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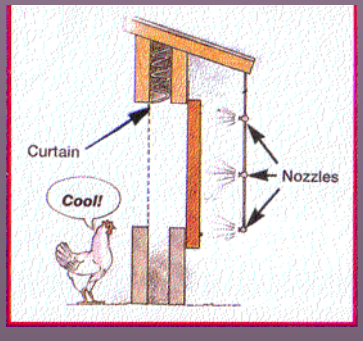
POULTRY CONSUMPTION; NO END IN SIGHT

MULE ARE SOMETIMES PREFERRED OVER PUREBIRDS



DO FOGGING-PAD COOLERS IMPROVE CLIMATE CONTROL?

IMPLICATIONS OF WHEAT QUALITY AND VARIABILITY FOR FEEDING BROILERS

Significant differences in the feeding value of cereal feedstuffs exist as a result of low starch, the presence of Non-Starch Polysaccharides (NSP), unidentified growth factors (suppressers) and feed processing (e.g. pelleting, extruding, expanding, etc.) methods.

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Variability in the feeding value of cereals is difficult to quantify and must be separated from the variability due to differences between and within the animals we feed (i.e. age, sex and strain effects). Currently, PARC in Agassiz is using a broiler chick bioassay to identify energy availability from cereals and classify the bird's adaptability to each feedstuff. These same samples are being used to validate lab-bench procedures being studied in other laboratories, capable of providing fast, reliable estimates of the feeding value of cereals.

Identify small differences

The Agassiz AME (Available Metabolic Energy) chick bioassay is designed to accurately identify small differences in energy between ingredients and to provide an explanation for this difference. In order to do this, each cereal is tested with and without enzyme supplementation, in broilers at two different ages, and by measuring digestibility utilising both excreta and ileal samples. There are a number of factors which distinguish the Agassiz AME chick bioassay from the previously used TME (Total Metabolic Energy) procedure and other AME procedures (Table 1). Specifically, the Agassiz AME chick bioassay “employs" young male broiler birds, identical to those being fed by the feed industry. The birds are fed a “balanced" test diet (Table 2) over a two-week period (4 to 17 d of age), during which feed intake and growth rate are measured. An extended feeding period enables young broiler chicks an opportunity to make physiological and anatomical adaptation (e.g. respond to gut capacity limits by increasing gut size, motility, gut absorption capacity, eating pattern).

Identification of feeding value differences in cereals, with procedures designed along practical feeding conventions, will permit validation of lab-bench procedures (e.g. Near Infra-Red Spectrometer (NIR), carbohydrate profiling, etc.). Arguments continue with regard to correction for endogenous plus metabolic energy losses (AME vs. TME). It was concluded that if a feedstuff promotes a loss of endogenous excretion then this should be "charged' to the feed as reduced AME and not to the bird.

Furthermore, AME measurements are more meaningful when assessed using birds on ad libitum feed and water intake, thereby providing a positive energy and protein balance.

Agassiz AME chick bioassay

The procedure in practice is specifically designed to evaluate cereal grains. A minimum of 45 kg of unground cereal grain is required. Upon receival of the grain, each cereal is identified and four 200 g samples of unground material are collected. Cereals are then ground (Jacobson grinder; 9/64th screen) and four 200 g samples of ground material are collected. Basal diets containing 80% of each cereal are mixed, producing a 50 kg basal ration (Table 2). Following mixing, the diet is split into two equal portions; one portion is fed without supplementation, the other is supplemented with the recommended quantity of commercial enzyme (e.g. ß-glucanase for barley and oats, xylanase for wheat and rye). Four subsamples of each complete diet are collected. The mash diets are then split into four equal portions, weighed and fed to one of four groups of six commercial broiler male chicks between 4 to 17 d of age. Feed intake and growth rate of the birds are recorded during this period of time.

Excreta samples are collected over 24 h periods at day 8, 14, 15 and 16. Collections on days 14, 15 and 16 are combined to estimate digestibility using total collection. On day 17, all the chicks are humanely killed and the intestinal tract is excised. Digesta is taken from the upper small intestine (duodenum and jejunum) of two to three birds for a single measure of digesta viscosity (eight viscosity measurements/diet). Ileal digesta from all birds in two pens (up to 12 birds) are combined in a single sample, providing two samples of ileal digesta for each diet. Feed, excreta and ileal digesta are dried, ground finely and analysed for dry matter, insoluble ash marker, gross energy and nitrogen. Based on these measurements, we are able to calculate apparent metabolisable energy (AME), dry matter digestibility, gross energy and nitrogen retention.

Table 1

COMPARISON OF MEASUREMENT COMPONENTS OF THE AGASSIZ AME AND THE STANDARD TME PROCEDURES

Component	*Agassiz AME*	*TME*
Bird	Commercial broiler chicks	White Leghorn Cockerels
Age (Nutrient requirement)	4 to 17 d of age (requirements for maintenance & growth)	Adult (maintenance only
Diet	cereal = 80% of test diet (balanced). -tested with & without enzyme supplementation	Cereal = 100% (diet is unbalanced)
Feeding	-ad libitum feeding throughout trial -diet fed for 13 d allowing birds to adjust	pre-starvation period followed by limited intubated feed followed by starvation period
Excreta measurements	-two measurements at 8 and 14-17 d of age -rely on acid insoluble market and total collection	-one measurement over 48 h period -total collection
Ileal Measurements	-birds killed at 17 d to collect ileal digesta	Not taken
Growth	-body weight gain recorded between 4 to 17 d of age	None
Feed:gain	-feed:gain calculated between 4 to 17 d of age	Fixed amount force fed
Viscosity	-digesta of upper small intestine collected and used to assess viscosity (non-starch polysaccharide content of diet)	None

Interpretation of observations

The Agassiz AME chick bioassay is designed to investigate why differences in AME and nutrient retention of cereals exist. For example, if two wheat sources differ in AME, we can identify whether this is related to the level of NSP by comparing the AME levels of diets with or without enzyme. Likewise, if AMEs determined at 8 d are lower than at 14-17 d, this may suggest that the young broiler's digestive capacity is limited but improved with time, or that gut microbial population changed. Differences in digestibility between excreta and ileal measurements (14-17 d) may indicate that digesta/ excreta microflora significantly influenced digestibility.

PARC (Agassiz) is currently involved in a collaborative project to evaluate the feeding value of nine varieties of wheat grown at four different geographical locations over two crop years. A similar study is also underway with 16 varieties of barley at two locations over three crop years. These studies will provide the feed industry and cereal breeders with a larger data bank on the feeding value of wheat and barley. The samples will be used to validate laboratory procedures capable of replacing the bioassay and providing the industry with a rapid, accurate and economic method of assessing feedstuffs.

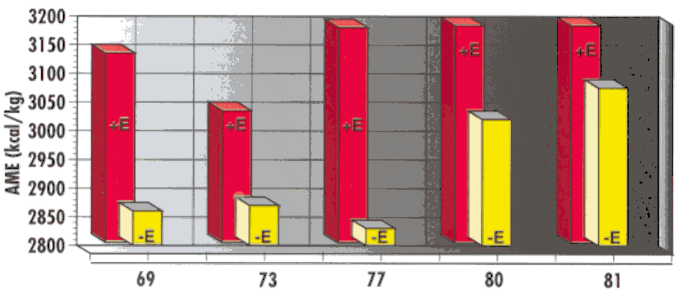
Feed wheat/frozen wheat

Wheat harvest in the Prairies in 1992 was marred by early frost and poor harvest conditions and "yielded" a large volume of feed wheat. Although feed wheat prices were competitive (with imported corn), there was resistance to feeding it to poultry. Anti-nutritional factors, such as non-starch polysaccharides (NSPs) may be higher in feed wheat, reducing the digestibility of nutrients in the grain.

PARC (Agassiz), in co-operation with the University of Saskatchewan, studied the nutritive value of a single sample of wheat which was separated into five different densities ranging from 69 to 81 kg/hl (55 to 65 lb/bushel). The lightest wheat sample was made up primarily of those immature kernels damaged by frost.

Energy (AME) of the low density wheats with no enzyme was lower than the high density wheats (Figure 1). These same low density wheats were demonstrated to have higher concentrations of NSPs. Enzyme addition reduced the effect of NSPs and improved the AME of all five wheat samples, especially the low density fractions. This work moves us one step closer to understanding the variability in feed grains and understanding how feed enzymes improve the feeding value.

Figure 1: **APPARENT METABOLISABLE ENERGY (AME); (+E = WITH ENZYME; -E = WITHOUT ENZYME)**



Five density (kg/hl) samples from one frozen wheat sample

Figure 2: **THE AME (KCAL/KG DIET) BASED ON 17 D EXCRETA MEASUREMENTS FROM BROILER BIRDS FED OF 32 DIFFERENT WHEATS WITH OR WITHOUT SUPPLEMENTAL ENZYME**

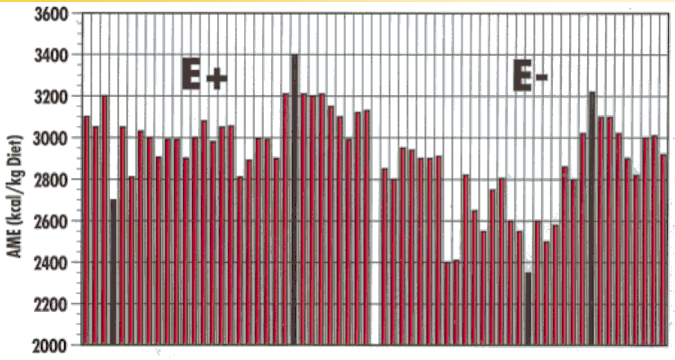


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Table 2

THE DIETARY INGREDIENT PROFILE OF BASAL TEST DIETS USED IN AGASSIZ AME CHICK BIOASSAY

Basal ingredient	% of diet
Test cereal	80.00
Tallow	2.00
Protein source	12.81
Vitamins & minerals	4.09
Marker	1.10
Total	100.00

Preliminary results from the wheat cultivar by environment study are summarised in Figure 2. The data depicts the AME (17 d of age) variability between samples when diets are either supplemented or un-supplemented with enzyme. Differences of 26 and 39% existed between the lowest and highest AME values within the 32 samples supplemented and unsupplemented with enzyme, respectively. Data from these samples and others will be used in other laboratories to validate Near Infra-Red (NIR) and Carbohydrate profiling tests as methods to predict the feeding value of wheat.

Rapid assessment of the feeding value of cereal grains will enable accurate feed formulation which will, in turn, reduce the need to over formulate. Reductions in over formulation of nutrients will reduce input costs and excretion of undigested nutrients which potentially increases environmental pollution. Similarly, rapid procedures for identifying feeding value will be useful tools for plant breeders in selecting new cultivars of cereals.

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SUMMARY

The feeding industry is still faced with finding an answer to the most fundamental question: "How much energy is available in feedstuffs?" The Agassiz chick bioassay is designed to improve the sensitivity of bioassay measurements by including an assessment of the bird's physiological and anatomical response to a feedstuff. The bioassay compares identical feeds with and without supplemental enzyme, at two different ages, using excreta and ileal digesta collection methods. Differences in energy value determined with these different methods will help us identify those factors in cereals which influence digestibility.

The bioassay samples will be used by other laboratories to validate their lab-bench procedures for measuring the feeding value of cereals. These lab-bench procedures (Near infra-red, Carbohydrate profiling, etc.) would allow feed manufacturers to identify individual cereal feeding value quickly, pay accordingly and/or make necessary adjustments (e.g. add specific quantities and types of enzymes or employ different processing methods) to improve feeding value.

Key Words
Avizyme 1300, Broiler, wheat, AME