

Wireworms in Lima Beans

control by seed treatment with high gamma
benzene hexachloride—BHC—investigated

W. H. Lange, E. C. Carlson, and L. D. Leach

Wireworms in lima bean fields often cause extensive losses regardless of the amount of seed planted.

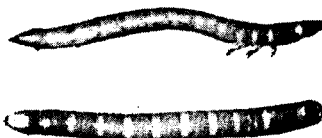
Soil fumigations with EDB or DD mixtures have given a satisfactory control of wireworms, but this method is expensive and requires the use of special fumigating equipment.

Soil applications of residual chemicals such as DDT, chlordane, or BHC—benzene hexachloride—which remain for several years in the soil and gradually reduce the numbers of wireworms—have shown some promise for wireworm control. The full effects of these chemicals upon the growth of plants and soil microorganisms are not known. Some materials, however, do reduce the acceptability of the produce by causing off-flavors.

Three years of laboratory and greenhouse experiments, supplemented by field tests during the past season, have proved the application of an insecticide to the seed to be effective, inexpensive and reasonably safe. This method reduces to a minimum the probability of obtaining off-flavors or the possibility of obtaining detrimental effects from the accumulation of large amounts of this chemical in the soil. It would take 16 years to apply the same amount of benzene hexachloride as a seed treatment as would be necessary to control wireworms by a single effective soil treatment.

Materials

Among the chemicals tested as seed treatments BHC appears most effective because of its quick action in killing wireworms.



Wireworm, *Melanotus oregonensis*, slightly enlarged.

For soil treatment a low gamma form of BHC has been commonly used which contains from 1% to 10% of the gamma isomer depending upon the particular formulation. These low gamma formulations have a characteristic musty odor, and are not recommended for seed treatment because there is a greater possibility of injuring germination, and a greater danger and possible discomfort to the operator.

For seed treatment the high gamma or purified types of BHC should be used.

Seed Treatment

There are several different ways to treat seed, and these can be listed as follows:

1 A measured dosage of a dry powder may be applied to the seed and simply mixed in a seed treater such as a diagonal barrel or in a cement mixer or other open container.

2 After the dry powder is applied, one-quarter to one-half pint of water to 100 pounds of seed may be sprayed on during the mixing process to stick more of the chemical on the seed and reduce the free dust hazard. The water can be sprayed on the seed by means of a compressed air

sprayer such as a paint gun, and if only this amount of water is used the seed can be bagged without drying.

3 Liquid treatments include the spraying of liquids on the seed either as suspensions of wettable powders or as solutions. A paint gun can be used to apply these liquids; and

4 Slurry treatment, which is the application of a slurry or thick liquid suspension to seed by means of a special slurry treater.

Unless a spray treater or slurry treater is available, the use of the dry treatment, with or without liquid fixation, is the most adaptable method for use by most growers. A more uniform treatment can be obtained if diagonal barrels, cement mixers, or other open mixers of this type are used. Mixing the materials in open cans, or seed hoppers should be used only if no other equipment is available.

Dosage

Under ordinary conditions a dosage of four ounces of 25% gamma BHC—the purified type—to 100 pounds of seed appears satisfactory both from the standpoint of minimum plant injury and effective control of wireworms. A dosage as low as two ounces to 100 pounds of seed has proved to be noninjurious to germination, but is less effective for wireworm control. Under some conditions a four ounce application resulted in a slight delay of emergence and retarded growth of seedlings.

With the slurry treater $1\frac{1}{3}$ ounces of a 75% high gamma BHC affords a com-

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Wireworm damage to lima bean field in 1948. Clear spaces indicate plants killed by wireworms.



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parable dosage. Thus, if one-half pint of total slurry is applied to 100 pounds of seed, this amount of insecticide should be used in each half pint of total liquid.

As a seed treatment BHC kills largely by contact action and as long as the high gamma forms are used does not repel the worms at the low dosages suggested. This chemical also acts as a stomach poison and fumigant. The worms upon coming in contact with the treated seed are almost immediately affected and stop feeding. In the laboratory 100% are sluggish and sickly or dead within two weeks. In the field within a few days, numerous worms are found on the surface of the soil as if trying to escape from the chemical, and those remaining in the soil adjacent to the seed are at first nervous, later sluggish, and gradually shrivel and die.

One seed treatment may kill from 75% to 90% of the wireworms in the immediate area of the beans. It is estimated that from 50% to 75% of the worms in the soil come up at the time of germination. The others remain at deeper levels in the soil and often come up later to feed on the plants. These worms coming up later may bore inside the stems of the beans, but usually this type of injury does not result in death of the bean plants. Because all the worms are not killed by a single seed treatment it may have to be repeated for each planting.

With Fungicide

To prevent seed decay Spergon dust at four ounces or Arasan at four to six ounces per 100 pounds of bean seed may be combined with the BHC. Tests on

slurry applications combining fungicides with BHC are very limited. Manufacturers of the fungicides recommend the use of 1 1/3 ounces of Arasan SF or two ounces of Spergon SL per 100 pounds of bean seed. If one-half pint of slurry is applied to 100 pounds of seed then each half pint of slurry should contain the above mentioned amount of one of the fungicides in addition to 1 1/3 ounces of the 75% gamma isomer BHC material.

Caution

BHC may injure lima beans if used at greater concentrations than suggested in this report and for this reason extreme care should be taken to measure accurately or weigh the amount of chemical needed. Seed treated with these chemicals should never be used for food or fed to domestic animals.

Seed treatment probably will not kill all the wireworms present in a particular field, so it will have to be repeated at every planting until the population is reduced to a level at which no economic damage occurs.

In the absence of sufficient information concerning the effects of the lengthy storage of BHC treated seed it is suggested that seed be treated within a few weeks of planting.

Operators should avoid breathing excessive amounts of BHC or other fungicides, and should wash thoroughly with soap and water following contact with these chemicals.

Most of the field experience reported here has been concerned with baby lima beans and it is suggested, therefore, that growers limit its use on large limas until more information concerning possible injurious effects is available.

Estimated Costs for Wireworm Control*

Method of control	Chemical	Amount of commercial product per acre	Amount of actual chemical per acre	Unit price dollars	Cost per acre dollars
Soil fumigation	Ethylene dibromide	10 gallons of 20% by vol.	2 gallons	1.91 per gallon	19.10
Soil fumigation	Dichloro-propane-dichloro-propene mixture	40 gallons	40 gallons (400 pounds)	0.165 per pound	66.00
Soil treatment	DDT	20-40 pounds of 50% wettable powder	10-20 pounds	0.37 per pound	7.40 to 14.80
Soil treatment	BHC	2 lbs. 25% gamma purified	0.5 pound gamma isomer	3.65 per pound	7.30
Seed treatment on beans	BHC	4 ounces 25% gamma purified	0.0313 pound gamma isomer	3.65 per pound	0.46**

* Both the cost and amounts used per acre are presented only as examples and will vary, depending upon the type of formulation used and the particular conditions under which these chemicals are used.

** Estimated cost if 50 pounds of beans are planted per acre.

This method is also being tested on other crop plants, but experiments indicate that a safe and effective dosage must be determined for each crop.

W. H. Lange, Jr., is Lecturer in Entomology and Assistant Entomologist in the Experiment Station, Davis.

E. C. Carlson is Senior Laboratory Technician in Entomology, Davis.

L. D. Leach is Professor of Plant Pathology and Plant Pathologist in the Experiment Station, Davis.

The above progress report is based on Research Projects No. 1275-A and No. 979.

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slightly less severe pruning is accompanied with thorough thinning.

Ribiers should be pruned to basal or one-bud spurs, and the other short-pruned varieties—such as Red Malaga, Emperor, Malaga and Tokay—to two- to three-bud spurs; the number of spurs to a vine must vary with the size of the vine.

Thompson Seedless when pruned for the production of table fruit should ordinarily not carry more than three to four canes of eight to 12 buds each.

Thinning

Such varieties as Red Malaga, Ribier, and Muscat that tend to set many shot berries should be flower-cluster thinned. This type of thinning can be done most efficiently when the shoots are six to 12 inches long. In general, the flower clusters should be reduced to one per shoot. The upper cluster is usually more shapely and slightly smaller and is favored. Many growers, however, retain the lower cluster with its large shoulders or wing.

Flower-cluster thinning improves quality because of the better setting of normal berries.

In those areas, where earliness is of greatest importance and where coloring at best is poor, 10 to 15 flower clusters to a vine would be ample for Red Malaga vines in full production. Ribier may carry a few more.

Too much fruit has been the rule with these varieties in the earliest regions.

Where zinc is deficient flower-cluster thinning will not increase the setting of normal berries.

The clusters of Tokay are usually too compact. Where this is the case, parts of the clusters should be removed by berry thinning which improves fruit quality and coloring. Usually the main stem is cut, retaining several of the upper branches of the cluster. A Tokay cluster of 80 to 90 berries is a desirable size.

The greatest increase—about 30%—is obtained when the thinning is done immediately after the drop of the flowers

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