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Animal Science Research Centre - Beef Unit Trial Results – 2013 (b)

Effect of reducing the starch content of cereal based rations by the partial replacement of barley with soya hulls for intensively finished dairy-bred bulls

Introduction and Objective:

It is acknowledged that starch is the key nutrient driver to optimise daily live weight gain (DLWG) with intensive finishing systems for beef cattle. This was confirmed in a study at Harper Adams (Marsh & Brown, 2007) to compare the performance of bulls fed diets with either a high (38.3% starch in DM) or low (9.3%) level of starch in a proprietary beef nut. The bulls fed the proprietary beef nut with the high starch content recorded significantly higher slaughter weights, DLWG's and carcass weights. There was also a reduction in the number of days to slaughter and an improvement in feed conversion ratio (FCR) and conformation score. Based on the costs prevailing at the time of the study, gross margins were increased by £96 per head with feeding the high starch ration.

The objective of the following study was to investigate the partial substitution of barley with soya hulls to evaluate different starch contents of intensive beef finishing diets. Soya hulls have a significantly lower starch content than rolled barley, similar crude protein content, higher NDF and lower ME value. Further details of the feed value of barley and soya hulls are shown in appendix 1. The replacement of some barley with soya hulls would therefore reduce the starch content and increase the NDF content of intensive beef finishing rations. Soya hulls have a similar feed price to rolled barley and are readily available. Alternatives to soya hulls are molassed sugar beet pulp and citrus pulp.

Animals & Timing:

48 Sept-Oct 2011 born Holstein (n = 42) and Beef cross Holstein (n = 6) dairy-bred bulls randomized according to live weight and breed to the following treatments:

Comparison:

High starch (43% Starch in DM, 36% as fed)

Ad libitum 14% crude protein (as fed) concentrates based on rolled barley.

Standard starch (37% Starch in DM, 32% as fed)

Ad libitum 14% CP concentrates based on rolled barley including 10% soya hulls.

Medium starch (30% Starch in DM, 26% as fed)

Ad libitum 14% CP concentrates based on rolled barley including 20% soya hulls.

Details of the above ration formulations and analysed nutrient values are shown in appendix 2. Straw was offered to the bulls from racks.

Results:

Table 1: Animal performance

(Kg/bull)	High	Standard	Medium	Sig
Start wt	299	298	299	NS
Slaughter wt	574 ^a	561 ^b	564 ^b	*
Days to slaughter	197	194	197	NS
DLWG	1.41	1.37	1.35	NS

Within row, means with the same superscript are not significantly different ($P>0.05$)
NS = not significant, * = $P<0.05$, ** = $P<0.01$, *** = $P<0.001$

Table 2: Carcase characteristics

	High	Standard	Medium	Sig
Carcase wt (kg)	297	291	292	=0.163
Kill out (%)	51.5	51.8	51.8	NS
Carcase DG (kg)	0.80	0.78	0.77	NS
Conformation ¹	2.3	2.3	2.4	NS
Fat class ¹	3.3	3.5	3.4	NS
Liver score ²	1.23	1.11	1.08	NS

¹ EUROP carcase classification: Conformation: P+=1 and E=7, Fat class: 1=1 and 5H=7.

² Liver assessment: 1= Healthy liver and 5 = Severe abscesses (due to acidosis)

Table 3: Feed intakes (kg/bull) and feed conversion ratio (FCR)

	High	Standard	Medium
Total concentrate intake (kg)	1907	1918	1932
Daily concentrate intake (kg)	9.68	9.89	9.81
FCR (kg feed: kg gain)	6.93	7.29	7.37
FCR (kg feed: kg carcase gain)	12.10	12.68	12.74

The FCR of 6.93:1 (fresh weight) for the High starch fed bulls appears relatively high but it must be taken into consideration that the trial did not include the period of growth from 110kg to 300kg. During this rearing phase dairy-bred bulls at Harper Adams typically record DLWGs of 1.52kg with an intake of 625kg of feed with an FCR of 3.29:1. Overall feed intakes from 12 weeks old to slaughter were 2.5-2.6t (fresh weight) per bull.

Table 4: Financial performance (£)

	High	Standard	Medium
Carcase price (£/kg - Nov 2012)	3.34	3.34	3.35
Carcase value (£)	992	972	978
Ration cost (£/t)	204.85	202.43	201.73
Feed cost (£/bull)	391	388	390
Margin over Feed (£/bull)	601	584	588
Feed cost/kg live wt gain (£/kg)	1.41	1.46	1.47
Feed cost/kg carcase gain (£/kg)	2.48	2.57	2.57

The ration costs were based on the following feed prices at the time of the study: rolled barley @ £172/t, Soya Hulls @ £165/t, soyabean meal @ £374/t, rapeseed meal @ £245/t, molasses @ £155/t, minerals @ £350/t plus £10/t mill & mix charge.

Discussion & Conclusions:

- Overall performance of the bulls was satisfactory achieving similar results to the EBLEX (2012) targets for intensive cereal beef production.
- The High starch fed bulls recorded significantly higher ($P<0.05$) slaughter weights compared to the Standard and Medium starch fed bulls.
- The High starch fed bulls recorded the highest DLWG but this was not significantly different.
- The High starch fed bulls recorded higher ($P=0.163$) carcass weights compared to the Standard and Medium starch fed bulls.
- There were no significant differences in carcass characteristics or liver damage scores.
- Daily concentrate feed intakes were the lowest for the High starch treatment which subsequently recorded the best FCR.
- Based on the costs prevailing at the time of the study the highest margin over feed was recorded with the High starch fed bulls which was increased by £13-17 per bull.

As concluded above the reducing the starch content of barley based rations by replacing 10% or 20% of barley with soya hulls had a negative effect on cattle performance and margins. Diets containing up to 42% starch in the DM which was **provided from lightly rolled barley** did not cause signs of liver damage (acidosis) in this experiment

A number of beef producers have contacted the author regarding feeding wheat to intensively finished cattle but this is not recommended due to the very high starch content of wheat and the issues of processing wheat grain since it is difficult to 'lightly roll' resulting in cattle being fed 'ground wheat' that would degrade rapidly in the rumen causing acidosis. The inclusion of soya hulls in wheat based rations could overcome the problems with feeding wheat and is worthy of investigation.

Acknowledgement:

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References:

- EBLEX Beef BRP Manual 10. 2012. Better Returns from Pure Dairy-bred Males. Huntingdon: EBLEX
- Marsh, S.P. and Brown, S.T. 2007 Effect of feeding a compound feed with a reduced starch content on the performance of intensively fed beef cattle *Proceedings of the British Society of Animal Science*. Paper 127
- Marsh, S.P., Harries, D.P.R. and Vickers, M. 2014. Effect of reducing the starch content of cereal based rations by the partial replacement of barley with soya hulls for intensively finished beef cattle. *Advances in Animal Biosciences*. 5. Paper 128

Appendix 1

Feed value of Barley and Soya Hulls

% in DM	Barley	Soya Hulls
ME (MJ/kg DM)	13.2	11.9
Starch	59.0	5.0
Sugar	3.0	3.0
Crude Protein	12.1	12.2
NDF	21.1	67.5
Oil	3.0	2.4

Source: EBLEX. 2008. The Mini Feeds Directory

Appendix 2

Trial diets

Feeds (kg/t)	High Starch	Standard Starch	Medium Starch
Rolled barley	785	675	575
Soya Hulls		100	200
Rapeseed meal	70	70	70
Soyabean meal	70	70	70
Molasses	50	50	50
Minerals	25	25	25
Analysis			
ME (MJ/kg DM)	12.9	12.8	12.7
Starch (% in DM)	42.9	37.4	29.9
Starch (% as fed)	36.1	31.8	25.7
NDF	16.0	27.5	34.6
Crude Protein (%)	14.3	14.0	13.9
Crude Protein (% in DM)	17.0	16.5	16.2