Department of Grain Science and Industry

Medicated Feed Additives for Beef Cattle and Calves

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Medicated feeds are instrumental in maintaining animal health and promoting growth and feed efficiency. However, it is important that medicated feeds be properly manufactured and withdrawal times be observed. If label instructions are not followed, animal health can be adversely affected and may result in illegal tissue residues.

The purpose of this bulletin is to explain the regulations regarding the use of medicated feed additives and to provide a list of approved drugs and drug combinations, use levels, and indications for use of medicated feed additives for beef cattle and calves.

Definitions

The regulations pertaining to the use of medicated feed additives are found in the Code of Federal Regulations (CFR), Title 21, Part 558. The Federal Food, Drug & Cosmetic Act provides the legal authority for these regulations. The following definitions will facilitate the understanding of the regulations regarding the use of medicated feed additives.

Medicated feed—Any manufactured or mixed feed that contains drug ingredients intended to promote growth or feed efficiency or to cure, mitigate, prevent, or treat diseases of animals other than human.

Category I drug—Drugs that require no withdrawal period at their lowest continuous-use level for all approved species.

Category II drug—Drugs that require a withdrawal period at the lowest continuous-use level for at least one of the approved species.

Type A medicated feed article—The most concentrated form of a medicated feed additive. It usually consists of a drug source and a carrier ingredient. It can be used in the manufacturing of another Type A medicated article or a Type B or Type C medicated feed.

Type B medicated feed—A medicated feed containing an animal drug and a substantial amount of nutrients including vitamins, minerals, and other nutritional ingredients. Nutritional ingredients must make up at least 25 percent of the feed by weight. It can be diluted to manufacture other Type B or Type C medicated feed.

Type C medicated feed—A medicated feed that is intended to be a complete feed. It can be fed as the sole ration, top-dressed, or free-choice (but not free-choice blocks or minerals). It is manufactured by diluting a Type A medicated feed article or a Type B or Type C medicated feed.

Veterinary Feed Directive (VFD) medicated feed—Historically, all drugs for use in medicated feed were made available on an over-the-counter (OTC) basis. Recently, the Veterinary Feed Directive (VFD 1997) category was created by Congress. VFD drugs are available in Type A medicated feed articles, Type B medicated feed, and Type C medicated feed. The Food and Drug Administration's Center of Veterinary Medicine (CVM) determines whether a product is approved as a VFD drug or as an OTC drug (FDA Veterinarian 1997).

CVM policy is that all **new** antimicrobials for therapeutic use in feed will be approved as VFD drugs. VFD-medicated feed requires that a veterinarian, under a valid veterinarian–client relationship, examine and diagnose animal conditions and determine that the use of a VFD-medicated feed is necessary. The veterinarian then issues a VFD by filling out a form supplied by the drug sponsor. The producer then presents this form to the feed supplier who will manufacture and distribute the feed in accordance with the VFD. VFD feed can only be fed in a manner consistent with the FDA conditions of approval, and extra label use is strictly prohibited. VFD feed may not be distributed without a

signed VFD form. The veterinarian, producer, and company supplying the VFD feed must all retain copies of the signed VFD form.

Registered vs. Nonregistered Feed Mills

Any feed manufacturer that uses a Category II, Type A medicated feed article must be registered with the FDA as a drug establishment (FDA-2656) and must register annually (FDA-2656e). Also, the facility must hold an approved medicated feed mill license. Registration as a drug establishment and FDA approval of a feed mill license is required before a Category II, Type A medicated feed article can be purchased. Category II, Type B or Type C medicated feeds do not require a federal license.

A nonregistered mill can use the following medicated feed article or feeds:

- Category I, Type A medicated feed article
- Category I, Type B or Type C medicated feed
- Category II, Type B or Type C medicated feed

Any questions regarding the status of a medicated feed additive should be directed to Kansas State University's Grain Science and Industry Extension office, the animal drug supplier, or the FDA.

Most on-farm feed manufacturers will be nonregistered (that is, not using a Category II, Type A medicated feed article). However, nonregistered mills are still subject to federal regulations. The Federal Food, Drug & Cosmetic Act provides that a medicated feed will be considered adulterated if the methods or equipment used for its manufacturing, processing, packing, or holding are not in compliance with Current Good Manufacturing Practices (CGMPs). CGMPs for nonregistered feed mills are explained in more detail in the K-State Research and Extension Bulletin MF-2091, *On-farm Feed Manufacturers Quality Assurance Pocket Manual.*

It is important to note that even though nonregistered feed mills are not subject to regular inspections by the FDA (or an authorized FDA agency), they can be inspected for cause, such as when they manufacture or distribute adulterated feed products or food products that are found to contain illegal drug residues.

Drug Labeling Symbols

The Animal Health Institute and the American Feed Industry Association have developed two symbols to appear on medicated feed additive labels to promote proper use: the "Eye Clock" and the "Double Arrows" universal warning symbols. The Eye Clock serves as a reminder to read directions carefully regardless of whether the particular drug has a withdrawal time. Some drugs have special manufacturing precautions and other feeding limitations. For example, some drugs, such as Monensin, can be fatal if ingested by equines. The Double Arrows warning symbol is designed to draw attention to precautions that must be observed if the producers are to avoid violative residues in their products. See Figure 1.

Withdrawal Times

The failure to follow label instructions and to observe withdrawal times are the major causes of violative drug residues in animal products destined for human consumption. The presence of residues above the specified tolerances set forth in the Code of Federal Regulations Title 21 violate federal law against the sale of adulterated products. Violative tissue residues can lead to delays in marketing and condemnation of a shipment. They also can result in regulatory actions in accordance with the Federal Food, Drug & Cosmetic Act.

Figure 2 illustrates how to calculate withdrawal times. Each withdrawal day is a full 24 hours starting with the last time an animal receives the drug. For example, if a drug has a 5-day withdrawal period and is discontinued at 9 a.m. on Friday, the end of the first withdrawal day will be 9 a.m. on Saturday. The fifth withdrawal day will end at 9 a.m. on Wednesday.

Approved Drugs and Drug Combinations

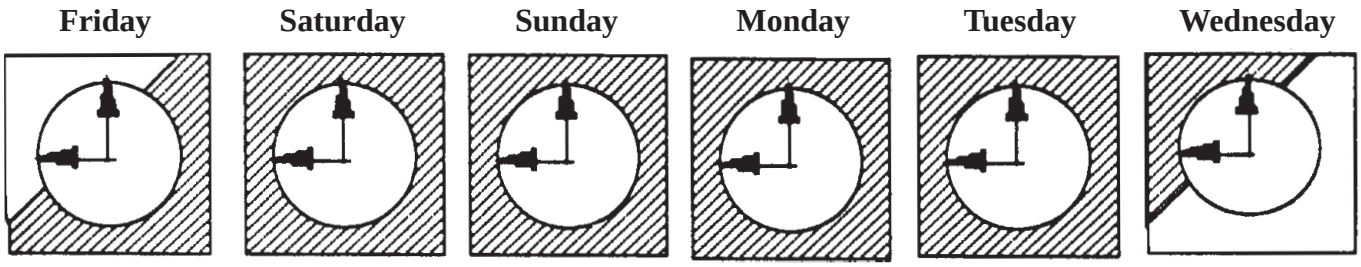
Tables 1–4 provide information regarding the proper use of drugs for beef cattle and calves (Title 21, CFR; 1997 *Feed Additive Compendium*).

- **Table 1.** Specific Applications of Approved Medicated Feed Additives for Beef Cattle.
- **Table 2.** Approved Medicated Feed Additive Use Levels for Beef Cattle.
- **Table 3.** Approved Medicated Feed Additive Combinations for Beef Cattle.
- **Table 4.** Approved Medicated Feed Additive Use Levels for Calves.

Note: Tables should not be used as a guide for mixing medicated feeds and are intended only as an overview of products. Regulations and approvals change fre-

Figure 1. "Eye Clock" and "Double Arrows" warning symbols

Figure 2. Calculating Withdrawal Times



quently. Use a current copy of the *Feed Additive Compendium* or product label for proper indications and dosages.

Federal law prohibits the use of different drugs, drug levels, drugs approved for one species used in another species or production class (for example, adult cattle vs. calves), or combination of drugs that are not listed for that use or drug in the Code of Federal Regulations. Such use may cause the drug to be adulterated and misbranded and may result in illegal tissue residues in the animals. Furthermore, such use may injure the animals fed such drugs.

Calculating the Amount of a Medicated Feed Article or Feed to Add to the Mixer

The "Drug Use Levels" presented in Table 2 and Table 3 represent the intended concentration of the active ingredient or drug in the final feed, **NOT** the amount of Type A medicated feed article or Type B or Type C medicated feed to be added at the mixer. Refer to the manufacturer's directions to determine the amount of medicated feed article or feed needed to achieve the desired concentration. Most manufacturers provide a table showing the amount of their product to add to attain the desired drug-use level. These values can be obtained by using Equation 1.

Equation 1.

$$\text{Amt. of product to add (lb)} = \frac{\text{Drug Use Level (g/ton)} \times \text{Batch Size (ton)}}{\text{Concentration of the Drug Source (g/lb)}}$$

Since the desired drug use levels can be listed in milligrams per head per day, milligrams per pounds of body weight, or milligrams per 100 pounds of body weight, it is necessary to convert these values to grams per ton before using Equation 1. The following equations can be used to convert the desired use levels to grams per ton.

Equation 2.

$$\text{Use Level (g/ton)} = \frac{\text{(mg/head/day)}}{\text{lb fed daily}} \times \frac{1\text{g}}{1000\text{ mg}} \times \frac{2000\text{ lb}}{1\text{ ton}}$$

Equation 3.

$$\text{Use Level (g/ton)} = \frac{\text{(mg/lb body weight/day)}}{\text{lb fed daily}} \times \text{(lb body weight)} \times \frac{1\text{g}}{1000\text{ mg}} \times \frac{2000\text{ lb}}{1\text{ ton}}$$

Equation 4.

$$\text{Use Level (g/ton)} = \frac{\text{(mg/100 lb body wt/day)}}{\text{lb fed daily}} \times \text{lb body weight} \times \frac{1\text{g}}{1000\text{ mg}} \times \frac{2000\text{ lb}}{1\text{ ton}}$$

If the drug activity level (concentration of the source) is listed as a percent, it can be converted to grams per pound by multiplying the decimal equivalent of the percent drug activity level by 454. The decimal equivalent of a percent is obtained by moving the decimal two places to the right.

Some medicated feed additive directions require that an intermediate premix be made before incorporation into the final feed. To determine how much intermediate premix to add, refer to Equation 1, but use the concentration of the intermediate premix as the "concentration of the drug source."

Examples:

1) Assume the table specifies that the desired drug use level is 500 milligrams per head per day. The drug concentration in the medicated feed additive is 11 percent and the animal will eat 5 pounds of feed per day. Use Equations 2 and 1 to arrive at the correct inclusion rate (12 pounds) of the medicated feed additive to add to the mixer, if 3 tons of feed are manufactured.

$$\text{Drug Use Level (g/ton)} = \frac{500 \times 2000}{5 \times 1000} = 200$$

$$\text{Amt of product to add (lb)} = \frac{200 \times 3}{454 \times 0.11} = 12.0$$

2) Assume the table specifies that the desired drug use level is 5 milligrams per pound of body weight per day. The medicated feed additive has a drug concentration (activity level) of 100 grams

per pound and cattle weighing an average of 1,000 pounds will be fed 10 pounds per day. To manufacture 2.5 tons of feed, use Equations 3 and Equation 1 to arrive at the correct inclusion amount (25 pounds) of medicated feed additive to add to the mixer.

$$\text{Drug Use Level (g/ton)} = \frac{5 \times 1000 \times 2000}{10 \times 1000} = 1000$$

$$\text{Amt of product to add (lb)} = \frac{1000 \times 2.5}{100} = 25.0 \text{ lb}$$

3) Assume the table specifies that the desired drug use level is 22.7 milligrams per 100 pounds of body weight per day. The drug concentration in the medicated feed additive is 27.2 grams per pound and the animal will be fed 10 pounds of feed per day. If the cattle weigh an average of 800 pounds, and 2 tons of feed will be manufactured, use Equations 4 and 1 to arrive at the correct inclusion rate (2.7 pounds) of the medicated feed additive to add to the mixer.

$$\text{Drug Use Level (g/ton)} = \frac{22.7 \times 800 \times 2000}{10 \times 100 \times 1000} = 36.32$$

$$\text{Amt of product to add (lb.)} = \frac{36.32 \times 2}{27.2} = 2.7$$

Table 1. Specific Applications of Approved Medicated Feed Additives for Beef Cattle

Feed Efficiency and Growth Promotion
Bacitracin Zinc
Bambermycins
Chlortetracycline
Laidlomycin Propionate
Lasalocid
Melengestrol Acetate
Monensin
Oxytetracycline
Virginiamycin

Milk Production
Oxytetracycline

Anaplasmosis
Chlortetracycline

Bacterial Calf Diarrhea
Chlortetracycline
Oxytetracycline

Bacterial Pneumonia
Chlortetracycline

Bloat
Poloxalene

Coccidiosis
Amprolium
Decoquinate
Lasalocid
Monensin

Face Flies
Rabon

Fecal Flies
Rabon

Foot Rot
Chlortetracycline

Horn Flies
Methoprene
Rabon

House Flies
Rabon

Ketosis
Propylene Glycol

Liver Abscesses
Bacitracin Methylene Disalicylate
Chlortetracycline
Oxytetracycline
Tylosin
Virginiamycin

Respiratory Infection
Chlortetracycline

Shipping Fever
Chlortetracycline
Oxytetracycline

Stable Flies
Rabon

Suppression of Estrus
Melengestrol Acetate

Worms
Coopers Worms–Cooperia
Fenbendazole
Levamisole Hydrochloride
Morantel Tartrate
Hair Worm–Trichostrongylus
Fenbendazole
Levamisole Hydrochloride
Morantel Tartrate
Hookworm–Bunostomum
Fenbendazole
Levamisole Hydrochloride
Large Intestinal Worms—Oesophagostomum—Nodular Worm
Fenbendazole
Levamisole Hydrochloride
Morantel Tartrate
Lungworms—Dictyocaulus viviparus
Levamisole Hydrochloride
Stomach Worm—Large, medium and small Haemonchus, Ostertagia, Trichostrongylus
Fenbendazole
Levamisole Hydrochloride
Morantel Tartrate
Thread-necked Strongylus—Nematodirus
Fenbendazole
Levamisole Hydrochloride
Morantel Tartrate
Thiabendazole

Table 2. Approved Medicated Feed Additive Use Levels for Beef Cattle

Drug	Drug Use Level	Indications for Use	Withdrawal Time (days)
Bacitracin Methylene Disalicylate	70 mg/head/day or 250 mg/head/day	Feedlot beef: reduction in number of condemnations due to liver abscesses.	None
Bacitracin Zinc	35–70 mg/head/day	Growing cattle: increased rate of weight gain and improved feed efficiency. To aid in stimulating growth.	None
Bambermycins	1–4 g/ton	Feedlot: for increased rate of weight gain and improved feed efficiency.	None
	2–40 g/ton	Pasture, slaughter, stocker, feeder cattle: for increased rate of weight gain. (Not for use in animals intended for breeding.)	None
Chlortetracycline	350 mg/head/day	Beef cattle: aid in prevention of bacterial pneumonia associated with shipping fever complex caused by *Pasteurella spp.* susceptible to Chlortetracycline.	2
	350 mg/head/day	Beef cattle less than 700 lb: control of active infection of anaplasmosis caused by *Anaplasma marginale* susceptible to Chlortetracycline.	2
	0.5 mg/lb of bodyweight/day	Beef cattle more than 700 lb: control of active infection of anaplasmosis caused by *Anaplasma marginale* susceptible to Chlortetracycline.	2
Decoquinate	22.7 mg/100 lb of bodyweight/day	For the prevention of coccidiosis in ruminating and nonruminating calves, including veal calves, and cattle. Not for use in adult animals.	None
Fenbendazole	2.27 mg/lb of bodyweight	For the removal and control of lungworms, barberpole worms, brown stomach worms, small stomach worms, hookworms, thread-necked intestinal worms, small intestinal worms, bankrupt worms, and nodular worms.	13
Laidlomycin Proprionate	5 g/ton	For improved feed efficiency and increased rate of weight gain in cattle fed in confinement for slaughter.	None
	5–10 g/ton	For improved feed efficiency in cattle fed in confinement for slaughter.	None
Lasalocid	1 mg/2.2 lb	For control of coccidiosis caused by *Eimeria bovis* and *Eimeria zuernii*.	None
	10–30 g/ton	For improved feed efficiency in cattle fed in confinement for slaughter.	None
	25–30 g/ton	For improved feed efficiency and increased rate of weight gain in cattle fed in confinement for slaughter.	None
	60–200 mg/head/day	For increased rate of weight gain in pasture cattle (slaughter, stocker, feeder cattle and dairy and beef replacement heifers).	None
Levamisole Hydrochloride	0.08–0.8% (0.36–3.6 g/lb)	For treating cattle infected with the following gastrointestinal worms and lungworms: stomachworms, intestinal worms, lungworms.	2
Melengestrol Acetate	0.25–0.50 mg/head/day	For increased rate of weight gain, improved feed efficiency and suppression of estrus (heat) in heifers fed for slaughter.	None
Methoprene	22.7–45.4 mg/100 lb of bodyweight/month	Insect growth regulator for continuous free-choice feeding during the fly season to prevent the breeding of horn flies in the manure of treated cattle. Use in block or granular feed supplements to give free-choice intake of 22.7–45.4 mg/100 lb.	None

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Table 2 (continued from previous page)

Drug	Drug Use Level	Indications for Use	Withdrawal Time (days)
Monensin	5–30 g/ton	Improved feed efficiency.	None
	10–30 g/ton	Confined or semi-confined cattle: for the prevention and control of coccidiosis.	None
	25–400 g/ton	For increased rate of weight gain. Feed at the rate of not less than 50 nor more than 200 mg per head per day in not less than 1 lb of feed. During the first five days, cattle should receive no more than 100 mg per day.	None
Morantel Tartrate	0.44g/100 lb of bodyweight	For removal and control of mature gastrointestinal nematode infections including stomach worms, worms of the small intestine, and worms of the large intestine.	14
Oxytetracycline	75 mg/head/day	Finishing cattle: to increase rate of gain and improve feed efficiency.	None
	75 mg/head/day	As an aid in reducing incidence and severity of liver abscesses.	None
	0.1–0.5 mg/lb of bodyweight/day	As an aid in the prevention of bacterial diarrhea, also known as scours.	0 to 5
	0.5–5.0 mg/lb of bodyweight/day	As an aid in the treatment of bacterial diarrhea, also known as scours.	0 to 5
	0.5–2.0 g/head/day	For the prevention and treatment of the early stages of shipping fever complex.	0 to 5
Poloxalene	1.0–2.0g/100 lb of bodyweight/day	Prevention of legume- (alfalfa, clover) and wheat-pasture bloat when fed continuously during exposure to bloat-producing conditions.	None
Rabon	0.00015 lb/100 lb of bodyweight/day	Control of fecal flies in manure of treated cattle. Prevents development of face flies, horn flies, house flies and stable flies in the manure of treated cattle.	None
Tylosin	8–10 g/ton	For reduction of incidence of liver abscesses in beef cattle.	None
Virginiamycin	11–16 g/ton	Improved feed efficiency.	None
	13.5–16 g/ton	Reduction of incidence of liver abscesses.	None
	16–22.5g/ton	Increased rate of weight gain.	None

Table 3. Approved Medicated Feed Additive Combinations for Beef Cattle

Drug	Drug Use Level	Indications for Use	Withdrawal Time (days)
Chlortetracycline & Sulfamethazine	350 mg/head/day 350 mg/head/day	Beef cattle: feed for 28 days as an aid in maintenance of weight gains in the presence of respiratory disease such as shipping fever.	7
Lasalocid & Oxytetracycline	25–30 g/ton 7.5 g/ton	For improved feed efficiency and increased rate of weight gain and reduction of incidence and severity of liver abscesses in cattle fed in confinement for slaughter.	None
	10–30 g/ton 7.5 g/ton	For improved feed efficiency and reduction of incidence and severity of liver abscesses in cattle fed in confinement for slaughter.	None

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Table 3 (continued from previous page)

Drug	Drug Use Level	Indications for Use	Withdrawal Time (days)
Lasalocid Sodium & Melengestrol Acetate	100–360 mg/head/day 0.25–0.50 mg/head/day	For increased rate of weight gain, improved feed efficiency and suppression of estrus (heat) in heifers fed in confinement for slaughter.	None
	100–1440 g/ton 0.125–1.0 mg/lb	For increased rate of weight gain, improved feed efficiency and suppression of estrus (heat) in heifers fed in confinement for slaughter.	None
Lasalocid Sodium & Melengestrol Acetate & Tylosin	10–30 g/ton 0.25–0.50 mg/head/day 90 mg/head/day	For increased rate of weight gain, improved feed efficiency, suppression of estrus (heat), and reduced incidence of liver abscesses in heifers fed in confinement for slaughter.	None
	100–1440 g/ton 0.125–1.0 mg/lb 90–360 g/ton	For increased rate of weight gain, improved feed efficiency, suppression of estrus (heat), and reduced incidence of liver abscesses in heifers fed in confinement for slaughter. Feed continuously in Type C medicated feed to provide no more than 360 mg/head/day of Lasalocid Sodium.	None
Melengestrol Acetate & Monensin	0.25–0.40 mg/head/day 5–30 g/ton	For increased rate of weight gain, improved feed efficiency and suppression of estrus (heat) in heifers fed for slaughter.	None
	0.25–0.40 mg/head/day 50–1200 g/ton	For increased rate of weight gain, improved feed efficiency and suppression of estrus (heat) in heifers fed for slaughter.	None
Melengestrol Acetate & Tylosin	0.125–1.0 mg/lb 90–360 g/ton	For increased rate of weight gain, improved feed efficiency, suppression of estrus (heat), and reduced incidence of liver abscesses in heifers fed in confinement for slaughter.	None
	0.25–0.50 mg/head/day 8–10 g/ton	For increased rate of weight gain, improved feed efficiency, suppression of estrus (heat), and reduced incidence of liver abscesses in heifers fed in confinement for slaughter.	None
Melengestrol Acetate & Tylosin & Monensin	0.125–1.0 mg/lb 90–360 g/ton 50–1200 g/ton	For increased rate of weight gain, improved feed efficiency, suppression of estrus (heat), and reduced incidence of liver abscesses in heifers fed in confinement for slaughter.	None
	0.25–0.50 mg/head/day 8–10 g/ton 5–30 g/ton	For increased rate of weight gain, improved feed efficiency, suppression of estrus (heat), and reduced incidence of liver abscesses in heifers fed in confinement for slaughter.	None
Monensin & Tylosin	5–30 g/ton 8–10 g/ton	Improved feed efficiency. For reduction of incidence of liver abscesses.	None
Oxytetracycline & Neomycin base	50 g/ton 35–140 g/ton	Aid in the prevention of bacterial enteritis (scours).	0–7
	100 g/ton 70–140 g/ton	Aid in the treatment of bacterial enteritis (scours).	0–7

When feeding cattle in confinement, the above combinations apply not only to an individual feed, but also to different feeds used in individual pens. For example, a feed containing oxytetracycline and a feed containing tylosin cannot be placed in separate bunks in the same pen. This would be considered an illegal drug combination. Switching medicated feeds in a particular bunk also can lead to illegal drug combinations. Before switching a medicated feed in a particular bunk, the bunk should be properly cleaned out or a non-medicated feed should be used to "flush" the bunk before the new medicated feed is added. This will help avoid illegal drug combinations. Also, using different drugs in morning and afternoon feedings is not allowed.

This publication was reviewed by Richard Sellers, director of feed control and nutrition, American Feed Industry Association.

Table 4. Approved Medicated Feed Additive Use Levels for Calves

Drug	Drug Use Level	Indications for Use	Withdrawal Time (days)
Amprolium	227 mg/100 lb of bodyweight/day	As an aid in the prevention of coccidiosis.	1
	454 mg/100 lb of bodyweight/day	As an aid in treatment of coccidiosis.	1
Chlortetracycline	0.1 mg/lb of bodyweight/day	Calves up to 250 lb: increased rate of weight gain and improved feed efficiency.	None
	10 mg/lb of bodyweight/day	Calves up to 250 lb: treatment of bacterial enteritis caused by *E. Coli* susceptible to chlortetracycline.	None
	25–70 mg/head/day	Calves up to 400 lb: increased rate of weight gain and improved feed efficiency.	None
	10.0 mg/lb of bodyweight/day	Treatment of bacterial enteritis caused by *E. coli* and bacterial pneumonia caused by *P. multocida* organisms susceptible to chlortetracycline.	Variable
Decoquinate	22.7mg/100 lb of bodyweight/day	For the prevention of coccidiosis in ruminating and nonruminating calves, including veal calves, and cattle caused by *Eimeria bovis* and *Eimeria zurnii*. Feed for at least 28 days during periods of coccidiosis exposure or when experience indicates coccidiosis is likely to be a hazard. Coccidiostats are not indicated for use in adult animals due to continuous previous exposure.	None
Oxytetracycline	0.05–0.1 mg/lb of bodyweight/day	To increase rate of gain and improve feed efficiency.	0 to 5
	0.5 mg/lb of bodyweight/day	As an aid in the prevention of bacterial diarrhea, also known as scours.	0 to 5
	0.5–5.0 mg/lb of bodyweight/day	As an aid in the treatment of bacterial diarrhea, also known as scours.	None
	25–75 mg/head/day	To increase rate of gain and improve feed efficiency.	None
	50 g/ton	As an aid in the prevention of bacterial diarrhea, also known as scours.	None
	100 g/ton	As an aid in the treatment of bacterial diarrhea, also known as scours.	None
Oxytetracycline & Neomycin Base	50 g/ton 35–140 g/ton	Aid in the prevention of bacterial enteritis (scours).	0–7
	100 g/ton 70–140 g/ton	Aid in the treatment of bacterial enteritis (scours).	0–7

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This, and other information, is available from the Department of Grain Science at www.oznet.ksu.edu/grsiext, or by contacting Tim Herrman, Extension State Leader
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