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Control of Insect Pests in Stored Grains, Peas, and Beans

THE CONTROL of insects in stored grains, cowpeas, beans, and other similar products is a major problem in Alabama. The greater part of the damage to grain is produced by the common corn or rice weevil and the Angoumois grain moth, although more than 40 different species of insects are known to attack grain and grain products. The most serious damage to beans and peas is produced by three species of small insects commonly called bean or pea weevils.

CONTROL BY HEAT

Pests of stored grains, peas, and beans can be successfully controlled by exposing them to a temperature of 120 to 130 degrees F. for 4 to 5 hours. The seed should be thoroughly dry when treated and should not be overheated or germination will be injured. The entire mass to be treated should be slowly brought up to a temperature of 120 to 130 degrees F. and held at this temperature for 4 to 5 hours. This treatment kills all stages of the insect.

The use of this method of control is rather limited because of the lack of heating facilities. Very few bins or cribs in Alabama can be heated to the proper temperature. Many cooking ovens, however, may be used satisfactorily for treating small quantities of seed, provided a thermometer is used to make certain the correct temperature is maintained.

CONTROL BY FUMIGATION

Fumigation is by far the most common method of controlling insects in stored products in Alabama. No elaborate equipment is needed. The materials to be fumigated are stored in a tight bin or other container and treated with a suitable gas.

Rooms or Containers Suitable for Fumigation.—The success of the fumigating operation depends largely upon the tightness of the crib or the container in which the grain is stored. Cribs made of tongue-and-groove material, with double walls and floors, are satisfactory for fumigating. Some cribs not constructed so well may easily be made tight enough. For example,

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several layers of heavy paper may be spread on floors that are not sufficiently tight and a tarpaulin may be spread over the corn or other products in the absence of a good overhead ceiling. It is much more difficult to make loosely constructed walls tight enough for a fumigation. Since the condition of such walls varies so greatly, the individual farmer must use his judgment in rebuilding them or in using tar paper, tarpaulins, or other materials to prevent the escape of the gas through the walls. Small quantities of seed may be fumigated in a good barrel, an empty calcium arsenate drum, a dry-goods box well lined with several thicknesses of heavy paper, or some other similar container.

Grain may be fumigated with fair results out of doors. In this procedure the grain is piled on dry ground and covered well with tarpaulins. The tarpaulins must completely cover the pile of grain and extend out over the ground around the pile. Soil should be shoveled on the edges of the tarpaulins to prevent the escape of the gas.

Material to Use.—Of the many different fumigants used to control pests in stored products, carbon disulphide ("high life") is perhaps the most satisfactory. This material is a clear liquid that volatilizes rapidly forming a heavy gas which penetrates well into piles of stored seed. It is both effective and economical. Carbon disulphide has the disadvantage, however, of being highly inflammable; its vapors, when mixed with air, are violently explosive.

The amount of carbon disulphide needed to kill insects varies considerably, depending upon the tightness of the fumigation chamber. In a practically air-tight bin 5 pounds of the material to each 1,000 cubic feet of content is sufficient. The average tongue-and-groove crib in Alabama, designed especially for fumigation, requires 8 to 10 pounds for each 1,000 cubic feet. In many cribs 15 to 20 pounds must be used for the same amount of space, if fumigation is possible at all. For fumigating small quantities of seed in tight containers the correct amount of carbon disulphide is 1 teaspoonful to a 1-gallon container or 1 pint (2 cupfuls) to a 60-gallon container.

Fumigating Procedure.—In fumigating grains, peas, or beans stored in a bin, crib, or other container, the following procedure should be followed:

(1) Determine the number of cubic feet in the room or container and calculate the amount of carbon disulphide needed. The cubic content refers to the capacity of the entire room and not to the part occupied by the materials to be treated. It may be desirable in a partly filled room, however, to spread a good tarpaulin over the materials to be treated and fumigate only the portion occupied by these materials rather than the entire room.

(2) Make the room or container as nearly air-tight as possible. All windows to cribs should be closed and paper should

be packed in the cracks around them. All other openings or cracks of any kind should be tightly closed.

(3) Remove enough corn or other needed livestock feed to last several days or until the fumigation is over and the grain is aired out.

(4) Pour the correct amount of carbon disulphide in thin layers in large shallow pans placed on top of the material to be fumigated or pour it on gunny sacks spread over the material. It is essential that the carbon disulphide be spread in thin layers over a considerable area so that it can vaporize rapidly. On such products as unshucked corn the liquid may be satisfactorily poured on the sacks or even directly on the corn, while on such products as shelled peas it is better to use shallow pans. It is necessary to place the fumigant on or above the material to be treated because carbon disulphide forms a heavy gas that tends to settle downward.

(5) Close the room or container tightly and do not disturb it for 36 hours. It is well also to post signs warning passers-by of the fumigation.

(6) Open the room or container after about 36 hours and allow it to air out thoroughly.

Precautions.—Several precautions are necessary in fumigating with carbon disulphide. Extreme care must be exercised to see that no lighted lanterns or other fires are carried in the vicinity of the fumigation as the fumigant is highly inflammable. Even a lighted cigarette, an electric spark, or a spark from the hammering of metals may cause an explosion. With the exercise of reasonable care, however, carbon disulphide may be used with relatively little danger.

Fumigation may be performed successfully only when the weather is warm. The temperature should be 70 degrees F. or above. During colder weather the insects are not active and the fumigant is only slowly volatile.

All seed should be mature and thoroughly dry when fumigated with carbon disulphide. The germination and feeding qualities of dry seed are not injured.

Time to Fumigate.—It is not possible to make any definite rule as to the best time to fumigate. Certainly cowpeas should be fumigated soon after harvesting. The soft grained varieties of corn should also be fumigated soon after harvesting, unless trap crops and other good farm practices have been used to protect the corn against weevil injury. Hard grained varieties may not need fumigating until spring; it is possible they may not need it then if practically weevil-free corn was stored in a weevil-free crib. The use of good judgment is necessary to determine the best time under a given condition.

Costs.—The cost of carbon disulphide is quite variable. In one-pound cans the retail price ranges from about 30 to 50 cents

a pound; when purchased in 500-pound drums the price is 4 to 6 cents a pound. Savings may be made by purchasing large quantities and holding over any unused portion until it is needed. It must be tightly sealed in the original container and stored in a cool place.

OTHER METHODS OF CONTROL

Weevils in corn may be at least partially controlled by growing corn with long, close-fitting shucks and by using trap crops. A trap crop to collect the weevils consists of a few rows of corn planted in each field two or three weeks earlier than the main crop of corn. To be effective, however, the trap crop must be harvested as soon as mature and thoroughly fumigated to destroy the insects trapped. If the corn is not harvested early, the trap crop becomes a breeding place to build up a large population of weevils which remains to infest the main crop of corn. The main crop should be harvested as soon as well mature and stored in an insect-free crib or bin.

To rid an empty crib of insects all old corn and shucks should be removed. The walls and floors should then be thoroughly swept and the trash and live weevils thus collected should be burned. It is sometimes desirable to fumigate an empty crib with sulphur dioxide, as the fumigation is more effective than the "clean up" without the fumigation.

To obtain the sulphur dioxide 5 to 6 pounds of sulphur should be burned in a bucket or other metal container for each 1,000 cubic feet of content in the crib. Wood "shavings" or chips should be placed in the bottom of the bucket and the sulphur, mixed with additional "shavings", should be added. A small quantity of wood alcohol or gasoline should then be poured on the sulphur and lighted cautiously. To reduce the danger from fire, the bucket of burning sulphur must rest evenly on a flattened mound of soil several times the diameter of the bucket. Asbestos or other non-inflammable material may be substituted for the soil.

Insect pests of stored peas and beans cannot be successfully controlled by any of the so-called farm practices. If insect-free seed is planted the injury in the field is less than when infested seed is planted, but protection against injury in storage is necessary in either case. Peas and beans stored in air-slaked lime are not attacked by weevils. For small quantities of peas the correct amount of lime is one pound to each two pounds of cowpeas. For large quantities of peas one pound of air-slaked lime mixed with three or four pounds of peas is sufficient.

Peas and beans that have been freed of weevils by fumigation may be stored in heavy closely woven sacks or other suitable containers to prevent or reduce reinfestation.

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