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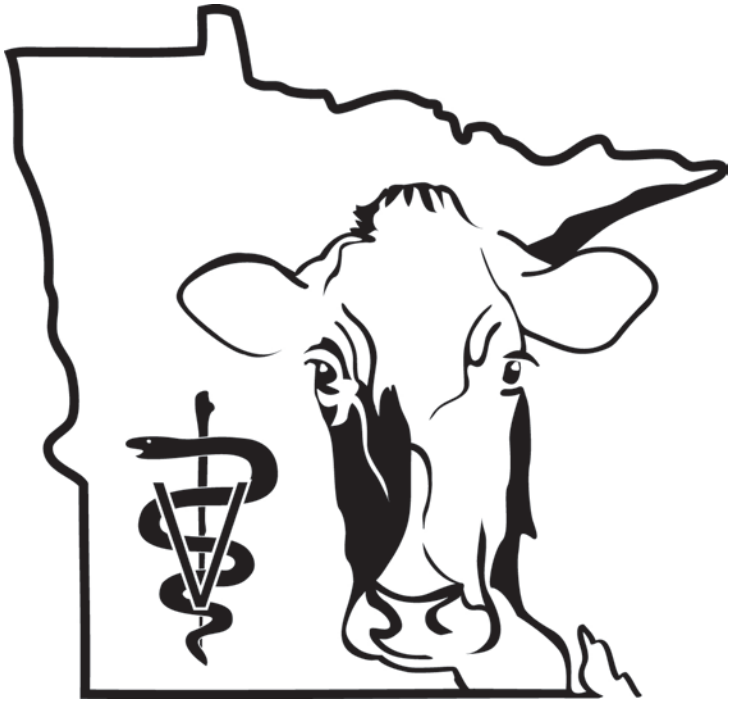

ST. PAUL, MINNESOTA
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Antibiotic Use in Production Agriculture

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Antibiotic use issues in livestock production are gaining an increasing presence in the national and local political arenas. Nationally, a bill was proposed in 2002 to restrict the use of antibiotics in livestock. The proposal limited the use of penicillin, tetracycline, bacitracin, macrolide, lincomycin, streptogrammin (virginiamycin), aminoglocosides and sulfonamides to 'therapeutic use' only (S. 2508, 2002). Locally, in the 2001-2002 Minnesota legislative session, a similar bill was proposed and included enacting a surcharge on any commercial feed containing antibiotics (S.F. 2884, 2001-2002). In response to the proposed legislation and increased interest in the issue, the Minnesota Department of Agriculture (MDA) and the University of Minnesota (UMN) formed an antibiotic resistance task force.

To address the issue, the MDA and UMN held meetings with each livestock or poultry species group to identify species specific concerns. During the meetings, several common issues were identified. First, no uniform definitions existed for how antibiotics were used (categories). Without common definitions, accurate discussions regarding antibiotic use patterns and resistance are difficult. Secondly, information describing how antibiotics are used in each species is vague and data on the use of specific antibiotics are not available. Many contrasting reports exist to estimate actual quantities of use. In addition to these issues, concerns regarding the public's lack of knowledge of how and why antibiotics are used in agriculture were apparent. Because less of the state's population is involved with agriculture than in the past, fewer people understand the reasons why these drugs need to be used in animals.

In order to address the issues that arose during the meetings, the MDA and University of Minnesota developed a basic educational document to describe antibiotic use in Minnesota livestock. The document contains basic descriptions of how each individual animal species are raised (turkeys, broiler chickens, layer chickens, swine, beef and dairy), a summary of specific diseases which may affect each species, descriptions of how antibiotics are used in each species, and a glossary of terms. Also, draft definitions for proposed categories of antibiotic use are included in the report. These definitions and the dairy industry section of the document follow Please note that this is a DRAFT document. We welcome additional input and constructive criticism. Developing these educational materials is a dynamic process as we attempt to communicate complex technical information to a naïve audience.

DRAFT

Proposed definitions of the use of antibiotics in food animal production
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Antibiotic use in food animal production is a necessary and integral part of assuring an abundant, wholesome supply of food, protecting animal health and relieving animal suffering. At the same time, use of antibiotics in food animal production may create a risk of developing antibiotic resistant pathogens in the animal that could be transmitted to humans in food. Antibiotics are used in food animals in a variety of ways. Specific antibiotics may be used in more than one way. Characterizing a particular use depends on several factors, including dose, duration, and the intended effect in the animal or group of animals.

The following definitions are proposed:

A. Disease Treatment (therapeutic):

Antibiotics used in known clinically diseased animals for the purpose of restoring health and recovery from disease.

Example: Ceftiofur hydrochloride (Excenel®, Pharmacia) is used to treat individual dairy cows that develop metritis (infection of the uterus) shortly after giving birth. Ceftiofur is one example of a class of antibiotics called cephalosporins. Cephalosporins are used in both human and veterinary medicine.

Example: Florfenicol (Nuflor®, Schering-Plough) is an injectable antibiotic that may be used to treat cases of pneumonia in beef cattle on an individual basis. Florfenicol is not used in human medicine, but is structurally related to chloramphenicol, an antibiotic with limited use in humans.

B. Disease Control (metaphylactic):

Antibiotics used in groups of animals in which some individuals are clinically diseased for the purpose of reducing the spread of the disease to other group members who have been exposed or treating clinical illness where identifying and treating individuals in not practical such as in a flock of chickens or a school of fish.

Examples: Tilmicosin (Micotil®, Elanco) is an injectable antibiotic that can be used to treat all steers in a pen of feeder steers when the first cases of shipping fever (pneumonia) are identified in the pen. Tilmicosin is not used in human medicine, but other related drugs, such as erythromycin, are used for human treatment.

Example: Neomycin (Biosol®, Pharmacia) can be used to control an outbreak of bacterial enteritis in a flock of turkey poults. In flocks experiencing high mortality rates due to enteritis, neomycin may be added to the water supply for the flock for 5 days to treat the poults that are

already sick and prevent the disease in the remainder of the flock. Neomycin is a member of the aminoglycoside class of antibiotics. Neomycin is a common over-the-counter topical antimicrobial agent used in humans.

C. Disease prevention (prophylactic):

Antibiotics given to animals at high risk of developing a disease with the purpose of keeping them free of that disease.

Example: Necrotic enteritis is a common intestinal disease that occurs in broilers (meat chickens). Outbreaks in individual flocks may have up to 50 percent death rates. To prevent infection and keep death rates low, the antibiotic bacitracin methylene disalicylate (BMD®, Alpharma) may be mixed in the feed of young broilers. Bacitracin is used by humans as an over-the-counter topical ointment.

Example: Post-weaning diarrhea caused by *E. coli* can be a reoccurring problem on some swine farms. *E. coli* enteritis can cause significant weight loss and death in severe cases. To prevent severe infections from occurring, the antibiotic combination of tiamulin and chlortetracycline (Denegard Plus®, Boehringer Ingelheim) may be included in the starter feed ration of these young pigs. Tiamulin is not used in humans, while chlortetracycline is a member of the tetracycline class of antibiotics, which contains many antibiotics that are used in humans.

D. Production Indications:

Antibiotics used for the principal purpose of improving production or metabolic efficiency of the animal, not for the prevention or treatment of disease.

Example: Monensin (Rumensin®, Elanco) is approved for feeding to specific classes of cattle to improve feed efficiency and rate of gain. Monensin alters the microbial populations within the cow's rumen (one of the four stomachs) and allows the cow to gain more energy from the same amount of feed. This effect has been demonstrated in both high forage diets (e.g. pasture) and for high energy feedlot rations. Because the cow can absorb more energy from the same feed, rates of gain improve and less feed is needed to produce the same amount of beef. Monensin is not used in human medicine.

Example: Tylosin (Tylan®, Elanco) is approved for increasing weight gain and feed efficiency in swine when it is fed at a low level (10 to 40 g/ton). These levels are lower than the specified treatment level for swine dysentery (40 to 100 g/ton). The drug can be fed at the lower level continuously in the ration of swine. Tylosin is not used in humans, however some related antibiotics, like erythromycin, are used in humans.

Other Definitions

No standard definitions exist for the terms subtherapeutic and non-therapeutic. For this reason, we recommend they not be used to describe categories of antimicrobial use.

Antibiotic use definitions.doc Last updated: 3/03/03
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DRAFT 11, March 24, 2003; Antibiotic Use in Minnesota Livestock Production

Section 4: Antibiotic use in Minnesota dairy production

Overview

Minnesota produces nearly 9 billion pounds (1 billion gallons) of milk each year, and ranks sixth among all states in milk production. The state's 6,500 dairy farms vary in size, ranging from large-scale operations with more than 1,000 cows to small farms with fewer than 50 cows. Average dairy herd size in Minnesota is about 70 cows, the second-lowest average herd size of the nation's top 10 dairy states.

Cow housing units differ according to herd size and preference of the farmer. Most farms with more than 100 cows house animals in free-stall barns that allow them to roam between the stalls and alleys. The feed is placed in bunks around the outer edges of the stalls. Many smaller farms employ stanchion barns, where cows are tied to a single stall and fed individually. There are also a number of rotational grazing dairies, which graze their cows on specially managed pastureland during the growing season.

Although dairy farm sizes and facilities vary greatly, most farms face similar disease challenges. Metabolic and infectious diseases are common causes of illness in these animals. Antibiotic use in the dairy industry is largely on an individual, case-by-case basis. Animal health is closely monitored because each animal is seen at least twice a day for milking.

Dairy farming requires active monitoring and control of a cow's life over a number of stages, including:

1. **Calves** - Calves are typically relocated from their mother within 24 hours of birth to prevent disease transmission. The calves are fed colostrum (first milk) to provide them the antibodies needed to fight disease. Typically, these calves are then raised on milk replacer or waste milk (milk that cannot be sold due to colostrums content, mastitis, or antibiotic treatment of the cow) for the first six to eight weeks of life. Typically, bull calves are then sold while heifers are retained to one day enter the milking herd. Retained heifers are called replacement heifers.

2. **Replacement Heifers** - As heifer calves grow, they are weaned off milk and gradually shifted to a forage-based ration that may include components such as hay, corn silage or haylage. Some concentrates, including corn and soybean meal, along with vitamins and minerals, are often added to the forage diets to maximize growth and weight gain and ready the heifer for pregnancy and milk production. A replacement heifer is usually bred for the first time around 15 months so she will have her first calf at approximately 24 months of age. The cow must produce a calf in order to begin a lactation cycle and produce milk.

3. **Cows** - After a heifer or cow calves, it begins to produce milk. At this point, cows are milked either two or three times per day. Traditionally, a cow would stay in this milking cycle for between 300 and 360 days and then she would be dried off (no longer milked) for the last two months of pregnancy in preparation for the next lactation. The entire cycle depends upon the cow becoming pregnant so she can calve again. To maintain an acceptable lactation period, the cow needs to become pregnant again about 60 to 120 days after she calves and begins her lactation.

4. **Dairy beef** –Two different types of dairy cattle comprise the dairy beef sector of this industry. Bull calves not kept for breeding are usually raised for meat production. Because these cattle are raised similarly to beef cattle, antibiotic use practices and disease issues are comparable with animals in that category and will not be discussed separately. The second group includes dairy cows sold for slaughter after they are no longer productive in a milking herd. Antibiotic use in this group is similar to those practices used in lactating dairy cows.

Disease Issues

Enteritis/diarrhea/scours (for calves and replacement heifers)
Bacteria such as *E. coli* and *Clostridium perfringens* are common causes of gastrointestinal infections in calves. In addition, coccidia and cryptosporidium are common causes of enteritis in calves. Viruses such as rotavirus or corona virus can cause severe enteritis as well. Calves that are affected by any of these agents are usually treated individually. Common antibiotics used for disease treatment in these calves are oxytetracycline boluses and sulfatrimethoprim boluses. Amprolium may also be given orally to treat coccidial infections, and decoquinate may be fed in the calves' starter grain mix.

Pneumonia (for calves and replacement heifers)
Because young calves are often housed inside, pneumonia can be a common respiratory malady - especially if ventilation is insufficient. Viruses and other stresses such as environmental changes or ventilation problems are common causes of pneumonia. Often, a secondary bacterial pathogen, such as *Mannheimia (Pasteurella) hemolytica, Pasteurella multocida, Haemophilus somnus* or *mycoplasma*, complicates the pneumonia. Antibiotics are usually used to treat these infections in individual animals. Oxytetracycline, tilmicosin, and florfenicol are commonly used to treat calf pneumonia.

Pneumonia can also occur in older heifers. However, they are often kept outside or on pasture and are therefore less likely to contract the disease. If pneumonia does occur in older heifers, the treatment approach is similar to that for young calves.

Metabolic Diseases (for lactating cows)

Calving is a very stressful time for the dairy cow. Because she is starting to produce milk, many metabolic changes occur in the cow as she makes this transition. For this reason, metabolic diseases are probably the most common disease challenges in adult dairy cows. Treatments for metabolic diseases usually do not include antibiotics. Metabolic diseases include:

- **Milk Fever** - Caused by an inadequate level of calcium in a cow's blood, milk fever usually occurs within a few days after calving. Treatment involves administration of calcium by injection or orally. Antibiotics are not used to treat milk fever.
- **Ketosis** – Like milk fever, ketosis commonly occurs within a few days after calving. Ketosis is the result of a cow having an inadequate energy supply as she begins to produce more milk. If a cow does not eat enough feed after calving, her body taps its energy reserves by mobilizing fat stores and eventually she produces excess blood levels of ketones. Treatment of ketosis involves administering an injection of dextrose (sugar water). Antibiotics are not used to treat ketosis.
- **Displaced abomasums** - There are a number of potential causes of twisted stomach, or displaced abomasum (DA). While many causes are not clearly understood, DA is often attributed to metabolic disturbances in the cow. This common condition often requires corrective surgery. After surgery, there is a risk of infections such as peritonitis or incisional abscesses. Antibiotics such as penicillin, ampicillin or ceftiofur are commonly given in these cases to prevent infection. The use of penicillin or ampicillin requires a milk withholding period, but ceftiofur does not.

Metritis

Metritis (uterine infection) occurs when the uterus becomes infected with bacteria after calving. This is most likely to occur when a cow has calving difficulties. Ceftiofur, penicillin and ampicillin are antibiotics commonly administered by injection to treat these infections. Milk withholding is required if penicillin or ampicillin is used. Without treatment, many of these infections would lead to systemic disease and may result in death or culling of the animal.

Mastitis

Reported mastitis rates (inflammation of the mammary gland) in dairy herds vary widely. Clinical cases have been reported in 16 percent to 64 percent of cows per year (Hoblet, 1991). Mastitis is typically caused by bacterial infection, although sometimes it can be caused by injury to the udder or teat end. Several types of bacteria can cause mastitis. Some bacteria, like *Staphylococcus aureus* and *Streptococcus agalactiae*, are contagious and can spread from cow to cow. Other types of bacteria are not contagious, but come from the environment.

Specific antibiotics are infused into the teat to treat mastitis. However, many bacteria can cause mastitis and antibiotic treatment is not always effective. Some farms culture milk samples on their farm to determine which type of bacteria is present. Other farms may take milk samples to culture in the future if the initial choice of treatment is not effective.

There are currently seven antibiotics approved for intramammary use in lactating cows. These include amoxicillin, cloxacillin, hetacillin, penicillin G procaine, cephapirin, pirlimycin, and erythromycin. Each of these antibiotics has a prescribed withdrawal period. Of these, amoxicillin, cloxacillin, hetacillin, and pirlimycin are only available with a veterinary prescription.

After a cow has milked a full lactation, she is dried off to prepare her for calving and the next lactation. Although they are no longer milking, dry cows are still susceptible to mastitis. For this reason, nearly all cows are treated with a long-acting intramammary antibiotic. Several antibiotics are approved for this use, including cloxacillin, penicillin, novobiocin, erythromycin and cephapirin.

Categories of Antibiotic Use

Production indications
Calves that have been weaned from milk replacer are usually fed a concentrate ration (pellets with protein, vitamins, minerals and other nutrients). These rations may contain antibiotics as well. Lasalocid and decoquinate are used as coccidiostats at this stage of growth. Older heifers may receive concentrate mixes with monensin to improve feed efficiency and growth. Monensin is an ionophore antimicrobial approved for growth promotion and coccidiosis prevention.

Disease prevention
Milk replacer typically contains an antibiotic for prevention of gastroenteritis. A combination of oxytetracycline and neomycin are commonly used, while chlortetracycline, decoquinate and lasalocid are available for use in milk replacers as well. Coccidiostats, such as decoquinate, lasalocid, and monensin, may be used to prevent coccidiosis in young calves or heifers on farms with disease problems.

Disease control
The most common disease control use of antibiotics in dairy is intramammary dry cow treatment as described in the mastitis discussion. Dry cow antibiotic treatment is an integral part of a good mastitis management and milk quality program.

Therapeutic
On dairy farms, most antibiotics are used therapeutically to treat individual animals affected by disease. Common routes of administration include injection, oral or intramammary. Common individual drugs used are listed under each disease described above.

Antibiotic Administration and Residues

The use of feed and water-grade antibiotics is prohibited in adult milking cows, so most antibiotics are administered orally or given by infusion or injection. When a milking dairy cow is treated with an antibiotic, the cow's milk must be withheld for a certain period. The producer must throw away this milk and receive no payment for it. For this reason, the decision to use antibiotics in a milking dairy cow is usually carefully scrutinized. Excessive antibiotic use on a dairy cow can be a very costly decision.

All loads of milk are testing for antibiotic residues to ensure that milk containing residue does not inadvertently enter the food supply. Having an antibiotic residue violation (antibiotics found in the milk to be sold) is an expensive mistake for a producer because an entire load of milk must be discarded at the offending producer's expense if it is found to be contaminated by even one cow treated with an antibiotic.

Alternative Methods of Disease Prevention and Control

Vaccination

Most herds within the state maintain a vaccination program for common infectious diseases dairy cattle may acquire. Some of these vaccines may include:

- Infectious Bovine Rhinotracheitis (IBR) vaccine
- Bovine Viral Diarrhea (BVD) vaccine
- Parainfluenza virus (PI3) vaccine
- Bovine Respiratory Syncitial virus (BRSV) vaccine
- Clostridium combination (7 or 8 different types of the bacteria *Clostridium* sp. vaccine)
- *Hemophilus somnus* vaccine
- *Pasteurella hemophilus* and *Pasteurella multocida* vaccine
- *Leptospirosis* vaccine
- Coliform (Environmental bacteria) mastitis vaccine

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