Gut health – the key to bird efficiency and performance

When discussing the profitability and performance of commercial poultry species, the focus is often placed on pushing for feed conversion improvements. While feed conversion ratio is seldom recorded in laying hen flocks, it is still a critical measure to gain an insight into how efficiently hens perform.

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Key to bird efficiency and all performance measures is gut health. It is often considered the limiting factor in poultry performance, and implementing measures to improve it is imperative to business success.

The gastrointestinal (GI) tract is the biggest collection of organs in the body. Its primary function is to digest and absorb food, converting energy from feed into a form that the bird can use for growth, egg production and bodily maintenance.

In order for the bird to efficiently digest feed, it must have the correct balance of enzymes and also the correct microbial population present.

Feed is composed of different fractions; some are easily digested by the bird, and some are not. Enzymes often help with this by breaking down some feed in the small intestine, allowing the bird's natural enzymes to work on less biologically complex fractions. The microbial population in the gut also helps to digest any remaining undigestible fractions through fermentation.

Caecal microbial population

Bacteria in the caeca produce specific enzymes to enable them to feed on the plant fractions, which are often broken down into products beneficial for both the bird and the bacterial cell. The production of butyrate occurs via this symbiotic process. It is a by-product of bacterial fermentation, which the bird uses as an energy source for its epithelial cells that line the gut.

Gut health is critical for this process. The caecal microbial population, or microbiota, is delicately balanced and easily tipped. High protein diets are common, as they help to contribute to growth and production. Protein is a complex molecule and so is difficult to digest, meaning excess protein will often reach the caeca, where it is fermented.

The bacteria that can metabolise protein the most quickly are often bacteria that can become pathogenic. As a result, excess protein in the caeca often leads to their proliferation. Birds move digested nutrients from the caeca back into the small intestine via retro-peristalsis, giving the bird a second chance to absorb nutrients that have now been broken down into fractions that were not absorbable the first time.

This process can move microbiota too, and so if the balance in the caeca has changed to favour pathogenic organisms, they are often moved into the small intestine, where they can bind to epithelial cells and proliferate. It is normal for birds to have some pathogenic organisms in their GI tract. However, when they can replicate to big enough numbers, there is a knock-on impact to the immune system.

An immune or inflammatory response is very energy expensive and, as a result, it can directly impact profitability because energy is being diverted away from growth.

For instance, it is common for sub-clinical infections to show via a reduction in egg production or FCR. It is estimated that 70% of the immune system functions through the gut.

As a result, improving gut health and microbial diversity can help to reduce the inflammatory response, preventing an impact being seen on performance. This happens due to the interaction between the microbiota and the cells of the immune system. Peyer's patches are 'sampling' cells that belong to the immune system but sit between epithelial cells in the gut.

They constantly sample the gut lumen for potential challenges and, if one is found, will send messages to mobile immune cells to respond.

Modulating the immune response

The microbial population are non-self organisms and, by having the right diversity in the gut, they modulate the immune response, helping to teach the immune system what foreign objects are worthy of a response and which are not. Inflammation is a primary immune response whereby excess mucus is produced.

This provides an extra barrier for pathogenic bacteria to cross over, preventing them from binding to the epithelial cells. In cases where there is an actual disease challenge, this is a useful mechanism. However, if birds have not got the correct microbial balance, then it is likely that an inflammatory response will be mounted in response to harmless objects.

The excess mucus produced also prevents nutrients from passing to the surface of the villi, which means that feed cannot be used efficiently, and nutrients will be wasted. Birds need all of their nutrient requirements met in

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order to produce to their genetic potential. If they are deficient in any component, including both micro and macronutrients, their bodily functions will not be as efficient, and therefore production suffers.

Central to gut health is the microbiota. The population of organisms interacts either directly or indirectly with all bodily systems. As discussed above, many studies have shown that having a diverse, balanced microbiota can help to influence the immune system and improve its functionality. Within the gut, there is an ecosystem, and similar to any closed system, there is competition.

Different bacterial species compete with one another to occupy a niche. Developing the correct balance of microbiota starts at birth, and if beneficial organisms can be helped to occupy their niches first, it helps to prevent potentially pathogenic or detrimental bacteria from growing as they are out-competed. The beneficial organisms, by out-competing others, provide a protective barrier for the epithelial cells, preventing pathogens binding.

The microbiota also influences the immune system. Beneficial bacteria help to promote the inner mucus layer and interact with Peyer's patches.

This helps to bolster the immune system, giving better overall health and performance. Inflammatory responses, when elicited, lead to the secretion of certain chemicals. These chemicals stress the bird and gut and, as a result, the tight junction proteins, which hold intestinal cells together, can become less functional.

When this happens, bacteria can translocate into the bloodstream, where they can access many areas, such as joints or the ovaries. E. coli is a common culprit, and translocation leads to leg health problems and peritonitis.

Improving tight junction integrity by promoting microbial diversity will help to prevent issues later in life that may have big impacts economically.

Improving gut health

Gut health can be improved in many ways. Actigen, for example, is an easy means of helping to improve microbial diversity with proven performance benefits.

Careful management of biosecurity and heat stress are other means of benefitting gut health, although the biggest impact comes from improving gut health in parent flocks. Microbiota are passed down from the mother to the offspring, so improving the diversity of the mother's microbiota will ensure that the organisms that seed the hatchling's gut first are more beneficial.

The GI tract is the only organ through which the nutrients from feed can enter the bird, and as such, improving its structure and functionality is a clear way to help birds produce to genetic potential.

It is the limiting factor to poultry performance in all species. A healthy gut will improve feed conversion, meaning that a producer will achieve more from less, not only improving their performance but their sustainability credentials too. Key to extending laying cycles and improving egg production is the health and well-being of the hen.

Ensuring the bird's nutrient requirements are met from hatch will prevent stress from being placed on her bodily systems, setting her up for a longer and more productive laying cycle.

Furthermore, due to the negative impact that the inflammatory response can have on the bird through stress, improving the functionality of the immune system through improving microbial diversity will help improve overall health status. This directly improves welfare parameters.

Gut health is relatively easy to improve with various implementations, but if not managed correctly, it can have disastrous economic impacts on the profitability of production systems.

Rather than always focusing on the least-cost formulation of diets, perhaps producers should give consideration to what increase in return they might have from implementing a gut health programme. It is truly an economic proposition. ■