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Animal Science Research Centre - Beef Unit Trial Results – 2016 (d)

**Evaluation of the partial replacement of barley with maize meal on the
performance of intensively finished bulls**

Introduction and Objective:

In a previous study to evaluate crimped grain maize against rolled barley at Harper Adams, bulls fed *ad lib* crimped grain maize recorded significantly improved performance with lower liver damage scores (Marsh *et al.*, 2011). Liver abscesses are associated with mild acidosis from feeding diets with very high starch content (Owens *et al.*, 1998) and therefore it could be assumed that the improved performance with crimped grain maize was partially attributed to reduced rumen acidosis. Unfortunately crimped grain maize can only be reliably grown in Southern England and grown in the Midlands under plastic which significantly increases production costs. However, maize meal is a dried product imported into the UK from the continent and USA and available from the feed trade for inclusion in blends and compounded feeds. Compared to barley, maize meal has a higher ME value (14.3 v 13.2 MJ/kg DM), higher starch content (71 v 59% in DM) and more of the starch in maize meal is by-pass starch (35 v 15%).

The objective of this experiment carried out at Harper Adams University was to determine the effect of partial replacement of barley with maize meal with rations containing a relatively high level of starch to intensively finished dairy-bred bulls.

Animals & Timing:

40 Oct-Nov 2014 born British Blue x Holstein (n=20) and Holstein (n=20) bulls weighing approximately 318kg at 7½ months old were randomized according to live weight and breed to the following treatments:

Comparison:

1. Control

Ad libitum concentrates based on 63.5% rolled barley @ £95/t, 15% soya hulls @ £119/t, 7% soyabean meal @ £247/t, 7% distiller dark grains @ £175/t, 5% molasses @ £170/t and 2.5% minerals @ £325/t formulated to contain 14.3% CP as fed, 34.4% starch as fed and 12.7 ME MJ/kg DM. The ration cost was £134/t.

2. 20% Maize Meal

Ad libitum concentrates based on 41.5% rolled barley, 20% maize meal @ £156/t, 15% soya hulls, 8% soyabean meal, 8% distiller dark grains, 5% molasses and 2.5% minerals formulated to contain 14.0% CP as fed, 35.2% starch as fed and 12.9 ME MJ/kg DM. The ration cost was £149/t.

Straw was offered *ad lib* to both groups of bulls from racks.

Results:

Table 1: Animal performance (kg)

(Kg/bull)	Control	Maize Meal	s.e.d	P Value	Sig
Start wt	318	318	14.2	0.909	NS
Slaughter wt	593	594	11.4	0.659	NS
Days to slaughter	184	181	9.9	0.652	NS
DLWG	1.52	1.55	0.060	0.606	NS
Age at slaughter (days)	402	401	6.1	0.787	NS

NS = not significant, * = P<0.05, ** = P<0.01, *** = P<0.001

Overall the British Blue and Holstein bulls recorded slaughter weights of 616kg and 572kg at slaughter ages of 401 and 406 days respectively.

Table 2: Carcase characteristics

	Control	Maize Meal	s.e.d	P Value	Sig
Carcase wt (kg)	312.5	313.4	6.92	0.913	NS
Kill out (%)	52.6	52.7	1.03	0.845	NS
Carcase DG (kg)	0.91	0.93	0.062	0.642	NS
Conformation ¹ (1-7)	3.05 (O+)	3.05	0.314	1.00	NS
Fat class ¹ (1-7)	3.16	3.17	0.176	0.950	NS
Liver score ² (1-5)	1.90	1.00	0.332	0.010	**

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)

Overall the British Blue and Holstein bulls recorded carcase weights of 338kg and 288kg at carcase grades of R3 and –O3 respectively.

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

	Control	Maize Meal
Total concentrate intake (kg)	1,798	1,782
Daily concentrate intake (kg)	9.77	9.85
FCR (kg feed: kg lwt gain)	6.54	6.46
FCR (kg feed: kg carcase gain)	10.74	10.59

The FCRs (kg feed: kg liveweight gain) appear relatively high compared to the target of 5.0:1 for cereal fed Continental x Holstein bulls but it must be taken into consideration that the experiment did not include the period of growth from 110kg to 318kg. During this rearing phase Continental x Holstein bulls at Harper Adams University typically record an FCR of 4.5:1 with a DLWG of 1.52kg having consumed 947kg of concentrates. Overall feed intakes from 12 weeks old to slaughter were approximately 2.69t (fresh weight) per head for the bulls.

Table 4: Financial performance (£)

	Control	Maize Meal	s.e.d	P Value	Sig
Carcase price (£/kg)	3.17	3.18	0.034	0.967	NS
Carcase value (£)	994	999	22.5	0.9	NS
Feed cost (£/t)	134	149			
Feed cost (£/bull)	241	266			
Margin over Feed (£/bull)	753	733			
Feed cost/kg live wt gain (£/kg)	0.86	0.95			
Feed cost/kg carcass gain (£/kg)	1.44	1.58			

[†] Carcass price standardised to a base price of £3.32/kg.

Overall the Continental x Holstein and Holstein bulls returned a gross margin of £354 and £331 per head respectively when calculated from being reared from calves through to slaughter.

Discussion & Conclusions:

- Overall performance of the bulls was very good with the Continental x Holstein bulls being slaughtered at 13.1 months old with carcass weights of 338kg with the pure Holstein bulls killing at 13.3 months at 288kg carcass weights exceeding the EBLEX (2005) targets for intensive cereal beef production.
- There was a small but non-significant improvement in the DLWG of the maize meal fed bulls.
- The bulls fed the ration including maize meal recorded significantly lower (P=0.01) liver abscess scores and all of the livers were perfect. It is not fully understood why this did not have a significant effect on performance. The rations contained 34-35% starch as fed i.e. 44-45% in DM, which is a reasonably high starch content for an intensive beef ration. If the soya hulls were removed from the ration and replaced with cereals (i.e. with rations including 80+% rolled barley) this would significantly increase the starch content to approximately 36-40% as fed (41-46% in DM) which is more likely to cause issues with acidosis than an effect of including maize meal might be seen.
- There were no differences in feed intakes or FCR.
- Based on the costs prevailing at the time of the study the bulls fed the maize meal based ration recorded an increase in carcass value of £5 but increased feed costs of £25 per bull resulting in a higher margin over feed of £20 per head for the barley fed bulls.
- The maize meal ration was £15 per tonne higher in price in the study. A sensitivity analysis would show a financial benefit for maize meal if prices fall in relation to barley.
- An alternative consideration for the inclusion of maize meal is if a significant quantity of rolled wheat is to be included in an intensive beef ration. Wheat breaks down rapidly in the rumen and can cause acidosis.

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References:

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