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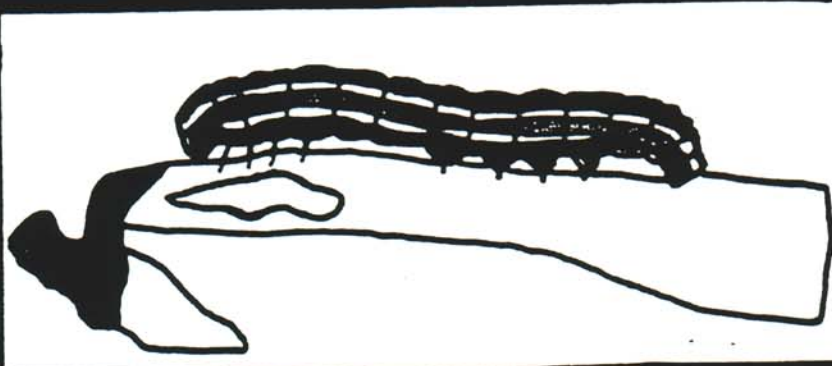
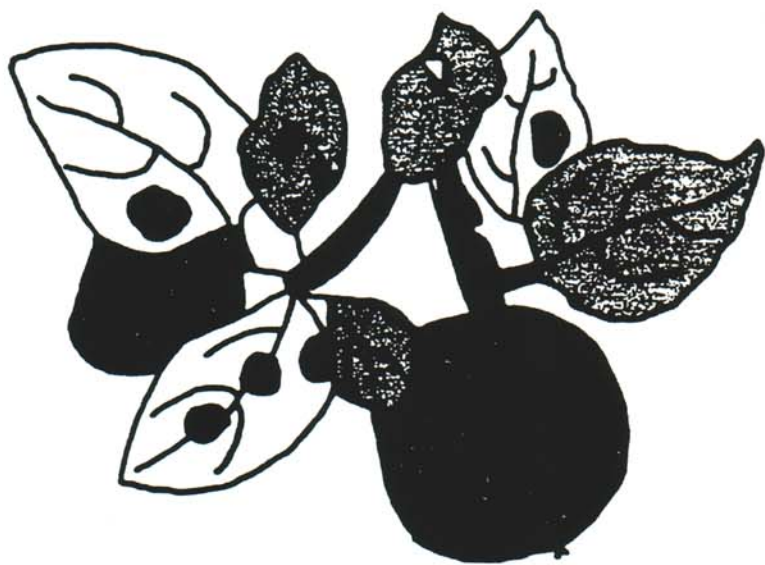
Chemical Treatment of Agronomic Seeds
Michigan State University Cooperative Extension Service
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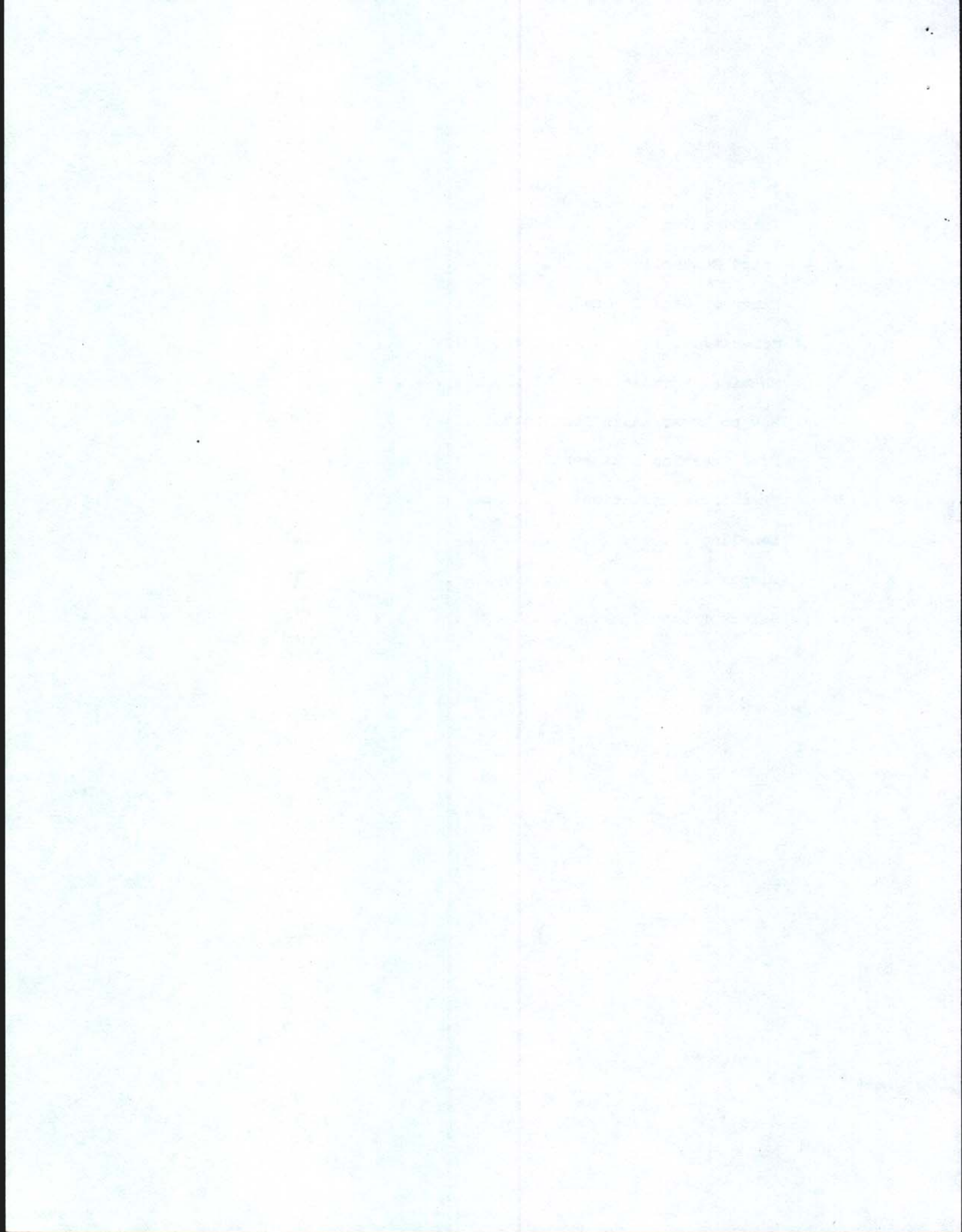
CHEMICAL TREATMENT OF AGRONOMIC SEEDS

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INTRODUCTION

In a broad sense, seed treating includes anything done to seeds between harvest and planting to protect or enhance the vigor and productivity of the seed or of the plants derived from the seed. Seed treatment is the activity whereby seed is amended with chemicals, irradiation or organisms to achieve a desirable or profitable advantage. Normally, seed treatment is done to remove or kill harmful organisms or to prevent organisms from attacking the germinating seeds once they are planted. Although seed treatment may also include several kinds of heat or irradiation treatment as well as the addition of chemicals, the pesticide is regulated only in the case of chemicals because of their real or potential danger to man and animals. This guide only accounts for those chemical pesticides which have been registered and approved for use by Federal regulatory agencies.

PESTS CONTROLLED

INSECTS--Insecticide seed treatment is used to protect the planted seed from the corn seed beetle, seed corn maggot, wireworms and the southern corn root-worm. Insecticides are also used to protect the seed during storage from such stored grain insects as the Indian meal moth, granary weevil, saw-tooth and grain beetle and others. Since most of the seed treatment insecticides are somewhat harmful to seeds when used alone, they should always be protected against this damage by using a fungicide as a safeguard as well.

FUNGI--By far the largest amount of general seed treatment is used to control the soil-borne fungi causing damping off, seedling blight, seed decay and root rot. The principle organisms to be controlled are in the genera Pythium, Rhizoctonia, Fusarium and Helminthosporium.

Some of the root rotting fungi including Fusarium and Thielaviopsis and others may be partly controlled by non-systemic materials. Soil-borne and superficially-borne smuts on the cereals are controlled with these compounds, but not corn smut. Systemic chemicals offer the only practical protection against pests such as loose smut of wheat and barley-borne smut inside the seed. Such systemic chemicals are tightly restricted to protect their entry into food channels.

BACTERIA--In Michigan, only the superficial infestations with bean blight bacteria are treated with streptomycin.

KINDS OF SEEDS TREATED

Commercial treatment in Michigan is largely for the seeded field crops including cereals (wheat, barley, oats, rye and corn). Beans, peas, soybeans and sugarbeets are also treated profitably. Some of the specialty crops and vegetable seeds are more often treated either by the seed producer or the grower himself than by an elevator or custom treater. These seed can be handled with commercial machines if proper adjustments for size of seed and amount of chemical are made.

MATERIALS

Seed treatment chemicals are used for the control of insects (insecticides), fungi (fungicides), bacteria (bacteriacides), animals and birds (repellents), minor element deficiencies (fertilizers) and to aid the treating or seeding process (adjuvants). Of these, the insecticides and fungicides present the most problems and account for nearly all seed treatment in Michigan.

The toxicities of some of the commonly used seed treatment pesticides are given below. The term "LD₅₀" is the amount of pesticide, in milligrams of pesticide per kilogram of body weight, needed to kill 50 percent of such test animals as laboratory rats either by ingestion (oral) or by skin contact (dermal). The LD₅₀ is a commonly used index of toxicity; the lower the LD₅₀, the more toxic the pesticide.

INSECTICIDES--Insecticides used in seed treating are synthetic organic types with the exception of pyrethrins, an insecticide of botanical origin that is sometimes used to protect stored seed. The insecticides used to protect planted seed must have some residual properties. The same property has made the most resistant suspect in the environment. As a result: aldrin and dieldrin have been banned for use, but old stock of seed treatment materials containing these insecticides can still be used; heptachlor is presently being considered for banning; and both BHC and lindane are suspect. Newer, less persistent materials are being tested as seed treatments and the present list of seed treatment insecticides should change within the next few years.

Insecticide	Acute LD ₅₀	
	Oral	Dermal
Storage Protectants		
malathion	885	> 4000
methoxychlor	5000	> 2820
pyrethrin	-	> 1800
pyseromyl butoxide	7500	> 1800
Seed Treatments		
diazinon	76	455
lindane	88	900
aldrin*	39	80
dieldrin*	40	52
heptachlor	40	118
chlorpyrifos (Dursban, Lorsban)	97	500
BHC	600	-

*Banned for use

FUNGICIDES--Most fungicides can be classified as either metallic or organic chemicals. Most of the early seed treatment fungicides were metal compounds especially containing copper or mercury. Few of these have commercial use now. Some of the mercury-containing compounds, especially the volatile mercury-organics such as Ceresan, Semesan and Panogen have been hazardous to applicators, growers and the environment. Mercury compounds are no longer allowed in commercial seed treatment. The organic compounds include an array of chemicals that do not contain or depend upon metal for most of their activity against pests. Those that remain on the outside of the seed and do not enter the plant during its development are "non-systemic." They act to repel or kill organisms that approach the seed or that are carried on the seed surface itself.

Systemic compounds offer an advantage by attacking pests harbored inside seed and later protecting the early growth of the plant. This very ability to remain in the plant, however, makes them possibly dangerous when such plants or parts therefrom are eaten by animals or man. It is very important that the systemic chemicals be regulated strictly. Since continuous use of such compounds can lead to their build up to toxic levels in the environment, they are regulated more severely or denied use on food or feed crops.

Fungicide	Oral	Acute LD ₅₀
		Dermal
chloroneb	>11,000	>3000
thiram	780	irritant
chloranil		
carboxin	3200	8000
pentachloroplenol (BCD)	125	105
penlachloronitrobenzene (PCNB)	1650	irritant
maneb	7000	7,1000
hexachlorobenzene (HCB)	-	irritant

BACTERIACIDES--The bacteriacides have little use in seed treatment except in special cases. The best known of these is the use of streptomycin (an antibiotic) for partial control of the organisms causing bacterial blight of beans. Streptomycin does not affect organisms inside the seed coat. Its acute oral LD₅₀ is 9000 and dermal above 600 as streptomycin sulphate.

REPELLANTS--These compounds have little or no commercial application as seed treatments in Michigan.

FERTILIZERS--In certain areas with known minor element deficiency such as manganese or molybdenum, it may be feasible to add deficient elements in the form of seed treatment. Application of these materials usually represents little or no hazard with the normal precautions.

ADJUVANTS--These compounds are not in themselves pesticides but certain of them may be injurious when eaten. Such materials as spreaders and stickers, graphite, clay, talc and other materials have been used alone or in varying combinations to aid in retention of the pesticide, to lubricate the seed for planting, or to alter seed size for precision planting. Since the adjuvants may affect pesticide activity, their use in such combinations is registered. The applicator must be aware that only the registered combinations are allowed for commercial use. The label on the seed treatment formulation that is used gives full detail on the specific, registered uses for that formulation.

Federal law requires that all seed treatment materials contain a contrasting colored dye that will color the treated seed. This is done so that treated seed is readily identifiable and will not be used as food or feed. The only exception to this regulation is planter box seed treatments (seed treatments

mixed with the seed in the planter box immediately before planting) and some seed storage protectants that are also used to protect stored food or feed grains.

CHEMICAL FORMULATIONS

Chemicals applied to seed are formulated either as wettable powders, slurries, dust or liquids. The kinds of formulations available are influenced by a number of factors including the stability of the active compound, the characteristics of the seed to which it is applied, and the kinds and availability of certain types of seed treating machinery.

Wettable powders are prepared for mixing in water primarily for application as sprays. They, therefore, may not be the best choice for seed treatments, often lacking the sticking ability of a good seed coating chemical. The wettable powders once in water are not solubilized so that constant agitation is required for a homogeneous suspension of chemical. Wettable powders are easily prepared in desired concentrations by adding prescribed amounts of water. The amount of chemical applied, therefore, is a function of a volume of water applied.

Slurries are flowable preparations of chemical pesticides. Though liquid in nature, solution is not complete so constant agitation is important during use. Addition of water or other suitable diluents can often be made to adjust the concentration of the active ingredient. Slurries provide excellent seed coverage and relatively low volumes of chemicals need be prepared. The efficiency of pest control on or in seeds is highest when uniform quantities of chemical reach each seed.

Dusts have an active chemical ingredient often coupled with additional chemicals that promote seed coverage (stickers). Dust with good sticker

characteristics used even in simple seed mixing procedures can make excellent seed treatments.

Liquid formulations of chemicals are true solutions of the active ingredient in a compatible solvent. Liquids thus are often ready to use without prior mixing or dilution. Liquid can be effectively applied to seeds in minute amounts using modern machinery designed for that purpose.

Seed treatment pesticides are usually sold as special formulations intended solely for use as seed treatments. These formulations contain the proper mixtures of pesticides and selected adjuvants for maximum effectiveness and a minimum risk to germination. The special seed treatment formulations should be used for treating seeds. Some mixes of seed treatment materials or adjuvants are not "compatible" as they can reduce the effectiveness of the separate materials or reduce the germination of the seed. Home mixing of different pesticides for seed treatment should not be done except with the approval of a competent specialist.

Consult your County Agricultural Extension Agent before making a home mix for seed treatment.

HOW TO TREAT SMALL SEED LOTS

Since all seed treatments are registered for the amount of material to be applied in certain ways, the presumption is that this amount will remain on the seed until it can do its work. Accuracy in proportioning the chemical and seed is important for both safety and effectiveness. Care must be taken that the chemical, once applied is not lost before planting. The safety of the treating personnel, seed handlers and the ultimate seed user are all important and must be assured by following the State and federal safety regulations.

Any small quantity of seed can be readily treated by mixing the proper amount of chemical and seed in a closed container. This should be no more than one-third full for good mixing. Dry chemicals or other suitable chemicals are weighed out or measured in the amount needed for the weight of the seed. Seed and chemical are tumbled in the container until the seed is uniformly coated.

Since the seed lots and the amount of chemical are small and rates are usually given in ounces per bushel (or 100 pounds of seed), it is advisable to convert to metric units in the calculations.

Example:

To treat one pound of peas with a thiram material at the rate of 2 ounces of active thiram for 100 pounds of seed. The commercial material is Arasan-50, a 50% wettable form of thiram.

2 oz. active thiram = 4 oz. Arasan 50

4 oz. Arasan 50 = 1/4 lb. per 100 lbs. of seed = 1/4 of 1% of seed weight = 0.0025 X seed weight

1 lb. seed = 454 grams

454 X 0.0025 = 1.135 grams Arasan 50 per pound of seed.

Once you have determined the correct amount of chemical and what its volume is in a measuring spoon, other treatments can be measured by the volume. Each chemical formulation is somewhat different and should be calibrated separately.

To apply a chemical to the seed as a slurry starting with a dry material, mix a little water with the chemical in a treating container drop by drop. Only enough water to make a runny mud is needed. Seeds differ in their absorbancy,

but most smooth seeds will require less than one-half of one percent added moisture to spread and stick the chemical, i.e. about 2 milliliters per pound of seed. Add the seeds to the slurry, cover the container and swirl and roll the seeds until the coverages is uniform. Do not shake seeds violently as it injures them. As the seeds absorb water, the chemical will stick to the seeds and leave the walls of the container. Some material is lost, however, and a little extra chemical (5-10%) should be allowed for the loss. Adhesion of some chemicals to a very smooth seed may be improved by substituting dilute spreader-sticker solution for water in the slurry. Calculations used in the example for small seed lots are basic for large batches or machine treating as well.

SEED TREATING EQUIPMENT

MANUAL SEED TREATMENT--For small order volumes of seed, mixing the prescribed amount of chemical and seed in jars, tanks, rotating drums and the like will suffice. A rotating container, like a small cement mixer, is most effective for all types of chemical formulations, virtually guaranteeing a uniform distribution of the chemical on all seeds.

CONTINUOUS FLOW TREATERS--For treatment of larger volumes of seed, like seed of small grains or beans, mechanical and semi-automatic treaters are available. These treaters have quantitative inlet compartments for seed and chemical and a mixing or dispersion chamber preceding the exit. Attachments can assist in bagging and treated seed or account for differing seed flowability and the characteristics of different chemical formulations.

SLURRY TREATER

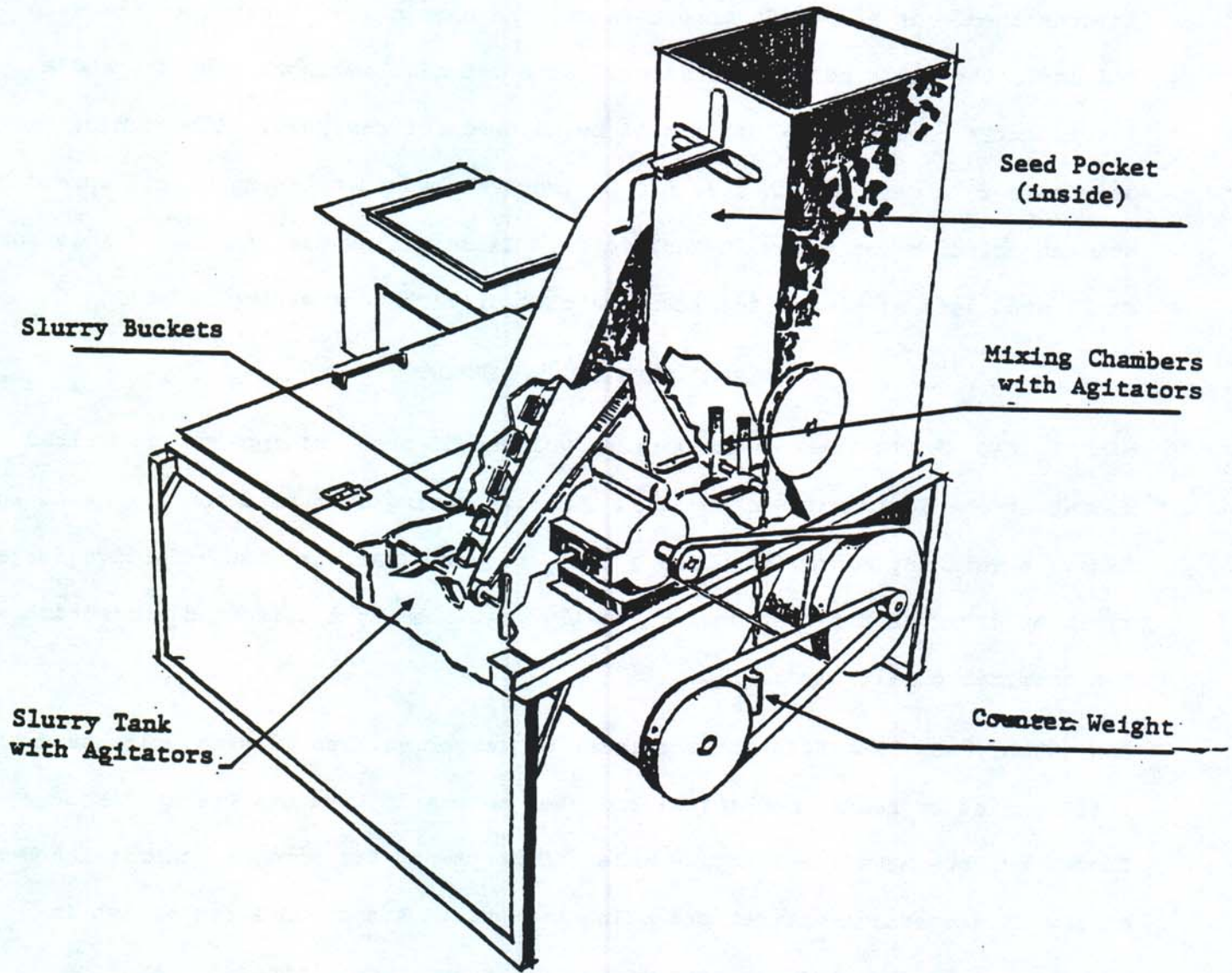


Fig. 1

MIST TYPE LIQUID SEED TREATER

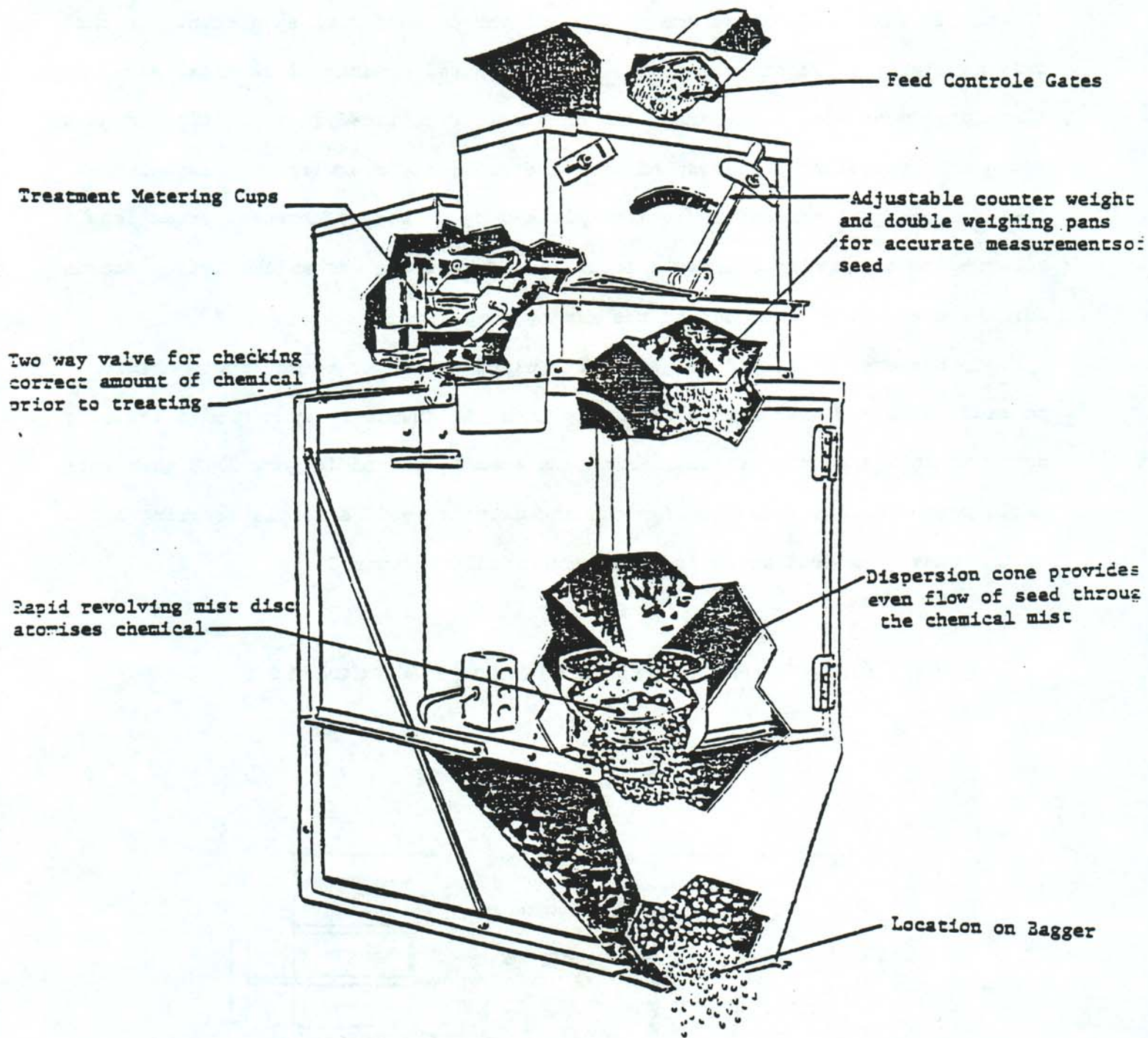


Fig. 2

Seed is metered into the treater by an adjustable tipping bucket mechanism (Figure 1) which will introduce a given weight of seed with each dump. In the case of slurry or liquid chemicals, small measured amounts of chemical are also introduced with each dump. The chemical is replaced in the tipping cups by means of a recycling pump coupled with the chemical reservoir. Mixing of the seed and chemical thereafter is accomplished by an auger, brushes, or pallets rotating in the mixing chamber (Figure 1). Gravity or mechanical action accounts for the movement of seed out of the mixing compartment.

In the case of liquid or slurry formulations, treaters may apply chemical to seed using the mist action resulting from the chemicals spun from a rotating drum within the chamber through which the seed is passed (Figure 2). When wettable powder or dusts are applied continuously to seed, a simple metering device at the base of a seed auger is used successfully (Figure 3).

Grain Auger With Dust Metering Attachment

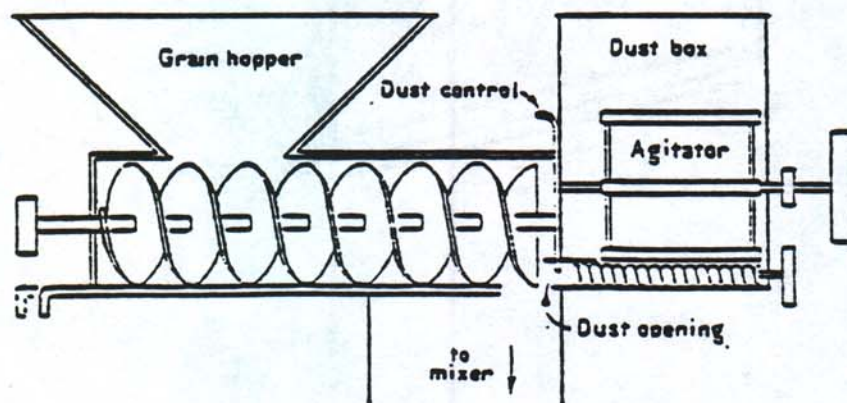


Fig. 3

If the automatic slurry machine has setting for dumping a certain weight of seeds and a certain volume of slurry from a cup into the mixer, usually the easiest way to change the rate of chemical applied to the seed is to change the amount of chemical per gallon of water in the supply tank. Some machines have replaceable feeding cups to supply different amounts of slurry to a constant weight of seed. Once a machine is operating and coated with chemical slurry, the coverage should be calculated. This is best done by disconnecting or separating the paths of chemical and seed through the treater so that each can be collected separately. After a period of continuous operation (after about 5 to 10 bushels of seeds have passed through the treater) determine the weight (or volume) of seed and chemical supplied by the treater. The proportions of chemical to seed should be within recommended levels. If not, adjustments to seed, chemical or both seed and chemical feeding rates should be made and the above steps repeated until approved chemical application rates are achieved.

It is important to remember that slurries tend to form solid coatings in the cup which will alter the volume. Thorough periodic cleaning of the cups is essential as is continuous agitation of the chemical mixture in the supply tank to maintain proper calibration.

Example:

If the seed dump is set at 10 lbs. and the slurry cup is 1/80 gallon, how much thiram in the form of 50% material will be needed in one gallon of slurry so that seeds will be treated at the rate of 2 ounces active thiram per 100 pounds of seed?

1/80 gallon for 10 pounds of seed = one gallon for 800 pounds seed.

2 ounces active thiram = 4 ounces of a 50 percent formulation for each 100 pounds of seed.

Therefore, 800 pounds seed or 1 gallon slurry will need 2 pounds of 50% formulation.

TREATER INSTALLATIONS

All existing and proposed seed treatment installations must comply with Regulation No. 553 of the Michigan Department of Agriculture. Total familiarity with this regulation and consultation with officials of the Plant Industry Division of the Michigan Department of Agriculture is essential to avoid conflicts with certain facets of law, especially those regulating treating equipment, location of the treating operation, storage, and labeling of treated seed. Understand that the purpose of the legislation is to protect persons directly handling hazardous chemicals and also to protect against the entry of such chemicals into the foods or feeds. The following is a partial list of precautions cited in Regulation 553:

The seed treater must be separated by permanent physical barriers from other seed, feed and grain handling operations (mixing equipment, elevators, conveyor belts carts, etc.). Exit and entry of seed, chemicals and personnel must be through portals not used in common with other seed, feed or feed handling operations. Adequate and separated ventilation of seed treating areas should be provided.

Chemical containers, feeding lines and the chemical metering portions of the treater should be inspected regularly to prevent leaks and/or spills.

Treated seed must be bagged and clearly labeled. At no time should it be stored in common locations with nontreated seeds nor should nontreated seed be stored or handled in, or come in contact with equipment or surfaces previously exposed to treated seed.

LABELING

All commercial treated seed must bear a label that clearly identifies the type of seed, the seed treatment material used, and the statement "Treated Seed--Do Not Use For Food, Feed, or Oil." This label will identify the seed as unfit for food or feed and will also tell the buyer what pesticides have been used on the seed. The label may be a separate tag attached to the seed bag or it may be conspicuously printed on the bag itself. In either case, all treated seed offered for sale must bear this label.

DISPOSAL

The disposal of excess treated seed in a manner that precludes any possible use as food or feed is extremely important. Once treated, the seed can only be used for one purpose--planting. Carryover stock of treated seeds cannot be used for any other purpose. Washing, brushing, or other methods of trying to remove the seed treatment is futile. The pesticides are simply too difficult to remove from the seed. Mixing (or blending) the treated seed with untreated grain is unsafe as well as illegal. The disposal of excess stock of treated seed has been a problem in Michigan. A means of avoiding the problem is to treat only the seed that will be used and to treat the seed just before planting. Any excess stock of treated seed should be buried in a specially designated landfill if one is available or in an open field where the seed will not contaminate water sources.

SAFETY PRECAUTIONS

Pesticides registered for use as seed treatments are to be used only on seed that is to be planted. Treated seeds cannot be used for food, feed or oil.

Since some treated seeds can be attractive to birds and wildlife and is poisonous to them, extra care is to be taken in planting. Be sure that the treated seeds are adequately covered with soil when planting.

The following precautions need to be constantly reviewed:

1. Treated seed cannot be used for feed, food or oil purposes.
Washing, brushing, soaking or rinsing the seed will not remove the pesticides from the seed.
2. Store seed treatment pesticides remote from feed or food products and where they cannot be contacted by people or livestock.
3. Treat only the amount of seed that will definitely be planted.
4. Treat the seed as near planting time as possible.
5. Read the label on the seed treatment formulation that you will use to be sure that it is registered for the specific use.
6. Handle the pesticides with care following the label instructions regarding use of safety equipments such as rubber gloves, respirators, and the like.
7. Calibrate equipment to insure continuous accuracy of application.
8. Apply the pesticides with care following label instructions.
9. Place the proper labels on bags of treated seed that are to be sold.
10. Store treated seed remote from feed or grain that is to be fed or processed for human consumption.
11. Remove and destroy excess stock of treated seed by burial.

SELF-HELP QUESTIONS FOR SEED TREATING MANUAL

Now that you have studied this text, answer the following questions. Write the answers with pencil without referring back to the text. When you are satisfied with your written answers, see if they are correct by checking them with the text. Erase your answer and write in the correct answer if your first answer is wrong. Note that these questions are not necessarily those that are used in the certification examination.

1. What is the seed treating activity and why is it desirable?
2. What pests of seed are controlled and which pest group accounts for most of the activity?
3. "LD₅₀" refers to pesticide toxicity? True or false.
4. Insecticides used in seed treatment must possess the following desirable characteristic?
5. What hazards are associated with treating seed with a systemic compound?
6. What are pesticide adjuvants?
7. Is treated seed identified in any way and if so, explain?
8. Describe a "wetttable powder"?
 " a "slurry"?
 " a "liquid formulation"?
 " "compatibility of pesticides"?
9. In treating small seed lots what two important factors must be considered?
10. Given the following factors determine the grams of Thiram-50 needed to treat 5 lbs of seed?
 Crop - Peas - Material - Thiram 50% W.P. Rate of application 2 oz. of active Thiram per 100 pounds of seed. Amount to treat - 5 lbs.

11. Explain the mixing of a slurry pesticide and the application procedure followed to gain uniform seed coverage?
12. Is manual seed treatment a recommended practice?
13. How best may the pesticide concentration in an automatic slurry machine be adjusted to add more pesticide? Explain.
14. What precautions must be considered when a slurry mixer is in continuous operation?
15. Who regulates seed treater installations?
16. Explain the purpose of Regulation 553 and its general seed treater requirements?
17. How must treated seed be labeled?
18. What precautions must be considered when disposing of surplus treated seed? How can this best be handled?
19. Fungicidal seed treatment can be used for feed purposes? True or false.
20. Review all seed treatment precautions! (page 16)



PESTICIDE EMERGENCY INFORMATION



For any type of an emergency involving a pesticide, immediately contact the following emergency information centers for assistance.
Current as of February 2002

Human Pesticide Poisoning

POISON CONTROL

From anywhere in the United States, call

1 - 8 0 0 - 2 2 2 - 1 2 2 2

Special Pesticide Emergencies

Animal Poisoning

Your veterinarian:

Pesticide Fire

Local fire department:

Traffic Accident

Local police department or sheriff's department:

Environmental Pollution

District Michigan Department of Environmental Quality (MDEQ) Office Phone No.

Pesticide Disposal Information

Michigan Clean Sweep, Michigan Department of Agriculture Environmental Stewardship Division.
Monday - Friday: 8 a.m.-5 p.m.
(517) 335-6529

Phone No.

or

Animal Health Diagnostic Laboratory (Toxicology) Michigan State University:
(517) 355-0281

Phone No.

and

Fire Marshal Division, Michigan State Police:
M - F: 8-12, 1-5
(517) 322-1924

Phone No.

and

Operations Division, Michigan State Police:
***(517) 336-6605**

Phone No.

and

MDEQ Pollution Emergency Alerting System (PEAS):
***1-800-292-4706**
also
***1-800-405-0101**
Michigan Department of Agriculture Spill Response

* Telephone Number Operated 24 Hours

National Pesticide Information Center

Provides advice on recognizing and managing pesticide poisoning, toxicology, general pesticide information and emergency response assistance. Funded by EPA, based at Oregon State University
7 days a week; excluding holidays
6:30 a.m. - 4:30 p.m. Pacific Time Zone
1-800-858-7378
FAX: 1-541-737-0761

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