Animal Science Research Centre - Beef Unit Trial Results – 2005 (a)

Evaluation of head-cut whole crop wheat and barley for beef cattle

Introduction: A preliminary investigation at Harper Adams University (Marsh and Gibson, 2004) indicated that head-cut whole crop wheat could offer beef finishers the opportunity to achieve high levels of animal performance and reduce feed costs per kg gain when compared to diets based on rolled barley.

Object: The objective of this experiment was to evaluate crop yield and animal performance with dairy-bred bulls and heifers, from winter wheat **and** winter barley crops harvested both conventionally and at the end of physiological grain fill (approx 70% dry matter). The latter being made into cracked head-cut urea treated whole crop.

Timing: The trial started in September 2004 with 72 Jan–Feb 2004 born British Blue x Holstein bulls and heifers. Slaughtered Feb-April 2005.

Forage: The conventionally combined cereals and whole crops were harvested from the same fields of winter barley (*v:* Pearl) and winter wheat (*v:* Solstice). The whole crop was harvested 10-14 days prior to conventional combining. The wheat had a standing height of 76cm at harvest and the top 25cm of the wheat was head-cut with a forager fitted with a 'Primary processing mill' therefore cracking the grains and treated with 35kg/t Home n' Dry (FiveF Agri LLP) at ensiling. The barley had a standing height of 87cm when 'whole cropped' and the top 35cm of the barley was head-cut and treated with 35kg/t Home n' Dry at ensiling. The target was to head-cut the top 25cm of the barley but this was not possible due to brackling (bending over) of the heads. The whole crop stubbles were mown and baled.

Table 1: Crop fresh weight yields (t/ha). DM yields in brackets.

	Barley		Wheat	
	Grain	Head-cut Whole crop	Grain	Head-cut Whole crop
Whole crop	-	13.0 (10.1)	-	16.1 (11.5)
Grain	7.3 (6.3)		9.8 (8.3)	
Straw	5.3 (4.9)	3.3 (2.9)	5.0 (4.3)	3.8 (3.3)
Additive	-	0.45 (0.41)	-	0.57 (0.51)
TOTAL (t DM/ha)	12.6 (10.9)	16.8 (13.3)	14.8 (12.6)	20.5 (15.3)

Table 2: Grain and whole crop production costs (£/ha – July 2004)

	Barley		Wheat	
	Grain	Head-cut Wholecrop	Grain	Head-cut Wholecrop
Machinery (a)	106.21	106.21	113.62	113.62
Seed	33.25	33.25	42.25	42.25
Sprays	70.56	70.56	89.12	89.12
Fertiliser	63.08	63.08	71.62	71.62
Harvesting	64.22	106.21	64.22	106.21
Additive (b)		172.77		214.32
Rent	122	122	122	122
Total (c)	459.32	674.08	502.83	759.14
Straw (d)	53.71	51.11	49.88	55.55
Grain cost (£/t)	62.83		60.29	
Grain cost (£/t DM)	72.46		70.51	
Whole crop cost (e) (£/t DM)		64.25		63.42
Straw cost (£/t)	10.07	15.25	10.08	14.65

(a) Ploughing, power harrowing and sowing @ £61.75/ha, spraying and fertiliser applications @ £7.41/ha per application. (HAU costs)
(b) Home n' Dry @ £380/t applied at 35kg/t
(c) Excludes straw harvesting charges
(d) Mowing charge of £17.36/ha for the whole crop stubble. Baling charge of £2.10 per 250kg Mini Heston bale, Haulage @ £2/t
(e) Includes dry matter provided by Home n' Dry i.e. 409kg and 508kg DM/ha for whole crop barley and wheat respectively

Treatments:

1. **Barley Beef:** A*d lib* 13% CP barley home mix plus *ad lib* barley straw.

2. **Whole crop barley:** *Ad lib* cracked head-cut urea treated whole crop barley (77.6% DM, 13.8% CP, 470 g NDF/kg DM, 39% starch) plus 150g mins per head per day.

3. **Wheat Beef:** *Ad lib* 13% CP wheat home mix plus *ad lib* wheat straw

4. **Whole crop wheat:** *Ad lib* cracked head-cut urea treated whole crop wheat (71.0% DM, 14.6% CP, 355 g NDF/kg DM, 43% starch) plus 150g mins per head per day.

The barley and wheat home mixes were formulated as follows: 84% rolled cereal, 8% soya-bean meal, 5% molasses, 2% minerals 1% sodium bicarbonate.

Results:

Table 3: Cattle performance (bull and heifer average)

	Barley		Wheat		
	Grain	Head-cut Wholecrop	Grain	Head-cut Wholecrop	Sig
Start wt (kg)	266	265	266	266	NS
Days	181.2a	242.4b	203.9a	229.9b	***
Slaughter wt (kg)	498	516	502	525	NS
DLWG (kg)	1.29a	1.01c	1.26a	1.12b	***
Carcase wt (kg)	274.5	275.6	276.0	285.0	NS
KO%	55.0a	53.3b	54.9a	54.2a	***
Conformation1 (1-7)	4.28	3.94	4.17	4.22	NS
Fatness1 (1-7)	3.44a	2.83b	3.38a	2.83b	*
Carcase DG (kg)	0.84a	0.62b	0.81a	0.70b	***
FCR (kg feed: kg carcase gain)	9.76	14.25	9.64	12.18	
DM Intake[2] (kg)	1,490	2,140	1,490	1,920	
FCR (kg feed DM: kg LWG)	6.41	8.52	6.31	7.41	
Carcase price (£/kg) - April 2005	1.92	1.89	1.91	1.92	
Carcase value (£)	527	521	527	547	
Feed cost (p/kg LWG)	61.2	58.5	57.8	50.4	
Feed cost (p/kg carcase gain)	94.0	95.5	89.6	80.7	
GM/head (£)	30	26	38	58	
GM/head/year (£)	61	38	73	92	
Stocking rate (cattle/ha)	5.57	4.79	7.53	5.94	
GM/ha (£)	168	122	287	343	

Notes:
Within row, means with the same superscripts are not significantly different (*p>0.05*)
[1] EUROP carcase classification: Conformation: P+=1 and E=7, Fat class: 1=1 and 5H=7.
[2] DM intakes exclude the straw eaten from racks by the barley and wheat grain fed catle

Conclusions:

Harvesting cereals at the end of physiological grain fill (approx 70% dry matter) compared to conventionally harvesting with a combine can increase dry matter yields by 16.7-18.7% (approx 2.1 tonnes per hectare)

The target should be to head-cut the top 20-25 cm of the cereal crop. A higher cutting height could leave some grain un-harvested. A lower cutting height will reduce the energy density of the forage.

There were no significant differences in animal performance between the barley and wheat grain fed beef cattle. The wheat however must be lightly rolled and it is recommended that straw must be available *ad libitum* from racks and the use of a rumen buffer, such as sodium bicarbonate, is considered necessary to minimize problems with bloat and acidosis.

Compared to the barley and wheat grain treatments the cattle fed the cracked head-cut urea treated whole crop wheat recorded lower daily and carcase weight gains, took longer to reach slaughter and recorded lower fat scores. The head-cut whole crop wheat fed **bulls** recorded significantly heavier slaughter and carcase weights.

The heifers fed cracked head-cut urea treated whole crop recorded lower fat classifications. It should therefore enable them to be slaughtered at heavier carcase weights which would be more suited to market requirements.

An intensive beef production system based on finishing young bulls housed year-round from 3 months old to slaughter at 14-15 months old on cracked head-cut urea treated whole crop **barley** cannot be recommended due to the relatively low head-cutting height and energy content of the crop resulting in reduced daily live weight gains and margins per head and per hectare. Cracked head-cut urea treated whole crop barley could however be suitable for **Semi-intensive** beef production.

The lowest feed costs per kg gain and highest margins per head and per hectare were recorded by the cattle fed cracked head-cut urea treated whole crop wheat.

Growing a potentially lower yielding crop of barley compared to wheat for intensive finishing of beef cattle is unnecessary.

The trial was carried out just after the decoupling of support payments and gross margins were ‘relatively low’ and do not include any contribution from the Single Farm Payment.

Some advantages and disadvantages of cracked head-cut urea treated whole crop beef production are summarized below:

Advantages

- A high energy and protein content ‘forage concentrate’
- Minimal bloat or acidosis disorders
- Can produce increased dry matter yields compared to fermented whole crop, grass and maize silage
- Enables intensively fed beef cattle to be fed higher yielding crops of wheat compared to barley
- One harvest and minimal (virtually zero) storage losses during winter and summer
- Elimination of the need to roll, mill, and mix cereals, purchase additional protein supplements and dry, or preserve cereals when harvested above 15% moisture content.
- Flexible harvest options - Cereals can be conventionally harvested if they are not to be made into whole crop and fed to livestock
- Harvesting 10-14 days prior to conventional combining allows earlier entry for the following crop
- A 'practical and simple beef production system’

It is critical that the effectiveness of the ‘Primary Processing Mill’ is checked at harvest with at least 90-95% of the grains being cracked, and that the urea-based additive is applied evenly throughout the clamp.

In the previous study at Harper Adams (Marsh and Gibson 2004) cattle fed cracked head-cut urea treated whole crop wheat supplemented with Dried Lactose recorded

significantly higher daily live weight gains compared to non Lactose supplemented cattle (1.37 v 1.23kg) which were comparable to DLWG's recorded by cereal fed cattle (1.42kg). However feeding Dried Lactose with cracked head-cut urea treated whole crop wheat was not financially viable when costed at £280/t. Relatively 'low-cost' liquid Lactose blends are commercially available and should be considered if suitable storage facilities are available.

Disadvantages

- Lodged crops cannot be Head-cut
- Problems may occur with mowing straw from the head-cut stubbles in rutted fields.
- Cannot be used as a break crop in an arable rotation, unlike grass or maize silage
- To convert from an intensive barley beef system to cracked head-cut urea treated whole crop beef production based production system may require investment in feed storage and feeding equipment i.e. conversion of feed hoppers to trough feeding, clamps etc.

Acknowledgement:

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References:

Marsh, S.P. and Gibson, I. 2004. Whole crop wheat for intensively finished beef cattle. *Proceedings of the British Society of Animal Science*. Paper 190.

Marsh S.P. and Keogh B. 2006. Evaluation of cracked head-cut urea treated whole crop wheat and barley and conventionally combined wheat and barley for finishing beef cattle. *Proceedings of the British Society of Animal Science.* Paper 132

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