Pests of Field Beans

insect and mite damage to pink, red beans investigated in Sutter Basin area

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Sweeping pink beans for Lygus

Increasing losses from certain insect pests and mites incurred by pink and red bean growers in the Sutter Basin area of northern California—reportedly in excess of $100,000 in sales returns alone during the 1956 season—resulted in studies of the problem during the 1957 and 1958 seasons.

Fields of Sutter Pinks, Standard Pinks and California Reds were examined at weekly intervals starting when the plants were approximately 25 days old and continuing until harvest. Surveys of the fields were made by taking a number of sweeps with a standard insect net as well as examining individual plants at random and recording the injurious and the beneficial insects present. At harvest time a sample of the beans was taken and examined for insect damage. The injury caused by lygus bugs and worms could be detected readily.

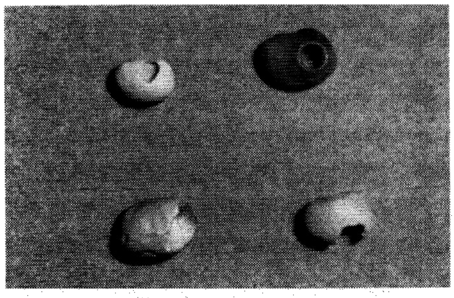
During the growing season the presence and relative abundance of lygus bugs could be detected by sweeping. A single, forceful pass of the net—about 8″–10″ deep into the foliage—across two rows of beans constituted one sweep. Ten sweeps in one area of the field constituted a series and a minimum of five series were taken in sampling the population in a given field. If well scattered, 5–10 series totaling 50–100 sweeps give a satisfactory and reproducible estimate of the relative abundance of lygus bugs. All adult lygus bugs and nymphs taken were tabulated.

The same sweep technique will detect larvae of the corn earworm—*Heliothis zea*—as soon as they hatch and appear on the foliage but is not practical for determining their relative abundance. Sweeping will not detect the larvae after they have left the foliage and entered the pods. Attempts to correlate numbers detected in sweeping with damage at harvest have been disappointing.

A number of caterpillars, in addition to the corn earworm, were detected by sweeping or examining plants: the western yellow striped armyworm—*Prodenia praefica;* the bean lycinid—*Strymon melinus;* the salt marsh caterpillar—*Estigmene acrea;* and the alfalfa semilooper—*Autographa californica.*

Other plant feeding pests encountered were several species of tetranychid spider mites; onion thrips—*Thrips tabaci;* flower thrips—*Frankliniella occidentalis;* leaf miner—*Liriomyza pictella;* western spotted cucumber beetle—*Diabrotica 11-punctata;* leafhoppers and *Empoasca* spp.

Corn earworm damage to pink bean



After becoming well established in the field, the bean plants in the Sutter Basin area are frequently attacked by heavy, migrating swarms of onion and flower thrips. Occasionally the thrips are abundant enough to cause cessation of plant growth. The pest situation at such times may or may not be complicated by the presence of heavy numbers of leaf miners and leafhoppers.

Later in the season—normally beginning at about the time of bloom—both lygus bugs and corn earworms appear. These are the most important pests and generally are the ones which must be controlled to produce a quality product.

Usually in the Sutter Basin it is the larva of the corn earworm which does most of the bean damage attributed to worms. This same pest is responsible for most of the worm damage on tomato, milo, and corn in that area.

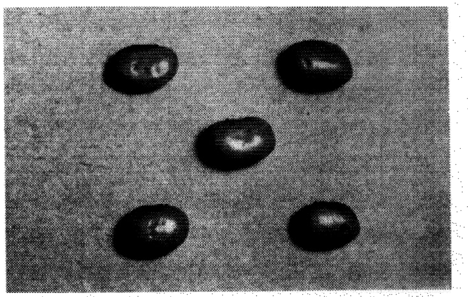
Other species of caterpillars may confine their feeding to the bean foliage or contribute a small amount of damage to the harvested bean. Seldom are they abundant enough to warrant a treatment over and above that necessary to control the corn earworm.

Notably absent as a pest, at least during the 1957 and 1958 seasons, was the destructive bean pod borer—*Etiella zinckinella*—found in small numbers on baby limas but not on pinks or reds in the Sutter Basin area, fortunately, because no chemical control for the pod borer is known.

Lygus bugs are nearly always present in blooming—or older—fields and at times may be more important than the corn earworm. If it were not for the corn earworm it would be possible to sweep fields and permit those with low lygus populations to remain untreated or else delay treatment so that one insecticide application would be certain to be all that was needed.

Feeding by lygus bugs on the bloom causes blossom drop and on the seed a necrosis, pitting or distortion which is characteristic. The whitish or brownish necrotic spot beneath the skin is diagnostic.

Lygus injury to California red bean.



Feeding spots on the bean are less extensive and far less noticeable on pink and red beans than they are on a white bean like the blackeye. As a consequence small feeding spots are not objectionable and often can only be noted and confirmed under magnification by removing the skin from the seed.

To determine the presence of insect pests and—in the case of lygus bugs—their relative abundance, bean fields should be checked at weekly intervals. When the lygus count reaches a level of one per sweep or when small corn earworm larvae first appear in the net—whichever occurs first—the fields should be treated, provided bloom or young

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BEANS

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pods are present. Normally, young pods are present on the plant before treatment is necessary. It is advantageous, if at all possible, to delay treatment until the presence of young lygus nymphs indicates that the eggs are hatching because the eggs are not affected by insecticides.

In the absence of field sampling, DDT or toxaphene dust applied thoroughly, usually will be adequate to protect the beans against the corn earworm and the lygus bug. Such treatments should be applied to Sutter Pinks between 40–45 days after planting; to Standard Pinks, 45–50 days and to California Reds, 50–55 days. After treatment the fields should be checked for adequacy of control and possible reinfestation prior to harvest.

Mites and leaf miners may occur in numbers sufficient to warrant suppressive measures, but generally are not too serious on pinks.

Many problems still remain to be answered but a careful grower can cope with bean insect and mite problems, and increase bean yield and quality.

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PENETROMETER

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the individual points suggested that the correlation probably would have been greater if the soil moisture range had been greater.

Differences between compaction treatments were highly significant. Penetrating compacted plots took 2½ times as many blows as penetrating noncompacted plots to an equal depth. When correlation coefficients were calculated, a highly significant positive correlation was found.

Two passes with the truck produced a compaction almost as severe as that caused by seven passes, probably because soil moisture content was near optimum for compaction. From bulk-density data it is apparent that compaction was greater in the surface foot of soil than in the second foot.

To study further the possibility of using a soil penetrometer to indicate a compacted soil condition, measurements were made on Chular sandy loam near Soledad. Soil-density core samples were extracted from the 6″, 12″, and 24″ depths. Soil moisture determinations were also made on the samples. The penetrometer was then driven 1′ and 2′ in five different locations around the area where density samples were removed. The density data and the five penetrometer measurements were averaged independently. Correlation between soil density and number of strokes required was again significant. Correlation with soil moisture was not significant at the rather narrow range existing at the time measurements were made.

Measurements were made at a third location on Sorrento clay soil near Tracy. In this study the penetrometer was used to estimate differences in soil compaction on plots on which ryegrass had been used as a winter cover crop. Plots, replicated three times, had been seeded to ryegrass the previous fall, and plowed under in the spring of 1958. The plots were then planted to tomatoes. Penetrometer measurements were made late in October, after the tomato crop was harvested. Differences were not significant in the first foot, but were significant in the second foot.

Results of these studies indicate that, under a given set of soil conditions, the penetrometer can be used to measure traffic-induced compaction. Furthermore, the pentrometer is relatively easy to use, no costly equipment is required, the data are immediately available, and samples need not be taken into the laboratory for analysis.

Variation in individual readings is considerable but the penetrometer will measure variations in degree of compaction. A large number of readings must be made for statistically valid data, but they are relatively easy to obtain.

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IRRIGATION

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water toll component on area, usually the area irrigated by district water. Area tolls may be the same for all crops or may differ among them.

In planning agricultural production a district member faces the unavoidable fixed annual assessment. However, the water toll charge is variable, depending upon the quantity used.

An important characteristic of the payment complex is that neither of the components are determined by usual market forces. Both are administratively established by the board of directors of each irrigation district. This permits the payment complex to be used as a tool in connection with many district activities: to allocate the district's supply of water among uses and users, to finance district operations, and to implement programs of water management.

The payment complex has undergone considerable variation, both over time and among different districts. Changes in the district assessment may be seen by considering its three determinants: the area assessed within a district, its valuation for assessment purposes, and the rate of levy that is applied.

Between 70% and 80% of the gross district acreage in California has been subject to assessment since official state records were published in 1929. The percentage of assessed acreage fell off through the depression years but since 1942 there has been a gradual annual increase. Prior to 1940 land held under tax default deed by California irrigation districts materially reduced the area susceptible to assessment. Such tax held land amounted to 10% of the gross district acreage for the years 1935–1937.

The second determinant of the assessment component has shown an increase —in terms of both total assessed valuation and average per acre assessed valuation—during 1930–1956 period. The per acre average valuation for all irrigation districts in 1938 represented the low—less than $60.00 per acre—as opposed to a high in 1956 of $95.00. Different methods are used in valuing lands for district assessment, which results in considerable variation between districts. For example, in 1955, districts in the Sacramento Valley had an average per acre assessed valuation of $179.00, while the average was $100.00 for districts in the San Joaquin Valley, and districts in the South Coastal Plain averaged $643.00 per acre.

The rate of assessment levy—expressed in terms of dollars assessed per $100.00 of valuation—shows less variation. The average rate of levy throughout the state has decreased from $5.00 in 1930 to a low of $2.50 in 1940, and subsequently increased to slightly over $3.00 in 1955. Its difference between geographical regions also has been small. In 1955 Sacramento Valley districts averaged $2.91, those in the San Joaquin Valley, $3.58, and the Southern Coastal Plain, $3.91 per $100.00 valuation.

The water toll element of the payment complex also has undergone change. Because of the various bases used for the toll element, no direct statewide comparison is possible. However, receipts from district water sales give some indication. In 1930, water sales receipts from all districts comprised less than 25% of total district receipts but in 1955 this had increased to over 60%.

There is considerable difference in the relative importance of the water toll component of the payment complex between types of district. Districts engag-