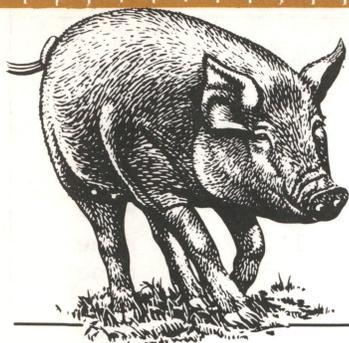


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Swine



Antibiotics and other additives for swine

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Antibiotics

The term *antibiotic* means against life, or destructive of life. An antibiotic is a compound synthesized by a living organism that inhibits the growth of another living organism.

Antibiotics are of biologic origin; nearly all are produced by bacteria or molds. Many microorganisms produce antibiotics that inhibit or kill other organisms, a process called *antibiosis*. Antibiotics are effective against many bacteria. Some antibiotics are *bacteriostatic*; they prevent growth of bacteria. Others, like penicillin, are *bactericidal*; they destroy bacteria. Groups of antibiotics based on their action are:

- Agents acting on the cell wall of bacteria, such as penicillin and bacitracin.
- Agents that have a detergent effect on the cell membrane, such as polymyxin and novobiocin.
- Agents interfering with protein synthesis, such as tetracyclines and streptomycin.
- Agents affecting new nucleic acid metabolism, such as griseofulvin.

Another comparison often made of antibiotics refers to their scope of effectiveness.

- Narrow-spectrum antibiotics have an antibacterial effect on a relatively small number of species.
- Broad spectrum antibiotics are active against a wide variety of organisms. In general, where no specific disease is isolated, the antibiotic having the broader spectrum—that is, effective against the greatest number of detrimental organisms—is preferred.

Antibiotics have a short history. Penicillin was first discovered in 1929, and several other antibiotics were identified during the 1930s and 1940s. From then until now, the development of a large number of antibiotics and other additives has helped increase

gain and reduce the feed required per unit of gain in swine.

At present, at least 11 antibacterial or antifungal compounds or groups of compounds are widely used in swine feeds. Some of these are used much more extensively than others. The list includes various salts of bacitracin, chlortetracycline, dynafac, furazolidone, mycostatin, oxytetracycline, oleandomycin, penicillin, streptomycin, bambermycins, and tylosin.

Chemotherapeutics and anthelmintics

Chemotherapeutics are organic compounds with bacteriostatic or bactericidal properties similar to those of antibiotics. But, unlike antibiotics, these compounds are produced chemically rather than microbiologically. Anthelmintics, or dewormers, are also organic compounds added to swine diets generally for short intervals to help control worms in growing-finishing swine and the breeding herd.

Other additives with potential for swine feeds are also commonly used, such as carbadox and sulfas. New products likely will continue to be developed and approved.

Mode of action

How antibiotics and other additives work to improve performance of livestock has been the subject of considerable research. Research trials would seem to support at least two main effects that antibiotics have:

Nutrient-sparing effect. Many research reports have shown that antibiotics enhance the growth of intestinal organisms that synthesize nutrients needed by the host animal. These organisms synthesize nutrients that are dietary essentials for the pigs; thus if a diet is deficient in certain vitamins, for example, this

*Some material in this guide is adapted from Pork Industry Factsheet (PIH-31).

deficiency could be partially overcome by the microbial synthesis.

Other reports show a depression of growth in organisms that compete with a host animal for certain dietary needs. Also, pigs fed diets with supplemented antibiotics have thinner intestinal walls. This could possibly account for an improved absorption of nutrients when animals are fed antibiotics.

Disease-control effect. Antibiotics are most effective in livestock that are under poor conditions or in a poor state of health. Healthy animals in an ideal environment respond less to antibiotic treatment. This supports the idea that antibiotics do have a disease-control effect.

Research has also documented well the growth-promoting potential of other feed additives. Most research suggests that the additives promote growth by influencing the parasitic microorganisms of the animal.

Choosing a feed additive

Several growth-promoting feed additives are available to swine producers. Table 1 lists several commonly used feed additives, their approved levels, and their withdrawal times.

Consider the required withdrawal time before slaughter when choosing a feed additive. Some feed additives may remain in tissues longer than others. The level fed and the duration of feeding also influence tissue retention of additives. *Abide by the required withdrawal times and use only the approved levels.*

Also consider your farm's environment, management conditions, and the stage of production cycle when choosing a feed additive. These things will cause the specific feed additive and the level needed for the best response to vary.

The degree of response to feed additives will vary with the control of disease organisms in the pig's environment. Response will also vary by stage of production; in certain stages, response to feed additives is clearly seen; in others, a response is less evident.

The first few weeks of the pig's life are by far the most critical in terms of nutritional needs or health protection. The pig is born with no protection against organisms into an environment saturated with a wide variety of bacterial organisms.

The first milk, colostrum, of the sow will supply the pig with antibodies against the disease organisms in the surroundings, if the sow has been previously exposed to the organisms for enough time to synthesize the antibodies and concentrate them in the colostrum. However, by three weeks of age, this acquired immunity begins to disappear. The pig does not begin producing antibodies until five to six weeks. Thus, between three and five weeks, the young pig is most vulnerable to the environment's organisms,

Table 1. Approved levels and withdrawal periods for commonly used feed additives.

Feed additive	Approved level, grams/ton	Pre-slaughter withdrawal period*
Antibiotics		
Bacitracin	10-50	none
Bacitracin, M.D.	10-30	none
Bacitracin, Zinc	20-40	none
Bambermycins	2-4	none
Chlortetracycline	10-50	none
Erythromycin	9.25-64.75	none
Oleandomycin	5-11.25	none
Oxytetracycline	7.5-50	none
Penicillin	10-50	none
Tylosin	10-100	none
Virginiamycin	5-10	none
Chemotherapeutics		
Arsanilic acid	45-90	5 days
Sodium arsanilate	45-90	5 days
Carbadox	10-25	10 wk. (75 lb.)
Furazolidone	100-200	5 days
Nitrofurazone	—	5 days
Roxarsone	22.7-34	5 days
Combinations†		
Chlortetracycline	100	15 days
+ sulfamethazine	100	
+ penicillin	50	
Chlortetracycline	100	7 days
+ sulfathiazole	100	
+ penicillin	50	
Penicillin +	1.5-8.5	none
streptomycin	7.5-41.5	
Tylosin +	100	15 days
sulfamethazine	100	

*Period of time the drug must be removed from the diet before slaughter.

†Not a complete list of approved combinations; for further information, consult the Feed Additive Compendium, Miller Publishing Co., Minneapolis, Minn.

especially to any new, infective organism that may gain entry to the pig's environment.

Also, during the early weeks of a pig's life, it is exposed to several stress conditions that render it more susceptible to diseases: castration, weaning, treating for anemia, ear notching, vaccination, climatic stresses, and exposure to internal and external parasites. Research has shown marked responses to antibiotics during these early production stages. By the time the pig reaches 40 to 50 pounds body weight, its own disease protective system—antibody formation—is functioning well, and it has adapted to environmental stresses. This is why a practical feed additive program calls for a reduction in levels as the pig develops or progresses to market weight. Fast growing, healthy pigs may not benefit from antibiotics or chemotherapeutics during the finishing phase.

Table 2. Feed additive use in swine production

Stage of production	Suggested level grams/ton	Remarks
Gilt developer	0-20	If disease problems are minimal, feed none or a low level.
Breeding (10 days pre-breeding to 10 days post-breeding)	0-200	Feed additives may improve conception rate and litter size.*
Gestation	0-20	Use additives <i>only</i> if disease and environmental stress are great.
Farrowing (7 days pre-farrowing to 14 days post-farrowing)	0-200	This is a high-stress period; feed additives may aid in preventing infections.
Lactation	0-100	Feed additives may help prevent poor milking performance of sows.
Pre-starter (early weaned or orphaned pigs) and starter (15-30 lb periods)	100-250	Stress and disease risks are high. The greatest response to feed additives is obtained with this age group.
Grower period (30-70 lb)	50-100 (250)	Use higher levels for purchased feeder pigs because of high-stress situations of shipping and marketing.
Developer period (70-130 lb)	0-100	Generally, the response to feed additives declines with age. The use of lower cost additives may be necessary for cost effectiveness.
Finisher period (130 lb to market weights)	0-50	Response of antibiotics is minimal during this stage of growth. If an additive is used, one that does not require a pre-slaughter withdrawal is preferable.

*Low conception rates, small litters and lactation problems in sows are caused by many factors (boar infertility, enteroviruses) other than bacterial infections. If you are experiencing serious problems, consult a veterinarian.

Proper use of feed additives

Consumers are increasingly concerned about bacterial resistance and drug residues in animal tissues. Thus, producers should use extreme caution and follow feeding directions on the label exactly. The Food and Drug Administration regulates the use of feed additives. The Animal-Plant Health Inspection Service of the U.S. Department of Agriculture and the State Feed Regulatory Agencies are responsible for compliance with FDA regulations and are actively initiating more rigid controls for monitoring feed and pork at packing houses for residues of feed additives. *Abide by the FDA regulations on removal of certain additives before selling hogs for slaughter.* Disregarding these regulations could cause costly losses to producers because of tissue residues and the loss of certain effective compounds for use as feed additives.

In addition to the formation required for non-medicated feeds, the FDA requires that all medicated feeds carry the following information on the tag:

- *Purpose of the medication.* The FDA evaluates the drugs for effectiveness in growth promotion or disease prevention and treatment. Those purposes that have been adequately tested will appear on the label.

- *Direction for use.* Mix at proper levels and do not use unapproved combinations.
- *Names and amounts of all active drug ingredients.*
- *The withdrawal period.* A warning or caution for withdrawal is on the label when required for the particular drug contained in the feed.
- *Warning against misuse.* This will explain the adverse effects of using too high levels or feeding at the wrong stage of production.

If you use medicated feeds:

- *Read the feed tag.* Be sure you're using the medicated feed for the right stage of production and for tested and approved reasons.
- *Meet the withdrawal times* to avoid residues and to ensure safe and wholesome pork.
- *Do not assume withdrawal will just happen.* The time after last feeding required for a drug to clear the system varies with the type of and level of drug. All approved drugs have been tested for clearance time, and the length of withdrawal is based on research.
- *Use medicated feeds only for purpose and species indicated.* Drugs that are effective and approved for use in other species may not be effective in pigs, or the clearance time may differ.

- Do not give additional drugs to animals on medicated feed without professional approval. One drug may interfere with the effectiveness or clearance rate of another drug.
- Do not permit other drugs to contaminate medicated or non-medicated feeds through mixer contamination or by other means.

Although the responses to additives are more variable in gestating-lactating sows, you can expect a response during breeding and just before and after farrowing. Research shows feed additives in the breeding ration will increase conception rate and litter size, and additives in the farrowing ration increase pig survival and performance. Table 2 presents some general recommended levels of antibiotics for the various stages of the production cycle.

In the case of certain specific diseases and parasites, you can feed additives that have proved effective for the specific problem at higher levels for a shorter period in comparison to levels allowed for growth promotion. Table 3 contains a list of specific diseases and the additives that have proved effective in controlling the problem. Correctly diagnosing the trouble and matching the additives to the problem are important.

Producers should have their own feed additive programs. Some may need to feed a certain antibiotic or chemotherapeutic during all stages of growth and development. Others may need to feed a certain additive or combination for a certain period, then change to another additive for additional growth periods only. Each of these programs can be effective as long as you maintain a standard feeding program, using certain antibiotics or chemotherapeutics for growth promotion while reserving others for disease outbreaks.

This does not mean that you should stay with one antibiotic or chemotherapeutic year after year, but you should avoid continual switching every two or three weeks or using a number of different antibiotics within a short period. By following a standard antibiotic or chemotherapeutic program, you and your veterinarian can plan and adapt a treatment or a preventive medicine program accordingly.

Always follow good feeding, sanitation, and disease control programs and don't expect to buy manure in a bag of medicated feed.

Summary

All additives available to swine producers have been thoroughly tested, approved, and found effective. We recommend additives for growth promotion, particularly for creep, starter, and grower diets. Use only

Table 3. Medicinal uses of feed additives.*

Disease	Pre-slaughter withdrawal
Atrophic rhinitis	
Chlortetracycline	none
Oxytetracycline	none
Tylosin	none
Chlortetracycline + sulfamethazine (or sulfathiazole) + penicillin	7 days
Tylosin + sulfamethazine	5 days
Bacterial swine enteritis (scours)	
Bacitracin	none
Bacitracin, M.D.	none
Bacitracin, Zinc	none
Carbadox	10 wk. (75 lb.)
Chlortetracycline	none
Furazolidone	5 days
Neomycin	20 days†
Nitrofurazone	5 days
Oxytetracycline	none
Chlortetracycline + sulfamethazine (or sulfathiazole) + penicillin	7 days
Neomycin + oxytetracycline	10 days‡
Penicillin + streptomycin	none
Cervical abscesses	
Chlortetracycline	none
Chlortetracycline + sulfamethazine (or sulfathiazole) + penicillin	7 days
Swine dysentery	
Arsanilic acid	5 days
Sodium arsanilate	5 days
Carbadox	10 wk. (75 lb.)
Chlortetracycline	none
Furazolidone	5 days
Lincomycin	6 days
Neomycin	20 days†
Oxytetracycline	none
Roxarsone	5 days
Tylosin	none
Neomycin + oxytetracycline	10 days‡
Tylosin + sulfamethazine	5 days
Virginiamycin	none
Leptospirosis	
Chlortetracycline	none
Oxytetracycline	5 days§

*Before treating sick animals, consult your veterinarian to determine the specific disease problem and what level to feed the prescribed antibiotic.

†Manufacturer's suggested withdrawal time, not established officially by FDA.

‡With 140 grams of neomycin; 5 days with less than 140 grams of neomycin.

§With 500 gm./ton use level.

approved additives at levels recommended and follow withdrawal times. Learn to evaluate your antibiotics and other additives in swine rations. See UMC Guide 2354, *Evaluating Additives for Swine Rations*.