Control of Insects that Attack DRY BEANS AND PEAS in Storage

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PRECAUTIONS

Fumigants that kill insects are poisonous to humans and to animals. When handling these fumigants, be careful and follow all directions on the labels attached to the cylinders in which the manufacturer delivers his product. Do not breathe the vapors or spill the liquid fumigants on your skin or clothing. Unless you are trained in the methods of using a fumigant, you should be instructed in its use by a professional or experienced fumigator. Large operations should be conducted by professional fumigators.

Use a gas mask equipped with a canister of the proper type for the fumigant being used. Do not enter any area where there is a high concentration of the fumigant. Gas masks protect only against the low concentrations encountered around the equipment being used to apply the fumigant.

Do not use a canister for longer than the period recommended by the manufacturer, even in light concentrations of the fumigant. After this period, replace it with a new canister.
INTRODUCTION

Of the many insects that attack dry beans and peas in storage the most important species are:

Bean weevil  
*Acanthoscelides obtectus* (Say)

Cowpea weevil  
*Callosobruchus maculatus* (F.)

Indian-meal moth  
*Plodia interpunctella* (Hbn.)

Tobacco moth  
*Ephestia elutella* (Hbn.)

Almond moth  
*Cadra cautella* (Wlk.)

Of these, the bean weevil and the cowpea weevil are the most destructive. Storage losses caused by all five insects, not counting the cost of control measures, amount to more than $600,000 each year. This publication was prepared by the Stored-Product Insects Research Branch to provide information that can be used to reduce this loss. The weevils infest ripening beans in the fields and continue breeding in them in storage. The moths may be considered as strictly storage pests, since they have not been observed attacking the ripening beans in the field. Since the habits of and control measures for the insects that attack beans and peas are similar, references to either beans or peas in this publication will, for convenience, apply to both of them.

Field infestations occur when small lots of beans held on farms supply weevils with a means of surviving throughout the year. Beans left in the seeder, leftover seed beans, unused bean screenings, and beans remaining in the straw offer ideal places for weevil survival and development.

Beans that have not become infested in the field may become infested in storage in the same manner as on the farm. Beans held in warehouses or packaging plants may harbor weevils and moths and contaminate uninfested materials.
The length of the life cycle of all these insects is affected by temperature and by the moisture content of the seeds. Under ideal conditions (80°F and 60 percent R.H.) the life cycle may be completed within 25 to 30 days, but under unfavorable conditions several months may be required. Damage is greatest in areas where the climate is warm.

DESCRIPTION AND HABITS

Bean Weevil

Adult bean weevils are grayish brown and from 2/16 to 3/16 inch long. They have well developed wings and are good flyers. A female may deposit 150 or more eggs during her lifetime. The eggs, which are smooth and white, are laid singly or in clusters among or near the beans. The eggs hatch into tiny white larvae, which eat their way into the beans. The entrance holes are small and easily overlooked.

During the winter the weevils develop slowly within the beans. When warm weather comes, the larvae develop rapidly and soon reach the pupal (or resting) stage, from which the adults are formed. The adults then chew a round opening through the seed coat and emerge. Within a short time mating occurs and the female is ready to lay eggs. She may lay her eggs on the stored beans or fly to the ripening crop in the field and lay eggs on the pods. At that time of the year the eggs soon hatch. If infestation occurs early in the ripening period, one generation may be completed before the beans have been thrashed and taken to the warehouse.

The bean weevil is capable of developing in all varieties of common dried beans and cowpeas. Several weevils have been found within a single seed.

Cowpea Weevil

Adult cowpea weevils are about the same size as adult bean weevils, but they differ from them in color, activity, and manner of egg laying. Cowpea weevils are various shades of brown and have four conspicuous black spots on their backs. They are extremely active and are strong fliers.

A female deposits approximately 85 eggs during her lifetime.
She attaches her eggs, which are nearly transparent when first laid, to the surface of the cowpeas. If the weather is warm, the eggs soon hatch and the larvae enter directly into the cowpeas. In chewing their entrance tunnel, the larvae push some of the borings back into the empty eggshells, making them white and very easily seen. The life cycle of the cowpea weevil is the same as that of the bean weevil.

The cowpea weevil is primarily a pest of dry cowpeas and is apparently not capable of developing successfully in the common varieties of beans. However, it will lay eggs on any of these varieties.

**Moths**

The Indian-meal moth, the tobacco moth, and the almond moth are similar in appearance and length (approximately 3/8 inch). Each female lays about 150 eggs among or near the beans.

Tiny caterpillars, or larvae, hatch from the eggs and soon start feeding on the stored beans. Fully grown larvae find their way to the top of open bins where beans are stored in bulk or to the outside of bags of beans piled in stacks. They then spin cocoons in some protected spot, where they develop into adult moths.

The damage caused by these moths results chiefly from the webbing and frass that feeding larvae deposit among the beans. Only beans and peas that are split...
or have cracked seed coats can be eaten by the larvae. They also attack such products as cereals, nut meats, dried fruits, and animal feeds. All foods and feeds in any retail store operated in a warehouse should be kept free of insects.

**CONTROL BY SANITATION**

After planting has been completed, the leftover seed should be properly cared for. It *should not* be used as feed or food if it has been treated with fungicides or insecticides other than malathion or a combination of pyrethrins and piperonyl butoxide. Untreated beans that are to be kept for eating should be fumigated, heated to 145°F for 10 minutes, or placed in a freezer at 0°F for 4 days. After these treatments, the beans should be stored in glass jars with lids.

If such a program is to be effective, all bean and pea growers in an area must cooperate. One careless grower may provide enough insects to infest his neighbor's crop.

Similar sanitation procedures should be followed by warehouse and packaging plant managers. After the beans are cleaned, all loose beans, odd lots of beans, and those remaining in the cleaning machinery should be gathered up and either fumigated or disposed of. The warehouse should be maintained under sanitary conditions as long as beans are stored there. All bean samples should be carefully examined and fumigated if necessary.

Bean and pea straw and screenings *should not* be fed to livestock if they contain residues of DDT, Aramite, toxaphene, or Kelthane.

**CONTROL BY FUMIGATION**

Fumigation will destroy insects that attack dry beans and peas in storage. The temperature of the beans, the dosage of fumigant, and the exposure period must be carefully regulated. The volume of beans in a fumigation chamber should not exceed 80 percent of the capacity of the chamber. In growing areas where weevils are known to be present, all beans and peas should be fumigated as soon as they reach the warehouse. Tol-

erances for residues on peas and beans have been established only for methyl bromide and hydrogen cyanide, and therefore only these two fumigants can be used legally.

1Trade names are used in this publication solely to provide information. Mention of a trade name does not constitute a guarantee or warranty by the U.S. Department of Agriculture and does not signify that the product is approved to the exclusion of other comparable products.
**Fumigation in Warehouses**

Whenever possible the entire warehouse should be fumigated. This should not be attempted, however, unless the building is tightly constructed or can be sealed without too much expense. It is desirable to circulate the gas-air mixture within the warehouse by means of fans for at least 30 minutes after the gas has been introduced. This will assure the thorough distribution of the fumigant.

**Fumigation Under Gastight Tarpaulins**

If the warehouse cannot be sealed, fumigation may be done under a gastight tarpaulin. Satisfactory results can be obtained by fumigating individual stacks. However, fumigants have no residual effect, and a treated stack may become reinfested soon after treatment by insects migrating from nearby unfumigated stacks. It is better to fumigate the entire warehouse whenever possible.

The tarpaulins used may be made of plastic film or of cotton or nylon that has been coated with plastic or rubber. The tarpaulin must be impervious to gas and its edges should be held securely to the floor to prevent gas from escaping. "Sand snakes" 4 to 6 inches in diameter and 4 to 5 feet long may be used for that purpose. Before a tarpaulin is placed over a stack, several bags of beans placed on end should be distributed over the top of the stack to create an airspace beneath the tarpaulin for the diffusion of the gas. Methyl bromide or hydrogen cyanide should be introduced into the airspace near the top center of the stack.

**Fumigation in Atmospheric Vaults**

Good results may be obtained by fumigating dry beans and peas in atmospheric vaults that are tightly constructed and have close-fitting doors. However, loading and unloading the vaults involves considerable time and expense.

**Fumigation in Railroad Cars**

Freight and refrigerator cars used for fumigating beans and peas should be capable of being tightly sealed. In preparation for fumigation, the cars should be sealed around the doors and other openings and conspicuously marked with proper warning signs. The cars should not be moved during the exposure period.
# FUMIGANT DOSAGE SCHEDULE

<table>
<thead>
<tr>
<th>Type of fumigation</th>
<th>Fumigant</th>
<th>Exposure</th>
<th>Dosage</th>
<th>Temperature</th>
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<tr>
<td>Warehouse</td>
<td>Methyl bromide</td>
<td>24</td>
<td>2</td>
<td>Above 60</td>
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<td></td>
<td>24</td>
<td>3</td>
<td>40 to 60</td>
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<tr>
<td></td>
<td>Hydrogen cyanide</td>
<td>24</td>
<td>1.5</td>
<td>Above 60</td>
</tr>
<tr>
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<td>12</td>
<td>2</td>
<td>Above 60</td>
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<tr>
<td>Tarpaulin</td>
<td>Methyl bromide</td>
<td>24</td>
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<td>Above 60</td>
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<td></td>
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<td>24</td>
<td>3</td>
<td>40 to 60</td>
</tr>
<tr>
<td></td>
<td>Hydrogen cyanide</td>
<td>12 to 24</td>
<td>1.5</td>
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</tr>
<tr>
<td>Atmospheric vault</td>
<td>Methyl bromide</td>
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<tr>
<td>Railroad car</td>
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