



**Neospark**

## Antibiotic Growth Promoters in Animal Production

### What is an Antibiotic?

An antibiotic is a substance that kills or stops the growth of bacteria. There are hundreds of naturally occurring antibiotics, but only a few are useful in treating conditions in poultry.

Antibiotics are used to control bacterial diseases in chickens. They prevent bacterial growth, provided they are used at recommended levels and the organism is not resistant. **Antibiotics are of no use in diseases caused by viruses.**

However, antibiotics are sometimes given in viral disease outbreaks to prevent secondary infection with bacterial agents like *Escherichia coli*.



### What are antibiotic growth promoters?

Also known as '**growth promotants**', these substances, as the name indicates, are antibiotics that are used in feed continuously at a low level to improve growth and feed conversion. This supplementation is not to be confused with therapeutic (curavite) uses of antibiotics in which high levels are given to treat a specific disease problem. Therefore, feed levels of antibiotic growth promoters should be those recommended by the manufacturer. However, development of resistance by bacteria has been associated with their use and therefore this practice is not permitted in many countries.

### What are the benefits of using antibiotic growth promoters?

They improve bird's performance, health status, uniformity and production efficiency.

## How do they work?

Antibiotic growth promoters (AGPs) act by modifying the intestinal microflora (bacterial population). On the basis of Gram's staining, bacteria are divided into two groups: Gram-positive and Gram-negative. Most AGPs act against Gram-positive organisms, which are associated with poorer health performance of the bird.

Recent work has revealed that use of AGPs in germ-free birds has no benefit on the performance. This clearly indicates that their effect is due to antimicrobial (antibacterial) activity, rather than due to any direct interaction with the physiology of the bird.

## How does intestinal microflora (bacterial population) reduce bird's efficiency?

They achieve this through the following mechanisms.

1. By competing with the host for nutrients in the intestinal tract. The bacteria use a significant amount of energy of the diet. This energy is then not available for the bird.
2. In some circumstances, bacteria produce an immune response that causes appetite depression and also breakdown of muscle protein to continue this response.
3. By producing diseases, particularly **necrotic enteritis**.
4. By reducing digestive efficiency of the bird, by destroying the digestive enzymes and reducing the absorptive surface area.
5. By increasing the size of the intestinal tract through the production of certain compounds that stimulate its size, such as polyamines and volatile fatty acids. The net result is an increase in the energy required to maintain the intestine, thereby leaving less energy available for productive processes, such as muscle growth.

## Under what environmental conditions do AGPs provide best results?

The negative effects of the intestinal bacteria, outlined above, indicate that the best results depend on the microbial loading of the small intestine. For example, as already indicated, in germ-free birds use of AGPs in the feed has no beneficial effect on the performance of the bird. This means that the lack of a microbial challenge will limit the response to growth promoters.



This challenge is made up of the background microflora present in the cage, pen or shed, where the bird lives. The environment is particularly important in this context because the intestine of the chick is sterile (free from bacteria) before hatching. The first bacteria to enter the intestinal tract are not at all challenged by others for space and nutrient. As a result, if they find the intestinal environment suitable, they rapidly become established.

As more and more bacteria enter the intestinal, competition between the species increases and only the fittest survive. Bacteria which become established and successfully colonize (grow) on day one, are not able to do so several days later, because the environment in the intestine becomes increasingly unfavorable to new comers (invaders) for reasons of space, the presence of toxins and the availability of nutrients. The growth of bacterial species that come to live in the intestine therefore depends on the bacteria present in the environment of the cage, pen or shed and the order in which the birds are exposed to such organisms. To conclude, environment plays the main role in the response to AGPs and best results are obtained under conventional (routine) conditions of poultry farming and not under germ-free conditions.

## What influence does diet have on the microflora and therefore on the response to antibiotic growth promoters?

From the above, it is clear that for a particular bacterial species to become established in the intestine, it must not only be present but must also find the correct nutrition and space in which to live. The nutrition present in the intestine ultimately comes from diet given to the chicken. It is now known that the diet can influence the microflora and therefore the response to antibiotic growth promoters.

**It is important to remember that diet is a source of nutrient for the microflora as much as it is for the bird.** Poultry have a very rapid process of feed processing. Because of the very low pH in the gizzard/proventriculus, feed entering the duodenum has very few bacteria. They are largely destroyed by the acidic environment of the gizzard and proventriculus. The various digestive enzymes, the high oxygen tension and the presence of high concentration of antimicrobial compounds (i.e. acting against bacteria), such as bile salts in the duodenum, further restrict the bacterial growth in this portion of the small intestine.

However, after duodenum, further down in the small intestine the environment changes and becomes more favourable for the bacterial growth because of the low oxygen tension, somewhat alkaline pH, and the lower concentrations of enzymes and bile salts.

When digestion is as its best, the rate of nutrient digestion and extraction from the intestine is such that there is little material left that can be digested (e.g. starch and protein) by the native microflora of the small intestine.



As a result, under ideal circumstances, best digestion and best absorption of nutrients restricts the bacterial population of the small intestine. The bacterial population is therefore kept to a minimum because nutrients are not available to the bacteria. Populations in the caeca are supported only by dietary fibre.

However, when digestion is poor (for whatever reason), more starch and protein reach the lower part of the small intestine and the restrictions on bacterial population are then removed to some degree. Also, there is a change in the type of food available, with more starch and protein than fibre. Therefore, not only population density but also species dominates change. High viscosity diets or diets with poorly digestible starch and/or protein, produce such reactions.

### **How does the bird respond to such a challenge?**

The bird responds to such a challenge through several mechanisms. These include:

1. There is an increase in the rate of production of digestive enzymes.
2. There is an increase in the weight of pancreas.
3. The size of the intestine increases to deal with the unabsorbed nutrients. The increase in size is brought about by bacterial by-products, such as polyamines (i.e. compounds having more than one amino group,  $\text{NH}_2$ ). Polyamines are known to stimulate mucosal growth and enterocyte (lining intestinal epithelial cell) turnover. In other words, they increase size of the intestine. Thus, the bird tries to compensate for the reduction in the rate of nutrient absorption by increasing the digestive capacity.

### **How effectively is the bird able to cope with diets having poorly digestible starch and/or protein?**

Unfortunately, in an attempt to increase the size of the intestine, the lining epithelial cells (enterocytes) grow and move up the villi more rapidly. Such epithelial cells are immature and are less able to absorb nutrients efficiently. This is because they have a limited range and concentration of digestive and absorptive enzymes. Moreover, the surface glycoproteins in immature cells differ greatly from those of mature cells. As a result, a totally new environment is presented to the intestinal bacteria. Due to this, a rapid change in the species of bacteria and their distribution takes place.

This usually results in intestinal disorders. Thus, a simple change in the diet can have far-reaching consequences. Antibiotic growth promoters markedly reduce the damage caused by such dietary fluctuations by directly destroying the harmful bacteria. As a result, adverse effects of dietary changes are kept to a minimum.

**What then is the overall conclusion regarding the use of antibiotic growth promoters in poultry?**

Antibiotic growth promoters have undoubtedly improved performance and health status in poultry throughout the world and are extremely helpful.

For Further information please refer to our Product details of:

<b>Megadox-FS</b>	<b>Megadox-N-FS</b>
<b>FuraTec-200</b>	<b>Nubiotic-100-FS</b>
<b>DoxiStin-FS</b>	<b>Oxy-100-FS</b>
<b>RimoDox-2%-FS</b>	<b>CTC-150-FS</b>
<b>TyloMax-FS</b>	<b>QuinCare-FS</b>
<b>SteviMax-500-FS</b>	