

DIAGNOSES OF PEAR DECLINE AND ROOTSTOCK IDENTIFICATION IN YOUNG PEAR ORCHARDS

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PEAR DECLINE has occurred predominantly with rootstocks of two oriental species, *Pyrus serotina* and *P. ussuriensis*, although there have been reports of tree losses with *P. communis* rootstocks. Most of the latter have been of the "old" French type imported from Europe prior to 1918. While decline has occasionally been suspected with additional types of *P. communis* rootstocks (domestic French), generally this species has been tolerant to decline. Although certain seedlings of *P. communis* have frequently been referred to as resistant or immune, some uncertainty now prevails regarding such resistance. Diagnosis of decline often has been made without microscopic examination of bud unions, and even when bud unions have been examined for phloem abnormalities, the identity of the rootstock may be open to question.

During 1963-65 in California, an increasing number of pear trees of 5 to 8 years of age exhibited external symptoms characteristic of pear decline. All were supposedly on *P. communis* rootstocks, in contrast to the accepted principle that decline occurs mostly with oriental species rootstocks. An investigation was therefore made to determine if these young pear decline-suspect trees were on sensitive rootstocks other than *P. communis*. Because it is recognized that such factors as girdling, soils saturated with water, malnutrition, various pathogens, and drought may cause external symptoms similar to those caused by pear decline, microscopic examination of bud unions was performed with the same tree whose rootstocks were being identified. Currently the best method of identification of decline is microscopic examination of the bud union which detects the presence of abnormal or necrotic sieve-tube elements in the phloem.

DIAGNOSIS OF PEAR DECLINE AND ROOTSTOCKS IDENTIFIED FOR TREES WITH EXTERNAL SYMPTOMS OF DECLINE

Phloem diagnosis*	No. trees	Chromatographic identification of rootstocks	
		<i>P. communis</i>	Hybrid <i>P. communis</i> & <i>P. serotina</i>
Normal	11	10	1
Indeterminate	9	9	0
Probable	6	6	0
Positive	22	19	3
Total	48	44	4

* Microscopic examination of bud union: NORMAL, phloem orderly and functional; INDETERMINATE, abnormal phloem that may or may not be due to decline; PROBABLE, similar to "positive" but less distinct; POSITIVE, phloem abnormalities typical of decline.

Trees with decline symptoms were sampled in orchards in Lake, Napa, Sacramento, San Joaquin, and Sutter counties and those with other obvious maladies were excluded. Samples of bark at the bud union were taken for microscopic examination of the phloem. Leaves from rootstock suckers on the same trees were obtained for extraction and chromatographic determination of species identity—a method which allows differentiation among *P. communis*, *P. serotina*, *P. ussuriensis*, *P. calleryana*, and *P. betulaeifolia* as well as most hybrids among these species (see accompanying report). Such identifications, especially with interspecific hybrids, are either impossible or questionable by traditional morphological procedures.

The results of phloem diagnosis and chromatographic identification of the rootstocks are given in the table. Of 48 trees that exhibited external symptoms of slow decline, 46% were found to be afflicted with pear decline on the basis of phloem abnormalities. An additional 13% of the trees possessed symptoms at the bud union which probably indicated decline but which were insufficient to establish positive diagnosis. Indeterminate ratings were obtained for an additional 19% of the trees. It is possible that

repeated sampling of unions, categorized as indeterminate or probable, might have given positive determinations of decline. The fact that 23% of these trees with slow decline symptoms had normal phloem emphasizes that caution should be taken in diagnosing pear decline without bud union analysis.

When extracts of sucker leaves were chromatographed, practically all rootstocks sampled—92%—gave patterns characteristic of *P. communis*. However, chromatographic patterns identical with those obtained from known hybrids between *P. communis* and *P. serotina* were found with 8% of the rootstocks sampled. Paper chromatograms of *P. communis*, *P. serotina*, and a hybrid between them are shown with the accompanying article. Six normal-appearing trees were also sampled as control trees and all proved to be on *P. communis* rootstocks. Four of these had normal phloem while two were classed as indeterminate.

It should be emphasized that the great majority of trees considered here were those which had external appearances

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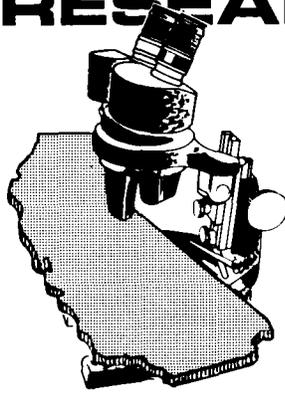
RESEARCH PREVIEW

that could be interpreted as pear decline symptoms. These trees were found infrequently in most orchards but were numerous in a few plantings. The results presented here do not represent a survey of any specific area or orchard.

It seems clear that pear decline is affecting some trees planted within the past 8 years. However, the disease was not diagnosed for all trees having external appearances of decline. It is also apparent that most of the decline-affected trees were on some kind of *P. communis* rootstock. No differentiation is made here among types or seedlings within this species since present methods do not allow varietal identification. Most were said to be "domestic" *P. communis*. Because some plantings had unusually high numbers of decline-affected trees, certain seed or seedling lots may be suspected as being susceptible rather than an occasional unsatisfactory seedling. It would seem that *P. communis* rootstocks, even excepting the "old" French type, cannot be referred to as being an immune, tolerant, or resistant species to pear decline although this may be true of certain types within the species. The presence of decline-susceptible *P. communis* rootstocks in certain plantings emphasizes the need for more specific knowledge of rootstock identity as well as susceptibility within this species.

The detection of a few hybrids between *P. communis* and the decline-susceptible *P. serotina*, points to further uncertainties in rootstock identity. The presence of even a few such seedling rootstocks suggests that inadequate knowledge exists about seed sources and control of seedling parentage. Pear rootstocks may be variously referred to as *P. communis*, "domestic" *P. communis*, or seedlings of a commercial variety. Except for own-rooted varietal cuttings, considerable uncertainty may exist about the parentage of seedlings. If flowers of an apparently tolerant variety were pollinated by a less tolerant or susceptible variety or seedling, then susceptibility could be imparted to the seedlings. A recent report of pear pollen being transported by wind over distances up to one-half mile suggests that caution be taken in naming both parents of seedlings because of the proximity of pollinator varieties.

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STORING CITRUS

Riverside plant physiologists are conducting storage experiments on naval orange fruits grown in central California in an attempt to prolong storage life. Field treatment with gibberellin and storage at different temperatures are being explored.

AERIAL CENSUS-TAKING

Several projects by foresters are aimed at determining the value of aerial photography for identifying forest species and delineating major timber types; evaluating wildland resources; and making an inventory of crops and livestock over wide areas.

CONTAINER-GROWN PLANTS

Landscape horticulturists at Davis are studying the effects of container size, root pruning, and transplanting time on the growth of ornamental plants. The information obtained may help nurserymen develop better growing methods.

TOMATO VARIETIES

The search for better varieties of both canning and fresh-market tomatoes is continuing at Davis and in plots as far away as Puerto Rico. A by-product of this research is further knowledge about genetics that may, in time, help in the whole science of plant breeding.

WINE-GRAPE VARIETY TRIALS

Over 70 different new wine-grape hybrids are now being tested by viticulturists at the Kearney Horticultural Field Station. These include grapes for red table wines, port-type sweet wines, and white table wines.

MORE EFFICIENT FERTILIZERS

Davis researchers are comparing nitrate and ammonium salts as sources of nitrogen fertilizer for several crop plants. Some important differences in growth and com-

A continuing program of research in many aspects of agriculture is carried on at University campuses, field stations, leased areas, and many temporary plots loaned by cooperating landowners throughout the state. Listed below are some of the projects currently under way, but on which no formal progress reports can yet be made.

position attributable to nitrogen source have been observed. These tests, along with evaluations of the effects of different rates of application, are aimed at developing recommendations for more efficient use of fertilizer.

BINDWEED CONTROL

Studies on use of picloram at low rates to control bindweed show promise, and further work on this problem is being carried on at Riverside.

INCENSE CEDAR FOR CONSTRUCTION

Preliminary tests with old-growth incense cedar trees from Blodgett Forest show that the wood may be as suitable for light construction as the more commonly used white fir and western hemlock. Incense cedar is currently used primarily for the manufacture of pencils.

MITE CONTROL ON CITRUS

Over 60 different compounds have been tried and evaluated at Riverside to try to find more efficient controls for citrus red mite and Pacific mite. Further studies are planned, and will include timing, rate of application, and the effectiveness of oils under conditions in which oils are not generally used.

THISTLE-CONTROL STUDIES

Attempts are being made to import a European insect into California (under strict quarantine) to test its host-restrictiveness for use in controlling yellow star thistle.

WALNUT HUSK FLY

Berkeley entomologists have experimented with applications of chemicals to the soil in which pupae of the walnut husk fly overwinter, in the hope of controlling the pest's emergence rate. Only one chemical showed promise, but none seems economically feasible at this time.