Innovations in Poultry Nutrition

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WATT POULTRY NUTRITION AND FEEDING SURVEY

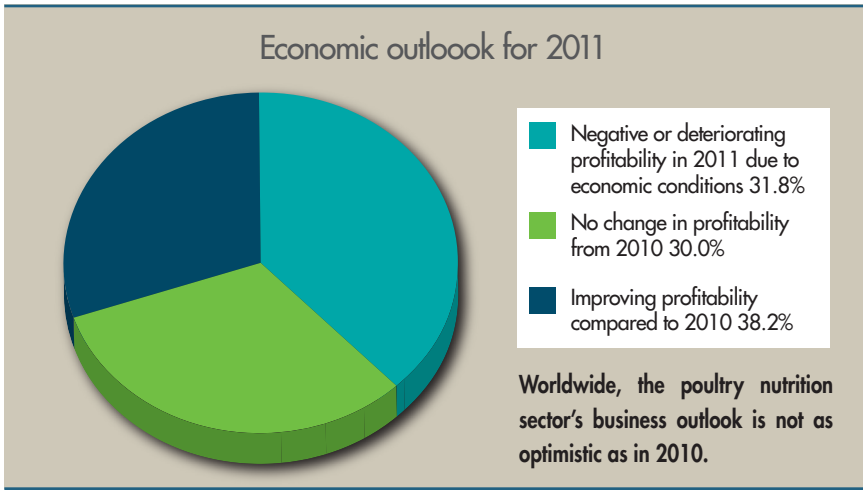
Poultry nutrition survey shows industry investment, use of enzymes

The world's poultry industries are set to invest in nutrition and feeding operations, while using more enzymes and DDGS, according to an exclusive WATT survey.

BY BENJAMIN RUIZ, MARK CLEMENTS AND GARY THORNTON

WATT's 2011 Poultry Nutrition and Feeding Survey shows a cautious industry, affected by the world grains crisis and energy costs, but with intentions of using more enzymes and dried distillers grains with solubles and investing in new equipment and facilities.

WATT PoultryUSA, Industria Avícola, Poultry International and Feed International magazines asked 224 industry people responsible for producing and using poultry feeds worldwide about their business outlook and key trends, involving composition of rations, sustainability, investment, use of enzymes and



Leading challenges in poultry nutrition

Challenges, rank by world region

	All	Latin America	North America	Asia
Cost of grains/volatility in grain prices	1	1.00	1.00	1.00
Energy costs, including for transportation and milling	2	2.00	2.00	2.00
Quality of grains, including mycotoxins (and other anti-nutritional factors)	3	4.00	6.00	3.00
Cost of micro-ingredients/feed additives	4	8.00	4.00	5.00
Food/feed safety and/or supply chain risk	5	6.00	5.00	6.00
Capital for expansion/replacement of production facilities	6	5.00	9.00	4.00
Regulation/legislation affecting feed milling/animal agriculture	7	3.00	8.00	9.00
Elimination of antibiotics for feeds due to regulation or consumer pressure	8	9.00	3.00	8.00
Environmental concerns and/or sustainability	9	7.00	7.00	7.00
Access to world markets/exchange rate fluctuations	10	10.00	10.00	10.00
	higher rank (greater importance) than "All"			
	lower rank (less importance) than "All"			

"Cost of grains" and "Energy costs, including for transportation and milling" were rated as the two most important concerns in all world regions.

more. Here are the key findings:

- In terms of business outlook for this year, more than a third feels there will be an improvement over 2010, as compared to more than 50% last year.
- Economics and financial issues dominate the top five challenges. Once again, "cost of grains/volatility in grain prices" was ranked as the most important concern in all world regions, followed by "energy costs, including transportation and milling."
- Feed production volume is predicted to increase from 2010 figures by more than half of respondents, just as poultry and egg production volume.
- To support these increases, companies are planning corresponding investments in feed equipment and facilities.
- The upward trend in the use of alternative feed ingredients, including DDGS and enzymes, continues.

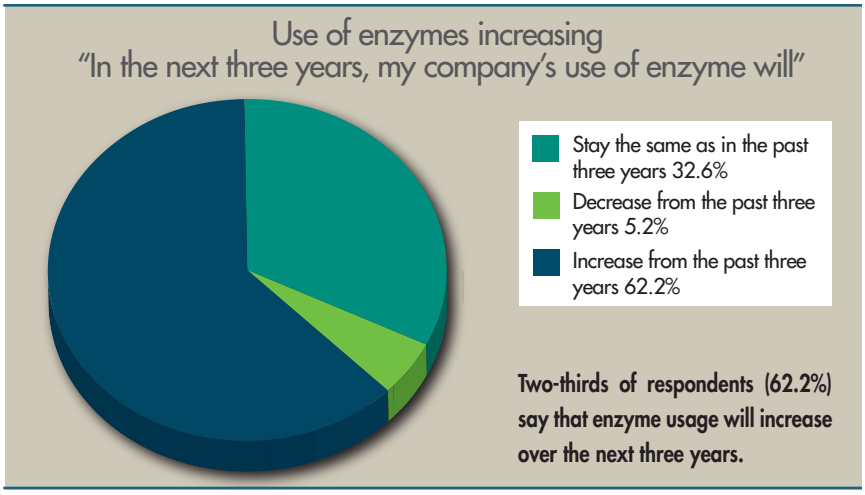
Read more Compare 2011 survey results with those of 2010
www.WATTAgNet.com/15913.html

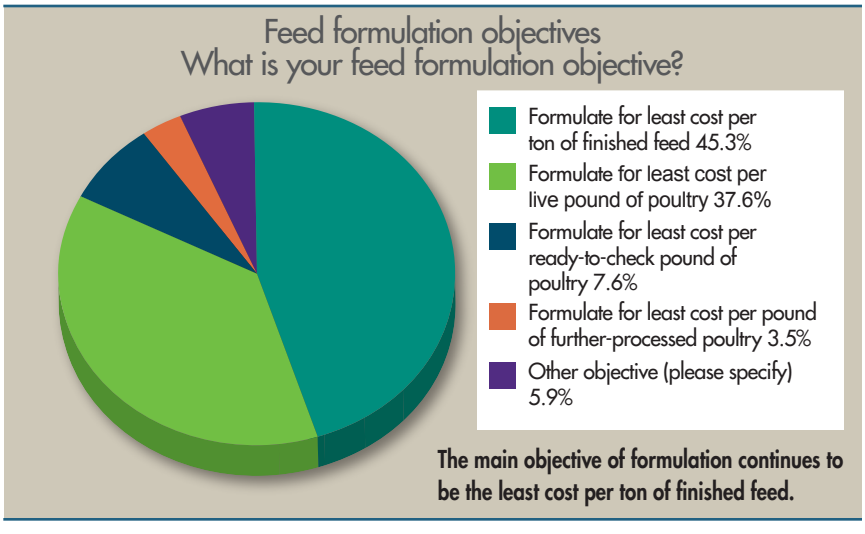
Business outlook for 2011

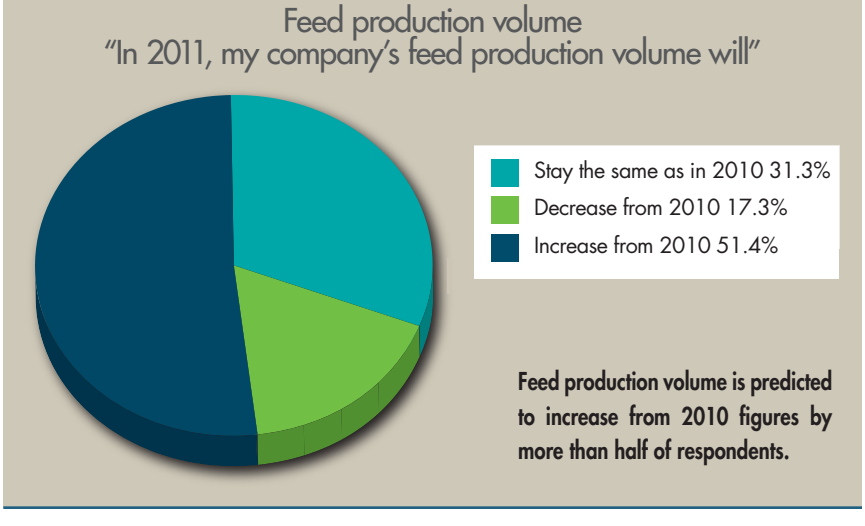
Worldwide, the poultry nutrition sector's business outlook is not as optimistic as it was in 2010. In terms of business outlook for 2011, more than a third (38.2%) feels there will be an improvement over 2010 – compared to more than 50% of last year's perception. Almost a third (31.8%) foresees negative or deteriorating profitability in 2011 due to economic conditions, while almost another third (30%) sees no change in profitability from 2010. The business outlook is quite different among the world regions. For almost half of the U.S. respondents (47.6%) the outlook is for negative or deteriorating business conditions, while in the rest of the world only 28.2% of respondents had a negative business outlook.

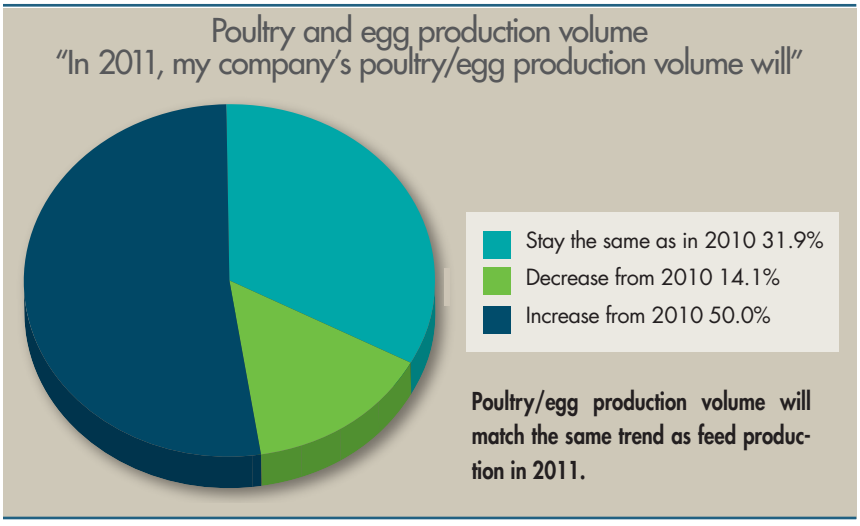
Major challenges in nutrition and feeding

Economics and financial issues were identified as among the top five









challenges. Once again, "cost of grains/volatility in grain prices" was ranked as the most important concern in all world regions, followed by "energy costs, including transportation and milling." "Quality of grains, including mycotoxins and other anti-nutritional factors" was rated third, followed by the "cost of micro-ingredients or feed additives" and "food/feed safety and/or supply chain risk" tied as the third most significant challenges. Respondents ranked "capital for expansion/replacement of production facilities" as the fifth most important challenge facing their operations.

Challenges of lesser importance

The three challenges ranked as less important by all world regions were "Elimination of antibiotics for feeds due to regulation or consumer pressure," "Environmental concerns and/or sustainability" and "Access to world markets/exchange rate fluctuations."

Composition of rations

Worldwide, the upward trend in the use of alternative feed ingredients, including DDGS and enzymes, continues, according to survey responses.

While 42.5% of respondents said "none is used now or in the past three years," 38.6% indicated their use alternative ingredients had increased. Twenty-four percent said usage had "increased somewhat over the past three years" and 18.2% said usage had "increased significantly over the past three years." Also, 18.8% said usage stayed the same over the past three years." Interestingly, almost a third (29.4%) thinks usage "will increase somewhat," and 10.6% believe usage "will increase significantly." A quarter of respondents said usage "will stay the same" in the next 12 months.

In terms of enzyme usage, almost half (46.8%) of the respondents say it will increase from 2010 levels, while almost 38.7% say it will remain the same. So the overwhelming majority is giving the use of enzymes an important role in feed formulation. Two-thirds of respondents (62.2%) say that enzyme usage will increase over the next three years. Almost half of respondents (48%), however, expect that their phytase use will remain the same as 2010, while 34.5% say it will increase.

The primary objective of formulation continues to be the least cost per ton of finished feed for almost half (45.3%) of the survey worldwide participants – less in the U.S. (35.9%) than in the rest of the world (47.7%). Nonetheless, 37.6% formulate for least cost per live pound/kg of poultry. Some forward-thinking producers believe that other formulation objectives, such as least cost per ready-to-cook pound/kg of poultry or per pound/kg of further-processed products, must be followed, but in this survey those percentages are still negligible.

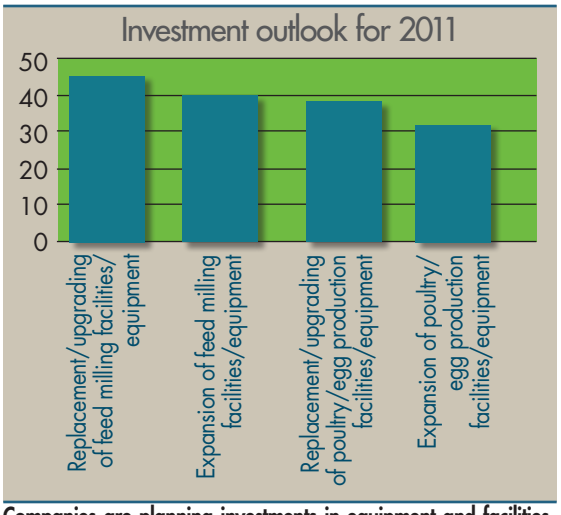
Marketing and labeling

There is no doubt labeling is increasingly important for poultry and egg products. Most of the respondents in this category make claims in their labels that their poultry, for example, is "all natural" or contains no hormones, no antibiotics/drugs, no animal by-products, among

WATT poultry nutrition survey participants

Survey responses came from a cross section of positions in the industry, including consulting nutritionists (32.2%), administrators (17.8%), consultants/R&D (13.8%), poultry farm owners/growers (12.1%), live production managers (9.2%), veterinarians (4.0%), and feed mill operators, quality control, processing managers and purchasing agents. Participating sectors were feed manufacturers (26%), consultants/veterinarians/nutritionists (17.3%), broiler producers (15%), egg producers (12.1%), manufacturers/producers of feed additives (8.1%), breeder farmers/hatchery (5.2%), poultry processors and feed/premix manufacturers (4.0% each), and turkey/duck producers, egg packers/processors, egg products manufacturers and poultry products marketers. Responses came from around the globe, including Asia (26.9%), North America (24%), Latin America (16%), Europe (12.6%), Africa (12.0%), Middle East (4.6%) and Asia Pacific (4%).

other claims. However, almost no one ties this to quality, such as HACCP or ISO, or the use of other enriching nutrients, such as omega 3.



Companies are planning investments in equipment and facilities, particularly replacement and upgrades to feed milling equipment.

Sustainability

More than half of respondents (52.4%) say their company has a written sustainability strategy, which includes nutrition and/or feeding.

Production and investment

More than half of respondents (51.4%) predict worldwide feed production volume to increase from 2010 figures, while a third (31.3%) thinks volume will stay the same. Only 17.3% believes it will decrease. Pretty much the same figures were obtained for the poultry/egg production volume, with 50%, 35.9% and 14.1%, respectively. However, in terms of poultry production, the U.S. is less optimistic, with 30.8% forecasting an increase in volume in 2011, compared to 57.4% in the rest of the world.

To support these increases, companies are planning corresponding investments in feed equipment and facilities, particularly replacement and upgrades to feed milling equipment. The same is also observed for poultry production facilities and equipment. In the U.S., three-quarters of the respondents believe investments will be in replacement/upgrading feed milling facilities and equipment, compared to 41.7% in the rest of the world.

Benjamin Ruiz, Mark Clements and Gary Thornton are the editors of Industria Avicola, Poultry International *and* WATT PoultryUSA, *respectively. Data compilation and statistical analysis by Research Director Joyce Neth and Research Associate Julia Caruso.*

Economics of DDGS use in layer rations improves

The price of DDGS relative to the price of corn has fallen as ethanol production has increased, and research suggests egg producers can benefit by feeding DDGS.

By Terrence O'Keefe

Corn prices have been driven to new heights by increased demand from the U.S. ethanol industry. According to some estimates, U.S. ethanol production in 2011 will consume an amount of corn equal to nearly 40% of last season's corn crop. The price of a commodity will rise as demand for the item increases or as supply of the item decreases. As supply of corn in storage dwindled this summer, users of corn not only had to pay higher prices for the corn but also had to move corn greater distances to reach their mills.

Read more about research on DDGS inclusion in layer diets at **www.WATTAgNet.com/21817.html**

To combat the high price and scarcity of corn, many egg producers in the Midwest have turned increasingly to distillers dried grains with solubles to replace a portion of the corn and soybean meal in their birds' rations. DDGS have been around for centuries as a byproduct of the production of beer and distilled spirits. Each 56-pound bushel of corn will produce 2.8 gallons of ethanol and 17.5 pounds of DDGS. Production of DDGS in the U.S. has more than doubled since 2007, along with the production of ethanol for fuel. According to the Renewable Fuels Association, 13.2 billion gallons of ethanol was produced in the U.S. last year along with approximately 41 million tons of DDGS, nearly one quarter of which was exported outside the U.S.

Photo credit: Andrea Saladino

Each 56-pound bushel of corn will produce 2.8 gallons of ethanol and 17.5 pounds of DDGS, which may offer an opportunity for all U.S. egg producers to lower cost of rations in the wake of high corn prices and increasing production of ethanol.

The price ratio for DDGS and corn in Iowa has fallen each year since 2007, according to the U.S. Department of Agriculture's Agricultural Marketing Service data. The decline in the ratio of the price of DDGS to corn from 0.97 in 2007 to 0.81 in 2011 has increased the economic incentive to substitute DDGS for corn in layer rations. Typical inclusion rates for DDGS in layer rations is 5% to 12%, but research suggests that higher inclusion rates can be used without harming bird performance.

Feeding higher concentrations of DDGS

The percent of protein in DDGS is about three times that of corn because fermentation uses the starches and

sugars and concentrates the protein, fiber and fat. DDGS are high in total phosphorous and nitrogen compared to corn, so the amount of inorganic phosphorous added to hen diets can be reduced if DDGS are included.

Dr. Sheila Purdum, University of Nebraska-Lincoln, reported on her research on DDGS and enzyme inclusion into layer diets at the Midwest Poultry Federation Convention this year. She said that exogenous enzymes, such as phytase and combinations of amylase, protease and carbohydrase, are incorporated more frequently into poultry diets, especially during times of high commodity prices. The focus of her research has been on the action of these enzymes in diets with a high level of DDGS.

Purdum said that in experimental diets with DDGS, synthetic lysine and a fat blend were added and dicalcium phosphate supplementation was decreased. In the initial studies, results indicated that feeding diets with DDGS at levels of up to 25% had no negative effect on egg production parameters.

Benefits of enzyme use

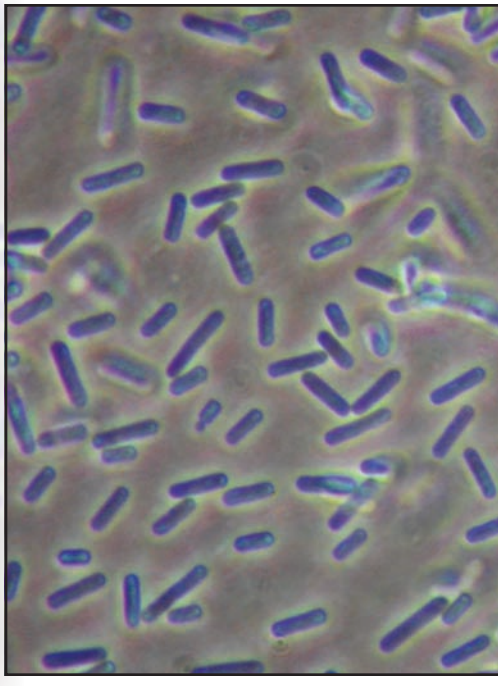
In further studies using exogenous enzymes such as phytase and combinations of amylase, protease and carbohydrase, inclusion rates of up to 30% DDGS in layer diets were shown to support good levels of production. Purdum concluded DDGS can be included at relatively high levels in diets for pullets and laying hens when the diet is formulated to balance amino acid requirements. She said dicalcium phosphate addition to layer diets can be reduced with DDGS inclusion to further reduce feed cost. Exogenous enzyme supplementation can significantly reduce the cost of diets for laying hens with or without DDGS inclusion.

DDGS availability

A number of reasons have been cited in the literature why poultry producers might choose not to utilize DDGS in rations. Some of them are variability of nutrient values in the product, distance from DDGS source, concerns over mycotoxin concentration in DDGS, and concerns about shelf life of DDGS. According to RFA data, nearly one quarter of U.S. DDGS production was exported in 2010, and the price of DDGS has fallen relative to the price of corn over the last five years. With corn prices expected to be high for at least another 12 months, DDGS may offer an opportunity for all U.S. egg producers, not just those in the Midwest, to lower the cost of their rations compared to the cost of a traditional corn and soybean meal ration. EI

Probiotics | by Michaela Mohnl DI (MSc)

Poultry production: How probiotics can play a role



Since the importance of a well-balanced gut microflora for adequate health and high performance has been recognised, feeding strategies have been directed to control the microbial GI environment by nutritional means.

A large and diverse range of bacteria are living in the gastrointestinal (GI) tract of our animals, and most of these bacteria form a symbiotic relationship with the host. The important role of GI microflora in health and disease of animals and humans is increasingly recognized. Nutrition is the most important factor influencing the composition and metabolic activity of the intestinal microflora.

Feeding errors, substantial dietary changes, low-quality feed components and inadequate feed hygiene all compromise the microflora. It should be a goal when formulating diets to favourably influence the microbial community in the gut and to keep up a state which is called Eubiosis. In this situation, the host and the microflora live together in symbiosis, meaning with mutual benefit.

Probiotics to achieve Eubiosis

Since the importance of a well-balanced gut microflora for adequate health and high performance has been recognised, feeding strategies have been directed to control the microbial GI environment by nutritional means. Especially the use of probiotics has been shown to be an effective means of manipulating or managing the composition of the microbial population in the GI tract of animals to achieve or re-establish the state of Eubiosis.

Intake of probiotics should result in the creation of gut microecology conditions that suppress harmful microorganisms and favour beneficial microorganisms, and ultimately enhance gut health. This is also necessary for a well-functioning and effective digestion of nutrients, resulting in good growth performance. Besides nutrient absorption, the intestine plays an important role as the biggest immune organ of the body. It is hence part of the body's defense system and represents an important barrier against invading pathogens.

New scientific insights about probiotics

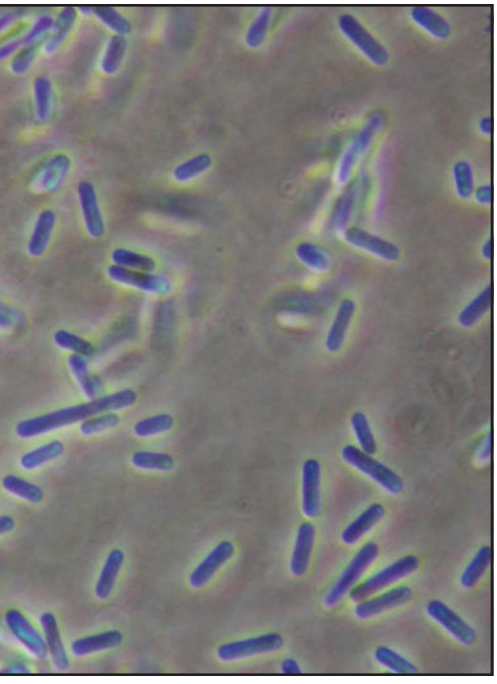
The scientific community is changing its way of looking at the mode of actions of probiotics. Since probiotics have been commercially available, they have been expected to exert their benefits derived from their ability to multiply, produce certain metabolites and colonize the surface of the intestinal epithelium.

Today (and for the last 10 years), researchers are challenging the "classic" mode of actions of probiotics with novel ones. So far, there is a good bulk of evidence suggesting that some of the effects of probiotics like the anti-inflammatory effect are mediated by fingerprints (structural molecules) rather than by the whole organisms or their ability to colonize the intestine.

In-case probiotics are also partly inactivated in the course of feed processing or antibiotic treatment at therapeutic doses; there are beneficial mechanism which do not depend on live bacteria and which will remain unaltered. As long as the effector molecules within the probiotics remain with the appropriate structure, a biological effect should be expected.

Commonly used probiotic bacteria in animal feeding are lactic acid-producing strains like *Enterococcus*, *Pediococcus*, *Lactobacillus* and *Bifidobacterium*, which are also genera commonly found in the poultry gut. Several scientific studies have shown that they have a beneficial effect on performance, pathogen inhibition, modulation of intestinal microflora and immunomodulation, especially during critical times in the production cycle when a protective gut microflora is not yet established or a disrupted probiotic application exerts its benefits.

STAY AHEAD:
Read more about nutritional solutions in poultry production to combat stress and disease.
www.WATTAgNet.com/23492



Clostridium perfringens TZT.

Probiotics to protect newly hatched chicks

Under normal conditions (i.e. in the wild), animals pick up their microflora from adult animals and from the environment very quickly, but under conditions of modern animal production, things are different. Commercial broiler chicks hatch in extremely clean conditions and don't have contact with adult animals. Then they are transferred in houses previously cleaned and disinfected. For them, to build up and establish a well-balanced microflora is difficult. During that time, the chicks are not protected against the colonization with pathogenic microbes.

For the chicks, it is crucial to develop a protecting microflora as early and fast as possible, which can be supported by the application of probiotics. Probiotic products can be sprayed onto the chicks already in the hatchery or be applied via the drinking water during the first days of life. They provide conditions in the chicks' intestines that favour the colonization by beneficial microbes.

TABLE 1: Metabolic and structural mode of action of probiotics

	Metabolic Live bacteria	Structural Dead bacteria
Competitive exclusion: Competition with pathogenic bacteria for intestinal attachment sides and space, aggregation of pathogens	✔	✔
Production of antimicrobial substances	✔	
Change of intestinal environment: e.g. pH reduction through production of volatile fatty acids and lactic acid	✔	
Modulation of immune system	✔	✔

Not all probiotics work in the same way.

Probiotics and antibiotic therapy

Antibiotics are useful tools to eliminate undesired pathogens. However, they also eliminate a large proportion of the beneficial microflora which needs to be re-established after the antibiotic treatments ends to avoid fast growth of opportunistic pathogens. Antibiotics may eliminate the pathogens, but they often do not sufficiently control inflammation. In many cases of pathogenic invasion, an exaggerated response of the immune system may cause even more damage than the pathogen itself.

Probiotics can help modulate the immune system. It is very common in the field to see the severe inflammation of the intestinal mucosa regardless of the ongoing antibiotic therapy. Intestinal inflammation is related to increased velocity of the intestinal content. As a consequence, feces with increased amount of humidity, gas, excess of indigested feed particles or fragments of intestinal mucosa may be a common finding derived from intestinal inflammation. Confirmation of intestinal inflammation can be obtained from necropsied animals.

Antibiotics may eliminate the pathogens, but they often do not sufficiently control inflammation.

The use of probiotics is recommended to fight side effects of diseases that will not be improved by the use of antibiotics. In this scenario, antibiotics in therapeutic doses should be taking care of pathogens; however, the intestinal inflammation often remains unattended. Even inactivated probiotics exert a beneficial effect reducing inflammation by means of their cellular structure and particularly their intact DNA molecules and receptors, which are unique to every probiotic strain.

Probiotics and Necrotic enteritis

Necrotic enteritis is one of the world's most common and financially crippling poultry diseases, which when triggered can cause mortality rates of up to 50%. A team of USDA research scientist has investigated if the use of a multi-species probiotic may be beneficial in the control of poultry diseases, which are related to Clostridium perfringens. In conclusion, the data of these studies suggest that the probiotic was able to control poultry diseases like Necrotic enteritis and Gangrenous dermatitis.

The use of probiotic products can provide the poultry industry with an alternative management tool that has the potential to promote better intestinal health by managing the composition of the microbial population in the GI tract, to protect poultry flocks from infections with pathogenic bacteria and to decrease monetary losses due to pathogens.

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Dr A. K. Panda

Alleviate poultry heat stress through antioxidant vitamin supplementation

Broiler and egg production declines when birds experience heat stress. When funds are unavailable for investment in buildings and ventilation, changes in diet may be the answer.

Figure 1. Effect of dietary vitamin E supplementation on production performance of White Leghorn layers under tropical summer conditions (Panda et al., 2008)

Vitamin E (mg/kg)	Production performance		Immune response	
	Egg production (%)	Food conversion (g egg mass/ g feed)	Newcastle disease virus titre (ELISA titre)	Lymphocyte proliferation ratio
25	84.78 b	0.441 b	3275 b	0.537 b
125	85.99 a	0.452 a	3326 a	0.549 a
250	86.03 a	0.451 a	3332 a	0.551 a

Vitamin E is one of the most important natural antioxidants, yet poultry are unable to synthesize it, making supplementation necessary.

High ambient temperature is one of the most important stressors for poultry, and has a direct relationship on the profitability of meat and egg production. A seasonal problem in many parts of the world, high environmental temperatures (35-43C in tropical countries) cause economic losses through reducing feed intake and decreasing nutrient utilization, live weight gain, egg production, egg quality and feed efficiency. The ideal temperature for broilers is 10-22C for optimum body weight, and 15-27C for feed efficiency. Layers will produce eggs constantly at temperatures of 10-30C. Above 30C, performance declines in terms of growth and egg production.

The lack of sweat glands and relatively high body temperature make poultry, especially meat-type, fast-growing chickens, more susceptible to heat stress. During exposure to high ambient temperature, poultry face difficulties in maintaining body temperature. Their primary means of heat loss above upper critical temperature is by an increase in breathing rate (panting) and by raising their wings (to increase the surface area).

Under stress conditions, avian blood undergoes a change from acid base balance to alkaline balance. There is a drop in the plasma, a decreased level of vitamin C in the adrenal cortex, a reduction in lymphocytes and a depression of immune response. As the temperature rises, the birds undergo many changes – increased water consumption, respiration rate, body temperature, inferior egg quality and susceptibility to diseases.

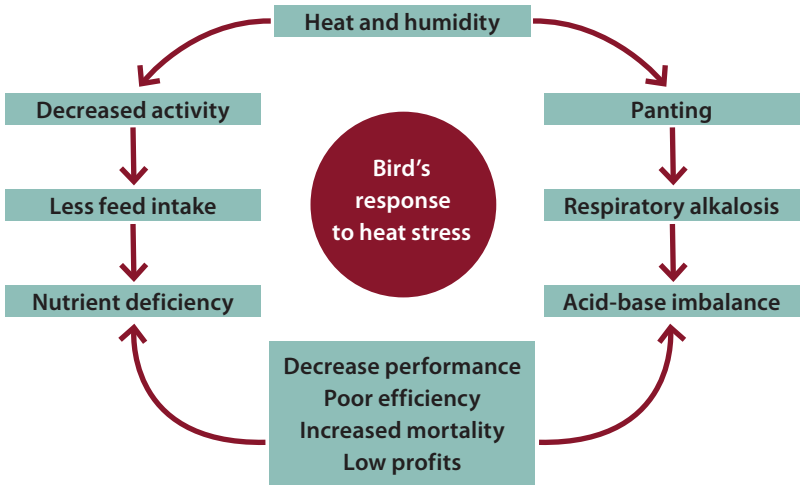
Dietary approach

Several methods are available to alleviate the negative effects of high environmental temperatures on performance. Heat stress can be regulated by controlling the environment where the poultry are being reared, i.e. housing temperature and ventilation. However, this may not always be possible because of economic factors, and so alternative strategies must be considered. One such strategy is nutritional manipulation. Nutritional modification usually involves optimizing the diet to meet the altered needs of stressed birds.

Ambient temperature has a considerable impact on feed consumption of birds, especially adult birds, because feed intake decreases as environmental temperature increases. At temperatures above 30C, consumption decreases by 2.5-4g per degree rise in temperature. It is advisable to formulate higher density diets in order to maintain daily intake in line with requirements for growth and egg production. Reduction in dietary protein, with suitable supplementation of essential amino acids, is also a way of combating the effects of rising temperatures. Electrolyte solutions (sodium, chloride, potassium and bicarbonate) in drinking water will help replenish the bird's electrolytes and correct the acid/base balance.

Supplementing antioxidant

Figure2. The effects of elevated temperatures on poultry



Heat stress leads to lower performance and, ultimately, lower profits.

vitamins is also an effective way of alleviating summer stress in poultry. Antioxidant vitamins such as vitamins A (retinol), E (α tocopherol) and C (ascorbic acid) are used in poultry diets because of their anti-stress effects and also because their synthesis is reduced during heat stress. Heat stress stimulates the release of corticosterone and catecholamines and initiates lipid peroxidation in cell membranes.

It has been observed that birds stressed due to high environmental temperatures have reduced plasma ascorbic acid, α tocopherol and ascorbic acid concentrations. Heat stress also impairs absorption of these vitamins (A, E and C) and thereby increasing the dietary requirement of these vitamins. Supplementation of these vitamins at higher doses may be beneficial in overcoming heat stress related depression in performance of poultry.

Vitamin E

Vitamin E is one of the most important natural antioxidants and is an excellent biological chain-breaking antioxidant that protects cells and tissues from lipoperoxidative damage induced by free radicals. Poultry cannot synthesize vitamin E, therefore requirements must be met from dietary sources. Heat stress stimulates the release of corticosterone and catecholamines and initiates lipid peroxidation in cell membranes. It is suggested that vitamin E can reduce the negative effects of corticosterone induced by stress. Vitamin E also provides protection for those cells involved in immune responses (lymphocytes, macrophages and plasma cells) against oxidative damage and enhances proliferation and functions of these cells. Therefore, additional vitamin E supplementation in diets is necessary under heat stress conditions.

Vitamin E can be supplemented in broiler diets at 250mg/kg as a protective management practice to reduce the negative effects of stress and to result in optimum performance in broilers. In layers, vitamin E supplementation at 125-250mg/kg improves egg production, feed efficiency and immunecompetence. Heat stress depresses egg production due to lower plasma concentrations of egg yolk precursors, vitellogenin and very low density lipoprotein. Vitamin E improves egg production by facilitating the release of vitellogenin from the liver and increasing the circulating supply of this precursor for yolk formation by protecting the liver from lipid peroxidation and damage to cell membranes.

Vitamin C

Vitamin C is necessary for various biosyntheses (collagen, 1,25-dihydroxy vitamin D and adrenaline) as well as for regulation of diverse reactions (secretion of corticocosterones, regulation of body temperature and activation of immune system). It has been reported that vitamin C enhances the antioxidant activity of vitamin E by reducing the tocopheroxy radicals back to their active form of vitamin E. Adult poultry under normal conditions are able to synthesize vitamin C to meet the requirement. However, it has been reported that vitamin C requirement is higher during stress and several reports have documented a beneficial effect of supplementing poultry feed with ascorbic acid.

Supplemental dietary vitamin C limits and alleviates the metabolic sign of stress and improves performance, immunological status and the behavior of birds. Optimum response in growth, feed efficiency and/or livability in broilers under heat stress seems to occur with supplements of about 250mg vitamin C/kg feed. Laying hens have also shown responses to supplemental vitamin C at 200-400mg/kg in terms of improvement in livability, feed intake, egg production and egg quality.

Vitamin A

Vitamin A is involved in several functions of the body including vision, epithelial cell differentiation, growth and reproduction. Due to its involvement in epithelial cell differentiation, vitamin A has an effect on the immune function of birds. It has been reported that conversion of carotene to vitamin A reduces under stress. Supplemental vitamin A at 15000IU/kg and zinc (30mg/kg) improves the performance and carcass

traits in broiler chickens and thus offer a potential protective management practice in preventing heat stress related depression in performance of broiler chickens. Supplementation of vitamin A at 9000IU/kg in commercial layer diets under heat stress is beneficial for optimizing laying performance and immunity.

Antioxidant vitamin combination

Combination of antioxidant vitamins may be more beneficial in overcoming heat-stress related depression in poultry performance. Overall antioxidant potential has been reported to be more efficient and crucial than single antioxidants.

To learn more about alleviating stress in poultry, read: Stress, diseae, nutritional solutions in poultry production.

www.WATTAgNet.com/18939.html

We have studied the combination of vitamin C (200mg/kg) and vitamin E (125mg/kg) in WL layers diet during summer stress and observed beneficial effect on production performance as well as on immune response. Vitamin A (15000IU/kg) and vitamin E (250mg/kg) has been shown to improve performance of broilers under summer stress.

High environmental temperature leads to deficiency of specific nutrients because of decline in feed intake, reduced absorption and poor utilization of vitamins. Therefore, appropriate supplemental dose of vitamins are required to sustain the performance of poultry during summer. Hence, vitamin E (125-250mg/kg), vitamin C (200-250mg/kg) and vitamin A (15000IU/kg) are recommended for alleviating summer stress in poultry. □

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