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CONTROL OF THE MEXICAN BEAN BEETLE IN CONNECTICUT

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As the result of a series of experiments carried on by this Station between 1930 and 1935, several good methods have been found for checking the ravages of the Mexican bean beetle in Connecticut. Spacing plants four to six inches apart in the row, planting beans so that they develop when beetles are least prevalent, spraying and dusting with materials poisonous and non-poisonous to man have all been found effective. Highly significant is the fact that certain *non-poisonous* sprays and dusts have proved themselves just as satisfactory as the poisonous types. Thus the grower may spray his plants before and after the pods are formed without fear of finding a poisonous residue on the beans at harvest.

This circular summarizes the results of experiments that were presented in technical form in Station Bulletin 371.

THE MEXICAN BEAN BEETLE IN CONNECTICUT

The Mexican bean beetle* first appeared in Connecticut in 1929. Three years later the pest was present in all parts of the State causing serious injury in the south. In 1932 and in succeeding years damage was common in all sections, but has recently decreased.

Life History

The adult Mexican bean beetle (Figure 6) is a lady beetle about one-quarter of an inch long. When newly emerged it is lemon yellow in color,

FIGURE 6. Adult, twice natural size.

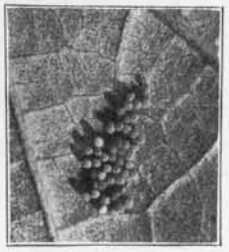

FIGURE 7. Egg-mass, twice natural size.

marked with eight small black spots on each wing-cover. Later the color deepens to a dark straw or buff, and over-wintering adults that appear in the spring are dark copper-colored. Yellow eggs (Figure 7) are usually deposited on the under surface of the bean leaves in clusters of 40 to 60 each. The young larvae are light yellow and are covered with numerous spines which are dark at the tips. During their feeding period they grow from an original length of approximately one-sixteenth of an inch to one-

* *Epilachna corrupta* Mulsant.

third inch (Figure 8). The pupa (Figure 9) is about the same size as the adult, and is usually yellow. The old larval skin remains attached to the posterior end of the pupal abdomen.

The adults usually hibernate in woodlands. In normal seasons they emerge during the last week in May and fly to bean fields. Eggs are

FIGURE 8. Fully grown larva, twice natural size.

FIGURE 9. Pupa, twice natural size.

deposited from about June 7 to July 1 and first generation larvae are present until the last of July. After a period of pupation, adults of this generation emerge during the last half of July and the first half of August and deposit eggs for the second generation from August 1 to about September 10. The new larvae infest the plants from the beginning of August until late September, developing into adults during September and the early part of October. The mature beetles feed for a few days and then seek winter quarters.

In 1935, the cool dry weather in May and the first half of June delayed emergence from hibernation for about two weeks.

Extent of Bean Beetle Injury

The reduction in yield of string beans due to bean beetle injury varies according to the time beans are planted. In our experiments the crop from plantings made in May was reduced about 20 per cent; from those made in June, from none to 15 per cent; and in July plantings, from 20 per cent to 50 per cent. In addition, the bean pods were damaged by feeding marks of adults and larvae. This damage ranged from 21 per cent to 37 per cent on sprayed rows, depending on the spacing between plants. It was noticed on all plantings, but was greatest on crops maturing during the first half of July and the last half of August.

In a series of experiments, the yield of lima beans was reduced from 20 per cent to 50 per cent by bean beetle attacks, the amount dependent on the number of bean beetles present. Beetles were responsible for a yield reduction of 13 per cent and 25 per cent respectively on two crops of horticultural beans.

CONTROL MEASURES

Spacing of Plants to Curtail Injury

Four crops of beans were grown in the years 1932, 1933 and 1934 to study the relation between spacing of plants and bean beetle injury. Bountiful string beans were planted 2, 4, 6 and 8 inches apart in the row.

Half of each planting was sprayed twice by hand, using 3 pounds of magnesium arsenate and 2 pounds of casein-lime mixture in 100 gallons of water. A count of the egg-masses present gave the following results: 100 plants, 2 inches apart, had 25 egg-masses; 100 plants, 4 inches apart, 20 egg-masses; 100 plants, 6 inches apart, 18 egg-masses; and 100 plants, 8 inches apart, only 13 egg-masses.

TABLE 1. SPACING AND YIELD

Spacing	Treatment	Yield-bushels per acre	Per cent of pods not injured
2 inches	Sprayed	275	63
2 "	Not sprayed	210	42
4 "	Sprayed	242	66
4 "	Not sprayed	204	61
6 "	Sprayed	202	79
6 "	Not sprayed	180	64
8 "	Sprayed	184	75
8 "	Not sprayed	162	71

Table 1 shows the calculated acre-yield, and the percentage of pods not injured by the Mexican bean beetle, averaged for the four crops. As the spacing between plants was increased, yield decreased, but the injury to pods also decreased. Plots in which beans were planted 2 inches apart required twice as much spray material as those with 8-inch spacing. In spite of the treatment, control of the bean beetle was not satisfactory on plants only 2 inches apart. The sprays were most effective when there was a distance of 6 inches between plants in the row. Considering the amount of insecticide required, the total yield and the percentage of injured pods, the profitable spacing appears to be at 4 inches, and preferably 6 inches, for more effective control of the bean beetle.

Planting Dates and Insecticidal Treatment

Bountiful string beans were planted at 10-day intervals in 1932 and 1933 to determine the dates when insecticides were necessary. The results may be summarized as follows:

(1) Beans planted during May required two treatments, about June 7 and 21.
(2) Those planted June 1 and June 11 failed to produce profitable increases in yield as a result of spray applications.
(3) Plantings made June 21 required one insecticidal application about July 29.
(4) Plantings made July 1 required two treatments about July 29 and August 9.
(5) Later July plantings required treatment about August 9 and 23.

Horticultural or shell beans require a slightly longer growing season than string beans and sometimes need three applications of insecticides. If this type is grown early in the season, treatment will be necessary about June 7, 21 and August 1. Later plantings may require sprays or dusts about July 29 and August 9.

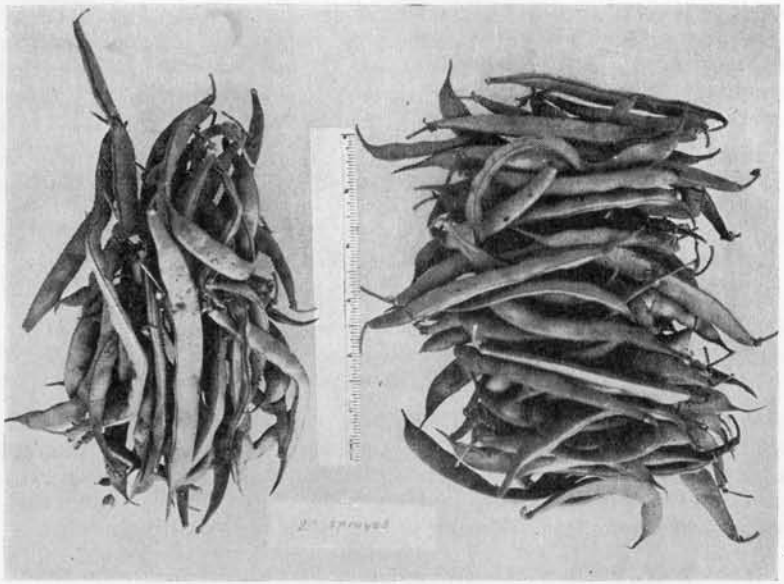

FIGURE 10. Sample of pods from sprayed plants 2 inches apart. Injured pods at left, clean pods at right.

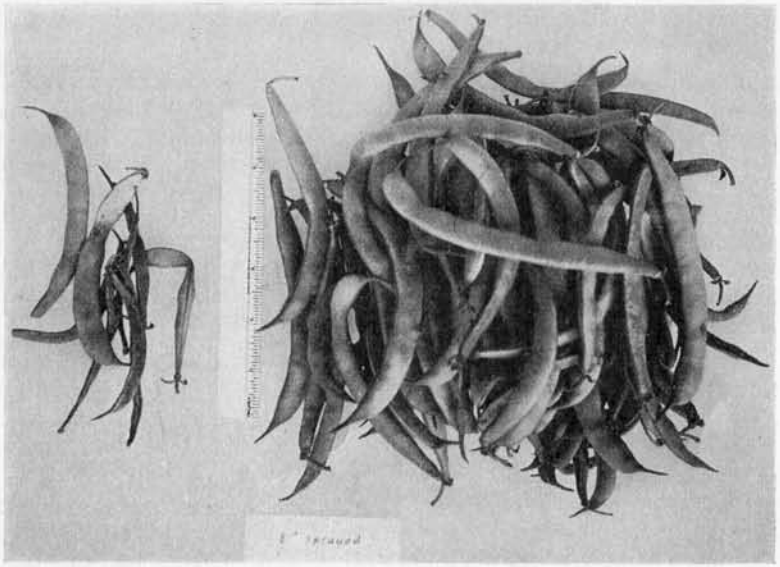

FIGURE 11. Sample of pods from sprayed plants 8 inches apart. Injured pods at left, clean pods at right.

Lima beans and pole string beans were attacked by both generations of bean beetles and required treatment about June 21, July 29 and August 9. In the experiments conducted, the yields of both lima and horticultural beans were increased by 25 per cent to 107 per cent by such a series of treatments. Only non-poisonous materials, such as derris or pyrethrum, should be used after the pods form.

It must be remembered that the above dates vary somewhat from season to season according to weather conditions. Growers can time their own applications as follows:

(1) Spray or dust for adult control about a week after the first adults appear.
(2) Spray or dust to control larvae should be applied when half the egg-masses present have hatched.
(3) If larval injury continues, make another application about 10 days later.

Destruction of Infested Plants

Infested plants of both early and late crops should be destroyed by plowing under cleanly or burning as soon as the beans are harvested. This procedure will keep the bean beetle population at a minimum and will therefore simplify insecticidal control. Followed in September or October, it will reduce the number of beetles going into hibernation.

Insecticides

All insecticides for control of the Mexican bean beetle must be applied to the under surface of the bean leaves. During the course of these experiments, barium fluosilicate, calcium arsenate and magnesium arsenate have been used as sprays and dusts. In addition, pyrethrum and derris sprays and dusts have been applied as supplementary treatments following poisonous applications, and pyrethrum and derris dusts have been used throughout the season.

Barium fluosilicate and magnesium arsenate, diluted at the rate of 1 pound with 5 pounds of hydrated lime, were effective when applied as dusts. A copper-lime-calcium arsenate dust, containing 19 per cent monohydrated copper sulfate, 64 per cent hydrated lime and 17 per cent calcium arsenate, was more effective than either barium fluosilicate or magnesium arsenate dust. Magnesium arsenate applied as a spray at the rate of 3 pounds in 100 gallons of water, with 2 pounds of casein-lime mixture as a spreader, was very satisfactory. Barium fluosilicate applied as a spray at the rate of 3 pounds in 100 gallons of water was also effective.

All of these materials are poisonous and leave a poisonous residue if applied to pods. Experiments in 1932 indicated that any poisonous spray applied after the pods were three inches long left residue in excess of tolerance. *Therefore no material containing arsenic or any fluosilicate compound should be used after pods form.*

Non-Poisonous Insecticides: Dusts and sprays containing derris and pyrethrum have been used in several series of tests and results indicate that both are highly satisfactory in controlling the Mexican bean beetle. Sprays of commercial preparations containing extracts of derris and of pyrethrum were used. These were somewhat more expensive than similar materials applied as dusts.

Derris dusts containing at least .4 per cent rotenone, and pyrethrum dusts containing at least 25 per cent pure pyrethrum flowers, controlled bean beetles. Derris dusts are at present less expensive than pyrethrum and supposedly do not leave a poisonous residue. They are highly effective and may be used throughout the growing season. As sold commercially, prepared ready for use, they contain from .5 per cent to 1.0 per cent rotenone. Growers may mix their own derris dusts by purchasing pure ground derris root, which is usually standardized to contain 4 or 5 per cent rotenone, and diluting 10 to 15 pounds of this material with 85 to 90 pounds of talc or gypsum. The dust should be mixed thoroughly in a barrel mixer.

Pure ground derris root diluted at the rate of 2 pounds in 50 gallons of water has been found very effective as a spray. The mixture must be well stirred to prevent the ground root from settling. This spray is more expensive than a dust containing .5 per cent rotenone.

The advantage of pyrethrum or derris dusts or sprays is that they may be used after the pods form without danger of poisonous residues. However, it is usually more profitable to treat the beans before the pods form in order to protect the foliage and increase the yield.

SUMMARY

1. The Mexican bean beetle has two generations a year; one develops between June 15 and August 1, and the second occurs from August 10 until October. The second generation adult beetles hibernate in woodlands.

2. During our experiments beetle feeding reduced the yield of green beans as much as 50 per cent. Largest losses occurred on beans planted in May and in July.

3. Horticultural or shell beans showed a reduction in yield varying from 13 per cent to 25 per cent, and lima beans from 20 per cent to 50 per cent, depending on the number of bean beetles.

4. Most effective control of the bean beetle by use of insecticides was possible when green bean plants were spaced six inches apart in the row. Satisfactory control was obtained with a spacing of four inches.

5. String beans planted at different dates required treatment as follows:

Dates planted	Insecticides applied
Before June 1	June 7 and 21
June 1 to 11	None
June 21	July 29
July 1	July 29 and August 9
July 10 or later	August 9 and 23

6. Dwarf horticultural beans required sprays or dusts on June 7, 21 and July 29 for early plantings, and about July 29 and August 9 for later plantings.

7. Dwarf lima and all pole beans required sprays or dusts about June 21, July 29 and August 9.

8. Growers can time their own schedule of applications as follows:

   a. Spray or dust to kill or repel adults about a week after the first adults appear.

   b. Spray or dust to kill larvae when half the egg-masses present have hatched.

   c. If larval injury continues, make another application about 10 days later.

9. Destruction of infested plants as soon as the crop was harvested aided control by reducing the population of Mexican bean beetles.

10. Magnesium arsenate and barium fluosilicate sprays and dusts, and copper-lime-calcium arsenate dust, were effective in controlling the bean beetle but left a poisonous residue if applied after the pods formed.

11. Derris and pyrethrum sprays and dusts were effective and left no poisonous residue.

12. Derris dust containing at least .4 per cent rotenone was as effective as pyrethrum dust containing 25 per cent pure pyrethrum flowers and was less expensive than the pyrethrum dust.

13. Derris dusts were used throughout the season on string, horticultural and lima beans, with excellent results.

14. Growers may prepare their own derris dusts by mixing thoroughly 10 to 15 pounds of pure ground derris root (containing from 4 to 5 per cent rotenone) with 85 to 90 pounds of talc or gypsum.

15. Pure ground derris root suspended in water, at the rate of 2 pounds in 50 gallons, is a highly effective spray mixture, but is more expensive than derris dust.