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Why Use Soil Insecticides?

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Total labor input was smaller. The total of capital used in crop production, excluding land, was smaller after consolidation.

We didn’t directly measure changes in building investment, but it was apparent that many of the buildings in the absorbed units weren’t in use or weren’t going to be used. Less than a quarter of the vacated houses were going to be used as residences.

**In Summary . . .**

Farm consolidation seems to result in the use of better management and farm practices on the land which is taken over. Output from a given land area tends to increase accordingly. Thus, consolidation tends to result in a more efficient farm unit, with higher returns for the resources used.

But this is to be expected as people leave agriculture. Most of those leaving have been at the greatest income disadvantage because of shortages of capital or farming knowledge and skills. Aside from farmers who retire or die, “income prospects” is the major reason that operators leave.

This is one important difference between farming and other industries. If the operator of a grocery store decides to give up the business and move to another occupation, chances are that the “building resource” will move out of grocery retailing too. It may be converted to an apartment house or a drug store. This kind of shift seldom takes place as a family gives up farming. Like the grocery store building, someone takes it over. But unlike the grocery store, the new owner keeps right on producing the same products.

And, as our study indicates, the new owner may do better than the man who left. So the labor force can shrink without shrinking the farm production plant. Output can increase through this process. This is exactly what has been happening over the last 20 years. Operators with more capital and managerial skills have stayed on and enlarged their farms. Those who have left have, on the average, possessed less capital and management skill.

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**Why Use Soil Insecticides?**

by Harold Gunderson

LAST YEAR was a “good” one for soil insects. And it was a convincing one for farm operators who left untreated check strips, deliberately or accidentally, in cornfields treated with soil insecticides. High winds and heavy rains early in August made damage, particularly from root-attacking insects, much more obvious.

Iowa farmers have known for many years that harmful insects which attack seeds, seedlings and established corn plants are present in the soil. But 25 years ago about the only way to try to prevent damage was to use judgment in when and where to plant corn. When cutworms attacked, a corn grower could always mix an arsenic-bran bait and broadcast it in the infested field. Sometimes he stopped the damage. More often, he replanted his field after the cutworms matured.

Research was begun about 10 years ago with the new synthetic organic insecticides in the control of soil insects. Two of these, aldrin and heptachlor, became readily available and relatively cheap. The first official recommendations from Iowa State on the use of these materials as soil insecticides were made in 1952. About 23,000 Iowa acres were treated with soil insecticides in that year. The treated acreage had increased to about 1½ million acres in 1956-57. Last year, the treated Iowa acreage approached 5½ million acres.

**Treat What?**

There are 20-24 species of insect pests that make up the total soil insect complex. Some of these are present in every planted cornfield every year. Some are most likely to be abundant in first-year corn following sod. Others, especially the rootworms, are more abundant in second- and third-year corn. Both previous cropping history and weather conditions during the growing season influence the numbers and kinds of insects present and the amount of damage they do.

In 1960, for example, seed corn
beetle damage was serious only along the western edge of the state. The black cutworm caused severe losses throughout the southern half of the state but apparently missed certain areas within the infested portion. White grub damage showed up mainly in northwestern Iowa but also in Mahaska County. Wireworm damage was reported in all parts of the state.

Perhaps the most widespread damage in 1960 was caused by the three species of corn rootworms:

The northern corn rootworm has been a major problem in fields planted to corn 2 or more years in succession ever since Iowa farmers began planting corn. The adult rootworm beetles are bright green or yellowish tan in color, about \( \frac{3}{4} \) inch long. They begin to appear in cornfields during the first 10 days of July. These beetles feed on corn pollen and corn silks. Sometimes they're abundant enough to interfere with normal pollination of the ear. They can be found in every cornfield in the state. They're strong fliers and do move considerable distances. Females lay eggs until killed by cold weather. Each female may deposit several hundred eggs in the soil of the cornfield. The eggs remain dormant through the winter, hatching in late May or early June of the average year. The young larvae don't move far in search of corn roots on which to feed. And, if the field is planted to some other crop, the worms die of starvation. Finding corn roots, however, the worms tunnel into them, destroying them and opening the way for root and stalk diseases.

The western corn rootworm has entered Iowa only during the past decade, though it had been a corn pest in Colorado, Kansas and Nebraska for a number of years. To date, adult western corn rootworm beetles have been collected only in the western half of the state. They're about the same size and color as the northern beetles but have black stripes on the margins of the wing covers. The life history and habits of the northern and western corn rootworms are similar. But the adult western beetles appear to do more feeding on corn silks and, thus, may cause greater damage through failure of the ear to pollinate. There's only one generation per year of each of these two species.

The southern corn rootworm is known also as the 12-spotted cucumber beetle. This insect apparently doesn't live through the winter in Iowa but migrates here from the south in spring and early summer. Adult beetles fly into cornfields in large numbers. In some years they've caused serious early damage from leaf feeding. Eggs are placed around the base of a growing corn plant, and the larvae don't have far to go to find corn roots to feed on.

Observations indicate that each larva of the southern species can do more damage than the larva of either the northern or western species. There may be several generations of the southern species in Iowa during the summer, and the larvae feed on the roots of a number of crops.

Thus, corn rootworm feeding results in several kinds of losses. The damaged root system of the corn plant isn't able to absorb enough plant food to produce the best ear. Wounds made by the...
1960 results from soil-insect treatments in second-year corn.

<table>
<thead>
<tr>
<th>County</th>
<th>Treatment</th>
<th>Yield in bushels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Treated</td>
</tr>
<tr>
<td>Adair</td>
<td>2 lbs. aldrin, broadcast 1959</td>
<td>118</td>
</tr>
<tr>
<td>Henry</td>
<td>2 lbs. heptachlor/A., broadcast 1959</td>
<td>79.3</td>
</tr>
<tr>
<td>Dallas</td>
<td>1 lb. aldrin or heptachlor/A., broadcast 1960</td>
<td>111</td>
</tr>
<tr>
<td>Guthrie</td>
<td>½ lb. aldrin/A., row treatment 1960</td>
<td>98</td>
</tr>
</tbody>
</table>

Larvae open the door for root and stalk rots. The reduced root system also means a less firm anchoring for a corn plant to withstand wind damage in late July or August. Wind lodging will increase the amount of corn left in the field and may also lead to harvesting problems. Even with no wind and rain damage, rootworm-damaged corn, with its reduced root system, is more likely to pull out of the ground as a picker moves through the field—increasing clogging and the accidents which accompany corn picker cleaning.

If adult beetles are abundant at pollination and silking time, they can prevent normal pollination by eating off the silks as fast as they emerge, and the resulting unfilled ears represent an additional loss. Applications of soil insecticides don't control adult beetles that fly into the field but do prevent emergence of adult beetles from the soil.

**Why Use?**

Why has the use of soil insecticides increased so rapidly since 1952 in Iowa? Avoiding yield losses from soil insect damage undoubtedly is one of the reasons. Tests at Iowa State and farm experiences have shown the value of soil insecticides in this regard. The table, for example, shows the yield results from four fields of second-year corn where growers left untreated check strips for comparison in 1960. Some of the other reasons are indicated in talking with farm operators who have used soil insecticides.

Many corn growers have had the experience of trying to pick badly lodged fields, and they want to avoid this problem if possible. Most Iowa farmers, at one time or another have had to replant fields damaged by seed corn maggots, seed corn beetles, wireworms, white grubs or cutworms, and the cost of replanting is as great as or greater than the cost of using a soil insecticide. Growers also are interested in getting the greatest returns from the money spent for seedbed preparation, seed, fertilizer, cultivation and harvesting; these costs vary little whether the final harvest is a good or a poor one. Most growers believe that their expenditures for soil insecticides have been profitable.

The two most commonly used soil insecticides, aldrin and heptachlor, have given about equal results in controlling the total group or complex of soil insects that damage corn in Iowa. In our tests, we've gotten the best control of the greatest number of hard-to-kill insects by broadcasting 2 pounds of actual aldrin or heptachlor per acre on plowed ground and working it into the soil immediately. (Specific suggestions for rates and applications of soil insecticides are given in our publication, IC-368, "Control of Soil Insects Which Attack Iowa Corn," available from your county extension office or from the Publications Distribution Room here at Ames.)

Soil insect damage—and, therefore, the relative value of soil insecticides in preventing damage—isn't consistent from year to year in different parts of the state. But the soil insecticides we've mentioned offer effective control of the soil insects that damage corn. So it appears that Iowa farm operators are increasing their annual use of soil insecticides partly as a form of insurance to protect their investment in the crop and to obtain the greatest return from it.

![Rootworm feeding often leads to several kinds of damage. Reduced roots make less firm anchors and may not absorb enough nutrients, and feeding wounds open the door for root and stalk rot diseases.](17-653)