformation scores.

9. Overall feed costs were greater than actual net gains in carcass value resulting in net losses per head of £8.71, £26.35 and £21.78 for diets G, GW and M, respectively.

10. Based on calculations that removed the effect of carcase conformation on carcase value (which was not effected by treatment but differed considerably due to animal genetics) feed costs exceeded the net increase in carcase value by £17.47, £21.69 and £4.64 per head for diets, G, GM and M, respectively.

Farmer Summary

1. Holstein Friesian dairy cows were dried off and feed for a period of 9 weeks on one of 3 dietary treatments whilst housed in cubicles and bedded on shavings.

2. The three dietary treatments were:

G	Grass silage fed as sole feed
GW	Grass silage + 3kg cracked wheat
M	TMR of maize silage : soyabean meal : rapeseed meal (91:4.8:4.2 DM basis)

3. Diet composition in terms of crude protein ranged between 12-14.5% (M-GW). Starch intake increased from 0 for diet G to 4.1 kg/d for diet M.

4. Dry matter intakes, subsequent growth rates and rates of feed conversion efficiency were highest with the maize silage TMR and lowest in the grass silage only diet.

5. Mean growth rates for diet G were 0.20 kg/d. Growth rates for diets GW and M were 0.66 and 1.25 kg/day. Respective feed conversion efficiencies were, 25.4, 11.5, 7.4 kg of DM intake required to gain 1 kg of live weight.

6. Animals on average, and irrespective of diet, gained 0.4 of a body condition score, theoretically improving EUROP fat class by one point from 3 to 4L.

7. There were no differences in killing-out percentages nor carcase fatness, with carcase weights increasing from 330 kg for diet G to 328 kg for diet GW and 362 kg for diet M.

8. Based on current feed and cull cow prices all three systems resulted in net financial losses (increase in carcass value – feed costs). Feed costs of £3.97, £2.12 and £0.85 per kg of live weight produced were recorded for diets G,

GW and M, respectively. The prevailing market value for these cows was considerably lower than any of these feed costs at approximately £0.52/kg liveweight. Losses of between approximately £5 and £22 per head were calculated (increase in carcase value – feed costs).

9. Given the relatively high breakeven cull cow price required to cover feed costs, selection criteria for dairy cows intended for finishing needs careful consideration. A number of factors such body condition at culling, reason for culling, age, health status etc, may have a significant bearing on how well these animals perform and the subsequent financial outcome.

10. Both cull cow prices and feed costs are highly variable and may vary from farm to farm. Therefore individual farmers need to assess whether their feed costs and opportunities for finishing of cull dairy cows is financially viable.

1. INTRODUCTION

As a result of the closure of the over thirty month scheme on 7 November 2005 about 635,000 cull cows from dairy and suckler herds will be eligible to enter the beef supply chain. A report entitled Finishing Cull Suckler and Dairy Cows for Beef Production was commissioned in 2004 by the Meat and Livestock Commission. The lack of available data on this topic is emphasised in the report as only 14 scientific papers, summaries or other reports could be found in the literature. The report noted that while cull cows could be finished off pasture during spring and summer, there were three main systems based on grass silage, maize silage or concentrate for cull cows being finished in the autumn and winter. It was recognised that forage based systems would be more widely used due to the higher cost of concentrates. While the report outlined a number of future research and development areas it highlights the lack of available information on feed intakes and live weight gain of modern dairy cull cows in the UK. Applied research studies are needed to establish industry performance benchmarks for beef produced under UK conditions from this class of stock.

The objectives of this study were to determine performance benchmarks of the modern dairy cull cow fed on autumn/winter forage-based feeding systems.

2. MATERIALS AND METHODS

2.1 Dietary treatments

The three diets used in this study comprised either grass silage as the sole feed (G), grass silage plus 3kg cracked wheat top dressed once daily (GW) or a maize silage total mixed ration (M) [Table 1]. Maize and grass silages were sourced from the same clamps throughout the study. Thorough mixing of diet M was performed using a small self-propelled mixer wagon (Calan Super Data Ranger, American Calan Inc., USA), fitted with a weighing device (Weightronix Model 1015, Fairmount, USA) which recorded the weight of forage and concentrate added to the hopper. Following mixing the ration was transferred to an experimental feed wagon (CEDAR design) fitted with an electronic weighing device (Digi-star E22000, Fort Atkinson, WI, USA.) which recorded the weight of feed dispensed into the feed bin. Grass silage for treatments G and GW was dispensed into feed bins using the same feeder wagon. A mineral supplement of 80 g/head was top dressed onto all diets once daily. Uneaten feed was removed daily prior to feeding and weighed to enable individual feed intake to be recorded.

Table 1 Component ingredients of maize silage total mixed ration (diet M)

Ingredient	Inclusion rate (g/kg DM)
Maize silage	910
Soya bean Meal†	48
Rape seed meal†	42

† mixed to form concentrate blend

2.2 Animals and experimental design

The study comprised 24 Holstein-Friesian/Friesian cull cows (equal numbers of each breed) born between November 1996 and November 2003, that were sourced from both the CEDAR herd and off farm. Animals were housed in six pens, with each pen containing four individually fed animals. Animals were blocked according to breed, live weight and body condition score and then randomly allocated to one of the three dietary treatments which they received for the 63 day duration of the study. Mean start live weight was 494 ± 35.9 kg with mean body condition score 3.2 ± 1.7.

2.3 Animal management

Cows were foot trimmed and assessed for foot health upon arrival. Animals were housed in groups of four animals in six yards that contained eight Calan Broadbent electronic gates and eight cubicles fitted with rubber comfort mats covered with white wood shavings. No other bedding substrate was available. Wet or soiled shavings were removed and replenished daily. Feed and loafing passages were scraped once daily.

Animals were trained to one gate within each yard prior to commencement of the study and remained with the same gate throughout the course of the study. During the period of gate training animals were offered a maize silage grass silage mixture (50:50 FW). This ration was progressively changed so that animals were receiving their respective experimental diets at commencement of the study. Data collected within the first week was highly variable indicating that animals had not completely adapted to the diets or feeding system. These data was subsequently disregarded and the study period extended by one week.

Fresh potable water was available at all times throughout the study from mains fed water tanks which were drained and cleaned regularly.

2.4 Animal performance measurements

Individual dry matter intake (DMI) was recorded on all cattle through electronic feed gates, by weighing feed offered and refused on a daily basis. Forage was offered twice daily *ad libitum*, maintaining refusals at approximately 100g/kg of daily intake. Throughout the study live weight and body condition score (BCS) of the cattle was recorded after feeding and rates of daily live weight gain (DLWG) and change in body condition score calculated from these data. Cattle were weighed and condition scored weekly, condition scoring was undertaken by the same person throughout the study. Live weight was recorded on two consecutive days at the start of the experiment and on the day prior to and day of transport to the abattoir. Feed conversion efficiency (F.C.E) was calculated as the amount of DM required to achieve 1 kg of live weight gain.

2.5 Slaughter

All cattle were transported to Guilford abattoir on 7th August 2006 and slaughtered on 8th August 2006. Cattle were slaughtered by captive bolt and exsanguination. All carcasses were visually graded for conformation and external fat cover using two classification scales; the European Carcass Classification Scheme and the 15-point carcass classification scale. Fat and conformation scores were converted to numerical values for statistical evaluation (DFAS, University of Bristol). Killing out percentages were calculated as the proportion of cold carcass weight to final live weight.

2.6 Statistical analysis

Statistically significant differences between individual treatments for all experimental variables were determined by analysis of variance using the GLM procedure (Minitab V.14). The data set contained 24 observations and the model consisted of diet (2 d.f.) and breed (1 d.f.) as sources of variation. Results are presented as LSM with the s.e.d.

Average DLWG for each individual animal were calculated by linear regression yielding the equation *y* = *mx* + *c*. Statistical differences between treatments in coefficients *m* of the resulting equations were determined by ANOVA using the GLM procedure of the SAS institute.

3. RESULTS

3.1 Ration composition

Mean laboratory derived nutrient densities of component feed stuffs are shown in Table 2. The grass silage used in this study was of moderate quality with mean D-value of 650 g/kg with mean dry matter (DM), crude protein (CP) and estimated metabolisable energy (ME) contents of 300 g/kg fresh weight (FW), 144 g/kg DM and 10.6 MJ/kg DM, respectively. The maize silage had a mean D-value of 680 g/kg with mean DM, CP and estimated ME contents of 373 g/kg FW, 88 g/kg DM and 10.9 MJ/kg DM, respectively.

The concentrate used in the TMR had a mean CP content of 450 g/kg DM and was initially formulated from book values to give a TMR CP content of 120 g/kg DM when included in the TMR at a forage to concentrate ratio of approximately 9:1. Subsequent laboratory analysis of the TMR gave a mean CP content of 117 ± 3.9 g/kg DM.

Table 2 Laboratory determined nutritional values of ration components (g/kg DM unless otherwise stated)

	Component			
	Grass silage	Maize silage	Cracked wheat	Maize concentrate
Dry matter (g/kg FW)	300 ± 22.5	373 ± 19.7	867 ± 1.7	886 ± 5.1
Crude protein	144 ± 5.6	88 ± 2.7	151 ± 2.8	450 ± 10.5
ME (MJ/kg DM)	10.6 ± 0.19	10.9 ± 0.21	13.8 ± 0.87	12.2 ± 0.59
Starch	ND	302 ± 27.8	756 ± 20.2	25 ± 20.5
NDF	476 ± 10.3	391 ± 12.5	110 ± 3.6	213 ± 17.1
ADF	359 ± 10.6	315 ± 33.5	40 ± 2.9	136 ± 11.7
Ash	90 ± 3.0	42 ± 1.0	18 ± 2.4	71 ± 0.6

3.2 Animal performance

3.2.1 Animal health

In the latter part of the study three animals were removed from the experiment. Two of these were chronically lame (diet G) and was attributed to a possible joint or tendon injury. These animals were removed from the gated area and placed into a larger pen as it was considered that the kerbs either side of the feed and loafing passages were aggravating the condition. The third animal (diet GW) had recurrent mastitis which was treated with antibiotic and dry cow therapy. Again, this animal was removed from the gated area so as to prevent further infection and to aid recovery. These three animals were considered by veterinary surgeon as not fit to travel to the abattoir for slaughter. All other animals remained healthy. Regular foot bathing with zinc sulphate solution was undertaken as a precautionary measure in an attempt to maintain foot health and control lameness resulting from microbial infection.

3.2.2 Nutrient intake

Mean nutrient intakes based on average DMI and laboratory determined nutritional composition of feeding stuffs are shown in Table 3. In general intakes of CP, ME, starch, NDF and ash were all significantly ($P < 0.005$) greater in diet M than in diets G and GW. The greater intakes of CP and NDF are the result of the significantly higher DMI of cattle receiving diet M, since CP and NDF concentrations of diets G and GW per unit DM were higher than those of diet M. The majority of the starch consumed by diet M cattle comprised maize starch, as the concentrate blend used in the TMR contained very little starch itself (Table 2). All of the starch consumed by cattle receiving diet GW comprised wheat starch, which was derived from the 3kg of cracked wheat that was top dressed daily.

Table 3 Mean daily nutrient intakes of finishing cull cows fed grass silage and maize silage based finishing rations (kg/day unless otherwise stated).

	Diet			s.e.m.	P. Value
	G	GW	M		
DMI	7.18	9.15	12.58	0.621	< 0.001
Crude protein	1.037	1.340	1.475	0.076	0.002
ME (MJ/day)	76.0	106.3	153.0	7.41	< 0.001
Starch	0.0	2.268	4.103	0.185	< 0.001
NDF	3.418	3.256	4.815	0.247	< 0.001
ADF	2.578	2.325	2.661	0.149	0.274
Ash	0.642	0.603	0.516	0.032	0.031

3.2.3 Physical performance

Data pertaining to animal physical performance are shown in Table 4. There were no differences between treatments in start weights or finish weights, although total weights gains and DLWG, whether calculated from absolute values or estimated by regression analysis, were highest in diet M when compared to the other two treatments. Furthermore, although there was no treatment effects on FCE, values were notably higher in diet G when compared to diets GW and M.

Table 4 Mean start weights, finish weights, total gains, DLWG, FCE and BCS of finishing cull cows fed grass silage and maize silage based finishing rations

	Diet			s.e.m.	P. Value
	G	GW	M		
Start weight (kg)	689	672	689	33.9	0.833
Finish weight (kg)	699	696	763	34.2	0.322
Total weight gain (kg)	10.33	24.25	74.38	22.14	0.085
$DLWG_1$ (kg/day)	0.163	0.385	1.181	0.351	0.085
$DLWG_2$ (kg/day)	0.201	0.657	1.250	0.300	0.069
FCE (kg DMI/kg LWG)	25.4	11.5	7.4	8.1	0.344
Start BCS	3.03	3.38	3.47	0.29	0.538
Finish BCS	4.00	3.69	4.00	0.20	0.437
Change in BCS	0.42	0.31	0.53	0.18	0.671
EBLEX live grade	3.17	3.27	3.50	0.22	0.559

$_1$ Absolute DLWG (Total weight gain/no. of days)

$_2$ DLWG determined by regression analysis

There were no effects of dietary treatment on start and finish BCS or change in BCS, all treatments on average gaining between 0.3 and 0.5 of a score. Similarly, there were no effects of dietary treatment on the EBLEX live grade with values ranging between 3.2 and 3.5 across treatments.

The relationship between daily ME intake and daily rates of live weight gain, with respect to treatment, is shown in Figure 2. Extrapolation of the regression equation indicates that at ME intakes lower than 85 MJ/day may result in net weight loss and that additional ME intake above this would result in modest increases in live weight gain.

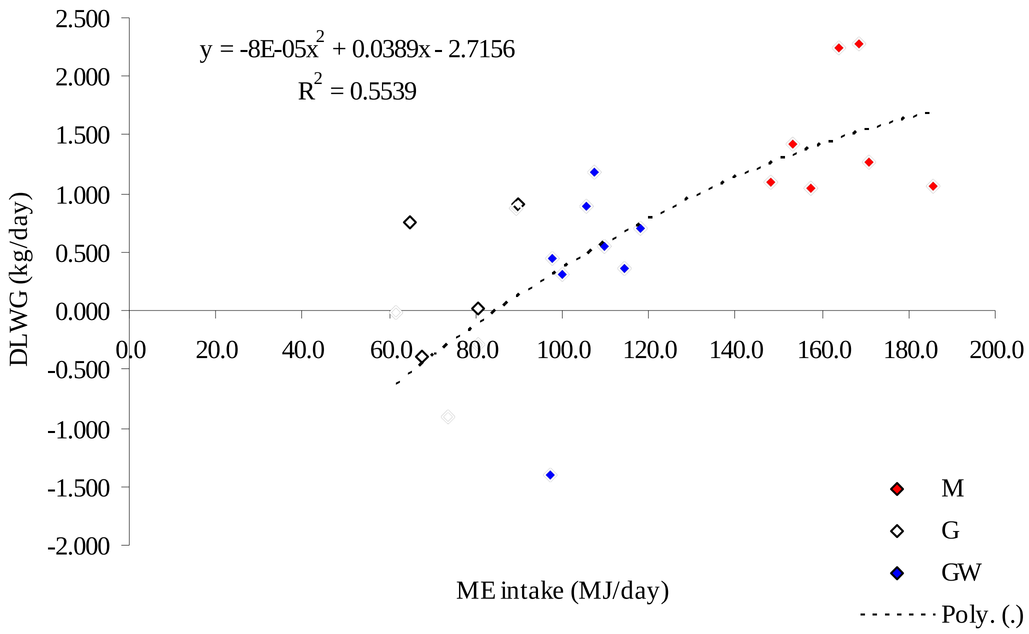

Figure 1 Relationship between daily ME intake and daily rates of gain in cull cows receiving grass silage and maize silage based finishing rations.

The relationship between total live weight gain and change in body condition score (weighted by dietary treatment) can be expressed in the following equation:

Change in condition score = 1.86 – 0.471x + 0.00458y (R^2 = 0.638)

where

x = Start BCS y = total weight gain (kg)

In general, for each full point score above a BCS of 3 it would require an additional 100 kg of weight gain to achieve a one point shift in BCS. However, due to the relatively good enrolment body condition of the cattle used in this study and the subsequent lack of data pertaining to condition scores lower than score 3 it is not possible to estimate weight gains required for one score shifts in animals with BCS lower than score 3.

3.2.4 Carcass characteristics

Data relating to carcass characteristics are shown in Table 5. Neither carcass weights nor killing out percentages were influenced by dietary treatment. However, not all cattle were dressed to the same specification as twelve animals were dressed to the new EU specification whereas the remainder had additional external fat removed. This was not balanced across treatments and it is likely that this may have influenced killing out percentage and carcass weight. All cattle were slaughtered as commercial cattle through a commercial abattoir and not under experimental conditions. MLC staff had at the time pointed out the different dressing specifications but nothing could be done about this.

Table 5 Carcass weights, killing out percentages, MLC conformation and fat scores and 15 point fat and conformation scores of finishing cull cows fed grass silage and maize silage based finishing rations

	Diet			s.e.m.	P. Value
	G	GW	M		
Carcass weight (kg)	330	328	362	17.9	0.541
Killing out %	47.22	46.28	47.27	0.73	0.609
MLC conformation score	23.33	21.30	21.25	2.42	0.802
MLC fat score	90.83	80.96	84.38	10.45	0.811
15 point conformation score	2.83	2.17	3.00	0.53	0.504
15 point fat score	11.33	8.43	9.63	1.09	0.218

EUROP conformation scores; 10 = -P 20 = P+ 30 = -O 55 = O+
EUROP fat scores 45 = 2 65 = 3 90 = 4L 105 = 4H 125 = 5L

All carcasses were graded for fat and conformation on the 15 point scale following the removal of the hide but prior to any trimming of external fat. Fat and conformation scores on the EUROP scale were conducted following fat trimming. There were no effects of dietary treatment on fat scores or conformation scores. Conformation scores, irrespective of treatment, were generally poor and corresponded to an MLC conformation grade of P+ whereas fat cover was generally better with an average MLC fat score of 4L.

The relationship between body condition scores of cattle recorded prior to dispatch to the abattoir and the MLC and 15 point fat scores recorded following slaughter are shown in Figure 2. Generally, in the context of this study, animals at enrolment had a mean BCS of 3.2 which corresponded to an estimated MLC and 15 point fat score of poor 3 and -3, respectively. The average post-mortem MLC fat score of 4L and 15 point fat score of -4 indicates a full one score shift in fat class irrespective of the fat scoring system. However, there is a disparity between these two fat scoring systems in the estimates of required changes in BCS to achieve the observed increases in fat scores, with changes of 0.6 and 0.2 of one BCS for the MLC and 15 point scoring systems, respectively, probably a result of the fat trimming which occurred prior to carcass classification using the 15 point system.

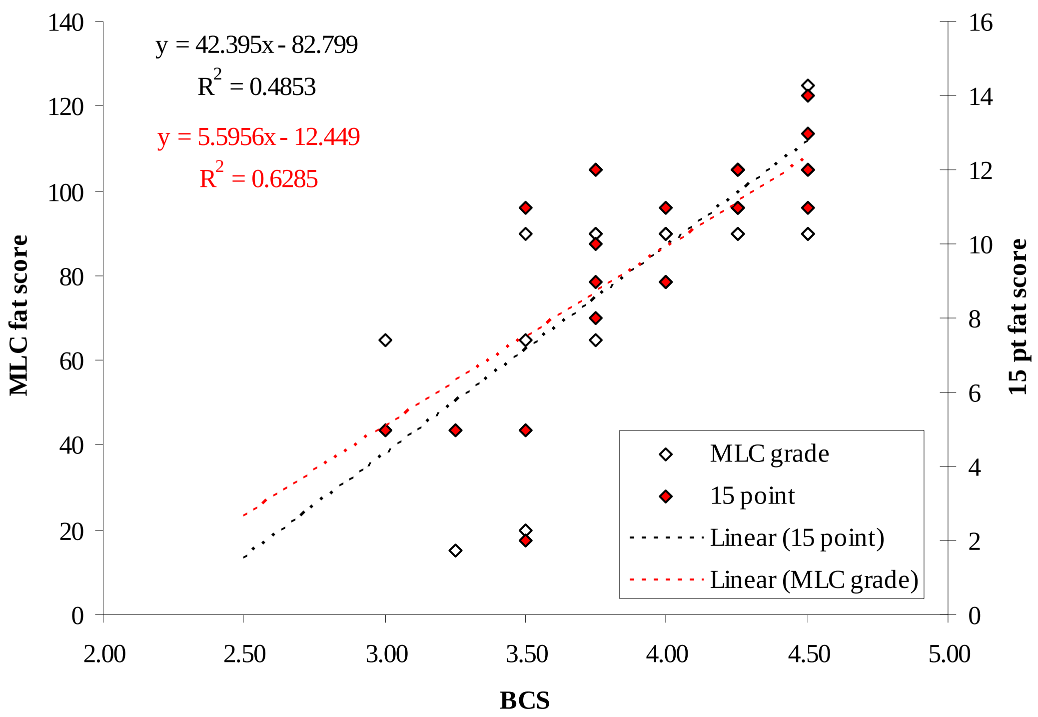

Figure 2 Relationship between live body condition score and post-mortem MLC and 15 point fat scores.

3.2.5 Financial evaluation

The financial consequences of this feeding trial have been evaluated in two ways:

1. Using regression of carcase data and value to estimate initial carcase value accompanied with actual deadweight carcase returns to calculate the increase in carcase value.
2. Initial carcase value was estimated using a mean killing out percentage across all treatments and assumed a carcase fatness classification of 3. The slaughter carcase value was calculated using actual carcase weights multiplied by a uniform carcase value that reflected the increase in fatness observed, i.e. it was assumed that carcase fatness increased by 1 fat class during the feeding trial, from 3 to 4L (as suggested by the increased body condition score recorded across all treatments).

The two different financial calculations described above were made because it became apparent that the first calculation method was devaluing carcases on some treatments more than others due to poor conformation classification. Estimating carcase values at the start of the study was difficult because no carcase data were available for cows starting the trial. Since the results of the study found no significant differences between treatments on final carcase fatness, conformation or killing out percentage it seemed reasonable to estimate carcase valuation changes using a common carcase weight value across treatments. In calculation 2 this unit value was the market value for P+3 carcases (£1.05 kg/dw) at the start of the trial and P+4L (£1.10/kgdw) at slaughter.

Estimates of carcass values (using the two calculations above) and of feed costs (CEDAR valuation prices) with respect to treatment are shown in Tables 6a and 6b, respectively.

Table 6a Financial evaluation using calculation 1 of different forage based feeding systems for finishing cull dairy cows (£/head, unless otherwise stated).

	Diet		
	G	**GW**	**M**
Carcase value			
Start carcase value †	352.1	340.5	338.1
Finish carcase value	384.7	365.6	379.7
Estimated cull cow price (p/kg LW)	54.7	52.0	48.7
Net carcase value increase	32.3	25.1	41.6
Finishing Diet Costs			
Feed cost (p/kg DMI)	9.1	8.9	8.0
Daily feed cost	0.65	0.81	1.01
Total feed costs	41.03	51.42	63.40
Feed cost (p/kg LWG)	397	212	85
Net Margin	- 8.71	- 26.35	- 21.78

† Estimates of pre-treatment carcass values are based on applying the same pricing system to the conversion of initial BCS to an estimate of pre-treatment MLC fat score using the equation derived from the regression analysis shown in Figure 1 and estimates of start carcass weights (KO% x start weight).

Table 6b Financial evaluation using calculation 2 of different forage based feeding systems for finishing cull dairy cows (£/head, unless otherwise stated).

	Diet		
	G	**GW**	**M**
Carcase value			
Start carcase value	339.4	331.1	339.4
Finish carcase value	363.0	360.8	398.2
Net carcase value increase	23.56	29.73	58.76
Finishing Diet Costs			
Feed cost (p/kg DMI)	9.1	8.9	8.0
Daily feed cost	0.65	0.81	1.01
Total feed costs	41.03	51.42	63.40
Feed cost (p/kg LWG)	397	212	85
Net Margin	-17.47	- 21.69	-4.64

The increase in carcase valuation estimating using calculation method 1 does not reflect the physical performance recorded during the study. For instance, for diet G an increase in carcase value of £32 was calculated compared to £25 for diet GW, this was despite liveweight gains for diet GW being twice those of diet G (24 kg compared to 10 kg).

For this reason it was considered that calculation 2 offer a better estimate of carcase value changes during the study given the information available. This calculation estimated that the increase in value of carcases from diets G, GW and M were, £23, £30 and £59, respectively. These results were a better reflection of the physical performance of the cows on the trial and consequently these are the financial results referred to in the executive and farmer summary and subsequently in this report.

Total feed costs were lowest in diet G increasing on average by £10 and £20 for diets GW and M, respectively, although when expressed as a function of live weight gain feed costs were considerably higher for diet G at 397 p/kg LW when compared to costs of 212 and 85 p/kg LW for diets GW and M respectively. Feed costs were higher than estimates of improvements in carcass values. Net losses per animal were estimated to be £17.47, £21.69 and £4.64 for diets G, GW and M respectively.

4. DISCUSSION

Much of the data that currently exists pertaining to performance benchmarks of cull dairy cows is dated, and since their publication there have been a number of significant changes in dairy cow genotype. The modern dairy cow has been selected to maximise milk yield, as there is a positive correlation between yield and gross efficiency. However, these increases in yields from high genetic merit cows were being fuelled by increased losses of body condition, as intake potential was unable to meet the nutrient demands placed upon the animal to remain in step with increased performance. As a consequence, in addition to selecting animals on the traits of increased milk production animals were also selected for increased feed intake. The combination of these two selection criteria have resulted in a much larger framed animal with greater intake potential that has been selected to partition nutrient resources into milk. Consequently, data that applied to cull cow finishing performance at the start of the over thirty month scheme in 1996 may not be appropriate for today's modern day Holstein Friesian dairy cow. The aim of this study was to address this information shortfall by assessing animal growth performance and post-mortem carcass characteristics of modern dairy cull cows fed forage based finishing diets for a 63 day finishing period and to evaluate the financial implications of each. However a recent study investigating the effects of feeding a single forage based diet to finishing cull cows had indicated that a finishing period of 30 days was sufficient. Data derived from this study did indicate that further improvements in animals performance beyond 30 day finishing period were negligible in cattle offered diets from grass silage based systems. This was not the case for cattle receiving maize silage based diets whose performance did not alter appreciably beyond the 30 day threshold.

The diets used in this study were predominantly of conserved forages, namely grass and maize silages that were either offered as grass silage as the sole feed (G), grass silage plus 3 kg/day of cracked wheat (GW) or a maize silage TMR that contained a small quantity of a soyabean and rapeseed protein supplement, and represented three over wintering forage based finishing systems that would be appropriate for cull dairy cows.

Intakes of CP, ME, NDF and ash were notably higher in those animals receiving diet M, principally due to the greater DMI of this treatment. Only intakes of starch in diet M were a function of DMI whereas starch intakes in diet GW were unrelated to DMI as its source was from the 3 kg of cracked wheat topped dressed on to the forage fraction of the diet daily.

Overall weight gains were notably better in diet M, with animals gaining approximately 50 and 64kg more weight during the course of the study than diets GW and G respectively. However, this failed to reach statistical difference, in part due to the large variation seen in total weight gains. This is also reflected in absolute rates of DLWG. Daily live weight gains calculated from regression analysis indicate trends in live weight gain and tend to compensate for occasional perturbations in animal performance. This method of determining rates of gain reduced overall variation and indicated better rates of gain than absolute values. However, these still fail to achieve statistical significance, despite the large numerical differences seen between treatment means. Furthermore, there were indications those animals receiving grass silage based diets performed better in the first half of the study when compared to the latter half, whereas the opposite was true for those animals receiving the maize silage TMR.

Five animals from diet G and one animal each from diets GW and M either failed to gain or lost weight over the duration of the study which was accompanied by lower than average DMI. Of these seven animals exhibiting low DMI and poor weight gains, one animal from diet GW developed mastitis and was removed from the Calan gates during the last week of the study. Two animals from diet G developed chronic lameness that appeared to be the result of joint or tendon problems rather than microbial infection and these animals were also removed from the Calan gates. There were no other health issues with the remaining four animals that had exhibited weight loss, although these four animals were identified as being some of the older animals on the study.

The relationship between ME intake and DLWG shown in Figure 2 indicates that animals on this study gained weight when ME intakes were in excess of 85 MJ/day, probably representing ME required for maintenance. Despite mean intakes of ME in diet G being below this 85 MJ/day threshold of weight gain, cattle receiving this diet gained approximately 0.2 kg/day. Intakes of ME in diet GW were higher than the threshold value with ME intakes of 106 MJ/day, although 36 MJ of this was provided by the 3kg of cracked wheat that was top dressed daily. ME intakes in diet M were twice that of those of diet G and is reflected in the rates of live weight gain which was approximately 1.2 kg/day which is 1.0 kg/day better than those recorded in diet G.

Carcass weights tended to be heavier in diet M animals than those offered diet G although killing out percentages appeared to be nearly identical between these two treatments. However, not all animals were dressed to the same specification and dressing specification was not uniform between treatments, such that prior to determination of carcass weight more animals from treatment G underwent additional trimming than those of treatments GW and M.

Conformation scores, irrespective of treatment, were generally poor with cattle grading on average P+, as would be expected from animals principally bred for efficiency of milk production. Conversely fat scores were good with cattle grading on average 4L, although there were still no differences in fat score between dietary treatments. Using the resultant equation from the plot of BCS against fat score it was possible to estimate pre-treatment fat scores and subsequent changes in fat scores that occurred during the course of the study. These equations indicated that animals at enrolment had an MLC fat score of approximately 3 and that the half score shift in BCS had resulted in a 1 point shift in MLC fat class (3 – 4L).

The finishing phase for animals principally kept for meat production tends to occur before the animal reaches full maturity and whilst the animal still has potential for lean tissue deposition. This is not necessarily the case for dairy cows, which can be culled for a number of reasons which include a failure to conceive, mastitis, recurrent lameness or other animal health related issues. As a result these animals tend to be much older than those specifically bred for meat production, and as a consequence may lack the potential to deposit lean tissue. This in turn may result in increased rates of fat deposition and significantly poorer feed conversion efficiencies. Furthermore, fat deposition not only occurs at inter and intra muscular sites but internally as well. Internal fat deposits, unlike inter and intra muscular deposits, are subject to trimming when the animal is dressed and as a consequence could reduce carcass weight and subsequent killing out percentage. Rates and sites of tissue deposition were not determined in this study and this information would have been beneficial in determining whether the greater weight gains seen under one dietary treatment or the poorer feed efficiencies of another were the result of increased fat deposition.

Total feed costs were higher than net gains in carcass values resulting in overall financial losses irrespective of treatment. This would imply that with the feed prices used in the calculations in this study and the cull cattle prices that were current at the time of slaughter it would appear to be uneconomical to finish cull dairy cows.

However, neither feed costs and cull cattle prices are static and are liable to considerable variation. To date, following the end of the OTM scheme, cull cow prices have not exceeded 68.1 p/kg LW and have been as low as 46.7 p/kg LW. These figures are, on average, notably lower than the calculated[1] cull cow breakeven prices of 67, 80 and 101 p/kg LW for diets G, M and GW, when feed costs were 397, 85 and 212 p/kg LWG.

However, it should be noted that these financial assumptions are based on the physical performance of a limited number of animals that were of good body condition score at the start of the study. Discrete data sets such as these do not permit the inclusion of other factors that may influence animal physical performance and eventual financial outcomes. Studies involving larger numbers of animals that permit blocking of additional factors are necessary to fully evaluate the potential for finishing cull dairy cows.

[1] Calculated using regression of carcase value gain against actual liveweight cull cow price

5 CONCLUSION

Dry matter intakes were significantly higher in those animals offered diet M when compared to those of diets G and GW. Total weight gains and overall feed conversion efficiency were notably better in those animals that had received diet M. However, due to the large amounts of variation within each treatment group for each of these parameters it was not possible to establish these differences statistically, although larger numbers of animals within each treatment may have reduced this variation. Similarly the lack of difference between treatments for change in condition score may have been attributable to large variation within treatment groups, partially because of the subjective nature of condition scoring and the variation that occurs between animals. There were no effects of treatment on carcass weights, killing out percentages or carcass classification; although carcass weights were heavier in animals that had received diet M than diets G and GW. Feed costs, irrespective of diet, in the context of this study, were greater than estimates of gains in carcass value, resulting in net financial losses irrespective of treatment. However, these losses are based on theoretical gains and current feed prices, the latter of which are prone to fluctuation. Farmers should take the performance figures detailed in this report and apply them according to their own circumstances.

REFERENCES

Rogers, CA., Fitzgerald, A.C., Carr, M.A., Covey, B.R., Thomas, J.D. and Looper, M.L. (2004). On-farm management decisions to improve beef quality of market dairy cows. *Journal of Dairy Science*, **87**:5, 1558 – 1564.

APPENDIX

Ration costs

Table A1 Unit costs of component feeding stuffs (£/tonne DM) and cull cattle prices (p/kg LW)

	Unit price		
Maize silage	75.0		
Grass silage	90.0		
	Low	Actual	High
Feed wheat[1]	63.2†	75.0	79.1‡
Soya bean meal	*	145.5	*
Rape seed meal	*	97.5	*
Cull cattle price[2]	46.9†	51.8	68.1‡

† Lowest unit price since end of OTM (used for sensitivity test)
‡ Highest unit price since end of OTM (used for sensitivity test)
[1] Source Farmers Weekly market trends
[2] Source MDC Datum

Carcass values

Table A2 Deadweight prices for EUROP fat and conformation scores (p/kg DW)

	-P	P+	-O
1	80		
2		85	
3		100	
4L		105	130
4H		100	130
5L		90	