



## **ANIMAL SCIENCE RESEARCH CENTRE**

### **Evaluation of progeny from Top 10% (Lorabar Mighty Prince) and Top 70% (Aynho Beck) Terminal Index Aberdeen Angus bulls intensively finished on a cereal beef system**



## **TRIAL REPORT B37**

## **FOR EBLEX and Genus**

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## Contents

	<b>Page</b>
EXECUTIVE SUMMARY	3
FARMER RECOMMENDATIONS	4
1 INTRODUCTION	5
2 MATERIALS AND METHODS	5
2.1. Location	5
2.2. Animals and Timing	5
2.3. Aberdeen Angus Bulls	6
2.4. Management and Nutrition	7
3 RESULTS	8
3.1. Calving ease and birth weight	9
3.2. Liveweight and days to slaughter	10
3.3. Carcase characteristics	10
3.4. Carcase price and value	11
4 DISCUSSION & CONCLUSIONS	11
4.1. Calving ease and birth weight	11
4.2. Growth rates and slaughter weights	12
4.3. Carcase characteristics	12
4.4. Carcase price and value	12
4.5. Economic assessment	12
5 RECOMMENDATIONS FOR FUTURE STUDY	13
6 ACKNOWLEDEMENTS	13
7 REFERENCES	13
8 APPENDICES	14

## Executive Summary

Aberdeen Angus male calves sired by bulls with either a Top 10% Terminal Index (Lorabar Mighty Prince - Terminal Index +34) or Top 70% Index (Aynho Beck –Terminal Index +20) were reared through to slaughter at Harper Adams University College. The calves were bred from Holstein-Friesian dairy cows.

The calves were reared as bulls through to slaughter on a cereal beef system. The Angus bulls recorded a mean carcass weights of 285kg which was identical to pure-bred intensively finished Holstein bulls, reared alongside them. This shows that the modern day Angus can be reared on an intensive beef system since Angus cattle are traditionally considered to be only suited to extensive grass based production systems to achieve a carcass weight acceptable to most abattoirs. The carcass weights however were markedly lower than Continental bred bulls which recorded a mean carcass weight of 346kg.

The EBLEX (2005) targets for cereal fed Holstein bulls are a slaughter weight of 540kg and carcass weight of 280kg classifying -O at 13 months old. Targets for Continental x Holstein Friesian bulls however are a slaughter weight of 570kg at 14 months old. If a killing out percentage of 55% is assumed for the Continentals this equates to a carcass weight of 314kg. The Angus sired bulls recorded a mean slaughter weight 547kg at 13.2 months old which exceeds the targets for Holstein bulls and similar to the targets for Continental bred bulls. However the Angus bulls had a mean kill out of 52.1% equating to a carcass weight of 285kg (classifying O+3) which is markedly lower than the target carcass weight for Continentals.

The calves sired by Top 10% Index Angus (Lorabar Mighty Prince) recorded significantly higher ( $P<0.05$ ) slaughter weights (562.3 v 532.2kg), higher ( $P<0.05$ ) DLWGs from birth to slaughter (1.30 v 1.24kg), significantly higher ( $P<0.05$ ) carcass weights (292.5 v 277.6kg), higher ( $P=0.069$ ) daily carcass gains (0.68 v 0.65kg), were slaughtered 6.1 days later, recorded improved ( $P<0.05$ ) carcass conformation scores (3.08 v 2.77 [score 3.0 = O+]), significantly higher ( $P<0.05$ ) carcass price (£3.35 v £3.31/kg) and significantly higher ( $P<0.001$ ) carcass values (£979.44 v £918.70) compared to the Top 70% Index (Aynho Beck) sired calves.

The calves sired by Aynho Beck recorded significantly ( $P<0.05$ ) shorter gestation lengths (281.2 v 282.9 days). Whilst the statistical analysis of the data indicated no significant differences in calving ease or birth weight, the Aynho Beck calves recorded a numerically lower calving ease score and birth weight which is in agreement with the respective bulls Estimated Breeding Values (EBV's) for these traits.

'Terminal Index' is an assessment of the economic genetic merit of an animal. The theoretical difference between the progeny from the sires should have been £7. In this study the increase in value of the carcass was £60.74 per head for the Top 10% sired calves. However the benefit of finishing the bulls sired by the Top 70% sire some 6 days earlier together with the reduction in

gestation length of 1.8 days was estimated to be worth £18.59 leaving a net benefit for the Top 10% sired calves worth £42.15 thus exceeding the predicted value by £35.15.

The results from this experiment confirm that EBVs provide a very accurate measure of an animal's genetic merit, however in this experiment they under predicted the financial benefit that can accrue from using a bull with a Top 10% Terminal Index compared to a bull with a Top 70% Index.

A scheme should be put in place to identify calves in markets sired by high index bulls so that a premium can be paid which should then encourage greater use of high index sires in the dairy industry.

### **Farmer Recommendations**

- Today's Angus cross Holstein bulls can be reared on an intensive beef system, especially calves sired by high index bulls.
- This study once again proved that beef calves sired by high index bulls will record significantly improved physical performance. In this experiment the Top 10% Index sired calves recorded increased DLWGs, slaughter weights, carcass weights and improved conformation grades resulting in a significant increase in net margin estimated to be worth £42.15 per calf.
- A scheme should be put in place to identify calves in markets sired by high index bulls so that a premium can be paid which should then encourage greater use of high index sires in the dairy industry.
- The beef industry must have faith in EBVs – they work!

## **1.0 Introduction:**

Previous studies at Harper Adams University College with progeny from Limousin bulls with different Beef Values have shown significant improvements in performance with calves sired by the higher Beef Value bulls (Marsh & Pullar, 2002; Marsh *et al.*, 2007; Marsh *et al.*, 2008).

To further the database to confirm that EBVs work it was agreed to conduct an additional study but with Aberdeen Angus sires.

The beef production system employed at Harper Adams is an intensive cereal beef system conventionally rearing Holstein and Continental cross Holstein bulls. The Holstein and Continental cross Holstein are late maturing breeds and are therefore suited to this production system. Recent batches of bulls have achieved carcase weights of 285kg and 335kg respectively at 13.5 months of age. Early maturing beef breeds such as the Hereford and Aberdeen Angus are traditionally considered to be more suited to extensive grass based production systems and would typically finish at carcase weights of under 270kg at fat class 4L if reared on intensive systems. These slaughter weights are considered to be relatively low especially for the abattoirs supplying the supermarket trade. However, the recent introduction of North American genetics into the majority of the Aberdeen Angus bloodlines have dramatically improved the performance of this breed resulting in increased 400 day weights (EBLEX, 2004). According to Ron McHattie (2007. Pers.Comm. Mr R McHattie is the Chief Executive of The Aberdeen Angus Cattle Society) approximately 95% of pedigree Angus herds in the UK have incorporated North American genetics into their herds.

There is a paucity of data on intensive finishing of modern day Angus cross Holstein bulls in the UK. The objective of this experiment was therefore to evaluate the performance of progeny from Aberdeen Angus bulls with either Top 10% or Top 70% Terminal Indexes intensively finished on a cereal beef system.

## **2.0 Materials & Method**

### **2.1 Location**

Harper Adams University College Beef Unit, Newport, Shropshire, TF10 8NB.

### **2.2 Animals & Timing**

The trial commenced in 2007 with Holstein cows from Harper Adams University College and Mr John Thomasson's (Aston Lower Hall, Nantwich, Cheshire) dairy herds being inseminated at random with either a Top 10% or Top 70% Terminal Index Angus bull. The bull calves were reared at Harper Adams on a cereal beef system and taken through to slaughter. There were 52 bull calves reared with 26 from each sire.

### 2.3 Aberdeen Angus Bulls

The bulls used were as follows:

#### Lorabar Mighty Prince - Terminal Index of +34 (Top 10%)



*(Plate 1 Lorabar Mighty Prince. Photo courtesy of Genus)*

#### Aynho Bech - Terminal Index +20 (Top 70%)



*(Plate 2 Aynho Bech. Photo courtesy of Genus)*

Both of the above bulls are standing in the Genus beef stud.

The full EBV details for the above bulls are shown in table 1. It can be noted that both bulls are in the Top 1% for Calving Ease Direct EBV. However Lorabar Mighty Prince has a longer gestation length and higher birth weight compared to Aynho Bech.

All of the growth and carcass weight EBVs are markedly higher for Lorabar Mighty Prince. He has a significantly higher Eye Muscle Area EBV which should result in improved carcass conformation grades and a lower negative Fat Depth EBV which should enable the progeny to reach heavier slaughter weights before reaching the target fat class.

Table 1: EBVs\* and Accuracy % for Aynho Beck, Lorabar Mighty Prince and Breed Average

	Aynho Beck			Lorabar Mighty Prince			Breed Avg. EBVs for 2010
	EBV	Accuracy (%)	Percentile Band	EBV	Accuracy (%)	Percentile Band	
<b>Calving Ease Direct (%)</b>	+6.6	65	Top 1%	+4.8	78	Top 1%	-2.1
<b>Gestation Length (days)</b>	-4.4	82	Top 1%	+2.8	88	Top 95%	+1.0
<b>Birth Wt (kg)</b>	+0.0	87	Top 1%	+2.7	93	Top 50%	+2.6
<b>200 Day Wt (kg)</b>	+28	80	Top 60%	+40	86	Top 15%	+31
<b>400 Day Wt (kg)</b>	+36	79	Top 85%	+62	86	Top 30%	+54
<b>600 Day wt (kg)</b>	+47	75	Top 85%	+75	84	Top 35%	+68
<b>Carcase Wt (kg)</b>	+22	65	Top 90%	+51	40	Top 15%	+40
<b>Eye Muscle Area (sq cm)</b>	+0.9	49	Top 95%	+3.9	70	Top 10%	+2.4
<b>Fat Depth (mm)</b>	-0.4	55	Top 80%	-0.8	62	Top 60%	-1.1
<b>Retail Beef Yield (%)</b>	+0.6	48	Top 60%	+1.5	70	Top 10%	+0.8
<b>IMF (%)</b>	-0.4	40	Top 95%	-0.1	54	Top 60%	+0.0
<b>Angus Terminal Index</b>	+20		Top 70%	+34		Top 10%	+24

\* Date BLUP'd July 2012.

It should be noted that the majority of the EBVs have a relatively high accuracy with most over 65%.

The calves were born from January 2008 and reared through to slaughter on a cereal beef system. The cattle were double weighed at slaughter.

## **2.4 Management and nutrition**

The feeding and management of the calves through to slaughter in the Harper Adams University College beef unit was as follows:

### Birth to 12 weeks:

Following birth the calves received a minimum of 2 litres of colostrum within 6 hours. They were then transferred to individual calf pens and fed colostrum for a further 4 days. Thereafter warm (37°C) milk replacer (18% oil, 22% protein) mixed at 150g per litre of water was fed twice per day at 4 litres per day. Calf starter concentrates ('Start 'n' Wean', Wynnstay Group Plc) containing 180g CP/kg (18%CP) straw and water were offered *ad libitum* from 7 days of age. The calves were weaned at 6 weeks of age providing they were eating 1kg of starter pellets for 3 consecutive days and placed into group pens.

### 12 weeks to slaughter:

The cattle were fed a 14% CP cereal mix *ad libitum* (67.5% rolled barley, 10% molassed sugar beet pulp, 7.5% soyabean meal, 7.5% rapeseed meal, 5% molasses, 2.5% high calcium intensive beef mineral) through to slaughter.

The cattle were housed in straw-bedded pens (9.8m x 4.6m) with access to water and barley straw from racks.



*Plate 3: The Harper Adams Beef Unit*

The cattle were reared through to slaughter at a target EU fat class of 3-4L. Fat classification was subjectively assessed by Mr. Simon Marsh (Senior Lecturer – Beef Cattle Specialist) at Harper Adams University College. All of the cattle were slaughtered at Anglo Beef Processors Ltd. (ABP) at Shrewsbury using the UK dressing specification. Slaughter live weight was recorded prior to being loaded on the cattle wagon. The journey from Harper Adams to ABP takes about 30 minutes and the cattle were slaughtered within approximately 1 hour of delivery at ABP.

### 3.0 Results:

During the same time period that the Angus bulls were reared some Holstein (68) and Continental cross Holstein bulls (16) were reared alongside them. The overall results for the three breed types are shown in table 2. This data must be viewed with caution but does provide some interesting comparisons.

Table 2: Overall performance results for three breed types of dairy-bred bulls

Breeds	Holstein	Continental x Holstein	Angus x Holstein
<b>Slaughter wt (kg)</b>	560	626	547
<b>Age at slaughter (months)</b>	13.9	14.0	13.2
<b>DLWG from birth (kg)</b>	1.23	1.37	1.26
<b>DLWG from 12 weeks old (kg)</b>	1.32	1.50	1.37
<b>Carcase wt (kg)</b>	285	346	285
<b>Kill out (%)</b>	50.9	55.3	52.1
<b>Carcase DG from birth (kg)</b>	0.62	0.75	0.66
<b>Carcase classification</b>	-O3	R3	O+3/4L
<b>Finishing concentrates</b>	2,452	2,502	2,195
<b>FCR (from 12 wks)</b>	5.51	4.90	5.08



Overall bull performance was satisfactory with the Holsteins recording slaughter weights of 560kg at 13.9 months old compared to the EBLEX (2005) target of 540kg at 13 months old. The Continental cross Holstein bulls were slaughtered at 626kg at 14.0 months old compared to the EBLEX target of 570kg at 14 months. If a killing out percentage of 55% is assumed for the Continentals this equates to a target carcass weight of 314kg. The Continental bulls at Harper recorded a carcass weight of 346kg. The Angus cross Holstein bulls recorded an identical carcass weight to the Holstein bulls however it was markedly lower than the Continental bred bulls. The Angus bulls were slaughtered at the youngest age being finished some 24 days sooner compared to the Continentals. The Angus DLWG and carcass gains were higher compared to the Holstein bulls but lower than the Continentals. Conformation score for the Angus was superior to the Holstein bulls but lower than the Continentals. The Angus bulls consumed the lowest amount of feed with a superior feed conversion ratio (FCR) compared to the Holstein, however the Continentals recorded the best overall FCR.

The data from the experiment was analysed using ANOVA with DLWG calculated by difference from birth to slaughter.



*Plate 4: Angus bulls in the Harper Adams Beef Unit*

### **3.1: Calving ease, gestation length and birth weight**

Details of the calving ease score scoring system are shown in appendix 1.

Table 3: Calving characteristics

	<b>Aynho Beck</b>	<b>Lorabar Mighty Prince</b>	<b>s.e.d</b>	<b>Sig</b>
<b>Calving Ease Score</b>	1.48	1.54	0.211	NS
<b>Gestation Length (days)</b>	281.1	282.9	0.777	*
<b>Birth Wt (kg)</b>	39.2	39.9	0.58	NS

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

The calves sired by the Top 70% bull recorded significantly shorter gestation lengths ( $P < 0.05$ ). The calves from the Top 70% sire recorded improved calving ease scores and lower birth weights however they were not

statistically significant different but the results do mirror the predicted performance for the bulls EBVs.

### 3.2: Liveweight and days to slaughter

As shown in table 4 the calves sired by the top 10% bull recorded significantly higher ( $P<0.05$ ) slaughter weights compared to the Top 70% bull. The Loarabar Mighty Prince sired bulls also recorded higher ( $P<0.05$ ) daily live weight gains (DLWG) from birth to slaughter and 12 weeks of age to slaughter compared to Aynho Beck sired bull calves.

Table 4: Animal performance (kg/bull)

	<b>Aynho Beck</b>	<b>Lorabar Mighty Prince</b>	<b>s.e.d</b>	<b>Sig</b>
<b>Birth wt (kg)</b>	39.2	39.9	0.58	NS
<b>Slaughter wt (kg)</b>	532.2	562.3	8.98	*
<b>Age at slaughter (days)</b>	400.1	406.2	22.1	NS
<b>DLWG (birth to slaughter)</b>	1.24	1.30	0.028	*
<b>DLWG (12 wks to slaughter)</b>	1.38	1.46	0.039	*

The calves sired by the Top 70% Index bull were slaughtered at 13.1 months old which was 6.1 days sooner than the Top 10% sired bull calves.

### 3.3 Carcase characteristics

Carcase results are shown in table 5. Killing out percentage appears relatively low however it must be noted that the calves were bred from Holstein cows, they were weighed 'gut full' prior to slaughter and the carcasses were trimmed to UK specification. The bulls sired by the Top 10% sire recorded a significantly higher ( $P<0.05$ ) carcase weight and carcase daily gain ( $P=0.069$ ) compared to the Top 70% sired bulls.

Table 5: Carcase characteristics

	<b>Aynho Beck</b>	<b>Lorabar Mighty Prince</b>	<b>s.e.d</b>	<b>Sig</b>
<b>Carcase wt (kg)</b>	277.6	292.5	4.50	*
<b>Kill out (%)</b>	51.2	51.0	0.30	NS
<b>Carcase DG from birth (kg)</b>	0.65	0.68	0.016	=0.069
<b>Conformation* (1-7)</b>	2.77	3.08	0.127	*
<b>Fat class* (1-7)</b>	3.69	3.54	0.14	NS

<sup>1</sup> EUROP carcase classification: Conformation: P+=1 and E=7, Fat class: 1=1 and 5H=7. See appendix 2 for full details.

The Lorabar Mighty Prince sired bull's recorded a significantly higher ( $P<0.05$ ) conformation score which reflects on the higher Eye Muscle Area EBV for this Top 10% bull.

The carcasses graded reasonably well for dairy-bred bulls with the majority of

the bulls grading O+. Of the 26 Lorabar Mighty Prince bulls, 15.3% graded R, 77.0% graded O+ and 7.7% graded –O. Of the 26 Aynho Beck bulls, 76.9% graded O+ and 23.1% graded –O. None of the bulls recorded P+ grades.

The mean carcass weight for Lorabar Mighty Prince and Aynho Beck was 292.5 and 277.6kg respectively with a higher percentage of carcasses weighing below 270kg for Aynho Beck.

The percentage of carcasses below the target of 270kg is shown in table 6.

Table 6: Percentage of carcass below 270kg

	<b>Aynho Beck</b>	<b>Lorabar Mighty Prince</b>
<b>% Carcasses below 270kg</b>	23.1	15.3

### **3.4 Carcass price and value**

Carcass price was standardised equating to a base price of £3.45/kg for an R grade with deductions for underweight carcasses. Full details are shown in appendix 3. It can be seen from table 5 that the carcasses from the Top 10% sire recorded a significantly higher carcass price ( $P<0.05$ ) and carcass value ( $P<0.001$ ).

Table 7: Carcass price and value

	<b>Aynho Beck</b>	<b>Lorabar Mighty Prince</b>	<b>s.e.d</b>	<b>Sig</b>
<b>Carcass price (£/kg)</b>	3.31	3.35	0.017	*
<b>Carcass value (£)</b>	918.70	979.44	15.8	***

The bulls from the Top 10% sire had a carcass value some £60.74 more than the bulls from the Top 70% sire.

## **4.0 Discussion and Conclusions**

Overall the carcass weights for the Angus sired bull calves was similar to Holstein bulls which shows that the modern day Angus can be reared on an intensive beef system. Carcass weights however were markedly lower compared to Continental bred calves.

### **4.1 Calving ease**

The calves sired by Aynho Beck recorded significantly shorter gestation lengths ( $P<0.05$ ) which agrees with the respective EBVs for the bulls. Whilst the statistical analysis of the data indicates no significant differences in any of the measured traits, the calves sired by the Top 70% bull recorded numerically lower birth weights and calving ease score which agrees with the current EBV's for the two bulls

## **4.2 Growth rates and slaughter weights**

The current EBVs for 400 day growth for Lorabar Mighty Prince and Aynho Beck are +62kg and +39kg respectively. Calves sired by Lorabar Mighty Prince recorded higher ( $P<0.05$ ) DLWG's from birth to slaughter (1.30 v 1.24kg) and significantly higher ( $P<0.05$ ) slaughter weights (562.3 v 532.2kg).

## **4.3 Carcase characteristics**

The Lorabar Mighty Prince sired calves also recorded significantly higher ( $P<0.05$ ) carcase weights (292.5 v 277.6kg) and higher ( $P=0.069$ ) daily carcase gains (0.68 v 0.65kg) compared to the Aynho Beck sired calves. The calves sired by the Top 10% bull recorded a mean conformation grade of just over O+ which was significantly higher ( $P<0.05$ ) compared to the calves sired by the Top 70% sire. This agrees with the current EBV's for Eye Muscle Area (+3.9 v +0.9sq cm) and Retail Beef Yield (+1.5 and +0.6%) for Lorabar Mighty Prince and Aynho Beck respectively. There was no difference in killing out percentage.

## **4.4 Carcase price and value**

The combination of an increased carcase weight and superior carcase conformation score with the Top 10% sired calves resulted in a significant ( $P<0.05$ ) improvement in carcase price (+4p/kg) and highly significant increase ( $P<0.001$ ) in carcase value worth £60.74 per head compared to the Top 70% sired bulls.

## **4.5 Economic assessment**

'Terminal Index' is an assessment of the economic genetic merit of an animal. The theoretical difference between the progeny from the sires should have been £7. In this study the difference in carcase value was £60.74 per calf thus exceeding the predicted value by £53.74. This calculation does not include the costs saved with finishing the bulls sired by the Top 70% bull some 6 days earlier thus reducing feed and fixed costs and also does not take into account the benefits accruing through the reduced gestation length of 1.8 days with Aynho Beck.

If it is assumed that the bulls were eating 10kg per day of concentrates which is valued at £172/t this would result in a saving of £10.49 per bull for the Top 70% sired calves. If other variable and fixed costs such as straw, machinery, water and electricity are costed at 30p per day this is worth an additional £1.80 per bull resulting in reduction in finishing costs worth £12.29 for each Aynho Beck sired bull calf. If the benefit of the reduced gestation length is valued at £3.50 per day to the dairy farmer this is worth £6.30 per bull. Despite these savings the overall benefit for the Top 10% bulls is estimated at £42.15.

The results from this experiment confirm that EBVs, especially with relatively high accuracy, can provide a very accurate measure of an animal's genetic merit, however in this experiment they under predicted the financial benefit that can accrue from using a bull with a Top 10% Terminal Index compared to a bull with a Top 70% Index.

## **5.0 Recommendations for future study**

It is proposed that further work should be carried out with sires with high and low Terminal Indexes of different breeds to provide further evidence to the beef industry of the economic benefits of selecting high index sires. We do need to keep on 're-inventing the wheel' to encourage greater uptake of EBVs by the beef industry. There are still a number of sceptics in the beef industry, particularly amongst pedigree breeders. Future studies could also focus on bulls with similar indexes but with contrasting EBVs, e.g. Calving Ease, Fat Depth and/or 400 Day Weights.

## **6.0 Acknowledgements:**

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## Appendix 1:

### Calving Ease

Calving ease was assessed by the herdsman using the following scale:

- 1 = unassisted
- 2 = slight assistance, no ropes
- 3 = considerable help, ropes and some pulling
- 4 = veterinary intervention, or considerable manipulation e.g. head back/breach
- 5 = caesarian

## Appendix 2:

### Carcase classification and pricing structure

Conformation and fat class scores were converted from the EU beef carcass classification scale to a numerical scheme as shown below:

Conformation:	> Improving Conformation >						
EU System	P+	-O	O+	R	-U	U+	E
Harper Adams System	1	2	3	4	5	6	7
Fat Class:	> Increasing Fatness >						
EU System	1	2	3	4L	4H	5L	5H
Harper Adams System	1	2	3	4	5	6	7

## Appendix 3:

### Standardised carcass prices (£/kg) for bulls for carcasses weighing 270-400kg

Conformation class	£/kg @ fat class 3 & 4L
R	3.45
O+	3.35
-O	3.20
Carcass wt 260-270kg	-2p/kg
Carcass wt 250-260kg	-4p/kg

(Source: ABP)