APRI FACTS

Atlantic Poultry Research Institute

PO Box 550
Truro, NS B2N 5E3
CANADA

Tel: (902) 893-6657
Fax: (902) 895-6734

apri@nsac.ns.ca
http://www.nsac.ns.ca/apri

FACTSHEET #21
August 2004

THE EFFECT OF WHEAT CULTIVAR AND ENZYME SUPPLEMENTATION ON NUTRIENT AVAILABILITY AND PERFORMANCE OF LAYING HENS

J.L. Rafuse[1], K.L. Budgell[1], F.G. Silversides[1,2]

[1] Nova Scotia Agricultural College, [2] Agriculture and Agri-Food Canada

---

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. There is no information in the literature on the AME (apparent metabolizable energy) of wheat cultivars grown in the Maritime provinces of Canada when fed to laying hens. The feeding value of wheat is influenced by the content of soluble non-starch polysaccharides (NSP), which depends on the cultivar and the environment of cultivation. Enzymes that break down NSP can improve the AME content of broiler diets but the negative effects of NSP and response to enzyme lessen as birds age.

The objective of this study was to examine the effect of four Maritime-grown wheat cultivars and dietary enzyme supplementation on nutrient availability and performance of laying hens and to compare these values to those obtained using a corn-based diet.

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 2001. *In vitro* viscosity of the wheat samples were analyzed. A control sample of corn was obtained from local sources. This and the wheat were fed in diets with or without enzyme supplementation (a total of 10 diets) to 240 Babcock B300 laying hens. Hens were fed a standard layer diet (formulated to contain 2860 kcal kg^{-1} AME, 18.0 % crude protein, and 3.85% calcium) from age 29 to 31 weeks. The major ingredients in this diet were 40.9% corn, 24.8% soybean meal, and 20.0% wheat and no enzymes were included. From 31 to 34 weeks of age, hens consumed a wheat/soybean meal or a corn/soybean meal based control diet (Table 1). Half of the diets included a commercial xylanase (AVIZYME® 1302, supplied by Danisco Animal Nutrition, Marlborough, Wiltshire, UK) to digest NSP in wheat. One of the corn diets contained a commercial enzyme

(AVIZYME® 1502) designed to improve low-viscosity grains.

Egg production was recorded for 2 weeks prior to the provision of the experimental diets and during the 3 weeks of feeding experimental diets. Hen-day production of good eggs, double-yolked, soft shell, and cracked eggs was calculated. Egg quality was assessed once prior to feeding the experimental diets and on Day 21 of the trial. Egg weight, yolk weight, shell weight, and albumen height and weight were recorded. Individual hen body weights were measured on day 0, 7, 14, and 21 of the trial, and feed consumption was recorded on a weekly basis. Egg weights were also measured on one day per week to allow calculation of the FCR (grams of feed per gram of egg). Excreta samples were collected 17 days after initiation of the dietary treatments to allow calculation of the AME and the digestibility of crude protein of the diets.

Table 1. Composition of Experimental Layer Diets

Ingredients (% as fed)	Wheat Diets	Corn Diets
Cereal[z]	60.95	56.06
SBM	21.91	28.91
Poultry Fat	5.23	2.82
Limestone	6.60	6.48
Oyster Shell	3.30	3.24
Dical. Phosphate	0.63	1.14
Vit/Min Premix	0.50	0.50
Iodized Salt	0.30	0.29
DL-Meth.	0.09	0.05
Celite®	0.50	0.50
Enzyme	0.05	0.04

[z]Wheat cultivars used were: Glenlea, Norboro, Walton, or Belvedere.

Xylanase activity of wheat-based diets, amylase activity of the corn diets, and *in vitro* viscosity of the wheat samples were measured by Danisco Animal Nutrition (Marlborough, Wiltshire, UK).

Results

In vitro Viscosity

The *in vitro* viscosities of the wheat samples were not highly variable (Table 2). Bedford (2003) reported that the range of viscosity for wheats is from 3 to 20 centipoise (cP), so these wheats appeared to be low viscosity with an average value of 5.72 cP.

Table 2. *In vitro* Viscosity (Centipoise, cP)[z] of Wheat Samples

Cultivar	Viscosity (cP)
Belvedere	5.23
Glenlea	4.58
Norboro	6.07
Walton	6.99

[z] Determined by Danisco Animal Nutrition

AME and CP of Wheat-based Diets

The diet significantly affected both AME and digestibility of CP (Table 3), despite being formulated to have the same AME. The highest AME values occurred when hens were fed Norboro wheat with and without enzyme, and Glenlea, Walton, and Belvedere wheat without enzyme. This was also true for the digestibility of CP, which is similar to that reported by Jaroni et al. (1999).

Xylanase supplementation decreased ($P \leq 0.05$) the AME and digestibility of CP when hens were fed diets containing Belvedere, Glenlea, and Walton wheats but had no effect on those containing Norboro wheat. It would be expected that the hens in this trial would be better able to digest diets high in NSP than broilers, however the reduction in AME and digestibility of crude protein with enzyme supplementation conflicts with other studies that reported improvements in AME (Pan et al. 1998) and digestibility of crude protein (Jaroni et al. 1999).

Enzyme Supplementation of Corn-Based Diets

An enzyme mixture containing xylanase, protease, and amylase activities significantly improved the digestibility of AME and CP of corn based diets. This is similar to the results of previous studies with broilers (Zanella et al. 1999). These authors found that the enzyme supplementation improved the overall digestibility of CP but the improvement was not the same for all amino acids. Use of the enzyme also allowed a reduction in the energy formulation of the diets.

Table 3. AME and DCP of Day 17 Excreta Samples

Grain	Enzyme	AME (kcal kg^{-1})	DCP (%)
Belvedere	+	3127*dc*	31.5*de*
Belvedere	-	3321*ab*	47.3*a*
Glenlea	+	3075*d*	22.2*f*
Glenlea	-	3362*a*	40.5*abc*
Norboro	+	3379*a*	47.9*a*
Norboro	-	3379*a*	47.2*a*
Walton	+	3164*cd*	34.7*cde*
Walton	-	3422*a*	46.5*ab*
Corn	+	3220*bc*	38.4*bcd*
Corn	-	3080*d*	29.4*ef*

a-f Means within the same column with different letters ard significantly different (P≤0.05)

Body Weight, FI, FCR, Egg Production and Quality

The diet had no significant effect on body weight change over the course of the 3 week trial. However, the week significantly affected both FI and FCR (Table 4). The highest FI occurred during the first week and the lowest during the third week. Layers reduce their feed intake when fed high energy rations (Grobas et al. 1999) possibly explaining the reduction in feed intake over the course of the trial. Hen-day egg production of good eggs was significantly affected by week (Table 4). Hen-day egg production was highest during the third week and lowest during the second week. The high egg production combined with the lower FI in the third week would have reduced the FCR. Hens fed corn-based diets appeared to produce more double-yolked eggs than those fed wheat-based diets, with no clear explanation. Diet had no significant effect on egg weight, yolk weight, shell weight, or albumen height and weight.

Table 4. FI, FCR, and Egg Production Data (hen-day%) from hens fed experimental diets

Grain - +/-enzyme	FI - g/bird /d	FCR	Good eggs (hen-d%)	Double yolked (hen-d%)
Belvedere(+)	114	1.98	94.6	1.4*abc*
Belvedere(-)	114	2.05	91.7	0.8*bcd*
Glenlea (+)	116	2.03	94.0	0.8*bcd*
Glenlea (-)	112	1.97	92.7	0.4*cd*
Norboro (+)	116	2.12	89.5	0.8*bcd*
Norboro (-)	112	1.96	92.7	0.2*cd*
Walton (+)	111	1.95	94.8	0.2*cd*
Walton (-)	112	1.89	94.4	0.0*d*
Corn (+)	112	1.99	91.7	2.0*ab*
Corn (-)	114	1.97	92.1	2.4*a*

a-d Means within the same column with different letters are significantly different (P≤0.05)

Conclusions

The wheat cultivar influenced the AME and digestibility of CP when these diets were fed to laying hens. It is unclear why enzyme supplementation reduced the AME and digestibility of CP for diets containing three of the four wheat cultivars, but the significant improvement with enzyme supplementation of the corn based diet is promising.

References

Bedford, M.R. 2003. Proceedings of Atlantic Poultry Conference, Moncton, N.B. February 13-14.

Grobas, S., Mendez, J., deBlas, C. and Mateos, G.G. 1999. Poult. Sci. 78: 1542-1551.

Jaroni, D., Scheideler, S.E., Beck, M. M. and Wyatt, C. 1999. Poult. Sci. 78: 1664-1674.

Pan, C.F., Igbasan, F.A., Guenter, W. and Marquardt, R.R. 1998. Poult. Sci. 77: 83-89.

Zanella, I., Sakomura, N.K., Silversides, F.G., Fiqueirdo, A. and Pack, M. 1999. Poult. Sci. 78: 561-568.

For more information on this project contact Fred Silversides at: silversidesf@agr.gc.ca

Funding Sources:
- Agriculture and Agri-Food Canada
- Agri-Focus 2000
- Danisco Animal Nutrition