

Future of Animal Feed: An Industry in Transition

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The focus of the feed industry in the coming year is to fulfill user's demand for security and resilience by increasing the competence and productivity through advanced processing technology, new developments in feed additives and supplements in animal nutrition during manufacturing of animal feed. Price and supply challenges on critical raw materials needed for feed formulations have lately been caused by extreme weather conditions, the global COVID-19 pandemic, and demands on logistic networks. As a result, operational efficiency has suffered, uncertainty has grown, and firms have lost a lot of money. The price volatility and lack of availability of conventional feed ingredients resulted in the necessity for the animal feed industry to re-explore new supply chains and enhance feed efficiency and animal nutrition. Novel feed ingredients may emerge as a result of advances in raw materials, potentially changing the overall approach to feed formulation.

With COVID-19 still in effect, it is predicted that price volatility will dominate the market in 2021. "Commodity pricing is likely to drive up feed costs even further, putting pressure on producer profitability across the supply chain." As it became important to supply animals with a "nutritionally balanced" diet for greater productive performance, a constantly changing feed business was formed. Today's generation is more curious to learn about the antibiotics, feed additives, supplements and alternative feedstuffs used to feed the animals they eat. We continue to learn more about nutritional balance and digestion via research and continue to utilize new technology developments to improve animal feed practices. Feed expenses are the largest component of the entire cost of production for a livestock farmer, regardless of whatever species is being produced. Feed cost can account for up to 70% of total production costs, especially in species like swine and poultry. The primary feeds are crop wastes and by-products, which account for 40% of total consumption (World Bank, 1996).



Livestock animals produce meat, eggs, milk, and other products using maize and soybean meal as energy and protein sources, accounting for one-fifth of protein consumption by man. As a result, animal output is expected to increase by 21% by the year 2025 (Mottet *et al.*, 2017). If feed efficiency remains constant, this anticipated expansion would necessitate an increase in global feed supply from 6.0 to 7.3 billion tonnes of dry matter (Kim *et al.*, 2019). Humans and animals are increasingly competing for grains (corn, wheat, bean, and other legumes). As a result of the rising demand on natural resources, global food security is jeopardised, posing a challenge to the long-term viability of food systems in general.

Consistency of Quality is Crucial in Animal Feeds

When it comes to young animal nutrition, the quality of the ingredients is a critical aspect that makes or breaks any commercial feed. Quality goods typically come at a cost, which is repaid via improved animal performance and health, as well as consumer loyalty. The feed industry's immediate goal is to enhance animal performance attributes, reduce feed costs, and increase feed production efficiency, which is frequently accomplished through key ingredients. Quality consistency, on the other hand, is a characteristic that the industry does not fully recognize or even acknowledge. A young animal while eating a low quality feed may openly refuse to eat it, however in most cases, feed consumption is just reduced. However, the danger to animal health outweighs any loss in growth performance, especially since that the antibiotics are no longer used as a preventative measure in feed. As a result, while quality is essential, it can never be guaranteed until each batch or source is thoroughly verified. Even then, there are unanticipated variables that might impact the final product's quality. It must be kept in mind that consistency and quality must always be assured while manufacturing animal feed.

Balancing Ingredient Variability and Diet Formulation

During different periods of life, nutrient requirements alter, notably in response to growth, pregnancy, and breastfeeding. Amino acids, fatty acids, glucose, or other substrates, as well as higher quantities of minerals and vitamins and related cofactors, are required for feed formulation.

Diet formulation is the process of choosing the types and amounts of ingredients (including vitamin and mineral supplements) that will be used to create a diet with specific nutrient concentrations. Choice of components will be impacted by the species to be fed and the



experimental or production aims. Estimated nutrient requirements, possible nutrient losses during manufacturing and storage, bioavailability of nutrients in the ingredients, and potential nutrient interactions must all be considered when determining target nutrient concentrations. The diet must be palatable enough to ensure adequate food consumption, as well as nutritionally balanced to deliver the nutrients required for a balanced diet. It should also be devoid of any potentially harmful chemicals or infectious microorganisms.

Research on farm animals show that growth and milk production rates have an impact on nutritional requirements. If high-energy diets are utilized, nutritional concentrations in the diet need to be increased to compensate for lower food consumption. As a result, when creating diets with unique nutrient concentrations, the possible impacts on other nutrients must be addressed, and nutrient amounts need to be adjusted if necessary. To achieve consistency in ingredient composition and inclusion rates, it is recommended to utilize feed additives which are designed to encourage animal resilience as well as premixes.

New Technology and Innovation: Optimization of Animal Feed Production

Many software's were created by computer programmers in order to provide the greatest choice for animal feed manufacturers when it came to ration preparation. Advanced features like live weight, racing, lactation time, and animal feed supply information may all be used to create optimal feeding plans. Many animal feed manufacturers utilize various automated animal feeding systems that include every stage of feeding, feed preparation, mixing equipment, and feed distribution installations to improve productivity. This process must also include brewing and other agro-industries, as well as food waste, grain by-products, and crop residues, as well as biofuel, and plants and plant products that are less well-known and not typically utilized as animal feeds. The optimization of resource usage must be based on continuous technological innovation and validation. Research and development are required to establish techniques and recommendations for the breeding of grasses that can thrive in severe climates and grow quicker under short growth periods while producing more biomass and digestibility for animal feeding. This necessitates ongoing nutritional content research in labs and field trials of potential feed supplies. Feed manufacturers may use the findings of these tests to partially or completely replace conventional animal feedings with more alternative innovative feeding techniques based on local resources, thereby influencing



livestock productivity while also preserving the environment and conserving natural resources.

To avoid degradation in quality and loss, all types of ingredients, as well as compound feeds, require specific handling during storage. Stock control is also necessary to guarantee that the animals' feed demands are met and that enough of each ingredient is accessible for production when it is needed. Even with the best production technology or storage conditions for animal feed, the feed output is mostly determined by the quality of the raw materials. Raw materials nutritional and physical quality varies considerably from year to year, depending on growth circumstances and harvest conditions. These variables, in particular, can have a significant influence on the raw materials protein level, as well as its digestibility and energy value amid other parameters.

Precise Nutrition

Rations are determined based on many factors (e.g., species, age, genetic potential, farming practices) in order to supply the correct quantity of nutrients to the animals. Many feed producers are opting to go deeper and use precision feeding techniques these days. Precision feeding is a component of the precision livestock farming method, and it entails employing various feeding strategies to provide the exact amount of nutrients to each individual animal at the right time in order to improve profitability, efficiency, and sustainability.

Feed additives used to replace antibiotics

Antibiotic overuse in animal feed and humans come up with a rising threat of antibiotic resistance. Some bacteria that cause severe infections in people have already developed resistance to most or all available treatments and medicines. Producers of livestock and poultry feed can decrease or eliminate the use of antibiotic growth promotion or prophylactic antibiotic usage by enhancing nutritional health. Feed additives can enhance intestinal health, which helps farm animals be more resilient and reduces the need for antibiotics. The importance of gut health in boosting animal immunity and minimising antibiotic use is becoming popular.

Plant extracts, phytochemicals: Antimicrobial activity may be found in a wide range of botanicals and synthetic chemical defined flavors. The gut sensing properties of certain of these chemicals, on the other hand, may be more significant in terms of the host's gastrointestinal health and immunity. Some of these chemicals have been found to cause

substantial changes in mucosal immunity when given at modest doses (<100 ppm). Certain plant-derived chemicals, such as spice and herb extracts, have high (in vitro) antibacterial and (or) antiviral activities, although findings in the field are inconsistent and brand-specific. Although this technology appears to be in its early stages, plant extracts tend to function best when combined with organic acids, since they appear to have a significant synergistic impact.

Enzymes: Supplemental enzymes, which are now widely employed to boost the nutritional value of most commercial feeds, will increase their functionality under a range of feed manufacturing circumstances and feed system methods for different animal species. Non-starch polysaccharides in cereals such as wheat, barley, oats, and rye can be reduced by carbohydrases. If left uncontrolled, these anti-nutritional substances increase digesta viscosity, which promotes the development of bacteria in the gut.

Probiotics in general may influence the makeup of the gut microbiota and the immune system. *Bacillus* spp. based probiotics are the most widely used in pigs and poultry due to the thermal stability of the spores during pelleting. Live yeast-based probiotics are another option. These are mostly used in dairy nutrition to increase rumen efficiency and avoid rumen acidosis, but they are also used in sow and piglet diets. Other bacteria such as *Lactobacilli* or *Enterococci* species, are occasionally used in newborn animals 'starter cultures', to steer the early microbiota in a desired direction.

Prebiotics: Specific sugars and fibres have the ability to alter the gut microbiota and selectively promote microorganisms that are thought to be advantageous to animal health. Some sugars can prevent pathogens from adhering to the mucosa, such as mannose-based sugars, which can prevent some *Salmonella* spp. from adhering to the mucosa.

Nutritional effects of vitamins and trace elements: When administered at considerably greater quantities than the NRC recommendations, several vitamins and trace elements may have an influence on the immunological competence of young animals. However, most vitamins are currently provided in practice at amounts that are far higher than what is required. In animal research, the effect of extra zinc and specific forms of zinc has been examined and linked to a variety of health indicators, mostly related to immune and skin condition parameters.

Novel ingredients for Animal Feed



The future of feed additives is rapidly changing, from insect protein to single-cell proteins. The need for sustainable animal nutrition is higher than ever, with the alternative protein market for animal feed projected to surpass in the coming years. Some of the unusual and often surprising ingredients that are helping feed producers to boost output and performance while also conserving the environment are discussed below:

Insects: Insects are among the most effective sources of protein in terms of production per area of land, as they may contain more than 80% protein and have a wide range of amino acids. Using insects as animal feed make sense biologically because many animals, particularly chicken and fish, consume insects naturally. Incorporating edible insects as alternative protein sources is an environmentally beneficial solution for the future of sustainable animal nutrition, because of their high nutritional content and higher feed conversion efficiency.

Seaweed or Microalgae: Algae is a source of starch, protein, lipids, pigments and vitamins that might become a frequent possible ingredient in feed formulation. Algae, which is already renowned as a key source of omega-3 fatty acids, is poised to become a large, nutritionally dense biomass as a result of emerging technologies. Initial experiments with algae have yielded positive results in terms of both reproductive performance and meat nutritional value. Seaweed can be utilized to improve the sustainability of livestock production systems as a source of bioactive chemicals for boosting animal health and productivity, as well as lowering enteric methane. Species of red submarine grass, *Asparagopsis taxiformis* and *Asparagopsis armata*, are washing up on shorelines throughout the world and have the ability to counteract methane emissions produced by livestock production. According to studies, even a tiny amount of this seaweed added to a daily diet has the potential to reduce methane emissions from cattle and dairy cows alone are enormous. Microalgae are also being studied as a viable alternative feed ingredient for poultry, with the goal of improving broiler health and reducing climate impacts.

Single-cell protein: Single-cell proteins (SCP) or microbial proteins such as yeast, bacteria, fungus, and algae are edible unicellular microorganisms that thrive on a variety of carbon sources. While SCPs are not new, technological and scientific breakthroughs are allowing unique proteins to alter the animal feed business, particularly in aquaculture. SCP-based



protein meals are a sustainable, renewable feed ingredient that compensates for the inadequacies of plant-based meals while also reducing the demand for fishmeal in aquafeeds.

Overcoming Agricultural Uncertainty

Cereals and grains used to feed farmed animals are a good source of energy, with protein levels typically ranging from 8 to 15%. It is critical to understand the nutritional value of each feed component when optimizing the nutrition of farmed animals. Cereals' amino acid makeup, on the other hand, isn't always appropriate for animals, as a result protein or amino acid supplement is needed even if the protein content of the grain is already high.

Any deviation from the special formulation may change the nutritional content of the final meal and may impair animal performance. When feeding farmed animals, the first thing to look for is excellent quality grain feed with good color, no moulds, and no unpleasant odors. It is feasible to assess the quality of raw material used in animal feed at any time and from any location using a device like GrainSense. The GrainSense gadget may be used in a variety of ways in animal production. The feed manufacturer can distinguish between different grain qualities and trade the feed quality to optimize the feeding. When buying grains, the feed manufacturer can also make sure that the quality is comparable to the price.

Feed Sector in the Digital Era

Nutrigenomic methods will become the industry standard for identifying nutritional and environmental variables that impede production efficiency and wellbeing. This data will enable feed formulation and livestock production to reach unprecedented levels of accuracy. In due course animal feed will be closer to accomplish genetic potential by targeting genes important in animals for growth rate, meat quality and disease prevention. The feed manufacturing plant will become "smarter" as a result of the application of NIR technology. This will allow for real-time analysis of incoming raw materials, as well as diet reformulation to assure uniformity in each batch. This will allow new feed ingredients, long-term nutritional conditioning, and other innovative supplement techniques to be used.

To summarize, the feed industry's future success depends on its capacity to fulfill customer demands for safety and sustainability while boosting efficiency and production in order to feed nine billion people by 2050. Analytical technologies like near-infrared spectroscopy, in vitro fermentation modeling, nutrigenomics, and bioinformatics will be used in feed formulation to quantify nutritional value, making feed formulation and production a more

exact science. All technologies that we are developing and applying in research, development, and innovation programmes will be commonplace in the not-too-distant future. They will make it possible to address the tremendous difficulties that animal feed manufacturers and animal nutrition confront today and in future to improve performance, considerably more effectively. That involves getting the most return out of animal feed and attaining maximum output at the lowest feasible cost. However, this isn't just about foreseeing the future; it's also about making it happen.

Krimanshi manufactures nutritious climate resilient animal feeds based on alternate fibers, proteins and fats derived from upcycling of organic food waste and agri residues. We transform organic food waste into nutritious alternate ingredients, replacing environment intensive plant protein as well as over harvested fish protein used in animal feeds, boosting the health of livestock, thereby making it a sustainable feed solution. Since plants have anti-nutritional compounds and non-optimal amino acid profile in addition to their exponential large price swings, fish rearing for fish meal is an expensive affair and leading cause of GHG emissions; functional ingredients from upcycled food waste offer great economical replacements and right amino acid profiles that rival fish and plant-based animal feed offering better productivity and ultimately farmer's profits.

References:

1. World Bank. India livestock sector review: Enhancing growth and development. The World Bank, Washington D.C. **1996**.
2. Mottet, A.; Haan, C.; Falcucci, A.; Tempio, G.; Opio, C.; Gerber, P. Livestock: On our plates or eating at our table? A new analysis of the feed/food debate. *Global Food Security*.**2017**, 14, 1–8.
3. Kim, S.W.; Less, J.F.; Wang, L.; Yan, T.; Kiron, V.; Kaushik, S.J.; Lei, X.G. Meeting Global Feed Protein Demand: Challenge, Opportunity, and Strategy. *Annual Review of Animal Biosciences*. **2019**, 7, 221–243.