Choosing the right fibre for poultry – eubiotic lignocellulose

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Dietary fibre is traditionally not discussed favourably amongst poultry nutritionists. High-fibre ingredients typically do not contribute significant quantities of nutrients to the diet and are not included in linear optimisation programs. But recent scientific and practical evidence is indicating that dietary fibre can have numerous positive impacts from litter quality and bird health to indoor air quality and environmental impact. While crude fibre is not a nutrient, per se, fermentable and non-fermentable fibre have physiological effects that can lead one to classify dietary fibre as essential in most livestock and poultry diets.

No. of animals: 515,000 broilers Eubiotic lignocellulose: 1% day 7-25	**Germany 2007**
Daily weight gain	+9%
FCR	-1.3%
European Broiler Index	+9%
No. of animals: 167,000 broilers Eubiotic lignocellulose: 1% day 7-11; 1.5% day 12-25	**Germany 2008**
Daily weight gain	+8%
FCR	±0%
European Broiler Index	+9.5%
No. of animals: 540,000 broilers Eubiotic lignocellulose: 1% day 7-11; 1.5% day 12-29	**Germany 2009**
Daily weight gain	+11%
FCR	-4.3%
European Broiler Index	+14%

Table 1. Trial results of using eubiotic lignocellulose compared to control groups receiving standard diets.

Dietary fibre

Dietary fibre is necessary to regulate digestion in broilers, laying hens, and turkeys. High-starch diets favour fermentation in the small intestine, where pathogens can quickly multiply. Including dietary fibre in the diet shifts the fermentation process back to the large intestine and increases the growth of beneficial bacteria.

These bacteria produce lactic acid and short-chain fatty acids that stimulate the health and integrity of the intestinal lining and improve water re-absorption, leading to drier excreta and fewer wet litter problems.

Healthy populations of beneficial bacteria decrease the pathogen load in the birds' intestine and in the environment, improving overall health status.

Additionally, research has shown that including fibre in poultry diets can decrease ammonia excretion. Ammonia is not only harmful to the environment, it impairs indoor air quality and leads to decreased bird performance and poor working conditions for animal caretakers.

Dietary fibre is 'automatically' included in all poultry diets, as most commonly used feed ingredients contain some small quantity of fibre. However, as modern strains of birds are genetically capable of higher production, diets are formulated with higher energy and nutrient densities. This, naturally, forces the fibre content lower and lower. Therefore, as the nutritionist strives to formulate a diet that can support the birds' genetic potential while maintaining optimal health status and digestive function, attention must be directed towards the fibre content of the diets.

Modes of action

While fibre, by definition, is not digested by the bird itself, the non-fermentable and fermentable fractions of dietary fibre are differentially degraded by intestinal microbes and, therefore, have different modes of action.

The non-fermentable fibre fraction is minimally degraded by the microbes and has primarily physical effects. It physically regulates digesta passage rate, influences faecal quality, and shifts fermentation to the large intestine. With inadequate fibre levels in nutrient-dense diets, fermentation moves farther up the intestine, where pathogens can negatively influence health status and production performance. Wet droppings contribute to sanitation problems.

Fermentable fibre, is as the name suggests, fermented by bacteria in the large intestine. The effects of fermentable fibre are directly related to this bacterial metabolism. The fermentable fibre fraction is not digested by the bird itself, but is utilised by the microbes in the large intestine, where lactate and the volatile fatty acids acetate, butyrate, and propionate are produced. Lactic acid and volatile fatty acids are essential to maintain eubiosis (stable and healthy micro-flora in the gut) in the large intestine and due to their effects on water re-absorption in the gut (butyrate) they lead to improved consistency of faeces. Additionally, some fermentable dietary fibre components are fermented by lactobacilli in the large intestine, which will naturally lead to an increased production of lactic acid. Lactic acid is known as an important antagonist to pathogens in the digestive tract and will therefore positively influence the gut health status of the animals.

Eubiotic lignocellulose

Recently, special dietary fibre products derived from lignocellulose are being used more and more in poultry nutrition due to

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their positive effects on digestive processes and gut health status with low inclusion rates.

Lignocellulose is a product made from fresh wood and has been used as a high quality fibre source in animal nutrition. Compared to traditional fibre sources, lignocellulose is characterised by high crude fibre (>55%) and high lignin (25-30%) contents. Recently, a new eubiotic lignocellulose product has become commercially available. In contrast to the first generation lignocellulose products that contain nearly 100% non-fermentable fibre (lignin, cellulose, and non-fermentable hemicellulose), eubiotic lignocellulose contains a synergistic blend of non-fermentable and fermentable fibre components.As discussed previously, both fibre types are necessary to obtain the maximum benefits from dietary fibre.

Due to its remarkably high fibre content, low inclusion rates of eubiotic lignocellulose (1.0-1.5%) positively influence the digestive processes of birds. Therefore, dramatic changes in diet formulations are not necessary to maintain nutrient and energy densities when eubiotic lignocellulose is used in poultry diets.

Traditional fibre sources available for animal diets are of varying quality and supply with mycotoxin contamination a constant concern. Because eubiotic lignocellulose is a wood product, it is guaranteed free of mycotoxins and supply is not influenced by climactic and growing conditions. Eubiotic lignocellulose is an exciting new feeding ingredient that can provide fibre in poultry diets without taking up significant amounts of valuable space in the diet.

Scientific studies

Scientific and practical studies show positive effects of eubiotic lignocellulose (OptiCell, agromed Austria) on production parameters of poultry. Field studies showed that 1.0-1.5% eubiotic lignocellulose consistently improved growth performance and economic returns 9% or more.

In these studies, the high-fibre product was allowed to dilute the diet slightly (the diet was not re-formulated after fibre addition) and performance was still better for the treatment compared to the control birds.

Studies with laying hens show that eubiotic lignocellulose leads to decreased problems with pathogenic bacteria (for example clostridia) especially at the end of the laying period.

The beneficial impact of this special dietary lignocellulose fibre positively influences gut health status of the birds. Trial results show that addition of 1% eubiotic lignocellulose starting at week 50 led to 40% decreased mortality, while total egg production was increased by 1.7%.

Additionally it was measured in that study that luxurious feed consumption (which can be a problem at the end of the laying period) was decreased by about 20%. Generally observations in layers show that stress behaviour of hens is improved as animals seem to be calmer after receiving 1.0-1.5% eubiotic lignocellulose.

Similar to broiler nutrition, eubiotic lignocellulose is also used in turkey nutrition. In turkeys, dietary fibre products are mainly used to decrease problems with diarrhoea and wet litter.

Therefore, eubiotic lignocellulose is mainly fed during phases II to IV where the risk of wet litter due to intestinal problems of the animals is highest.

In a study conducted at a commercial turkey farm, mortality was decreased 26% and average daily gain was increased 3.6% when birds were fed 1.5% eubiotic lignocellulose from 29 to 77 days of age (Table 2).

Table 2. Growth performance of turkeys fed eubiotic lignocellulose at 1.5% of the diet from 29-77 days of age.

	Control	Eubiotic lignocellulose	Difference (%)
Mortality (%)	7.3	9.2	–26.0
Body weight (kg)	19.8	20.5	+3.5
Feed conversion	2.70	2.66	–1.5
Average daily gain (g/d)	137	142	+3.6

Conclusion

Dietary fibre can greatly improve production performance and the health status of poultry. However, traditional views that high-fibre feed ingredients cannot 'fit' into diets must be abandoned, as highly concentrated fibre sources are commercially available. Eubiotic lignocellulose provides the wide-range of benefits from both fermentable and non-fermentable fibre, while requiring only 1.0-1.5% inclusion rates.

Eubiotic lignocellulose seems to be an ideal tool to improve productivity in all poultry species. ■