Effect of Maxammon grain treatment on performance of finishing beef cattle.

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INTRODUCTION

Feed is a major cost and an important contributor to the environmental impact of beef production. An improvement in feed efficiency should result in higher margins and lower environmental impact per unit of production. Diets that are predominantly composed of cereal grains have a relatively higher risk of acidosis than diets based on forage and might lead to clinical disorders and impaired production. Harbro Limited's Maxammon process was developed to preserve cereal crops harvested with high moisture content and involves treatment with urea and enzyme to produce ammonia, which increases pH to approximately 9.0 and simultaneously increases the crude protein content.

A study was carried out on a commercial beef finisher unit to compare the production performance and incidence of diarrhoea in cattle finished on a Maxammon treated barley diet with a propionate treated barley (Prograin) diet, which was routinely used on the farm in the past.

MATERIALS & METHODS

The study was carried out on a 600 acre beef breeder and finisher unit with approximately 900 cattle in Aberdeenshire, North East Scotland. Barley was harvested from the farm and formed the basis of the finishing ration fed to store cattle that comprised a mix of on-farm bred cattle and cattle purchased from local sales. In this study, 217 continental crossbreed steers (predominantly Limousin and Charolais) with an average weight of 481.5 kg (SD = 37.9 kg) were housed in a shed and allocated to 4 pens on the basis of weight and breed to ensure equal weights and breed representation in each group. After allocation to groups on 27/07/2017, three transition diets were fed to all animals. The first animals were sold after 83 days and the last animals to be sold were removed after 125 days on feed. Average duration of the feeding period was 114 days (SD = 10 days).

The diets, including the transition rations, are in Table 1 and were formulated to ensure that the two treatment groups received similar amounts of protein, meaning that the Maxammon diets received a lower allocation of pot ale syrup. All animals received the same allocation of minerals, Yea-Sacc (Alltech) and RumiTech (essential oils – Harbro). Group 1 and Group 2 (62 and 31 animals respectively) were fed a diet based on Maxammon treated barley harvested on-farm (15 kg urea and 5 kg Maxammon/tonne of barley treated). Groups 3 and 4 (both with 62 animals) were fed a diet based on barley harvested on-farm and preserved with propionic acid (Prograin). Prograin inclusion rates varied according to moisture content of the cereal, which ranged from 17.81 to 20.98% in this study. Hence, Prograin inclusion ranged according to the recommendations of the supplier from 6.5 to 7.5 litres/tonne. All dietary components were analysed by NIR.

Animals were weighed when housed, on the 8th week of the feeding period and when sent for slaughter. On 6 occasions, approximately every three weeks through the feeding period, 10 faecal pats were randomly selected (5 faecal pats for the small pen with 31 animals), generating a total of 95 samples from pens of cattle fed with Maxammon and 120 from the animals fed on Prograin. Faeces was scored for diarrhoea from 1 to 5, 1 being very dry forming a pile of more than 50 mm high, and 5 being moist to liquid with blood or mucus. Samples were randomly selected: the researcher walked along two standard transects across each pen and selected the first 10 (or 5) faecal pats encountered on that transect.

Data were analysed using R (R Core Team, 2016). Effect of treatment on continuous response variables was tested using analysis of variance (with pen as the experimental unit) and categorical variables were tested by Chi square test of proportions. A threshold level of 1.2 kg/day for average daily liveweight gain was arbitrarily selected in consultation with the farmer and other local farmers on the basis that a value below this would be considered to be an unsatisfactory level of performance.

RESULTS

Table 2 shows selected results from the study. Feed conversion ratio was lower in the Maxammon groups than in Prograin fed animals ($p < 0.05$). Proportion of animals with a daily liveweight gain lower than 1.2 kg/day was higher in Prograin fed animals ($p < 0.05$). Proportion of animals with diarrhoea (faecal score of 3 or 4 or 5) was higher in the Prograin fed group ($p < 0.05$).

CONCLUSIONS

The animals fed the diet based on Maxammon treated barley showed more efficient production performance than the animals on the Prograin diet. The Maxammon diet also led to a lower incidence of diarrhoea than the Prograin group and a smaller proportion of animals failing to meet the target specifications.

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Table 1: Rations and nutritional composition of the diets fed to cattle on the trial.

	Maxammon				Prograin			
Component (kg/head as fed)	27-31 Jul	1-5 Aug	6-14 Aug	Final diet	27-31 Jul	1-3 Aug	4-7 Aug	Final diet
Pot ale syrup	1.75	-	-	-	3.25	2.89	2.53	3.45
Molasses	-	0.9	0.87	0.96	-	-	-	-
Straw	1.83	2.19	0.86	0.58	1.81	1.08	0.72	0.50
Prograin Barley	-	-	-	-	5.06	6.14	7.59	11.33
Maxammon Barley	6.37	7.7	9.58	13.14	-	-	-	-
Grampian Beefmax Minerals + Rumitech +Yea-Sacc	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Total as fed (kg)	10.08	10.92	11.44	14.81	10.25	10.24	10.97	15.41
DMI (kg)	7.8	9.0	9.4	12.2	7.1	7.2	7.9	11.1
Nutrient (% of DM)								
Dry matter	77.2	82.7	82.4	82.4	69.7	70.4	71.9	71.9
CP	13.4	10.9	12.3	12.8	13.2	13.3	13	13.3
NDF	29.1	30.1	22.1	16.3	30.4	25.8	23.7	21.6
Oil	2.3	2.4	2.6	1.7	2	2.2	2.4	2.5
Starch	33.5	34.8	41.5	43.1	23.3	27.9	31.4	33.4
Sugar	1.7	3.9	3.8	3.5	2.8	3	3.1	3.2
Na	0.26	0.24	0.22	0.18	0.28	0.26	0.24	0.18
K	0.89	0.89	0.76	0.71	1.04	0.92	0.81	0.77
Ca	0.57	0.54	0.48	0.39	0.63	0.60	0.53	0.41
Mg	0.15	0.12	0.13	0.12	0.21	0.21	0.19	0.19
Cl	0.50	0.54	0.48	0.40	0.52	0.49	0.43	0.33
P	0.45	0.27	0.30	0.31	0.66	0.65	0.61	0.60
S	0.22	0.19	0.18	0.18	0.28	0.26	0.24	0.23

Table 2: Average daily gain, liveweight, proportion of animals below 1.2 kg daily gain and proportion of animals with diarrhoea (score ≥ 3/5 and ≥4/5). The on-feed average daily liveweight gain (ADLWG) and final weight (LW) data were obtained for individual animals and presented here as mean values of the means of two pens subjected to each treatment. The mean feed conversion ratio (FCR) was derived from individual level live weights and pen level feed intakes and are presented as the pen means for each treatment. The p values presented here for ADLWG, LW and FCR are derived from t tests applied to pen means with Diet as the explanatory variable

Variable	Prograin	Maxammon	
Performance measures	(n = 122 animals)	(n = 92 animals)	*P*-value
Mean on-feed average daily liveweight gain (ADLWG, kg/d ± sd)	1.65 ± 0.42	1.82 ± 0.29	0.25
Mean final weight (LW) (kg ± sd)	649 ± 57	665 ± 57	0.22
Mean feed conversion ratio (FCR) (kg DM feed/kg liveweight gain)	8.02 ± 2.0	7.13 ± 1.3	0.042
Count ADLWG ≤ 1.2 kg/d	14/122 (12%)	2/92 (2%)	0.01244
Faecal observations	**(n=120 samples)**	**(n = 95 samples)**	
Count with faeces ≥3	44/120 (37%)	17/95(18%)	0.00398
Count with faeces ≥4	21/120 (18%)	3/95(3%)	0.00195