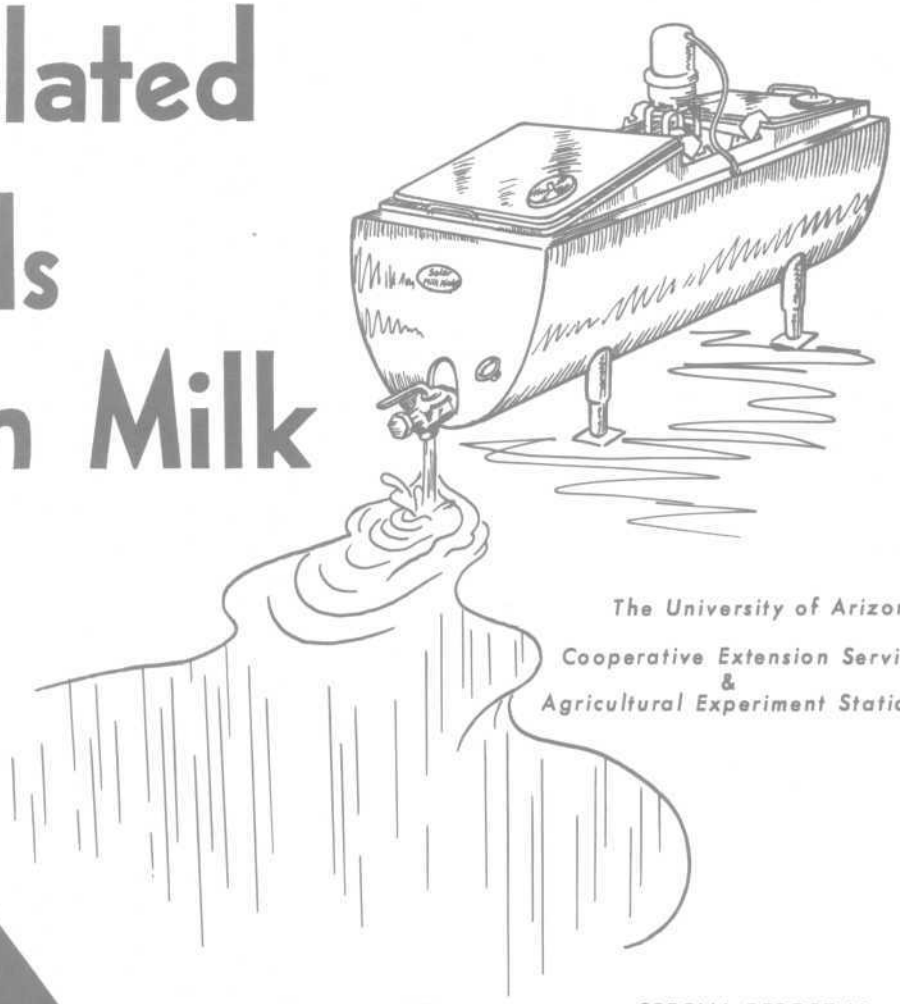
Antibiotics, Pesticides, and Related Materials in Milk

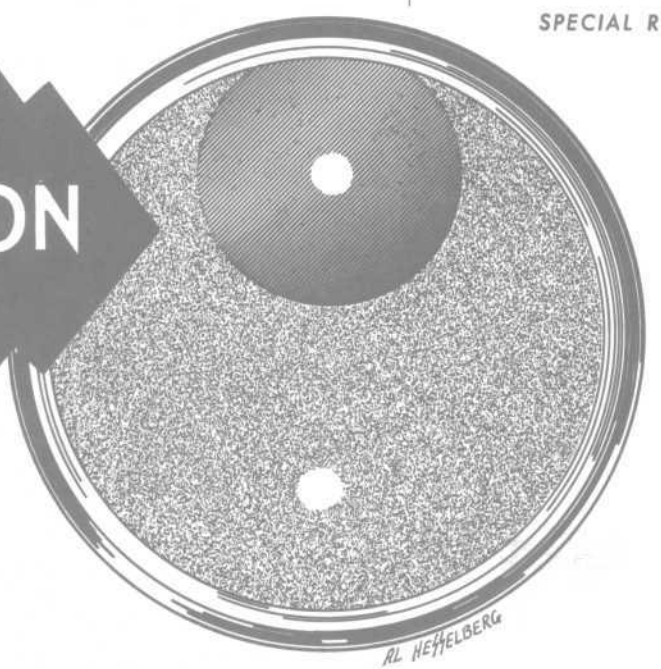


The University of Arizona
Cooperative Extension Service
&
Agricultural Experiment Station

SPECIAL REPORT No. 6

PREVENT CONTAMINATION

IT PAYS!



ANTIBIOTICS, PESTICIDES, AND RELATED MATERIALS IN MILK

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Here are some important points about the problem of antibiotics and other contaminants in milk:

1. Mastitis and other diseases can be kept at a minimum by proper management practices. This will reduce the amount of antibiotics or other drugs required.

2. If antibiotics or other drugs are used, withhold milk from shipment until there is certainty that it is free from contaminants. This may be for up to 5 days or even longer under certain conditions.

3. Pesticides, herbicides and other materials get into milk by careless or improper use on feeds, animals or equipment. Many insecticides cannot be used at all on feeds or by-product feed going to dairy animals. Some materials can be used within certain limitations. Follow The University of Arizona, Federal, or manufacturer's recommendations concerning their application.

4. Regulatory provisions require "zero tolerance" for all of these materials. No contaminants or adulterants are allowed in milk. This restriction is not likely to be relaxed.

The United States Public Health Milk Ordinance and Code adopted by the Arizona Legislature states that, "the presence of antibiotics, chemical bactericides, or other unapproved additives shall be deemed a violation --------." Milk is defined in the ordinance as, "the lacteal secretion -------- obtained -------- (from) one or more healthy cows, -----." Finally, "any adulterated, misbranded, and/or improperly labeled milk or milk products may be impounded by the health officer and disposed of in accordance with State Law."

The Federal Food and Drug Administration (F.D.A.) has regulatory jurisdiction over foods shipped from one state to another. F.D.A. officials and the Commissioner of Public Health in the Arizona State Department of Health have taken a firm, rigid stand on the enforcement of these provisions as they apply to the presence of antibiotics and related materials in milk and milk products. Milk products manufactured from raw milk containing these materials will be contaminated and subject to seizure and confiscation.

TYPES AND ORIGIN OF POSSIBLE CONTAMINATING MATERIALS

It should be recognized that several types of materials of varying origin may be involved. They may be classed and described as follows:

I. Agents used in the treatment of animal diseases.

   A. Antibiotics

      1. Bacitracin
      2. Chloramphenicol (Aureomycin)
      3. Neomycin
      4. Oxytetracycline (Terramicin)
      5. Penicillin
      6. Streptomycin
      7. Tetracycline (Acromycin or polyotic)
      8. Tyrothricin

   B. Other chemo-theraputic preparations

      1. Nitrofurans (Furacin)
      2. Phenothiazine
      3. Sulfa drugs

II. Other materials related to dairy farm operation.

   A. Detergents

      1. Alkaline cleaners
      2. Acid milk stone removers
      3. Soaps

   B. Sterilizing compounds

      1. Hypochlorites
      2. Iodophors
      3. Quaternary ammonium compounds

III. Chemicals used in insect and weed control.

A. Insecticides which may be used on some crops in Arizona

1. Aldrin
2. Aramite
3. BHC
4. Chlordane
5. DDT
6. Demeton (Systox)
7. Diazinon
8. Dieldrin
9. Dilan
10. Dylox
11. Endrin
12. Heptachlor
13. Kelthane
14. Lindane
15. Malathion
16. Methylparathion
17. Parathion
18. Phorate (Thimet)
19. Phosdrin
20. Sevin
21. Tedion
22. Toxaphene
23. Trithion

B. Insecticides used directly on dairy animals

1. Malathion
2. Methoxychlor
3. Pyrethrum
4. Rotenone

C. Herbicides which may be used in forage crop production

1. DNAP - phenol
2. DNBP - phenol
3. DNBP - ammonium salt

REASONS FOR CONCERN ABOUT ANTIBIOTICS AND OTHER DRUGS

Why is there concern about the effects of small amounts of these materials in foods such as milk? In the case of all except antibiotics the concern is based primarily on the possible toxicity of the materials for human beings.

The reason for interest in the presence of minute quantities of antibiotics in milk are of two categories.

First, in dairy plant operation antibiotics cause financial loss in contaminated milk due to failures: (a) of bacterial starter cultures to grow when propagated; (b) in acid and flavor production in cultured buttermilk and similar products; (c) in the curdling of milk for all cheese varieties and in cheese ripening; and (d) of some quality control tests to give valid results.

Second, there are possible public health hazards associated with the consumption of antibiotic-contaminated milk and milk products. These include the possibility of (a) causing or aggravating allergic responses; (b) changes in intestinal function; and (c) development of antibiotic-resistant disease producing bacteria.

Extremely minute amounts of antibiotics may cause some of the difficulties mentioned above. For example, milk from one quarter of a treated udder can contaminate (in detectable amounts) the combined milking from more than 100 cows for up to 72 hours or longer after treatment.

The antibiotic most commonly mentioned as being of concern is penicillin. It should be kept in mind, however, that any or all of the ones listed (or any new ones developed in the future) can cause difficulty.

HOW ANTIBIOTICS AND OTHER DRUGS MAY GET INTO MILK

The question is sometimes asked about the method of treatment or application least likely to contaminate milk. In this regard the possible methods of treatment for diseases are: (a) udder infusion, (b) intravenous injection, (c) intramuscular injection, (d) oral administration, (e) intraperitoneal injection, (f) intrauterine infusion, and (g) open wound or epithelial dressing.

In the treatment of an infectious disorder such as mastitis, the therapeutic value of the antibiotic or other drug is based on the development and maintenance of a certain required concentration of the agent at the site of the infection. It is therefore impossible to treat a lactating animal by any of the methods without the possibility of some milk contamination. Most veterinary practitioners feel that the type of infection should determine the method of treatment.

What are some of the factors which affect the amount and/or duration of milk contamination from a treated animal? These include:

(a) Method of treatment. Udder infusion will obviously give the greatest contamination for a relatively shorter duration.

While directions for use commonly recommend that milk from an animal treated by infusion should be segregated for 72 hours, some technicians have detected antibiotics for 120 hours or more after infusion. Each quarter of the udder is a separate, isolated gland. It might seem, therefore, that in the case of infusion treatment of only one quarter the milk from the other three could be saved for human use.

Material infused into one diseased quarter may be absorbed into the blood stream and then appear in small amounts in the milk of the other three quarters. It is advisable to discard all milk from a treated animal for the recommended length of time. On the other hand, treatment by intravenous, intramuscular, or intraperitoneal injection, or infusion in the uterus will also result in contamination of milk from animals so treated. In addition, the treatment of animals orally or the feeding of feeds containing antibiotics, if in sufficient amounts, may result in the contamination of milk.

One of the most direct sources of contamination has been traced to materials applied as an ointment or balm which find their way from the exterior of the udder and teats to the teat cup surfaces and then into the milk.

(b) Size or concentration in the dosage. The greater size or concentration of dose will cause greater contamination.

(c) Level of milk production. The amount of contamination is greater for lower producing animals.

(d) The size of the animals. For equal dosages, the larger animals would normally be expected to throw off relatively less material in the milk.

(e) The type of solution or carrier used with the antibiotic. Water solutions pass into the milk more quickly than do other preparations. Oil

emulsions given intramuscularly are released into the blood and milk over a longer period of time. Many other types of carriers may be used. Each has its own characteristic release rate for the antibiotic.

(f) The type of antibiotic. Some antibiotics or other drugs may pass from the blood into the milk more quickly than others.

(g) The chemical form of any given antibiotic. Penicillin, for example, may be supplied in several different chemical forms.

Each has its own characteristic rate of appearance in the milk. It can be seen, therefore, than many factors affect the extent and duration of milk contaminated in treated animals.

THE PROBLEM OF DETECTION

The detection of antibiotics and related materials is made by various methods. The regulatory interpretation of adulteration is based on "zero tolerance." This term may be defined as the minimum detectable amount. On this basis, it should be recognized that the absolute amount for "zero tolerance" will probably change to smaller and smaller values as methods of detection become more and more precise. This accounts, in part, for the seriousness of the problem.

At present, detection of antibiotics is based mainly on a biological test--the disc assay method. In the method, a culture of antibiotic-sensitive bacteria is grown under standardized, controlled conditions. Then an absorbent disc of paper impregnated with the milk is placed on the culture. Antibiotics prevent (inhibit) the growth of the bacteria around the edges of the disc. A specific neutralizing material used in conjunction with the test will confirm the presence of penicillin. The exact type of antibiotic in the case of the other possibilities is not identified except by extremely complicated modifications of this procedure.

In this method, a positive test then will show only as penicillin or simply as one or more of the other possibilities.

The biological test will not detect the presence of other drugs, pesticides, herbicides, detergents and sterilizing compounds listed on pages 2 and 3, except at exceedingly high and unlikely concentrations. Chemical analyses or other methods are used to detect the presence of these materials.

Milk suspected of containing any of the materials discussed here should not be included in the product intended for human consumption until there is certainty that it is entirely free from those materials.

DETERGENTS AND STERILIZING COMPOUNDS

The likelihood of significant contamination with detergents and sterilizing compounds is extremely remote if directions for their use are followed with even the minimum sincerity. It is not a sound practice to cut down on the use of these materials because of concern about them getting into milk.

REASONS FOR CONCERN ABOUT INSECTICIDES AND OTHER PESTICIDE RESIDUES

People often think of a harmful reaction from a poison in terms of consuming a given amount at one time followed by an immediate deleterious response such as death or debilitation. While this may be a problem with handling concentrated insecticides, it is never a problem with pesticide residues in food. The hazard from residues is the consumption of amounts very much less than ordinarily considered poisonous over a period of several years causing a debilitation known as "chronic toxicity."

It is concern over this chronic toxicity that has caused the Food and Drug Administration to limit the amount of pesticide chemicals that can be legally present on or in food to a level sufficiently low that there can be no doubt that it is safe. This level may be different for different kinds of food for the same pesticide. The Food and Drug Administration has set this level at zero for all pesticides in milk!!

Milk occupies a special place in the diet of the public. It is often the sole food of infants, the aged, and infirm--a group who are peculiarly susceptible to damage from chronic dosages of pesticides. For this reason extreme efforts are taken to assure that milk continues to occupy a position of being a wholesome, nutritious, pure, uncontaminated food.

HOW INSECTICIDES AND OTHER PESTICIDE RESIDUES MAY GET INTO MILK

Pesticides can get into milk from feed and water supplies, skin penetration or direct contamination by at least five possible application methods:

(a) Contamination of milk handling equipment, feed and water, or animals by improper treatment of the barn for fly control.

(b) Improper treatment of animals for control of flies, lice, ticks or grubs.

(c) Improper treatment for pests of forage or grain crops to be used for feed.

(d) Contamination of forage or grain crops from pest control treatments intended for adjacent crops.

(e) Use of contaminated by-product feeds.

(a) Contamination of milk handling equipment, feed and water, or animals during treatment of the barn for fly control: Many insecticides can be used to treat the interior of milking barns and rooms or corrals and shades for fly control which cannot be used on the animals or animal feed. It is essential to remove animals, feed and water, and to cover milk handling equipment so that none of these will become accidentally contaminated with any pesticide while treating the barn.

(b) Improper treatment of animals for control of flies, lice, ticks, or grubs: The insecticides which can be used to treat milking animals directly are very limited in number--they include only rotenone, pyrethrum, methoxychlor (only once in three weeks), and malathion (only as a 5% dust no less than 5 hours before milking). If other insecticides are used accidentally or intentionally, the treated animal must be pulled out of the milking herd for from 4 days to 8 weeks or more, depending on the insecticide used.

(c) Improper treatment for pests of forage or grain crops to be used for feed: Some farmers may treat their forage and grain with insecticides which are not recommended. Long after a crop such as alfalfa has been treated for insect control, minute amounts of the insecticide may remain at the time it is harvested and fed to a producing cow. Some insecticides will be destroyed by the cow, but others will be concentrated many-fold in the milk. This property of a long residual life and concentration in the milk prohibits the use of many insecticides, particularly the DDT-like insecticides, on feeds for dairy cattle. The amount of these materials that can be tolerated in milk is ZERO!

(d) Contamination of forage or grain crops from pest control treatments intended for adjacent crops: When alfalfa is grown adjacent to another crop, such as cotton, which requires intensive use of insecticides in its production, it is quite possible that sufficient insecticide can accidentally drift from the cotton to the alfalfa to show up in the milk. In a test in a neighboring state, eleven hay fields near or adjoining cotton fields were analyzed for residues of DDT. In nine of the eleven fields there was a concentration of DDT ranging from 4 to 98 parts per million--considerably above the Zero parts per million allowed for this insecticide on alfalfa hay. It would be reasonable to presume that contamination of alfalfa hay can occur from any adjacent insecticide treatment. A good dairyman will attempt to ascertain that his feed is free from contamination both from improper treatment and from drift.

(e) Use of contaminated by-product feeds: An important source of entry of insecticide into the milk may be the use of by-product feeds that were treated in accordance with tolerance regulations for production of the primary crop, but which did not take into account that a possible secondary use of remaining plant parts would be for dairy feed. This often places more rigid restrictions on the insecticides which can be used. There are probably so few by-product feeds that can safely be fed to dairy animals that it is best to forget about it.

PESTICIDES WHICH MAY BE USED ON ALFALFA FED TO DAIRY COWS

Insecticide	Days After Treatment - to Harvest	Tolerance on Feed in ppm*	Tolerance in milk in ppm*
Demeton (Systox)	21	5	Zero
Dibrom	4	Zero	Zero
Dylox	14	Zero	Zero
Malathion	7	8	Zero
Methoxychlor	14	100	Zero
Methyl parathion	20	Zero	Zero
Parathion	15	1	Zero
Phosdrin	1	1	Zero
Herbicide			
DNAP - phenol	Dormant or	Zero	Zero
DNBP - phenol	Stubble Treatment	Zero	Zero
DNBP - ammonium salt	only	Zero	Zero

INSECTICIDES WHICH MAY BE USED DIRECTLY ON PRODUCING DAIRY COWS

Insecticide	Application	Tolerance in Milk in ppm*
Malathion	Applied as a 5% dust not less than 5 hours before milking	Zero
Methoxychlor	Applied only as a dust not more often than every 21 days	Zero
Pyrethrum	Applied at any time as a dust or spray	Zero
Rotenone	Applied at any time as a dust or spray	Zero

* ppm = parts per million

INSECTICIDES AND OTHER PESTICIDES RECOMMENDED FOR CROPS NOT TO BE USED FOR FEED

The following insecticides, and possibly others, are used for control of insects attacking alfalfa being grown for seed. The straw and remains after threshing must never be fed to dairy animals. These materials cannot be used on alfalfa being grown for feed.

DDT
Diazinon
Dieldrin
Kelthane
Toxaphene

There are many insecticides that are used on a variety of crops producing by-product feeds which cannot be used on dairy feed. If these have been used, neither the crop nor the by-product feed from it can be fed dairy cattle. The following list of insecticides in this category cannot be complete, but is merely illustrative of the more common ones which cannot be used.

Aldrin
Aramite
BHC
Chlordane
DDT
Diazinon
Dieldrin
Dilan
Endrin
Heptachlor
Kelthane
Lindane
Phorate (Thimet)
Sevin
Tedion
Toxaphene
Trithion

The following herbicides have not been recommended for use on feed crops in Arizona:

4-(2,4-DB)
Endothal
Dalapon
Diuron
DNBP - amine salt
PCP

Do not use any insecticide or other pesticide in, on, or near dairy cows dairy feed, dairy barns, or milk rooms that has not been recommended specifically for such use.

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SUMMARY OF INSECTICIDES APPROVED FOR USE ON OR NEAR DAIRY CATTLE AND FEED

On the Feed

1. Demeton
2. Dibrom
3. Dylox
4. Malathion
5. Methoxychlor
6. Methyl parathion
7. Parathion
8. Phosdrin

On the Animal

1. Malathion
2. Methoxychlor
3. Pyrethrum
4. Rotenone

In the Barn

1. Diazinon
2. Dylox
3. Malathion
4. Methoxychlor
5. Pyrethrum

IT IS IMPERATIVE THAT FEED PRODUCERS, DAIRYMEN, PROCESSORS AND PUBLIC HEALTH AUTHORITIES WORK TOGETHER TO ELIMINATE THIS PROBLEM. IF ITS ELIMINATION IS LEFT TO THE ENFORCEMENT AUTHORITIES, IT WILL HURT NOT ONLY THE PARTICULAR PRODUCER AND PROCESSOR, BUT THE ENTIRE DAIRY INDUSTRY.

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75th Anniversary of Founding

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