IPM IN FIELD AND VEGETABLE CROPS

Integrated pest management of sugar beet insects

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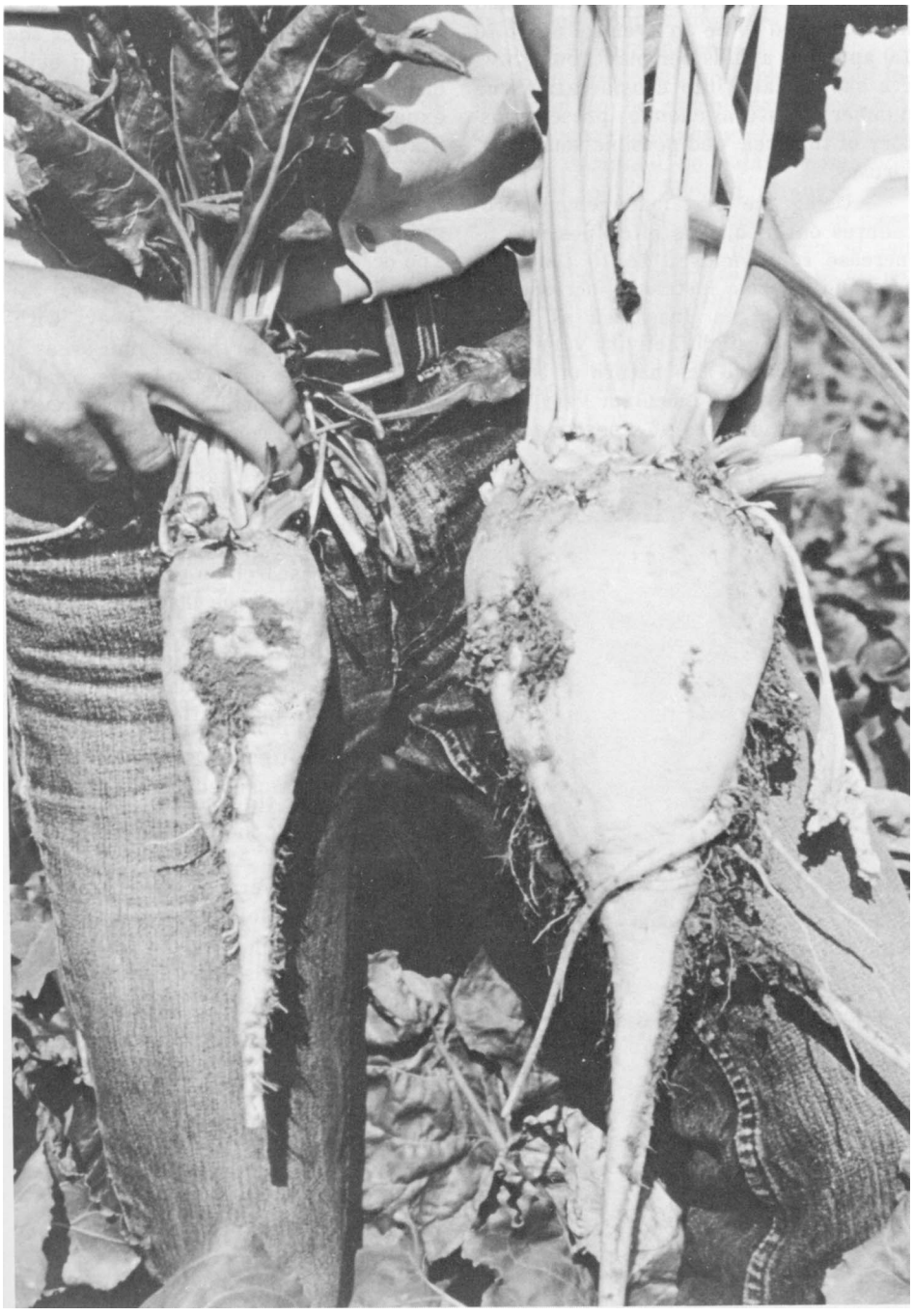

Sugar beets are subject to attack by over 150 different insects of which 40 to 50 often cause damage but only a few are of primary importance. The key pests include the green peach aphid *(Myzus persicae)*, the vector of beet mosaic and two yellowing viruses, Beet Yellows and Western Yellows; the beet leafhopper *(Circulifer tenellus)*, the vector of curly top virus; and a complex of lepidopterous larvae of which the beet armyworm *(Spodoptera exigua)* and the alfalfa cutworm *(Scotogramma trifolii)* are frequently the most prevalent. The key pests often vary in composition of species in different parts of the state. Sugar beets also harbor many beneficial insects which have to be considered in any pest management scheme.

Suppressing yellowing viruses

Since 1958 we have been concerned with working out a method for the suppression of yellowing viruses, and a very satisfactory integrated control is now in operation as a result of this research. The pest management program involves the following:

■ Avoid sources of virus inoculum. A number of beet-free periods are enforced in the several beet-growing districts of California. The district offices of the California Beet Growers Association and the Association field force police their own plantings. The roguing of groundkeepers is important (beets in alfalfa fields, along railway rights-of-way, etc.) and adequate distances (10 to 20 miles) between new and old plant-

Untreated sugar beet (left) showing severe curly top symptoms and poor root development; sugar beet at right was treated at time of planting with systemic granular insecticide.

ings must be maintained. In areas where beets are overwintered it is usually necessary to harvest all beets before the emergence of beets in new plantings.

■ Planting resistant seed. The new monogerm hybrid top crosses—USH9A, USH9B, and new ones being developed—are results of cooperative work between the U.S.D.A. and the University of California. In addition to breeding tolerance to curly top and the yellowing viruses, investigators are now incorporating nematode and powdery mildew resistance.

■ Plant to avoid peaks in aphid flights. Farm advisors and researchers have cooperated in keeping records of aphid flights in 13 areas of California. For as long as 10 years many have used yellow water pan traps. By altering planting dates to avoid peak aphid flights, growers can reduce the need for insecticide applications for aphid control. In the northern Sacramento Valley, an April 1 planting date makes it possible to avoid peaks of aphids with a minimum sacrifice of ideal growing conditions. In one area an answering service has given growers almost daily data on aphid trap catches. The time of planting in some areas cannot be changed and in these situations other measures must be taken.

■ Application of systemic granular insecticides under the seed at planting time. Many years of experiments have shown that in most situations a single application of systemic insecticide will protect and delay the spread of the yellowing viruses at a critical growth stage. Early infection can result in severe root yield losses and any delay in infection can result in greater yields. The success of chemical control depends on many factors including the strain of the virus present, the time period needed for protection and the abundance of aphids.

In some cases applications of systemic topical applications of insecticides are necessary in addition to the granular treatments. An economic threshold is considered to be an average of 0.5 to 1.0 apterous aphids per plant, but growers should take into consideration the number of natural enemies present, history of the area, and possible sources of viruses.

Using the pest management procedures outlined, it is often possible to increase root yields 3 to 10 tons per acre and in some instances increase sucrose percentages. Inasmuch as aphid abundance and flight activity vary from year to year, and the nature of the viruses and level of inoculum vary from year to year, success of a pest management program cannot always be predicted.

Applying systemic granular insecticide to sugar beets at planting time.

Yellow water-pan trap used to trap green peach aphids.

Curly top control

Curly top vectored by the beet leafhopper has been a problem in California as early as 1899, and, until resistant beets were developed, threatened the future of beet production in the state. Severe outbreaks occur at intervals. Since the State of California began conducting a spray program on the west side of the San Joaquin Valley, losses have been reduced in beets and other susceptible crops such as beans, tomatoes, and melons, although some losses occurred in 1950, 1956, 1966, and 1977.

In sugar beets, an application of a granular systemic insecticide under the seed at planting time has proved quite effective in alleviating losses. In 1977 experiments at the West Side Field Station with timed topical applications of a systemic insecticide gave poor control of leafhoppers in comparison with granular time-of-planting applications. The occurrence of more virulent strains in recent years means that even the resistant varieties do not always withstand the attack. In the endemic areas of the state where curly top is present the current management program for curly top suppression consists of *placement of a granular systemic insecticide under the seed at time of planting,* and *use of resistant seed.*

The State of California is currently supporting research on the effect on the beet leafhopper of the changing ecological conditions in the west side of the San Joaquin Valley and studies on the epidemiology of curly top and investigations leading to the purification of the virus.

Lepidopterous pests

Economic thresholds are currently being studied for the lepidopterous pests of sugar beets. Artificial (simulated) defoliation at several levels—50, 75, and 100 percent defoliation—both in the greenhouse and in the field, and at several time intervals, indicates that beets can sustain considerable loss of leaf surface area without loss in yield. Age of the plants, where the damage occurs, and leaf area loss all have to be considered. Some species of larvae feed on the crowns or roots and have to be considered in a role of predisposing the roots to root rot organisms.

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