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Dairy Update

HEPTACHLOR CONTAMINATION OF DAIRY CATTLE

DAIRY UPDATE NO. 76

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NOTE TO EXTENSION PERSONNEL: The recent heptachlor contamination in Arkansas has created much concern. Federal Extension has prepared a news release warning farmers not to use "pink-treated seed" as animal feed, and suggests any producers having done so contact their Agricultural Extension Agent. In the Arkansas case, a gasohol plant processed these seeds and the resulting mash was used for cattle feed. It is unlikely dairy farmers could observe visual signs of contamination in the fermented mash.

We have chosen to not distribute the news release; however, it will probably appear in some of our farm magazines. Should you be contacted by local producers, we suggest you be familiar with the material that follows, which describes:

1. how chlorinated hydrocarbons react in a cow's body;
2. how to manage the cow if contamination occurs; and
3. economics of decontamination.

R. D. Appleman and M. M. Pullen

HEPTACHLOR CONTAMINATION OF DAIRY CATTLE*

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Introduction

Heptachlor and chlordane are chlorinated hydrocarbon insecticides that are very fat soluble and thus tend to accumulate in the body fat of animals that eat contaminated feeds. The recent contamination of stillage in the midwestern states has led to widespread contamination of dairy cattle as well as other livestock. The finding of violative levels of heptachlor epoxide (the major metabolite of heptachlor) in milk and milk products resulted in the quarantine of many dairies. This fact sheet contains information that should be helpful to you if your herd is contaminated. Further information and assistance can be obtained from your local Cooperative Extension agent and campus based specialists, your state Veterinary Diagnostic Laboratory, and your regional FARAD (Food Animal Residue Avoidance Databank) Access Center. This fact sheet focuses on heptachlor which is more persistent in animals than chlordane.

Fate of Heptachlor in Dairy Cattle

Absorption: Heptachlor and heptachlor epoxide (HE) are well absorbed from the gastrointestinal tract of ruminants. Over 80% of the amount eaten is absorbed into the bloodstream. Heptachlor is converted to HE as a result of environmental degradation and metabolism within the body.

Distribution: Heptachlor epoxide is distributed throughout the body and tends to accumulate in body fat.

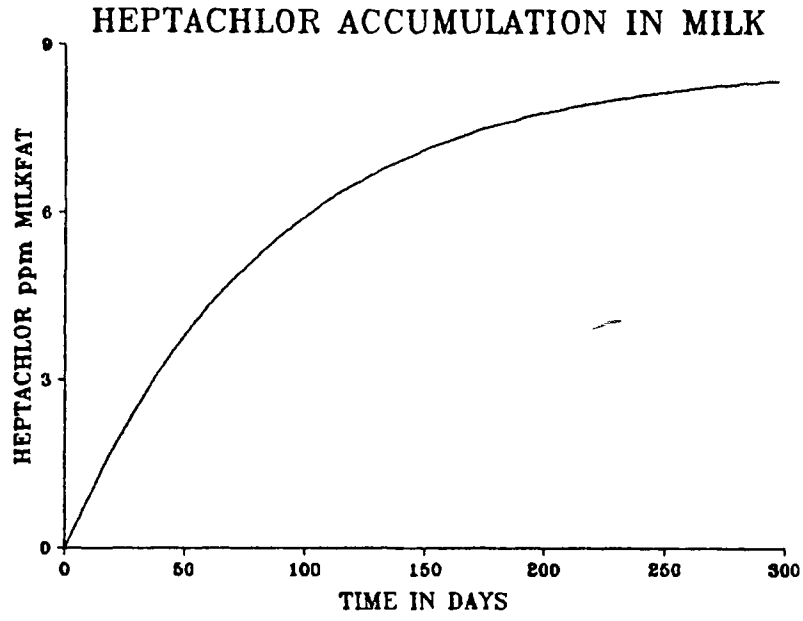
Metabolism: Heptachlor is metabolized in the body to HE which is then stored in body fat. HE is not further metabolized to any significant extent.

Elimination: The heptachlor and HE not absorbed from contaminated feed are excreted in the feces (manure). Heptachlor and HE that have been absorbed into the animals blood is excreted in milk and feces. In lactating animals, milk excretion accounts for more than 80% of elimination. Only trace amounts of heptachlor and HE can be detected in the urine. The concentration of HE excreted in milk fat is almost exactly the concentration of HE in body fat. Thus, milk fat HE levels can predict the level in body fat and be used as a guideline for decontamination. Nearly all of the HE in milk is in the butterfat because HE is very soluble in fat and very insoluble in water.

* See also "HEPTACHLOR CONTAMINATION OF LIVESTOCK AND POULTRY"

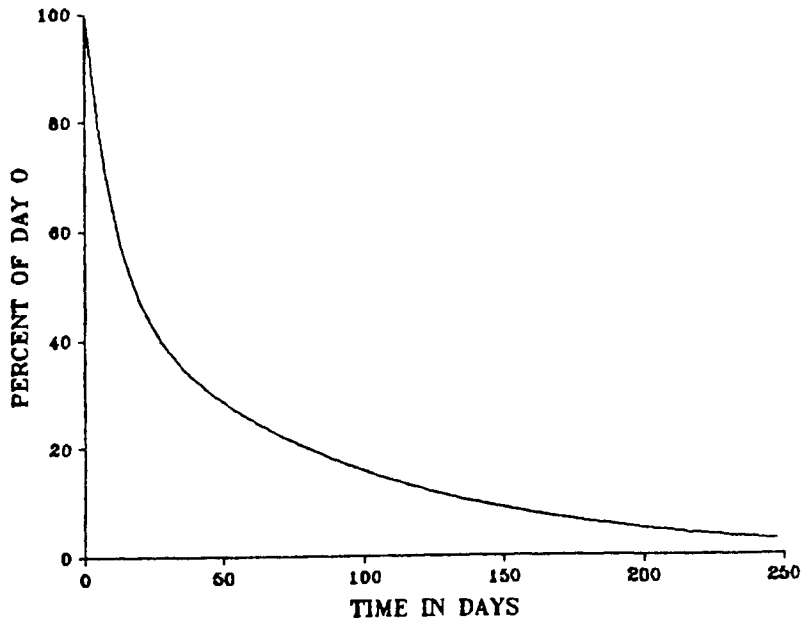
Kinetics (Time Course) of Heptachlor Absorption and Elimination

The following graph shows what happens while a dairy cow is fed heptachlor or HE contaminated feed.



HE shows up in milk within 36 hours after first feeding contaminated feed. The level in milk fat (and body fat) continues to increase until the amount being excreted equals the amount absorbed.

The next graph shows what happens to the milk excretion of HE when the contaminated feed is "shut off" and replaced with clean feed.



The concentration of HE in milk fat drops 50% or more in the first two to four weeks, depending on the level and duration of exposure. For short term exposures to high levels of HE (like the current situation in the midwest), the drop may be very fast, reaching levels of only 2-3 ppm even after starting at levels as high as 50 ppm. Then the rate of elimination decreases considerably. This slow phase of elimination has a half-life of about 60 days in lactating cattle. (Thus every 60 days the concentration drops to 50% of what was there at the start of that 60 day period as shown in Table 1.) This T 1/2 is an average of many cows. Some will have much shorter T 1/2's and others much longer depending on stage of lactation, and management factors.

Table 1

Concentration in Milk	Time	T 1/2
10	0	---
5	60 days	1
2.5	120 "	2
1.25	180 "	3

Because of the consistency of this half-life, if we know when the exposure occurred and the level of HE in milk fat, it is possible to make good predictions of how long it will take to decrease to the butterfat action level of 0.1 ppm.

CONTAMINATION MANAGEMENT

Feed and Manage Lactating Animals for Maximum Milk Fat Production

A. Fresh cows - early lactation.

1. Feed as usual for first 7 days. It is important to feed good high energy feeds for the first week in order to decrease the chance of ketosis.

2. From the 7th to the 60th days, feed a low energy, high protein ration. Animals must receive 10-12 lbs TDN and 2-3 lbs protein daily. The objective is to get them to lose 100-150 lbs body weight. and to mobilize body fat and increase the amount of HE excreted in milk. Watch cows and their milk production closely as this regimen will make them susceptible to ketosis. This treatment is especially recommended for cows that were fed contaminated feed while dry because when they freshen they will start excreting HE in milk at levels higher than those found in lactating animals. This is because they did not have milk excretion to help get rid of the HE and the half-life of heptachlor in nonlactating cattle is approximately 180 days.

B. Mid to late lactation.

1. Feed to optimize milk fat production.

2. Feed rations containing 18% crude fiber and 68-70% TDN on a dry matter basis.

3. Feed long hay if available (at least 5 lbs/head/day.

C. Calves.

Calves born to cows fed contaminated feed will be contaminated at the same level as the dam. These animals should not be used for veal production. As the animals grow, they will eliminate the HE in their bodies and it will also be "diluted" as they gain weight. Heifer calves may be given colostrum from contaminated cows, and could be fed whole milk for three to four months. By the time they have matured and are ready to freshen for the first time, they will have excreted and diluted the HE residues in their bodies to well below the milk action level. Bull calves from contaminated cows may be handled in a similar way and kept for breeding or raised for slaughter. By the time these animals are two years old they will have excreted and diluted the HE to below action levels. Be sure to identify calves fed contaminated whole milk and do not send them to slaughter until they are two years old.

D. General

Identify which groups of your cattle have actually been fed contaminated feed. Separate out those animals that were fed none or only very small amounts from those that were fed large amounts. If your dry cows and bred heifers have been fed contaminated feed, they will start milking at levels of HE in milk fat higher than the level in your cows fed contaminated feed while milking. Keep them together and separate from the rest of the herd. Milk them after milking your clean cows, and have their milk tested as a group. Manage them according to the recommendations given above, and they should come clean faster than the predictive equations show. In some situations in which the time it will take to decrease below the action level is longer than economically feasible, you may decide to get rid of the cows. Consult state and federal officials for proper means of disposal of these animals.

If you have a severely contaminated herd with some prize stock, you may want to keep the best animals just for breeding. This will work out fine since by the time their calves first freshen, they will be clean. The levels of HE in the cows will not interfere with reproductive function and you can gradually rebuild the herd that you have worked so hard to select.

Milk Disposal

Follow the guidelines established by the lead agency in your state. Land disposal has been approved in Arkansas and is effective in preventing environmental accumulation of Heptachlor and HE. Heptachlor and HE are broken down quickly by sunlight and more slowly by soil microbes. Since nearly 100%

of the HE in milk is in the milk fat, skim milk might safely be fed to calves without causing them to become contaminated, but do not feed it to calves intended for use as veal. By turning off the agitator of your bulk tank, up to 90% of the butterfat will separate within 12-24 hours. This would help to salvage some of the milk and also reduce the volume that has to be discarded.

DECONTAMINATION OF DAIRY CATTLE

Antidotes

There have been numerous research trials to test the effectiveness of activated charcoal, mineral oil, phenobarbital, protomone, cholestyramine and thyroprotein in helping to speed up the elimination of HE from dairy cattle. While some of these substances have proven effective in decreasing contamination caused by acute exposure to other chlorinated HC insecticides, their effects on HE elimination in dairy cattle is disappointing. The strategy of their use is to enhance the milk or fecal elimination of HE. While some of these treatments have been shown to increase fecal elimination by about 10%, the effect is not dramatic because in lactating cattle, fecal elimination of HE accounts for only 10% of total HE elimination. Activated charcoal and mineral oil will not hurt, but will also be of unknown benefit and add additional cost (not to mention mess). The ability of most activated charcoal preparations to bind chemicals and hasten their elimination from the body varies considerably. **Because the effectiveness of activated charcoal is not proven, it should be considered an experimental procedure and should be carried out only under the supervision of your veterinarian.** The FARAD Midwest Regional Access Center at the National Animal Poison Control Center can provide further information to your veterinarian about the use of a superactive charcoal that is being tested for decontamination effectiveness.

Economics

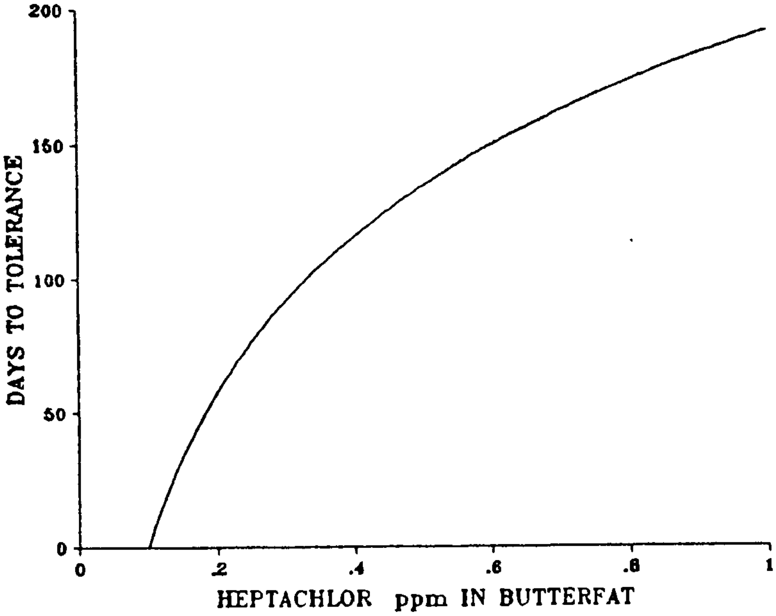
The decision to "cleanup" a herd or to get rid of it is an individual economic decision that must be made using the best possible data. The graphs on the next page can be used to estimate the time it will take to reach the action level of 0.1 ppm in milk fat. Use a straight edge to draw a line up from the level of HE in butterfat to the curve. Then draw a line over to the days to tolerance. There are two graphs shown each representing different levels of contamination. (The curves are based on following the recommendations for lactating animals discussed above.) These graphs ignore the early, rapid elimination that takes place in the first two weeks after contaminated feed is withdrawn, so use the latest test data you have available to make the prediction. You may also use the following formula to calculate the time to tolerance.

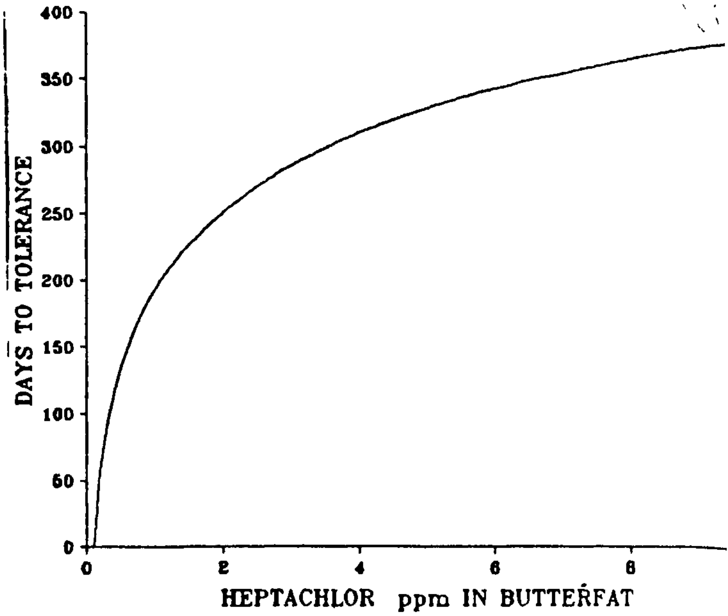
$$\text{Time} = \frac{\ln (0.1 \,/\, \text{HE ppm in milk fat})}{-0.01155}$$

For example if the milk fat level in your herd is 0.3 ppm the equation is:

$$\text{Time} = \frac{\ln (0.1 \,/ 0.3)}{-0.01155} = \frac{\ln (0.3333)}{-0.01155} = \frac{-1.09861}{-0.01155} = 103.3 \text{ days}$$

(Many math calculators can determine the natural logarithm (ln) of a value and thus may be used with this equation.)





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