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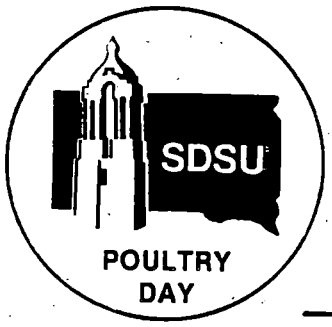

SOME EFFECTS OF ENZYME SUPPLEMENTATION AND VARIOUS WHEAT BRAN LEVELS IN A BROILER DIET ON APPARENT DIGESTIBILITY

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It is generally recognized that birds do not have an enzyme in their digestive fluid which digests cellulose. However, cellulosic materials are major renewable resources available in large quantities which need to be properly utilized to help meet our needs for energy, chemicals, food and feed for a long-range solution. A variety of lignocellulosic materials containing acid-detergent fibers are available and microorganisms capable of degrading either one or more of the three main constituents, viz., cellulose, hemicelluose and lignin, have been studied. A further variety of strategies are being explored, including thermal methods of degradation such as pyrolysis or biological methods such as enzymatic hydrolysis and fermentation.

In this experiment, 3-week-old, broiler-type chicks were assigned to 24 groups of 10 chicks each for two replicates of 12 treatments. A completely randomized experiment with a 4 x 3 x 2 factorial arrangement involved feeding 0, 10 or 20% wheat bran or 20% wheat bran plus an enzyme. The birds were housed in electrically heated batteries with raised wire floors. Feed and water were supplied ad libitum. The wheat bran was defatted and the enzyme was an .008% culture filtrate of Trichoderma Viride obtained as a commercial T. Viride enzyme product (Boerhinger, Mannheim, Gmn H, West Germany). The enzyme supplementation to the diet was as a dry preparation. After a 5-week experimental period without a marker, the four diets were supplemented with 1% chromic oxide and fed for 96 hours. At the end of 4 days, the feed was removed and birds were randomly selected for slaughter at 2, 4 or 8 hours after feed removal. Feces were collected three times daily at 2, 4 and 8 hours after feeding.

The entire gastrointestinal tract (GIT) was removed and ligated to form five compartments, the gizzard, the proximal small intestine which is the duodenum and jejunum, the distal small intestine which is the ileum and the cecum and the rectum. The digesta from each compartment was removed for analyses and immediately weighed, placed in aluminum pans and freeze dried. The dried samples were ground using a 1 mm mesh Udy mill. Samples of dried feed, feces and gastrointestinal contents were stored in air-tight glass bottles until analyzed. Nitrogen was determined in all samples by the standard Kjeldahl procedure, chromic oxide by the method of Dansky and Hill (1952) and neutral detergent fiber (cell wall), acid-detergent fiber, cellulose, hemicellulose and lignin by the methods of Goering and VanSoest (1970).

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Chicks fed diets containing 20% wheat bran plus the enzyme had significantly less moisture and more ash in their feces than birds receiving 20% wheat bran without the enzyme ($P<0.05$, Table 1). This increased ash content indicated improved feed utilization. Effects of the enzyme on dry matter content of digesta in each segment were nonsignificant, but the dry matter tended to be higher for the enzyme supplemented chicks than for those without enzyme supplementation. Apparent digestibilities of dry matter, cell wall, acid-detergent fiber and cellulose were higher for the group fed 20% wheat bran with enzyme in the diet than for those given the 20% wheat bran without enzyme (Table 2).

The degradation of crystalline cellulose is a complex process requiring the activity of many enzymes. At least three different enzymes of the multicomponent cellulose system are involved. Cellobiohydrolase, endo-glucanase and B-glucosidase, which Selby and Mailtand (1967) isolated from the culture of T. Viride using Sephadex and ion exchange chromatography, are involved in the degradation of crystalline cellulose into glucose (Bisaria and Ghose, 1981).

Further details need to be worked out, but this work indicates that enzyme additions to high fiber feeds for poultry show promise for the future.

Table 1. Ash Content (% of Dry Matter) and Dry Matter (DM) Content of Digesta in Each Segment and Feces of Chicks Fed 0, 10, 20 or 20% Wheat Bran Plus Enzyme

Diet	Gizzard		Small intestine: Proximal		Small intestine: Distal		Cecum		Rectum		Feces	
	DM %	Ash %	DM %	Ash %	DM %	Ash %	DM %	Ash %	DM %	Ash %	DM %	Ash %
Basal	38.1	4.5	19.9	9.9	18.0	13.3	16.5	12.7	16.8^{a}	21.8^{a}	22.2^{a}	21.9^{a}
10% wheat bran	35.5	4.4	18.1	9.0	17.5	12.0	16.0	12.8	16.5^{a}	19.4^{b}	21.5^{b}	20.0^{a}
20% wheat bran	34.5	5.0	18.1	8.3	16.8	11.9	15.4	13.1	14.4^{b}	17.6^{c}	18.3^{c}	18.6^{b}
20% wheat bran plus enzyme	33.6	4.4	18.9	8.9	17.6	12.3	15.6	13.1	16.6^{a}	20.1^{b}	21.9^{ab}	20.7^{a}

^{a,b,c} Means with different superscripts are significantly different ($P<0.05$).

Table 2. Effects of Level of Dietary Wheat Bran on Apparent Digestibility of Dry Matter, Cell Wall, Acid-detergent Fiber, Hemicellulose, Cellulose and Nitrogen in Chicks

	Diet - % Wheat Bran			
Diet component	0	10	20	20 + enzyme
Dry matter	75.76[a]	70.77[b]	64.82[c]	67.03[c]
Cell wall	61.34[a]	43.84[b]	37.15[d]	40.16[c]
Acid-detergent fiber	53.55[a]	33.24[b]	16.19[d]	20.66[c]
Hemicellulose	67.47[a]	58.14[b]	55.75[bc]	54.57[c]
Cellulose	57.47[a]	38.01[b]	25.58[d]	30.30[c]
Nitrogen	62.27[a]	57.30[a]	58.64[a]	59.21[a]

[a,b,c,d] Means within the same row and within the same criterion without a common superscript are significantly different ($P<0.05$).