

GROWTH PROMOTION IN BROILERS

Poultry rearing, the world over is either for meat production or egg production. Broiler is a class of poultry developed for meat production. Hence, in case of broilers the main thrust is to improve growth. This is achieved through various measures including the use of feed additives claiming to enhance broiler performance in terms of body weight gain. Broiler farmers are faced with choosing from a myriad of growth promoting substances all claiming to improve performance. These products are non – nutritional and often contain nothing that contributes directly towards meeting the animals requirement for nutrients. Yet, many have been found to be highly cost effective when added to feeds. The selection of a growth promotant must be based on safety and reliability to produce high economic returns. The most

widely used are the antimicrobial agents, including antibiotics. In recent years, there has been a flurry of interest in the use of other non- nutritive substances such as acidifiers, probiotics, enzymes, herbal products, microflora enhancers and immunomodulators.

Feed supplements originating from microbial sources

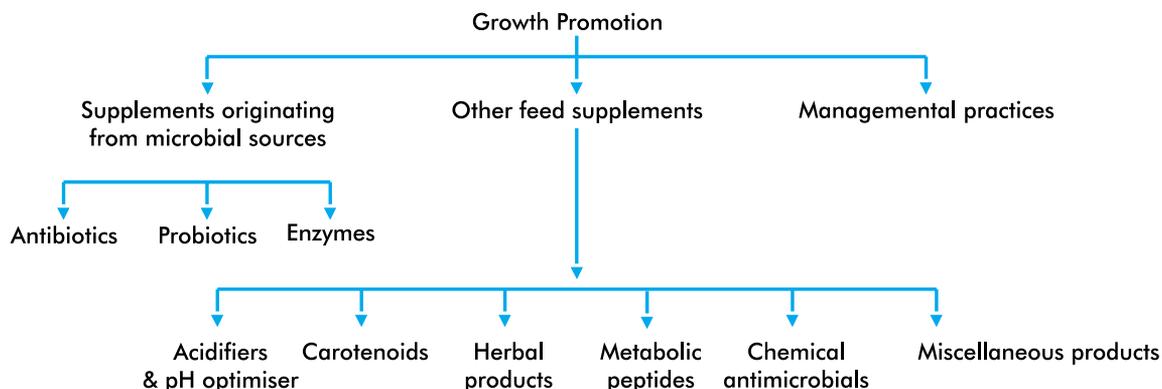
Antibiotics

High levels of production and efficient feed conversion are the need of the modern poultry industry. Today, poultry is reared in intensive conditions. Hence there is a manifold risk of infections .To keep birds healthy, we rely on antibiotics, which promote growth by warding off infections. Using antibiotics in feed gives producers an

economic advantage in raising animals to market weight quickly and at a low cost. The routine addition of growth promoting antibiotics to animal feeds has become commonplace in poultry industry.

The initial use of antibiotics in diets arose from the discovery in the late 1940's, in the United States that including the fermentation products of *Streptomyces aureofaciens* (a strain of bacteria) in the diets of simple stomached animals, such as pigs and poultry, resulted in a growth response. In the next fifty years, the use of antibiotics as feed additives in pigs and poultry production became virtually universal. Because prevention of disease transmission and enhancement of growth and feed efficiency are critical in modern animal husbandry, there has been widespread

Growth promotion options



incorporation of antibiotics into animal feeds in many countries. Today, more than 50 % of all antibiotics produced are used in animal feeds.

Mode of Action

Antibiotics as growth promoters show more or less definite antimicrobial and/or antiparasitic activity. Antibiotics are primarily intended for three purposes:

- Growth promotion, to improve feed efficiency at low dosages
- Prevention of common infectious diseases in the respective species
- Treatment of specific diseases (antibiotic chemotherapy)

The exact mechanism by which antibiotics bring about improved performances in growth and/or feed efficiency is not very clear. They may involve more than one mechanism such as:

- Thinning of the mucous membrane of the gut, facilitating better absorption
- Altering gut motility to enhance better assimilation
- Producing favorable conditions to beneficial microbes in the gut of the animal, most likely by destroying harmful bacteria
- Lower immune stress resulting in a shift of protein synthesis towards muscle and away from antibody production.

Feeding of antibiotics to chicks has clearly been shown to improve performance and decrease the population of *Clostridium perfringens* across different diets. Various

reports in the literature indicate that feeding of sub-therapeutic levels of antibiotics and antimicrobial result in:

- Suppression of bacteria responsible for mild but unrecognizable infections,
- Reduced production of growth depressing toxins from microflora,
- Lower nutrient use by the microflora leaving more for the animal,
- A thinner gut wall capable of enhanced nutrient absorption,
- Lower production of ammonia in the gut which reduces turnover of mucosal cells and results in less energy consumption by the animal.

It is possible that antibiotic growth promoters allow animals to express their natural potential for growth and that growth promotion is achieved by antibiotics exerting their effects through a direct influence on bacteria in the animal gut. This is evidenced by the fact that there is no response to the use of antibiotic growth promoters in germ free animals.

Concern over feeding antibiotics to farm animals

Bacteria are very adaptable organisms because of their very short generation time (as little as 15 to 20 minutes for some species under ideal conditions) and the propensity for sharing genetic information even among different species of bacteria. From the outset, there have

been worries that through over-use, the effectiveness of feed antibiotics might diminish and that strains of bacteria would arise which were resistant to their effect. Of greatest concern was the possibility that resistance generated on the farm could lead to a loss of effectiveness of key antibiotics in human medicine. Recently the European Community reviewed the technical information and changing social attitudes to the use of additives in animal feed. As a result the EU has introduced legislation, which effectively bans most feed antibiotics from August 1999.

Drawback of banning antibiotics

If antibiotic growth promoters are to be removed completely, it will inevitably be at a cost either to the consumer or to the producers, unless an effective replacement is found. Management practices can help to reduce the risk of widespread intestinal disorders but cannot address the problem entirely.

Probiotics

The potential future removal of growth – promoting antibiotics from farm animals has led to renewed interest in the use of live microbial cultures (probiotics) as growth promoting agents. Probiotics are live cultures of microbes, often lactic acid producing bacteria but also some other species, which are fed to

animals to improve health and growth by altering intestinal microbial balance. Some bacterial cultures are specifically used for competitive exclusion (CE). Probiotic microorganisms added to feed might protect birds from intestinal pathogens by several possible mechanisms, referred to as competitive exclusion:

- adherence to intestinal mucosa thereby preventing attachment of pathogens
- production of antimicrobial compounds such as bacteriocins and organic acids
- competition with pathogens for nutrients
- stimulation of the intestinal immune response
- affecting the permeability of gut and increasing the uptake of nutrients.

Enzymes

Poultry possess a variety of gastrointestinal enzymes to aid the digestion of feed.

However, young birds may produce inadequate amounts

of certain enzymes and even older birds cannot digest some plant materials containing complex carbohydrates such as cellulose, arabino-xylans and B-glucans. Therefore the addition of enzymes to feed may be a useful strategy to increase its digestibility. Dietary enzymes may supplement the birds own digestive enzyme activity or enable the bird to utilize the energy in complex carbohydrates which normally passes unchanged through the gastrointestinal tract. The non-starch polysaccharides (NSP's) present in the feed may lead to poor performances due to;

- Increased viscosity because of their water binding capacity
- Entrapping the essential nutrients due to cluster formation
- Decreased digestibility and absorption of nutrients

This leads to sticky droppings, increased microbial proliferation and also decreased fat digestibility.

Majority of plant

phosphorus in feeds is present in the form of phytic acid, which is not available to the bird. An enzyme, phytase, hydrolyses phytic acid to myoinositol and phosphoric acid, thereby releasing phosphorus. Phytase makes free phosphorus contained in cereals and oilseeds, and by breaking down the phytate structure also achieves the release of other nutrients, such as calcium, amino acids, which are bound to phytate.

Other feed supplements

Acidifiers and pH optimizers

The pH of the gastric and intestinal chyme directly affects the activity of various digestive enzymes and rates of digestion of feedstuffs. Additionally, pH affects the species composition of the intestinal microflora and the prevalence of potential pathogens. The low pH (acidic) environment of the proventriculus and gizzard provides a barrier to pathogens. However, pH is also of significant importance in other regions of the GI tract, possibly affecting the ability of pathogens to colonize the gut. Additionally, the growth of opportunistic organisms, including pathogenic E.coli and Salmonella is known to be favored by near neutral pH, whereas lower pH values are more conducive to the growth of friendly bacteria, including lactobacilli.

Dietary additives that may

**Bird's main digestive enzymes
(enzymes secreted inside the body)**

SOURCE	ENZYMES
Proventriculus	Amylase
Pancreas	Amylase Lipase Trypsin Carboxypeptidase A+B Chymotrypsin Elastase
Small intestine	Amylase Maltase Iso-maltase Sucrase Lipase Peptidase and Enterokinase

affect intestinal pH include organic acids and compounds that promote short chain fatty acid production by the microflora. Acids such as formic, fumaric, lactic, propionic, citric, sorbic, and phosphoric have been studied for potential growth promoting properties. Acidifiers have a function similar to other anti microbial substances. Acidifier combinations and enterically protected acidifiers hold the promise of consistent performance. Feed grade acidifiers are generally recognized as safe.

Carotenoids

Growth promoting, immune stimulating effects of carotenoids are recently gaining importance in the field of poultry nutrition. Dietary inclusion of Astaxanthin at 2 ppm has been reported to improve weight gain and FCR in broilers. Carotenoids have also been reported to stimulate phagocytic and bacteria killing ability of blood neutrophils and peritoneal macrophages. Beta-carotene in combination with vitamin E, biotin, folic acid and vitamin C has been shown to improve reproductive performance.

Herbal Products

Herbal remedies have been used for thousands of years to treat infectious diseases, making use of the antibacterial properties of individual herbs. The rationale for using these

natural remedies is that many herbs and spices are known to have compounds with anti bacterial effects. Herbs may also increase the palatability of diets and thereby increase feed intake. Some herbs are thought to promote growth by preventing or limiting pathogenic bacteria in the digestive system, just like a conventional anti microbial. Natural growth promoters seem to lend themselves more to synergies of action, where a number of components come together, in formula of sorts, to create the desired effect. Plant derived agents include saponins, alkaloids, esters, quinines, isobutylamides, phenol, carboxylic acid esters and terpenoids are currently under study for their growth promoting and immune modulating effects.

Phytogenic (plant origin) substances like essential oils and bitter substances are natural solutions for poultry fattening. Essential oils stimulate the production of saliva and gastric juices during feed intake leading to a better-feed conversion. These possess antibacterial properties also. Bitter substances have a reflectory influence on digestive organs (stomach, intestine, liver, pancreas) through the central nervous system improving feed intake and digestion of nutrients.

Metabolic peptides

Peptides represent a new

class of safe and efficient growth promotant. Peptides appear to function by increasing the number of nutrient transporters present in mucosal cell membranes. Agents such as epidermal growth factor and pancreatic polypeptide have been found to enhance glucose and amino acid absorption when applied to the lumen of the gut hence there is a need to produce such substances at economical cost and practical methods need to be found out to deliver these compounds to intestinal cells without destruction.

Chemical Antimicrobials

These are synthesized chemicals that inhibit microorganisms. They have similar properties as antibiotics. These include arsenicals such as arsanic acid and roxarsone and others such as carbadox, olaquinox, haloquinol and copper sulphate. Most countries have banned sulfonamides and nitrofurans (furazolidone) as growth promotant because of problems with tissue residue and suspected carcinogenicity.

The major benefit of feeding an antimicrobial is cost savings from improved feed conversion. Feed efficiency response is highest in fast growing genetically improved animals. The magnitude of response depends on animal management, disinfection procedures, age of the farm buildings and feed quality.

Products including roxarsone, halquinol, carbadox and olaquinox potentiate the effect of anticoccidial drugs.

Roxarsone and arsenic acid are beneficial in improving pigmentation in poultry.

Copper sulphate, halquinol are useful antifungal agents. Although these products will not destroy mycotoxins already present in raw materials, they will limit further growth of mould. The use of copper sulphate, arsenicals, acidifiers, and olaquinox in the presence of gizzard erosion is contraindicated as it may cause further irritation and limit endogenous acid production.

Miscellaneous products

• Metal chelates and Organic Mineral sources

High producing poultry require additional supplementation of critical nutrients to ensure performance upto potential. In the last ten years, for instance we have seen breeder performance increase from 90 chicks per breeder to the present level of 160+ chicks per broiler breeder. Similar improvements are evident in broilers and layers. This enormous increase in productivity requires us to examine closely the nutrition package being provided to poultry.

Trace minerals play a critical role in the immune system, egg formation, fertility and enzyme functions in poultry. One of

the options available to us is to increase the inorganic supplementation of trace minerals in the diet. However, several studies have concluded that supplementing additional inorganic minerals does not, beyond a point, increase the bioavailability of these minerals to the bird. In fact, additional inorganic minerals often work in a negative manner by interacting with each other and having a negative influence on mineral bioavailability. To meet the additional requirement of minerals the only option, therefore, is to include organic trace minerals in the diet, the bioavailability of which is assured.

Generally poultry producers do not observe mineral deficiency symptoms. However, between efficient performance to a bird's potential and the observation of mineral deficiency symptoms there is a large gap which is a gap that is sought to be covered by organic trace minerals. The deficiency of any trace mineral cannot be observed symptomatically until the deficiency is severe but there are chances that production parameters may be affected. This implies that organic trace minerals allow the flock to perform to its true potential.

Organic minerals are special sources of minerals, which are more efficiently absorbed by the animal than ordinary salts, such as ferrous sulphate, copper sulphate etc. Minerals chelated with

organic compounds like amino acids enables better production performances.

• Polyunsaturated fatty acids

Polyunsaturated fatty acids (PUFA's) are components of dietary fats and oils. In contrast to saturated and monounsaturated fatty acids, PUFA's have at least two double bonds, a feature which affects crucially their structural, physical and chemical properties. Long chain PUFA's have been shown to have an important role in health and disease. They have important structural functions notably in the brain and nervous tissues and are precursor of prostaglandin's, thromboxanes and leuco-trienes, a group of hormone like compounds collectively called as eicosanoids.

Conjugated linoleic acids refers to a mixture of positional and geometric isomers of linoleic acid with conjugated double bonds in the region of carbon atoms 8-13. It has been demonstrated to have anticarcinogenic effects and also shown to provide small improvements in average daily weight gain and feed efficiency during some stages of growth. Limitations of the inflammatory processes that accompany an immune response may be beneficial to growth rate provided it does not interfere with the ability of the bird to fight the disease in question. Conjugated linoleic acid is

one such product of interest. It is a compound that has shown to reduce the negative effects of cytokines in animals undergoing immune stress.

- **Complex Carbohydrates**

These products are claimed to benefit animal performance in one of two ways; either their presence may prevent pathogenic bacteria adhering to gut wall or by reaching the hindgut of the animal in an undigested form, they may influence the pattern of hind-gut fermentation towards more desirable bacteria. Mannan oligosaccharides (MOS) are carbohydrates that are derived from the cell wall of yeast. The non-digestible MOS improve the performances and health of poultry, primarily by promoting gastro-intestinal tract health. The substance does not only affect the non-immunologic defence mechanisms in the GI tract, but also functions by modulating the immunologic protection mechanism.

- **Natural silicates**

Silicates are used by the feed milling industry as anti-caking agents, carriers for premixes and binders. A new practice is the use as

detoxifier and growth promoters. There are various types of natural silicates, which bind mycotoxins in the GI tract and reduce their absorption. The greatest potential for this kind of application is through "clinoptilolites" a negatively charged Zeolite. The so-called hydrated sodium calcium aluminosilicates (HSCAS) belongs to the clinoptilolites. The mode of action is based on the three dimensional structure of clinoptilolites crystals. Mycotoxins, particularly aflatoxin, and ammonia are irreversibly bound by HSCAS and excreted with the faeces. It does not act in the feed. The chyme liquid in the digestive tract of animals activates it. Clinoptilolite allows the prolonged stay of feed in the gastro-intestinal tract so that the utilization of nutrients is improved.

- **Emulsifiers**

Young animals are not capable to digest fats present in feed efficiently. To utilize the fat efficiently emulsifiers are added. Products containing phospholipids can aid in nutrient uptake from the digestive tract. Addition of such products may improve growth and feed conversion.

Management practices

Good hygiene and husbandry practices are extremely important for flocks to perform efficiently. If the routine use of antibiotics in feeds is discontinued, it may become even more important to maintain a clean environment for livestock. Improvements in the environment which have demonstrated effectiveness include:

- Attention to efficient cleaning methods and effective sanitiser use to minimize spread of disease.
- Maintenance of an appropriate ventilation rate.
- Appropriate environmental temperatures.
- Stocking density appropriate for the age of the flock and housing conditions.

To summarize the decision for selecting a growth promotant should be based on known field problems and disease challenge at the farm level. Although used for promoting growth, many additives have additional benefits that justify their specific use over other products under certain conditions.



Corporate Heights, SCO - 24, Sector - 14, Gurgaon 122001 India

Ph : (0124) 6315044 / 45 / 46 Fax : (0124) 6314680 email : avitech@vsnl.com