



pork industry handbook

COOPERATIVE EXTENSION SERVICE • MICHIGAN STATE UNIVERSITY

Feed Additives for Swine

Authors

Mack D. Whiteker, University of Kentucky
Virgil W. Hays, University of Kentucky
Gary R. Parker, University of Kentucky

Reviewers

Vaylord D. Ladwig, University of Illinois
Jake L. Krider, Purdue University
Jim Butler, Austin, Minnesota

The use of feed additives in swine rations has been extensive in the United States for more than 25 years. Feed additives are used by most swine producers because of their demonstrated ability to increase growth rate; improve feed utilization; and reduce mortality and morbidity from clinical and sub-clinical infections.

In general, additives available for swine producers fall into three classifications: (1) antibiotics; (2) chemotherapeutics; and (3) anthelmintics (dewormers). Additives on the market can be used with reliability when recommended rates and specifications are followed.

Antibiotics

An antibiotic is a compound synthesized by a living organism which inhibits the growth of another. Therefore, it is biologically derived from bacteria and molds. The one thing antibiotics have in common in improving animal performance is their demonstrated ability to kill or inhibit the growth of certain microorganisms.

There are many antibiotics on the market, and they differ widely in chemical composition and mode of action. Thus, some have an antibacterial effect on a relatively small number of organisms, whereas others are active against a wider variety of organisms.

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 worm accumulation in growing-finishing swine and the breeding herd.

Some feed additives may remain in tissues longer than others. The level fed and the duration of feeding also influence clearance rates. Therefore, producers should abide by the required withdrawal times and use only the approved levels when incorporating additives into their swine rations. Tables 1 and 2 present some of the commonly used feed additives, their withdrawal times, and their approved usage levels.

Choosing a Feed Additive

Research has well documented the growth-promoting potential of feed additives. Most observations suggest that this effect is mainly a result of their influence on the parasitic microorganisms of the host animal. Also it is well documented that the degree of response varies with the control of specific or non-specific disease organisms in the animals' environment. Several feed additives are available to producers for growth promotion in swine. Table 1 lists several of the available feed additives and their approved growth-promoting levels.

Selection of a specific feed additive and the level needed for optimal response will vary with the existing farm environment, management conditions and the stage of the production cycle. In certain stages of the production cycle one can be rather sure of a response to feed additives; in other stages the likelihood of obtaining 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 that is highly 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, provided the sow has

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

Feed additive	Approved growth promotion level, grams/ton	Pre-slaughter withdrawal period*
Antibiotics		
Bacitracin	10-50	None
Bacitracin, M.D.	10-50	None
Bacitracin, Zinc	10-50	None
Bambermycins	2	None
Chlortetracycline	10-50	None
Erythromycin	10-70	None
Oleandomycin	5-11.25	None
Oxytetracycline	7.5-50	None
Penicillin	10-50	None
Tylosin	10-100	None
Virginiamycin	10	None
Chemotherapeutics		
Arsanilic acid	45-90	5 days
Sodium arsanilate	45-90	5 days
Carbadox	10-25	10 wk. (75 lb.)
Furazolidone	---	5 days
Nitrofurazone	---	5 days
Roxarsone	22.7-68.1	5 days
Combinations†		
Chlortetracycline	100	15 days
+ sulfamethazine	100	
+ penicillin	50	
Chlortetracycline	100	7 days
+sulfathiazole	100	
+ penicillin	50	
Penicillin + streptomycin	1.5-8.5	None
Tylosin + sulfamethazine	7.5-41.5	15 days
	100	
	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.

Table 2. Feed additives for worm control.

Feed additive	Pre-slaughter withdrawal time
Large roundworms	
Dichlorvos	None
Hygromycin B	48 hr.
Levamisole hydrochloride	72 hr.
Piperazine	None
Pyrantel tartrate	24 hr.
Thiabendazole	30 days
Lungworms	
Levamisole hydrochloride	72 hr.
Nodular worms	
Dichlorvos	None
Hygromycin B	48 hr.
Levamisole hydrochloride	72 hr.
Phenothiazine	None
Piperazine	None
Pyrantel tartrate	24 hr.
Thick stomach worms	
Dichlorvos	None
Threadworms	
Levamisole hydrochloride	72 hr.
Whipworms	
Dichlorvos	None
Hygromycin B	48 hr.

been previously exposed to the organisms for a sufficient time to synthesize the antibodies and concentrate them in the colostrum milk. However, by three weeks of age this acquired immunity begins to disappear. The pig does not begin producing sufficient antibodies until 5 to 6 weeks of age. It is during this period that the young pig is more vulnerable to the organisms of his environment, especially to any new infective organism that may gain entry to that environment. Also, during these early weeks of the pig's life he is exposed to a number of stress conditions which render him more susceptible to diseases. Castration, weaning, treating for anemia, ear notching, vaccination, climatic stresses and exposure to internal and external parasites are some of these stress conditions. It is during these early stages of production that marked responses to antibiotics have been observed. By the time the pig reaches 40-50 lb. body weight, his own disease protective system—antibody formation—is functioning well, and he has adapted to the environmental stresses to which he will be exposed. This helps explain why a practical feed additive program calls for a reduction in levels as the pig develops or progresses to market weight.

Proper Use of Feed Additives by Producers

With concern increasing about bacterial resistance and drug residues in animal tissues, the producer should use extreme caution and follow feeding directions exactly as indicated. The use of feed additives is regulated by the Food and Drug Administration. The Animal-Plant Health Inspection Service (APHIS) of the USDA and the State Feed Regulatory Agencies are responsible for compliance in the FDA regulations and are actively initiating more rigid controls on monitoring feed levels and pork at packing houses for residues of feed additives. Every pork producer must take precautions to abide by the FDA regulations on removal of certain additives before selling hogs for slaughter. To disregard these regulations could result in sizeable monetary losses to producers because of tissue residues and could result in the loss of certain effective compounds for use as feed additives.

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

- The purpose of the medication—the drugs are evaluated for their effectiveness in growth promotion or disease prevention and treatment. Those purposes which have been adequately tested will appear on the label.
- Direction for use of the feed—mix at proper levels and do not use unapproved combinations.
- The names and amounts of all active drug ingredients.
- A warning or caution statement for a withdrawal period when required for the particular drug contained in the feed.
- A warning against misuse—this will explain the adverse effects of using levels too high or feeding at the wrong stage of production.

In using medicated feeds the producer should:

1. *Read the feed tag*—to be sure that he is using the medicated feed for the right stage of production and for tested and approved reasons.
2. *Meet the withdrawal times*—to avoid residues and to ensure safe and wholesome pork.
3. *Not assume withdrawal will just happen*—the time after last feeding required for a drug to clear the system varies with the type of drug and level of drug. All approved drugs have been tested for clearance time, and the length of withdrawal is based on research data.
4. Use medicated feeds only for purpose and species indicated. Drugs which are effective and approved for use in other species may not be effective in pigs, or the drug clearance time may differ.
5. 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.
6. 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, producers should expect a response during breeding and just prior to and after farrowing. It has been demonstrated that proper use of feed additives will increase conception rate and litter size by having additives in the breeding ration, and increase survival and performance of pigs by having additives in the farrowing rations. Table 3 presents some *general* recommended levels of antibiotics for the various stages of the production cycle.

In the case of certain specific disease situations and parasite infestations, additives which have proved effective for the specific problem can be fed at higher levels for a shorter period in comparison to levels allowed for growth promotion. Table 4 contains a list of specific disease problems and those additives that have proved effective in controlling the problem. Correctly diagnosing the trouble and matching the additives to the problem are important.

Each producer should have his own feed additive program. 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 producers maintain

Table 3. Antibiotic feeding.

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	Use high levels of antibiotics to improve conception rate and litter size.*
Gestation	0-20	Use antibiotics only if disease and environmental stress are great.
Farrowing (7 days pre-farrowing to 14 days post-farrowing)	100-200	This is a high-stress period; use antibiotics to aid in preventing infections.
Lactation	0-50	Use antibiotics to help prevent poor milking performance of sows.
Pre-starter (early weaned or orphaned pigs)	100-250	Stress and disease risks are high, and response to antibiotics is great.
Starter (up to 25-30 lb.)	100-250	Stress and disease risks are high, and response to antibiotics is great.
Grower (25-60 lb.)	50-100	Use higher level for purchased feeder pigs because of high-stress situations of shipping and marketing.
Developer (60-125 lb.)	20-50	Generally, feeding of antibiotics will result in more economical gain during these stages.
Finisher (125 to market weights)	20-50	Response to antibiotics is less during this stage of growth than it is at younger ages. Use of an additive 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, etc.) other than bacterial infections. If you are experiencing serious problems, consult a veterinarian.

Table 4. Medicinal uses of feed additives.*

Disease	Preslaughter withdrawal
Atrophic rhinitis	
Chlortetracycline	None
Oxytetracycline	None
Tylosin	None
Chlortetracycline + sulfamethazine + penicillin	15 days
Chlortetracycline + sulfathiazole + penicillin	7 days
Tylosin + sulfamethazine	15 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 + penicillin	15 days
Chlortetracycline + sulfathiazole + penicillin	7 days
Neomycin + oxytetracycline	10 days‡
Penicillin + streptomycin	None
Cervical abscesses	
Chlortetracycline	None
Chlortetracycline + sulfamethazine + penicillin	15 days
Chlortetracycline + 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	15 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.

‡10-day withdrawal with 140 gm. of neomycin; 5 days with less than 140 gm. of neomycin.

§500 gm./ton use level, recommended 5-day withdrawal.

a standard feeding program, using certain antibiotics or chemotherapeutics for growth promotion while reserving others for disease outbreaks. This does not mean that producers should stay with one antibiotic or chemotherapeutic year after year; but they should avoid continual switching every two or three weeks using a number of different antibiotics within a short period. By following a standard antibiotic or chemotherapeutic feeding program, the producer allows his veterinarian to adapt a treatment or a preventive medicine program accordingly.

A continuous feeding program is advisable for pigs up to market weight. The additive of choice and the level needed for optimal response, as mentioned earlier, will vary with existing environmental conditions. In general, under conditions of no specific disease problems, the antibiotic or chemotherapeutic having the broader spectrum—that is, effective against the greater number of detrimental organisms—should be the antibiotic of choice.

It is advisable that a producer develop and follow a specific antibiotic feeding program instead of jumping from one program or one additive to another. This will prevent the additional problems associated with meeting withdrawal times, and it will make it easier to plan disease prevention and treatment programs. Always follow good feeding, sanitation and disease control programs, and don't expect to buy management in a bag of medicated feed.

Summary

With the intensification of swine production into confinement facilities, the risk of a higher incidence of clinical and sub-clinical disease increases because of the greater ease of transmittal from one animal to another. Although more knowledge about the role of hygiene in animal performance has accumulated and swine producers are expending greater effort, this increase in confinement rearing of swine has partially offset advances made in sanitation practices. This does not imply that antibiotics should be substituted for good nutrition and management but should *accompany* these facets of swine production. Although the percentage response to antibiotics or chemotherapeutics will be much greater where disease levels are high, these additives will not completely overcome the problems and permit performance equal to that which can be obtained by the combined effects of good diets, sound management and a carefully planned feed additive program.

All additives available to swine producers have been thoroughly tested, approved and found effective in increasing performance. Additives for growth promotion are recommended, particularly for creep, starter, and grower diets. Use only approved additives at levels recommended and follow withdrawal times. Misuse of additives cannot be tolerated. **Read the Feed Tag!**

MICHIGAN STATE UNIVERSITY

ES

**COOPERATIVE
EXTENSION
SERVICE**

MSU is an Affirmative Action/Equal Opportunity Institution. Cooperative Extension Service programs are open to all without regard to race, color, national origin, sex, or handicap.

Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8, and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Gordon E. Guyer, Director, Cooperative Extension Service, Michigan State University, E. Lansing, MI 48824.

This information is for educational purposes only. Reference to commercial products or trade names does not imply endorsement by the Cooperative Extension Service or bias against those not mentioned. This bulletin becomes public property upon publication and may be reprinted verbatim as a separate or within another publication with credit to MSU. Reprinting cannot be used to endorse or advertise a commercial product or company.

Reprinted 5:85-3M-KMF-UP, Price 10 cents. Single copy free to Michigan residents.