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ANTIBIOTICS IN POULTRY NUTRITION
A Review of Recent Research Work
By I. C. MILLER, B.Sc. (Agric.)

O\VER the past few years considerable publicity has been given to the use of "growth-promoting" substances in the rations of livestock. As yet, comparatively little is known concerning the manner in which these substances benefit the birds or animals, but in this article I have endeavoured to indicate the results of research work which had been carried out and the lines on which current research is now operating.

Most farmers are already aware that proteins play a very important part in livestock rations. These proteins are not all constructed on the same pattern but are built up from several substances known as amino acids. Just as the pattern and nature of say a brick wall can be varied by using different types of bricks in its construction, so can the protein be varied according to the number and types of the amino acid "bricks" from which it is composed.

It has been recognised for a long time that proteins of animal origin such as those found in milk or meat are better for promoting growth than the vegetable proteins such as those found in fodder plants. It was thought that this was due to the fact that animal proteins possibly contained more and possibly better-balanced selections of the amino acids required for animal growth than did the vegetable proteins. As a result of the number of investigations which were carried out by research workers it soon became evident however that some other factor present in the animal protein played an important part in the growth stimulation of pigs and poultry. For want of a better name this was called the Animal Protein Factor or A.P.F.

A NEW VITAMIN

In 1948, a new vitamin isolated from liver extract was found to possess growth-promoting properties when added to vegetable diets. This vitamin, known as the anti-pernicious-anaemia, or B12, vitamin was established as the important part of the Animal Protein Factor.

It then became necessary to discover other sources from which this vitamin could be obtained and it was found to exist in the crude residues from the industrial preparation of "antibiotics"—especially aureomycin and streptomycin.

It is well known that some moulds secrete substances which have the ability to suppress the growth of certain types of bacteria and these substances are known as "antibiotics". Penicillin was the first of these substances to capture the popular imagination and its discovery was followed by many others, the range of which is still being extended. When these industrial residues were used as growth-promoting agents in poultry rations, a somewhat surprising result was obtained. It was found that these crude residues gave a greater growth-promoting effect than equivalent quantities of pure vitamin B12 and it was shown in 1950 that this greater response was due to the traces of aureomycin remaining in the residues.

VARIED RESULTS

Since then a considerable amount of work has been carried out on the use of antibiotics in rations containing varying proportions of vegetable and animal proteins. The most noticeable fact arising from all this work is the very great degree of variability in the results obtained.

It is obvious from the experiments carried out in many countries that the use of antibiotics will not reduce increases in the growth rates in poultry in every case. Various theories have been put forward to explain this and it may be of interest to examine some of them.
Firstly it was believed that the antibiotics stimulated growth by changing the bacteria in the chicks' intestines from "undesirable" to "desirable" types. These desirable types produced unknown factors which are responsible for the growth effect. However, results from studies to determine changes in the bacterial population of the gut are very varied—some record considerable changes; others none at all.

**THE INFECTION THEORY**

As you know, antibiotics are used primarily to combat diseases and the obvious suggestion has been made that the growth promoting properties may be due to the suppression of harmful bacteria, especially if housing and sanitation are poor. This then gave rise to the "Infection" theory which assumed that the antibiotic in feeding stuffs controlled a disease which, though not present in a form severe enough to produce any well-marked symptoms would nevertheless depress the growth rate. Many workers have found that birds kept in new premises do not respond to antibiotics but similar birds housed in old "germ-laden" sheds do respond quite markedly.

"Beginners' Luck" is a common saying in the poultry industry and this could result from the cleanliness to be expected in new yards and pens. The infection theory is supported by some very interesting work carried out using "germ-free" chicks. It was found that the growth of ordinary chicks was raised from 4-10 per cent. by antibiotics but the "germ-free" birds on a similar diet did not respond to the antibiotic. However they did grow as well as the treated ordinary birds and this fact indicated that the function of the antibiotic was to destroy the bacteria which depressed the growth rate, rather than to supply additional nutrients. This theory seems quite a logical one but it is by no means universally accepted.

An interesting difference was noted between the "germ-free" and ordinary chicks and that was a difference in the thickness of the lining of the gut. The "germ-free" chicks had a thinner lining which the workers theorised enabled more efficient utilisation of the feed and therefore a faster growth rate.

Some workers obtained a growth response by injecting antibiotics instead of providing them in the feed. They concluded that the growth-stimulating activity of antibiotics could be due to a direct action within the chick rather than to an indirect action on the bacteria in the gut. It has since been shown, however, that antibiotics injected into the bloodstream can pass into the gut cavity and so affect the bacteria.

It has also been reported that the water consumption of treated animals is very much greater than that of the controls but there is no consistent evidence on this point. Certainly in the experiment conducted here there was no apparent differences between the groups.

Another unproven theory is that animals receiving antibiotics show an increased appetite, but this effect on the appetite could be secondary, that is, it could result from general well-being rather than be a primary cause.

**LOCAL EXPERIMENTS**

At the Animal Health and Nutrition Laboratories, two trials have been conducted to determine the possible effect of feeding a penicillin supplement in a practical ration.

In the first trial, 70 turkey poults of mixed sex were used and the antibiotic tablets (penicillin) were dissolved in the drinking water. No significant difference was obtained between the treated and untreated birds, although turkeys are reputed to be very responsive to antibiotics.

The second trial employed 8 groups, each of 15 cockerel chicks. Four groups received procaine penicillin in the feed and other four groups were used as controls. At 16 weeks of age the penicillin groups were significantly heavier than the control groups, the difference being noticeable from the first week onwards. By the 22nd week, however, there was no difference at all. This follows the general pattern of several investigations—a marked response in the early stages but by the time maturity is reached there is little or no difference between the birds.

The pens used for this experiment, although cleaned with hot caustic solution prior to the beginning of the trial, had...
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been used to house poultry for some time previously. The fact that there was no difference in mortality in the groups, however, suggests that the results obtained were not due to suppression of any obvious disease.

It is always necessary when reporting or reading the results of any experiment to remember that those results were obtained under certain conditions of feeding and environment and that they will not necessarily be repeated in any other cases.

**SUMMARY**

From a consideration of all available experiments, however, we can summarise some facts which have been fairly consistently true.

1. Young growing birds show the greatest response to antibiotics and, therefore, the use of antibiotics in the rations of mature fowls is unwarranted. Obviously, in order to gain the greatest financial benefit it is necessary to market the birds before the effect of the supplement has been reduced, i.e., before approximately 19 weeks of age in the case of cockerels.

2. The use of antibiotics has no influence on the age at which pullets commence laying or on the subsequent egg production.

3. Antibiotics, even under conditions most favourable to their beneficial effect, cease to stimulate growth from approximately the 12th week and can therefore be withdrawn from the ration after this period.

4. There is no conclusive evidence to show that the feeding of antibiotics reduces the protein requirements of poultry.

5. No response has been obtained in the growth rate of ducks but positive results have sometimes been obtained with geese. Very little work on these species has been carried out so far.

It must be kept in mind that antibiotics in animal nutrition should not be considered as "wonder drugs". They will not replace good feeding and careful sanitation and also their effect is far from consistent.

Although under some conditions the use of antibiotics will have advantages, there could be a very real danger in their unrestricted use.

It is common knowledge that the continued use of antibiotics in the control of disease has led to the development of resistant strains of bacteria in the same way as insects have developed resistance to various insecticides. It is possible that the continuous feeding of antibiotics will result in a gradual lessening of the response due to resistant strains tending to become dominant. It therefore seems desirable to restrict the use of antibiotics to the control of bacterial disease by massive dosage rather than run the risk of developing resistant noxious strains by the consistent feeding of small amounts in an attempt to promote growth.

The evidence available indicates that good feeding and cleanliness, over a period, will provide results equally as good as those obtained by supplementing the ration with antibiotics.

**Reference**

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