

# Enzymes improve broiler body weight uniformity for increased profitability

**Body weight uniformity in broilers is a profit-winner. However, even the most carefully formulated rations can contain inherent variability in digestible energy through the cereals used. Reducing such variability can be achieved using a specially formulated cocktail of enzymes, which can be tailored to suit each diet.**

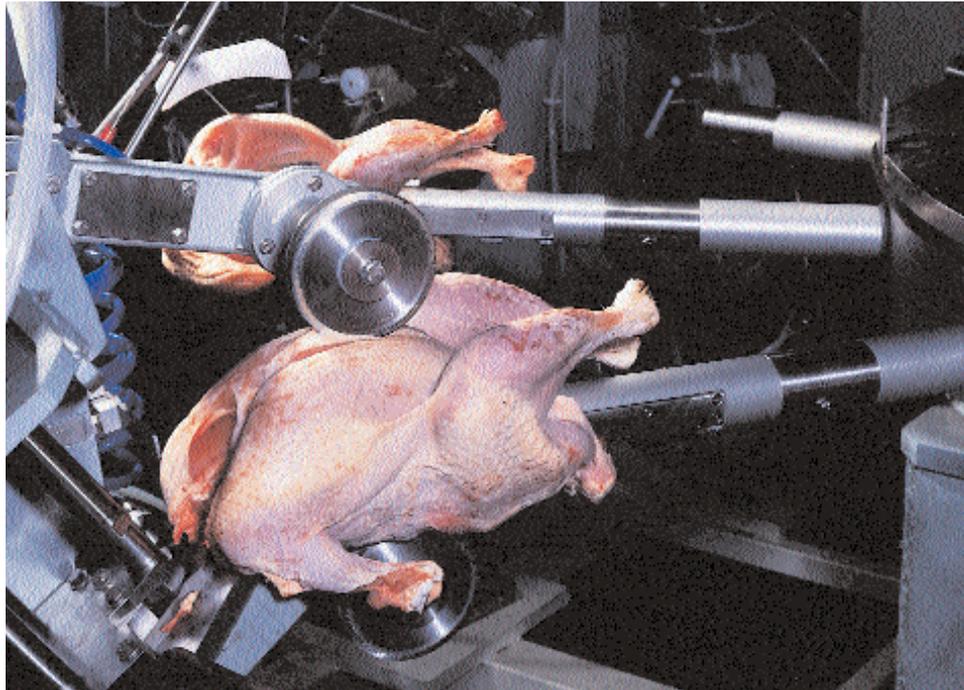
By Mike Bedford, Finnfeeds, UK

The benefits of improving uniformity of broiler body weight at farm level are that a greater proportion of the flock reach the specified target weight range in a shorter time period. At the processing plant, a key benefit is that a higher percentage of slaughtered birds fall within the size standards of the pre-set eviscerating and cutting equipment during processing such that losses of premium body parts, for example, breast meat in birds above the target body weight range are reduced. A further benefit includes fewer birds failing to meet the specified target weight range, resulting in a higher percentage of birds reaching the premium priced weight targets specified by retailers and supermarkets.

Independent research has shown that significant variation in apparent metabolisable energy (AME) can exist between different batches of wheat or barley. Differences in cornstarch digestibility are a major factor contributing to the variability in AME between different batches of corn. Variable corn quality in terms of AME will translate into variable bird performance, and consequently have an impact on producer profitability.

## Variability in maize quality

Leeson *et al.* (1993) compared 26 samples of maize harvested in 1991, and measures apparent metabolisable energy (kcal/kg) in roosters. The mean value was 3218 kcal/kg, with a deviation from the mean of 162. Collins and colleagues performed a similar study in 1998, measuring AME of 18 different samples of maize in 10-day-old chicks and



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roosters (Figure 1). When Leeson's results are compared with other studies on wheat and barley, (Figure 2), uniformity of maize quality, as measured by apparent metabolisable energy (AME) is not as uniform as it has traditionally been considered, even when compared to its "traditionally" more variable counterparts, wheat and barley.

In the same study, Leeson *et al.* (1993) converted their AME values into a range of expected feed conversion ratios. For the same 26 samples of maize, the group made the assumption that 100 kcal/kg AME was equivalent to four points in FCR at a broiler liveweight of 2000g. These calculations gave the divergences from the expected FCR (points at 42 days) shown in Figure 3. Clearly, such wide variation in feed conversion will lead to equally wide variation in liveweight at slaughter form target weight.

## What can be done?

The variation in AME experienced between samples of a single feedstuff occurs as a result of differences in non-starch polysaccharide (NSP), starch and protein content. This, in turn is influenced by many factors includ-

ing variety, geographical location, crop management etc. In this modern age of automation and high demands from consumers, high variability is not a desirable outcome. Even two samples of apparently similar nutrient content may differ significantly in nutrient availability at the level of the gut. This would have serious consequences for feed formulations, as formulating on the basis of AME would require considerable reformulation depending on source material. In maize, differences in starch digestibility are a major factor contributing to the variability in AME between different batches. Variable corn quality in terms of AME will translate into variable bird performance, and consequently have an impact on producer profitability.

A popular and simple way of increasing nutrient availability from plant sources is through the use of enzymes. Numerous studies have shown that by adding exogenous enzymes to cereal-based rations, nutrient availability can be enhanced. There are two main ways in which this occurs. Firstly, adding enzymes to a diet can enhance the bird's own digestive enzyme capacity. Secondly, cereal grains contain many long

Figure 1. Variability of maize quality as measured by AME in chicks at ten days and in roosters

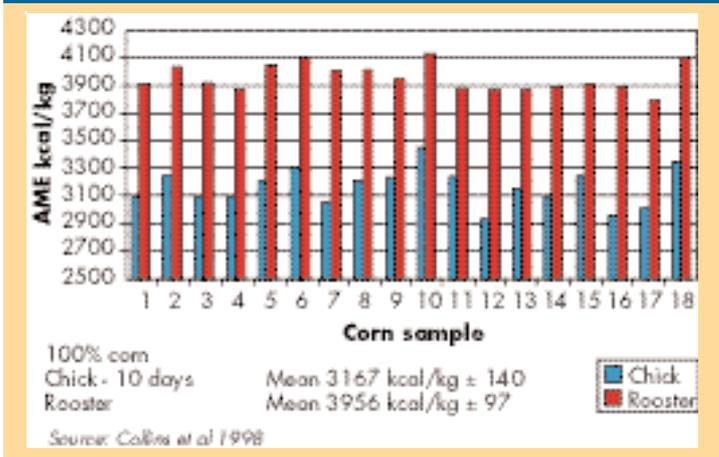


Figure 2. Maize quality can be as variable as that of wheat or barley

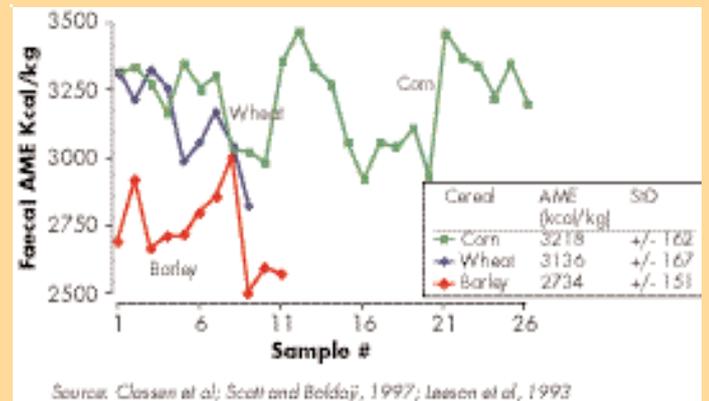


Figure 3. Variable maize quality results in variable broiler performance

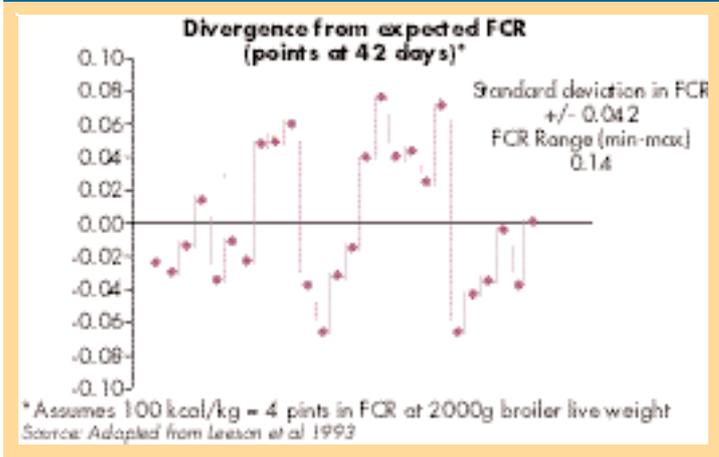
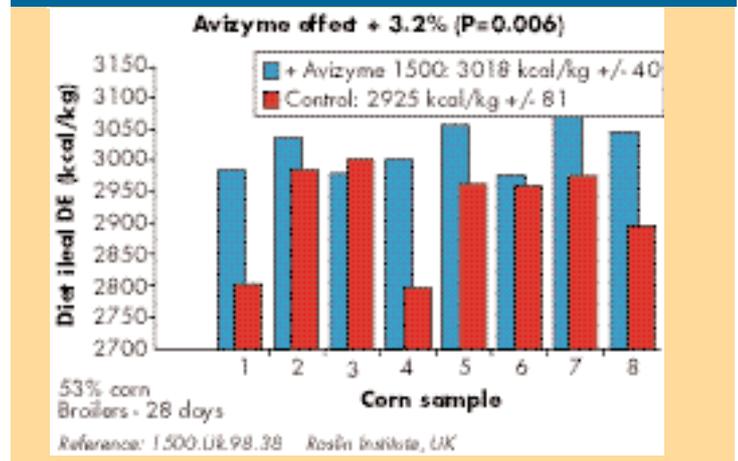


Figure 4. Enzyme supplementation reduced variability in ileal digestible energy in eight maize samples



chain carbohydrate molecules, (eg. amylose-starch, cellulose and other non-starch polysaccharides). In plant cells, these are found mainly in the cell wall, where they are bound together in a complex matrix. This makes them relatively inaccessible to the enzymes secreted by the bird's digestive tract. Adding exogenous enzymes to the feed unlocks more of this potential by opening up the structure and increasing accessibility to digestive enzymes (for a review, see Adams, 2000).

### Experimental data

Using a commercial enzyme preparation containing dose-optimised activities of three enzymes- protease, amylase and xylanase, researchers at the Roslin Institute in the UK reduced the percentage variability in 8 different batches of maize could be reduced significantly. They formulated diets containing 53% maize, and measured the ileal digestible energy in broilers at 28 days of age and found that using the enzyme preparation there was a 3.2% improvement in DE uniformity (Figure 4). Since ileal DE has a close correlation with FCR (Figure 5), use of enzymes in the diet results in improved,

more uniform performance, and reduced feed costs when a diet of reduced nutrient specification is used. For example, a study by Finnfeeds indicated that inclusion of a commercial preparation of protease, amylase and xylanase at 0.1% of the diet could reduce variation in broiler body weight from 10% in control birds to 6.4% in treated birds. This gives a flock variation as shown in Figure 6. Hence a larger proportion of the flock will reach target weight over a shorter period of time. For a given number of days' production, more birds will fall within the target weight range, and fewer above and below.

### Meaning in economic terms

A recent survey of trials by Finnfeeds has shown that supplementing corn-soy based broiler diets with a protease, amylase and xylanase enzyme blend (Avizyme<sup>®</sup> 1500, Finnfeeds) improved uniformity of body weight in broilers. The survey involved evaluating data from nine trials, which included 34 datasets where the coefficient of variation (CV) in broiler body weight was measured in the presence and absence of enzymes. On average, across the 34 datasets, enzyme supplementation improved uniformity of body-

weight by 25%. The 34 datasets were used to develop a strong linear regression equation ( $R^2=0.69$ ) for prediction of improvement in uniformity of final broiler body weight in response to dietary supplementation with enzymes. Broiler producers can use this regression equation as a basis for evaluating the economic benefits of improved uniformity of broiler bodyweight using corn-soy based diets. Using these values, 21% more birds fall within the target weight range (Table 1). The actual percent improvement in uniformity will depend on the initial degree of variability within the flock. The poorer the flock uniformity in the absence of enzymes, the greater will be the improvement in uniformity derived from their use.

At the processing plant, a key benefit is that a higher percentage of slaughtered birds fall within the size standards of the pre-set eviscerating and cutting equipment during processing such that losses of premium body parts, for example breast meat, in birds above the target weight range are reduced. A further benefit includes fewer birds failing to meet the specified target weight range, resulting in a higher percentage of birds reaching the premium priced weight targets speci-

Figure 5. Increasing ileal DE reduces FCR

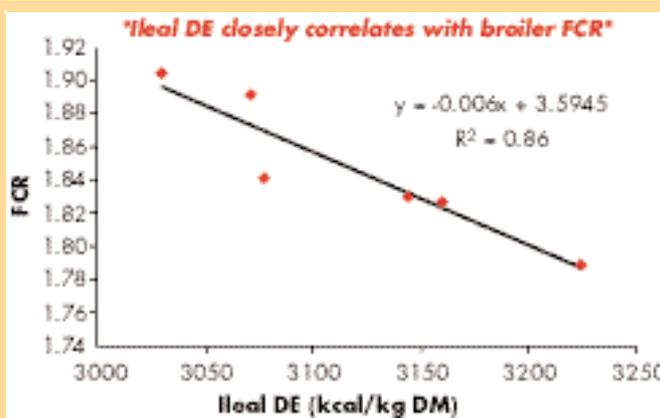


Figure 6. What does improved uniformity of body weight mean?

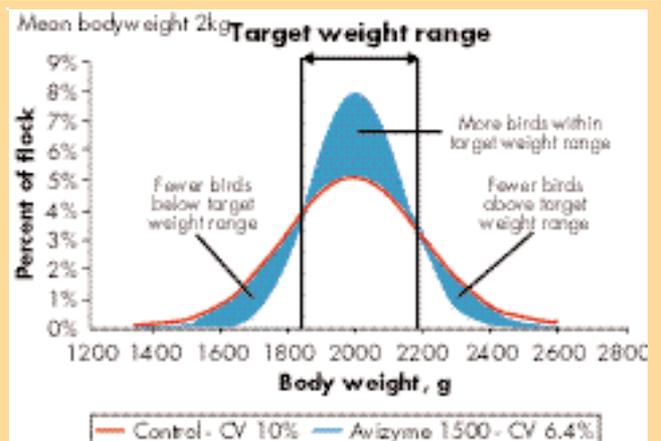


Table 1. Reducing the coefficient of variation of body weight by using a preparation of enzymes improves the uniformity of body weight achieved in broilers

	Control	Enzyme*	Difference caused by enzyme addition
Within target target weight range (%)	58.1	79.1	+21
Above target weight range (%)	20.8	8.7	-12.1
Below target weight range (%)	21.1	12.2	-8.9

\*Protease, xylanase and amylase (Avizyme<sup>®</sup>, Finnfeeds, UK).

Table 2. For every million broilers, more uniformity in weight means less meat wastage from the carcass and therefore more revenue from total breast meat recovered

	Standard (no enzyme)	With enzyme addition*
Total weight of birds in excess of the 2.2kg target weight	16114	4131
Weight of breast meat remaining on carcass (kg)	2739	702
Additional breast meat recovered from the carcass (kg)		2037
Revenue from additional breast meat recovered (\$)		5378

\*Protease, xylanase and amylase (Avizyme<sup>®</sup> 1500, Finnfeeds)

meat on birds above the target weight range will remain on the carcass and fail to attract its premium market value.

For a broiler producer, this may have significant economic implications. As an example economic calculation, the following assumptions were made: Average body weight, 2kg; target weight range 1.85-2.2kg; bodyweight coefficient for birds fed the control (standard) diet without enzymes 10%; breast meat as a percentage of body weight 17%; value of breast meat per kg US\$ 2.64. If enzyme addition reduces the coefficient of variation of bodyweight to 6.4% and the percentage of birds above the target weight range from 21.1 to 12.2%, for every million broilers the revenue from additional breast meat recovered is calculated as shown in Table 2. It follows that for a producer slaughtering a million broilers per week, enzyme addition to the diet could increase producer revenue from recovered breast meat by as much as US\$ 280,000 per annum. h

fied by retailers and supermarkets. Potential losses in revenue also exist where bird weight is above the target weight range, be-

cause at the processing plant breast cutting equipment is typically preset for one size only. Consequently some of the valuable breast

**Further reading**

Adams (2000). *Enzymes are important components in antibiotic-free poultry feeds. World Poultry Vol. 16. No. 8.*