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NUTRIENT AVAILABILITY AND PERFORMANCE OF BROILERS FED CULTIVARS OF MARITIME CANADIAN WHEAT

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Introduction

In Nova Scotia, corn is the main cereal used as an energy source in poultry rations, but wheat is sometimes more economical to feed than corn. Wheat is a valuable source of feed energy for chickens**,** and published sources provide estimates of the Apparent Metabolizable Energy (AME) that it contains. The AME of wheat is variable and is dependent on both cultivar and the environment in which it is grown, and wheat may contain deleterious levels of soluble non-starch polysaccharides (NSP). When exogenous enzymes are not provided for their digestion, NSP become soluble in the gastrointestinal tract of broilers and result in sticky droppings, reduced uptake of nutrients, and decreased weight gain (Bedford 1995).

Wheat cultivars are highly variable in their AME content. Scott et al. (1998b) reported that the AME of nine Western Canadian cultivars grown in three locations ranged from 3280 to 3650 kcal kg^{-1} DM, and that xylanase supplementation of diets containing these wheat samples improved the AME and performance of the chickens and reduced the variability between wheat samples. Supplementing the diet with xylanase enzymes can improve the growth performance of broilers fed wheat-containing diets. Bedford (1994) found that addition of xylanases to wheat/triticale based diets resulted in an improvement in weight gain and FCR of broiler chicks. Enzyme addition to low ME wheat based diets can improve performance to a level equal to that of birds fed a corn-based control diet.

The AME of wheat cultivars grown in the Maritime provinces of Canada has not been studied. The objective of this study was to examine variation in feeding value and the need for feed enzymes for cultivars of wheat grown in two crop years in the Maritimes of Canada.

Trials

Four hard red spring wheat cultivars (Belvedere, Glenlea, Norboro, and Walton) were grown at the Crops and Livestock Research Centre in Charlottetown, PEI in each of 2000 and 2001. For each year, a sample of hard red spring (Katepwa) wheat was obtained rom Western Canada and a sample of corn was obtained from local sources.

Broiler Chick Bioassay

The bioassays followed procedures similar to those described by Scott et al. (1998a). Half of the diets included a commercial enzyme (AVIZYME® 1302, supplied by Danisco Animal Nutrition). The five wheat samples, each with and without enzyme, represented a total of 10diets(Table1).

Table 1. Diet Composition

Ingredient (%)	Bioassay		Starter Diets		Grower Diets	
	Yr. 1	Yr. 2	Wheat	Corn	Wheat	Corn
Cereal	80	80	54.3	51.4	62.1	58.7
Isolated Soy Protein	13.8	13.9	1.55	0.00	1.60	0.00
SBM	0.00	0.00	34.0	40.2	24.6	32.7
Poultry Fat	1.00	1.00	5.37	3.78	6.35	4.38
Corn Gluten Meal	1.21	0.99	1.06	0.00	1.07	0.00
Dical. Phosphate	0.00	0.31	6.65	1.12	7.43	0.97
Vit/Min Premix	0.50	0.50	6.50	0.50	7.50	0.50
Enzyme	0.05	0.05	0.05	0.05	0.05	0.05

Growth Trial

For the growth trials, diets containing the Maritime cultivars or corn obtained from local sources were fed to a total of 720 male broilers (Starbro x Arbor Acres) with or without enzyme supplementation (Table 1). Half of the wheat diets included a commercial enzyme (AVIZYME® 1302) while one of the corn diets contained AVIZYME® 1502, both supplied by Danisco Animal Nutrition.

Results

Broiler Chick Bioassay

Wheat cultivar, enzyme and crop year were all significant for AME at 7d (Table 2). Glenlea yielded the highest AME but was not significantly different from Belvedere, Walton, and Katepwa. Diets containing Glenlea wheat consistently had the highest AME values in the present study. This was possibly related to its low *in vitro* viscosity in both crop years (Table 2), because the increase in viscosity from feeding wheat high in NSP reduces nutrient availability in poultry. The AME was improved with addition of supplemental xylanase/protease enzyme mixture to the diet.

Wheat cultivar, year, and their interaction were significant for AME at 16d (Table 3). The significant effect of the wheat cultivar on the measures of AME was expected because other studies have reported significant variation in AME among wheat cultivars. Digestible crude protein

(DCP) at 16d was affected by both wheat cultivar and enzyme supplementation (Table 3). Norboro, Glenlea, and Belvedere yielded the highest values. Enzyme supplementation improved DCP.

Table 2. *In vitro* Viscosity (centipoise, cP)[z] of Wheat Samples Used in the Experimental Diets

Cultivars	Year 1 (cP)	Year 2 (cP)
Belvedere	10.20	5.23
Glenlea	5.05	4.58
Norboro	6.50	6.07
Walton	7.35	6.99
Katepwa	17.95	9.62

[z] Determined by Danisco Animal Nutrition

Table 3. The AME and DCP of Excreta Samples

Cultivar	d7 AME Kcal/kg	d16 AME Kcal/kg	d7 DCP %	d16 DCP %
Belveder	3017*a*	3189*c*	55.0*a*	58.3*a*
Glenlea	3088*a*	3449*a*	53.7*ab*	58.3*a*
Norboro	2742*b*	3306*abc*	50.8*bc*	58.4*a*
Walton	2964*ab*	3265*bc*	50.5*bc*	53.9*b*
Katepwa	3067*a*	3354*ab*	49.6*c*	54.2*b*
Enzyme				
+	3037*a*	3358	54.6*a*	58.7*a*
-	2911*b*	3268	49.2*b*	54.6*b*
Year				
2001	3284*a*	3475*a*	57.6*a*	56.2
2002	2658*b*	3151*b*	49.2*b*	57.1

a-c Means in a column within the main effects followed by no common letter are significantly different at $P \leq 0.05$

Growth Trial

Crop year and the diet by crop year interaction were both significant for starter BWG (Table 4). Norboro wheat with enzyme had the highest starter BWG during the first year but was not different from Walton and Glenlea. Among the diets fed in the second crop year with enzyme, corn and Glenlea gave the highest BWG. During the grower period diet and the crop year, and their interaction were all significant for BWG (Table 4). Among diets fed in the first year without enzyme supplementation, the highest BWG occurred when broilers were fed diets containing Walton, Norboro, and Glenlea wheats or corn and the lowest when they were fed Belvedere wheat. Results of the present study suggested that enzyme supplementation was not needed to achieve ideal growth performance when these Maritime-grown wheat cultivars were included in broiler diets, and it was actually detrimental in diets containing Walton wheat. However, previous studies have reported improvements in body weight gain when xylanases were included in wheat-based diets (Bedford 1994).

The diet had no effect on the starter FCR, which also indicated that enzyme supplementation had no effect on FCR (Table 5). The grower FCR was significantly affected by the diet and crop year (Table 5). Diets containing Belvedere wheat both with and without enzyme and Norboro wheat without enzyme had the highest FCR values. During the grower period, enzyme supplementation significantly lowered the FCR when diets containing Norboro wheat were fed.

The diet had no significant effect on the feed intake (FI) of broilers during the starter period, which indicates that there also was no significant effect of enzyme supplementation (Table 5). The general lack of response to enzyme for growth performance variables may be related to the relatively low viscosity values since poor wheats tend to have greater responses to enzyme.

Table 4. Starter and Grower BWG

Grain	Enzyme	Year	Starter BWG (g/bird)	Grower BWG (g/bird)
Belvedere	+	1	319*c*	560*def*
Belvedere	+	2	274*efgh*	515*gh*
Belvedere	-	1	330*bc*	574*cde*
Belvedere	-	2	265*gh*	518*fgh*
Glenlea	+	1	338*ab*	635*a*
Glenlea	+	2	286*de*	539*efg*
Glenlea	-	1	332*abc*	611*abc*
Glenlea	-	2	282*defg*	540*efg*
Norboro	+	1	350*a*	646*a*
Norboro	+	2	268*fgh*	528*fgh*
Norboro	-	1	343*ab*	619*ab*
Norboro	-	2	277*defgh*	551*defg*
Walton	+	1	339*ab*	627*ab*
Walton	+	2	262*h*	488*h*
Walton	-	1	335*abc*	635*a*
Walton	-	2	284*def*	544*defg*
Corn	+	1	327*bc*	607*abc*
Corn	+	2	292*d*	607*abc*
Corn	-	1	342*ab*	623*ab*
Corn	-	2	279*defgh*	586*bcd*

a-h Means in a column within the main effects followed by no common letter are significantly different at $P \leq 0.05$

Table 5. Starter and Grower FCR and FI

Grain	Enzyme	Starter FCR	Grower FCR	Starter FI g/bird/d	Grower FI g/bird/d
Belveder	+	1.40	1.82*abc*	29.2	88.4*d*
Belveder	-	1.52	1.90*a*	32.3	93.8*abc*
Glenlea	+	1.35	1.70*d*	30.0	89.6*cd*
Glenlea	-	1.44	1.73*cd*	31.5	91.3*bcd*
Norboro	+	1.37	1.73*cd*	29.9	90.6*bcd*
Norboro	-	1.41	1.86*ab*	31.0	97.6*a*
Walton	+	1.43	1.74*cd*	31.3	87.2*d*
Walton	-	1.35	1.72*cd*	29.6	90.4*cd*
Corn	+	1.43	1.76*bcd*	31.8	95.4*ab*
Corn	-	1.41	1.79*bcd*	31.1	96.7*a*

a-d Means in a column within the main effects followed by no common letter are significantly different at $P \leq 0.05$

Conclusions

The Maritime wheat cultivars were equal or compared favourably to both Western wheat and locally obtained corn. In this study, enzyme supplementation had a beneficial effect on AME and DCP that was generally not seen in performance. Locally grown wheat appears to be a viable alternative to corn for Maritime broiler producers, particularly when wheat prices make it more economical to feed than corn.

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