Global food production must increase by more than 1 percent per year — nearly 70 percent in total — over the next 35 years. Forecasts suggest poultry will account for a sizable portion of the future food supply. In fact, production and consumption are predicted to double by 2050 — growth propelled by its low-cost, small environmental footprint, positive health attributes and lack of religious restrictions.

Such growth will be made possible by advances in genetics, management and nutrition.

“The future is extremely bright for poultry,” says Aidan Connolly, chief innovation officer with global animal health and nutrition company Alltech, who believes the poultry industry will soon achieve 1:1 feed conversion.

“Genetically, this should be possible by 2024, but there are many other factors that are preventing us from getting there,” Connolly explains. “If we see an improvement of a point, point and a half, in feed conversion every year, it could take 30 years; however, a 15-year time frame is possible if we really address underlying issues of precision nutrition from a gene
expression perspective and disease management such as viral and coccidiosis control.”

First, it is crucial to identify what precision nutrition means for growers and how developing technologies will advance poultry production for maximum efficiency and profitability.

**Precision nutrition in action**

Precision nutrition is defined as “the effective utilization of available feed resources with the aim of maximizing the animals’ response to nutrients” by meeting its precise nutritional requirements for optimum protein production.

“The precision nutrition concept is sustainable based on the minimum nutrient offered to the animals, achieving the right amount to respond to their potential genetics background,” said Mario Penz, Cargill poultry director. “To get the best results from nutrition, there are mandatory needs to be fulfilled, such as feed production quality, uniform diets, continuous pellet quality, farm biosecurity and healthy birds.”

While holistic feed and farm management isn’t new to poultry production, advancements in supporting technologies are fast-tracking opportunities for producers to better utilize the benefits of precision nutrition.

Here are several areas where precision nutrition will enhance feeding strategies:

1. **The role of NIR analysis**
   Near-infrared spectroscopy (NIRS) equipment utilizes light wavelengths to analyze the nutrient composition of raw materials. NIRS measurements mitigate the economic losses of nutrient variability and allow poultry feed manufacturers to adjust formulations accordingly.
   “Rapid sample analysis allows nutritionists to change their diet formulation, adjust ingredient safety margins, and monitor feed mill efficiency by correlating formulated diets to the actual diet nutrient value — minimizing over- and under-formulating diets and ensuring the birds receive adequate nutrition,” said Dr. Kendre Stringfellow, AB Vista’s North American technical and sales manager.

   Precise NIR measurements are used in conjunction with available science-based nutrition data to enhance a producer’s feeding strategy.

2. **New nutrient utilization**
   Advances in NIR technology have resulted in a larger number of analyzed nutrients and in the development of new nutrients, Cargill poultry technology director Henk Eerings said, citing the development of the Amino Acid Index Database for protein-rich raw materials.

   “Depending on the quality of the protein-rich raw material, the digestibility coefficients of amino acids are changed so we have a more precise prediction of the digestible amino acids in protein-rich raw materials,” he says. “These new nutrients have been validated by animal trials and result in a more precise formulation of our feeds. Also, fat quality can be analyzed more precisely by NIR by incorporating, for example, non-esterifiable matter.”

3. **Feeding for genetics**
   Similarities in gene expression between the two primary genetics companies can be used as an advantage when it comes to the precise feeding of chickens or "the ability to feed specific genes and deliver nutrients to those genes at the right time and in the right form.”

   “Today, we are fairly imprecise in how we feed nutrients — meaning diets are currently not determined by gene changes; they are determined by nutritional studies which are imprecise because we have great variability in respect to genetics, conditions and ingredients," Connolly said, noting, for example, that feeding additives on exact days for an exact duration with the intent to make gene changes is the direction in which the industry is moving going forward.

   “Changes in gene expression will be critical for fertility, productivity and immunity,” Connolly said.
Digestibility adjustments

Different conditions produce different nutritional requirements in chickens. In time, companies will be better equipped to adjust their feed formulations to the circumstances.

For example, Penz states, “A connection with more NIR analyses in excreta — where changes in the spectra can be related to changes in digestion — during the grow-out period, feeds can be adjusted to reduce the amount of undigested nutrients. This can help to improve both performance under challenging conditions and to improve litter quality at the same time.”

Raw material rankings

Going beyond the digestibility of nutrients, Penz feels the post-absorptive processes that rank raw materials based on digestibility coefficients will garner more attention.

As more is known about feeding bird microflora, its link to improved absorption processes and the regulation of immune responses at the intestinal level, it will spur further changes in the ranking of raw materials for poultry feeds, he says.

Business-to-consumer traceability

BIOMIN’s development director Franz Waxenecker said precision nutrition systems will introduce semi- or fully automated traceability to the consumer. For example, ingredient or feed additive information could be captured and carried throughout broiler production and processing to the grocery store.

Technological advancements

In the future, digital technology, automation and artificial intelligence are expected to revolutionize how chickens are fed and raised.

“At the moment, we are imprecise in our understanding of what happens on a day-to-day basis in the chicken house,” Connolly said. “We estimate environmental conditions, litter conditions, nutrition. We don’t know the variation that occurs on a bird-by-bird basis. We don’t know a bird’s real-time data — weight, feed consumption, water consumption. … But I believe sensors will be a big part of things moving forward.”

Waxenecker agrees, “The sensors deployed in a precision nutrition system will provide additional eyes and ears to farm managers and technicians.”

In his opinion, the lack of connectivity between various systems, e.g. ventilation, feeding and health monitoring, causes data to be lost or underutilized.

The “Farm 4.0” concept — or the utilization of digital technologies for data capture — in precision agriculture programs form the basis of this model.

“With Farm 4.0, artificial intelligence should support the farm manager in decision-making,” Waxenecker says. “In the future, we see high-tech sensors being deployed throughout production to monitor feed, feces, barn air, animal behavior and more. Sensors connected to significant computing power would use deep learning algorithms to correlate monitored inputs with potential underlying issues to identify arising problems and suggest or even take corrective action as needed.”

Real-time adaptations will also be made using “machine vision” technology, or the use of smart cameras, to observe bird behavior to monitor what is actually happening in the house, Connolly predicts.

References available upon request.

This is the seventh article in WATT Global Media’s 100-year anniversary series, which considers bird welfare. The next article in the series will explore industry structure.