University of California

Research on Pear Decline

organized to find means to control or to live with the disease

PAUL F. SHARP

Pear decline—first found in British Columbia—moved rapidly into Oregon and Washington and was first recognized in California in March, 1959. More than 150,000 California pear trees—mostly 30–40 years old—have been killed by pear decline since the outbreak. California growers' gross returns from pears for the year 1959 amounted to more than 27 million dollars. During the 1960 growing season the loss of trees has caused an estimated reduction in statewide yield of 13,000–15,000 tons. An additional loss of approximately 5,000 tons can be attributed to poor sizing of fruit in orchards where decline was prevalent.

If California's pear producers are to survive, a remedy for pear tree decline must be found and toward that end the University of California Agricultural Experiment Station has organized an all-out research program guided by a statewide committee with Dr. T. A. Shalla of Davis, as chairman. Personnel of the committee includes economists, representatives of the Agricultural Extension Service, irrigation specialists, entomologists, plant pathologists, pomologists, and a plant nematologist, from Berkeley, Davis, and Riverside. The California State Department of Agriculture, the states of Oregon and Washington, and the United States Department of Agriculture have designated representatives to work with the California research committee.

To obtain accurate data concerning the distribution of pear decline in California, its rate and pattern of spread, and its relation to rootstocks, cultural practices, soil types, and so forth, 181 pear orchards—25,000 trees—were included in a statewide survey. The orchards surveyed were selected at random in each county from orchards producing 100 or more tons during the 1959 season. Such orchards comprise about 85% of the total California acreage. Each tree was graded as to the degree of decline and a record made as to whether it was quick decline or slow decline.

Other data obtained in orchards surveyed include variety, age, rootstocks, and interstocks, if any, soil type, culture —method of irrigation, frequency and amounts of water used—location of diseased trees in relation to position in orchard. Information was gathered also on amount and types of fertilizers, spray program, insecticides, fungicides; orchard location—hillside, near river, wooded area, open fields—and types of soil management: noncultivated, cultivated, cultivated in spring only, year-round clean cultivation.

From experience in Washington it is highly probable that all pear trees on Oriental rootstocks, and a certain amount on imported French, may be killed eventually by decline. For this reason special attention is given to a determination of rootstocks in a survey being made. Because the spread has been so rapid there is every indication that no area will escape pear decline. Orchards in Lake County had unusually large numbers of trees with reddened foliage during the fall of 1960. Reddening of pear foliage in the fall occurs as a result of girdling or root injury. It is believed to be, among other things, an expression of impending decline.

The cause of pear decline and factors affecting its spread and development have not been proven definitely. A check of more than 2,600 trees in fertilizer and soil management plots in 17 orchards in six California counties has failed to show any pattern related to nutritional status. Several hundred Bartlett trees were indexed for red leaves, brown line and growth status for treatments planned for early spring of 1961. Leaf samples were taken from a portion of the trees to establish their nutritional status by chemical analyses.

Irrigation test plots in pear orchards in many parts of California are directed towards improving soil moisture control in orchards through more efficient irrigation practices or by installing drainage facilities to remove excess surface or sub-surface waters.

When pear decline was first found in Washington and Oregon, it was anticipated that the disease might spread to California. Therefore, research was started by the California Agricultural Experiment Station in those two states. Dr. Henry Schneider, Department of Plant Pathology, Riverside, conducted research that indicated failure of certain plant constituents to pass the bud union of affected trees, which produced an effect similar to girdling. All of this pointed to a virus infection, probably insect transmitted. Every effort is being made to find the insect responsible, but the spread has been so rapid and extensive that control of the disease through control of the insect does not appear hopeful.

Experiments are being conducted to test various insect species as possible vectors of the cause of pear decline. To date these tests have involved aphids, leafhoppers, and the pear psylla. Thousands of susceptible plants for graft and insect transmission trials are being developed at Davis, Bakersfield, and San Jose, which will be available for statewide inoculation trials early in 1961.

The only practical means of controlling pear decline at present is by replanting on resistant rootstocks. There is considerable evidence that trees on Old

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BRIEFS

Short reports on current agricultural research

Electronic devices to detect

FRUIT MATURITY

An adapted spectrophotometer has made it possible to pass light of relatively pure chromaticity, or color, through whole peaches, nectarines, and plums. The amounts of light absorbed at different wavelengths appear to vary with the maturity of the fruit. A ratio of the amount of light absorbed at two different wavelengths can be utilized to eliminate the effects of differences in fruit size or opaqueness. Although additional research is necessary, there is promise that such a device may be utilized in the rapid separation of some fruits into several maturity categories.

Being investigated for the first time in its possible application to the detection of fruit maturity is the phenomenon of chemiluminescence — the result of chemical action within the fruit which causes the return of a certain minute portion of the applied light energy that is readily detected by sensitive phototubes. In contrast to the direct physical nature of fluorescence, chemiluminescence is dependent upon enzymatic reactions and may well reflect the physiological state or maturity of a tissue.—*Roger J. Romani, Dept. of Pomology, Davis.*

Flight patterns of the

PEACH TWIG BORER

Peach twig borer moths do not enter bait traps in the manner of codling moths or oriental fruit moths. As a consequence, the flight patterns of the twig borer are not known. In 1959, exploratory work indicated that it was possible for an experienced observer to make a direct count of twig borer moths on the bark of host trees, and that this count apparently could serve as a reliable index of the moth population in the orchard.

To test the usefulness of this technique, moth counts were made at frequent intervals during the 1960 season in an almond orchard at Davis. Results were encouraging. Three distinct flights were detected. The first occurred from mid-April to early June; the second from late June through July. The third flight developed abruptly during the second week in August and was very much stronger than either of the two earlier flights. Sample counts of moths obtained during the peak of the flight, in late August, were about ten times as high as counts obtained earlier in the season.

Judicious use of this technique should enable entomologists to plot flights of this moth, to test the effect of insecticides on moth populations, to estimate levels of infestation, and to use moth flight data to predict the appearance of larval broods during the growing season.—*Douglas W. Price, Dept. of Entomology, Davis.*

New method for studies on

IRRIGATION EFFICIENCIES

Irrigation efficiency, from the engineering and economic standpoints, is under study for more precise information on the use of water for agriculture. Recently developed methods for determining the flow of water in furrow and border irrigation systems by mathematical equations have been tested for several seasons under field conditions and have proved to be accurate and simple.

The equation method will be used to prepare detailed information describing the characteristics and performance of any irrigation system as affected by soils, flow rate of water, field slope, and crop. With such information comparative economic situations also can be analyzed and the labor energy and capital available can become a part of the irrigation design.—*J. R. Davis, Dept. of Irrigation, Davis.*

Blanching as an aid in

DEWATERING FORAGE

To make one ton of hay from freshly cut forage requires the extraction of about 6,000 pounds of water. A pressing process can rapidly remove as much as 5,000 pounds of this water.

If fresh forage is placed between two flat plates and pressure applied, liquid will be expressed. If the forage is blanched prior to pressing, a larger proportion of the total water in the forage will be removed and the amount of protein and dry matter contained in the expressed liquid will be reduced.

With alfalfa there may be expected losses of about 15% of the dry matter—5% of the liquid removed—as well as a small decrease of digestibility and an increase of the protein content of the pressed solid material.

Maximum dryness achieved ranged from 43% to 38% moisture, so final drying for storage would be necessary.—*William Chancellor, Dept. of Agricultural Engineering, Davis.*

Home pear roots are not affected by pear decline. There are approximately 30,000 pear trees on Old Home roots in the Medford, Oregon, area that are unaffected by pear decline. The apparent resistance of Old Home rootstock to pear decline, together with methods developed for propagating by hardwood cuttings, make Old Home a likely candidate for a replant rootstock. However, Old Home like other common pear varieties is probably universally infected with a vein-yellows virus which causes reduced vigor and stunted trees, particularly in Comice and Anjou. Furthermore, recent surveys indicate that in California, Bartlett trees on Old Home roots have a high incidence of measles, a condition believed to be caused by a virus and which may reduce the pear crop by one-third to one-half.

Bartlett variety on its own roots, thereby eliminating a graft or bud union, might be unaffected by pear decline. However, Bartlett can be rooted only with great difficulty. Studies are under way to develop commercially practical methods for rooting, even though Bartlett on its own roots would be less desirable than Old Home because of its susceptibility to fire blight.

The situation seems to be an emergency so all factors which might conceivably be contributing to pear decline should be investigated as quickly as possible. The extensive studies under way—by all available and knowledgeable staff members shifted to the problem—are designed to find the factors causing pear decline, as well as to eliminate those which are not.

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