

# The effect of fermented whole crop cereal species on botanical composition, chemical composition, *in vivo* digestibility and liveweight change in sheep.

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**Introduction** In the wetter parts of the UK where maize production is marginal, whole crop cereals can be used to boost milk yield from home grown forages, and thereby maintain profitability in the current climate of falling milk prices. In spite of the fact that barley and oat production are more suited to such wetter, marginal areas of the UK (Lockhart and Wiseman, 1978), most of the nutritional studies on whole crop cereals have been conducted on wheat. In Denmark which has a more established tradition of producing whole crop cereals, barley is the cereal of choice (Kristensen, 1992). This study therefore evaluated the chemical composition, *in vivo* digestibility and animal performance from fermented whole crop barley (WCB) and whole crop oats (WCO) to determine their potential as winter feeds in marginal areas of the UK.

**Materials and methods** Spring crops of barley (cv. Hart) and oats (cv. Dula) were harvested at 470 g dry matter (DM)/kg (growth stage 83; Zadoks *et al.*, 1979) to optimise DM yield and seed coat suppleness. The forages were conserved in round bales without treatment and the resulting whole crop silages were analysed for DM, pH, ash, crude protein (CP), ammonia nitrogen (NH<sub>3</sub>N), water soluble carbohydrates (WSC), starch and neutral detergent fibre (NDF). Four individually penned, Texel cross lambs (mean initial liveweight 35 kg) were randomly allocated to each forage in a completely randomised design. The lambs were fed at the estimated maintenance level (15 g DM/kg live weight daily; AFRC, 1993) and digestibility *in vivo* was measured for ten days following ten days of adaptation. The live weight of the lambs was also measured on the first, tenth and twentieth day of the trial.

**Results and discussion** The grain to straw ratios of the WCB and WCO were 0.53:0.47 and 0.50:0.50 respectively while the pH values were 5.3 and 5.1. The remaining analytical results are shown in Table 1. There were no significant differences between the ash and DM contents of the forages but WCB had higher (P<0.05) CP, WSC and starch contents and a lower (P<0.05) NDF content. Starch digestibility was consistently high and did not differ with forage type (Table 2). However, metabolisable energy (ME) and digestibility of organic matter (OM), DM and digestible OM were significantly (P<0.05) higher in WCB. There were no significant effects of cereal species on liveweight loss in the lambs. Though the digestibility and ME values obtained for the barley were disappointing, they are similar to values (ME = 8.4 MJ/kg DM; DOMD = 588) found by Adesogan *et al.*, (1998) for whole crop wheat (WCW) harvested at a similar maturity stage (492 g DM/kg). The poorer nutritive quality of the WCO is mainly due to the relatively high cell wall content, as indicated by the grain to straw ratio and NDF content. In general, these results agree with findings in Canada where the *in vivo* digestibility of different WCO varieties was found to be lower than in WCB and WCW (Christensen, *et al.*, 1977).

**Table 1** The chemical composition of whole crop oats and whole crop barley (g/kg DM)

	DM (g/kg)	Ash	CP	WSC	Starch	NDF	NH <sub>3</sub> N
WCB	452.6	45.2	79.6	18	342.0	532.0	100.4
WCO	464.3	41.5	49.0	11	148.0	682.0	59.2
SED	14.37	4.33	6.37	2.16	23.00	54.8	3.30
Sig	*	*	***	*	***	*	***

**Table 2** The effect of cereal species on *in vivo* digestibility and liveweight change of lambs fed whole crop cereals

	Digestibility coefficients			DOMD <sup>1</sup> (g/kg DM)	ME <sup>2</sup> (MJ/kg DM)	Liveweight (kg)		Liveweight change (kg /d)
	Starch	OM	DM			Initial 1	Final	
WCB	0.942	0.519	0.477	499	8.47	35.4	32.8	-0.128
WCO	0.853	0.378	0.344	366	6.22	36.0	34.1	-0.078
SED	0.007	0.047	0.053	46.1	0.784	2.44	1.68	0.085
Sig	***	*	*	**	**	NS	NS	NS

<sup>1</sup> Digestible organic matter content

<sup>2</sup> Predicted using the equation  $ME = 0.017 \times DOMD$  (Adesogan *et al.*, 1998)

**Conclusions** This study shows that the nutritive quality of WCB is superior to that of WCO but similar to that of WCW (in other studies) when the forages are harvested at the early dough stage of grain ripeness (growth stage 83). Thus in the marginal areas of the UK which are more suited to barley production, the conservation of WCB instead of WCW is advisable when the target maturity at harvest is the early dough stage. Future work should investigate the potential of naked oats as a whole crop and the applicability of these findings to whole crop cereals harvested at other maturity stages.

**References** Adesogan, A.T., Givens, D.I. and Owen, E., 1998. The chemical composition, digestibility and energy value of fermented and urea-treated whole crop wheat harvested at three stages of maturity. *Grass Forage Science* **53**:66-75.

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