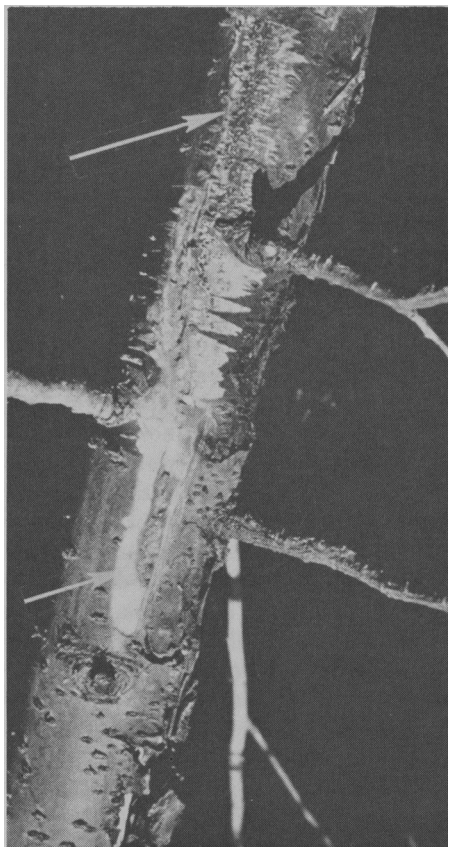

Photo 1. **Cytospora** canker on a President plum tree. Upper arrow points to the advancing margin of the canker, lower arrow points to fruiting or spore-producing bodies of **Cytospora leucostoma.**

Controlling CYTOSPORA *in President of*

J. E. DE VAY · M. GERDTS
H. ENGLISH · F. L. LUKEZIC

A modified system of pruning President plum trees has reduced losses caused by a dieback disease, increased plum yields, and extended the life and productivity of the trees.

PRESIDENT PLUM TREES (*Prunus domestica*) have been subject to a dieback disease in California which causes them to decline rapidly after 10 to 15 years of age. The dieback disease has several contributing factors but the main one is *Cytospora leucostoma*, a fungus which invades branches via wounds and

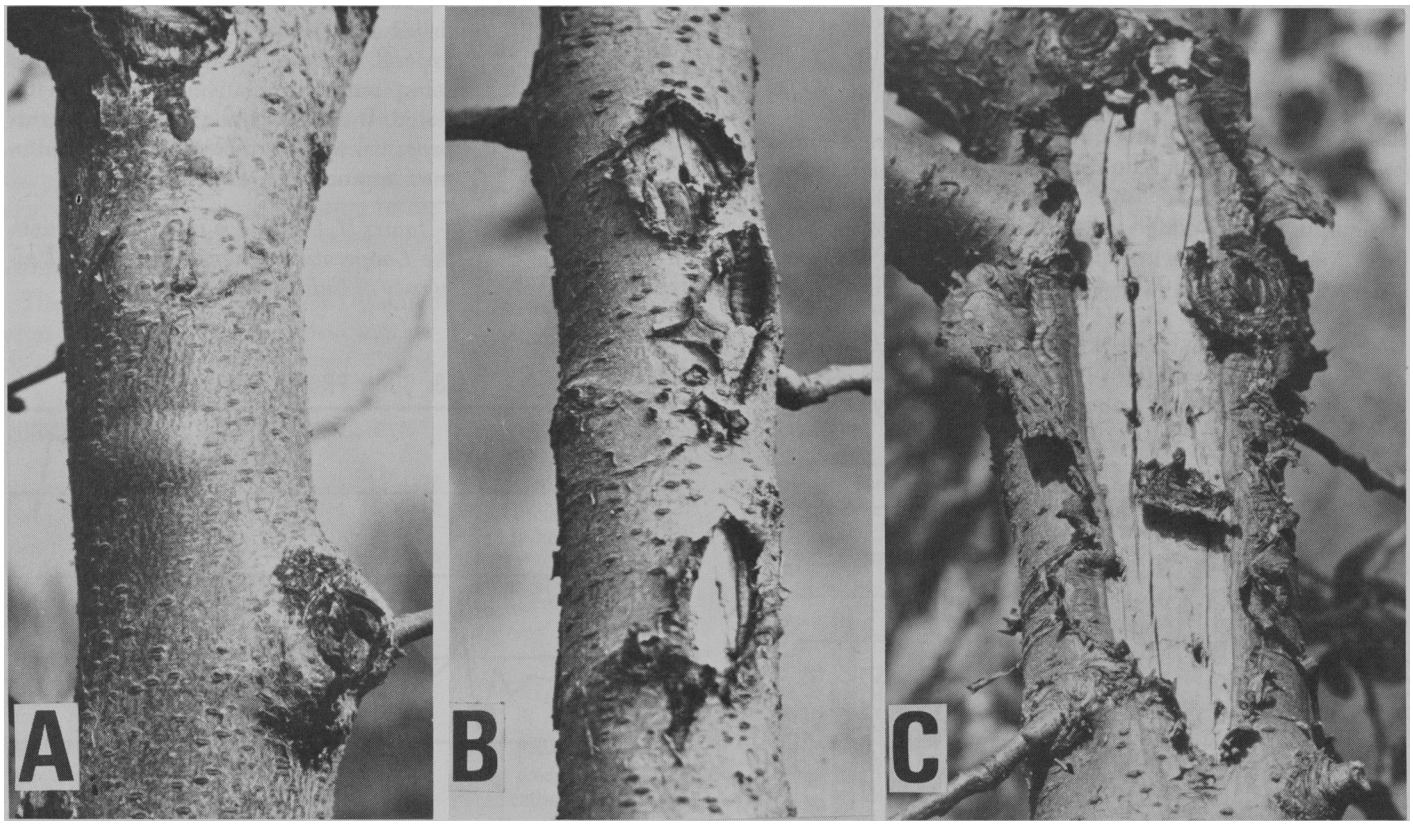

Photo 2. Sunburn on a President plum tree. A. Bark blisters on a young limb. B. Continued sun injury for several years results in open wounds in the bark that eventually coalesce to form sunburn cankers (C). C. Bark injuries such as these are the main entry points for **Cytospora leucostoma** and the origin of **Cytospora** cankers.

CANKER
Plum Orchards
California

EFFECT ON CANKER DEVELOPMENT OF **CYTOSPORA LEUCOSTOMA** INOCULATION TIMING ON PRESIDENT PLUM TREES, REEDLEY, CALIFORNIA

Fungus Isolate	Date of branch inoculation	Average length of 9 cankers after 1 year
		mm
F55	September, 1958	447
	March, 1959	716
F61	September, 1958	219
	March, 1959	620

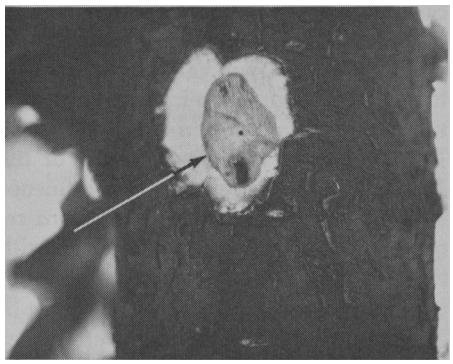

Photo 3. In this photo, outer bark has been removed to show canker (see arrow), which is spreading out from the entry point of a shot hole borer.

kills surrounding bark tissues, producing large lesions called cankers (photo 1). The cankers often remain active, year after year, spreading further into healthy bark and eventually girdling and killing branches and scaffold limbs.

A typical sequence of events leading to infection by *Cytospora* and the dieback disease begins with the development of heat blisters due to sunburn on limbs (photo 2). Scars and dead bark tissue resulting from sun injury are usually the avenues of entrance for *Cytospora*. Once established the fungus quickly spreads into healthy bark.

Pruning wounds, which are important points for *Cytospora* in plum trees grown in colder areas such as Idaho, apparently are of minor importance as infection sites in California orchards. However, any condition which causes stress on trees such as sun injury, water deficiency, scale insects, chemical injury, or nutritional deficiencies or toxicities will increase the chances for infection by *Cytospora*. Bark injuries caused by birds such as woodpeckers or sapsuckers, or by insects such as shot hole borers (photo 3), also can provide points of entry for *Cytospora*. In the case of shot hole borers (*Scolytus rugulosus*) a small percentage act as vectors and carry *Cytospora* to branches under stress which attract the borers.

Of the many strains of *Cytospora* fungus, not all cause the dieback disease. Some strains of *Cytospora* are good saprophytes and prefer to grow on dead bark, whereas other strains are pathogenic and invade living tissues of certain plum varieties. Japanese plums such as Beauty and

Photo 5. Pruning out cankers on limbs or branches is the best way to clean up diseased trees. Frequently, however, part of a **Cytospora** canker remains, as indicated by pen. Arrow indicates where cut should have been made.

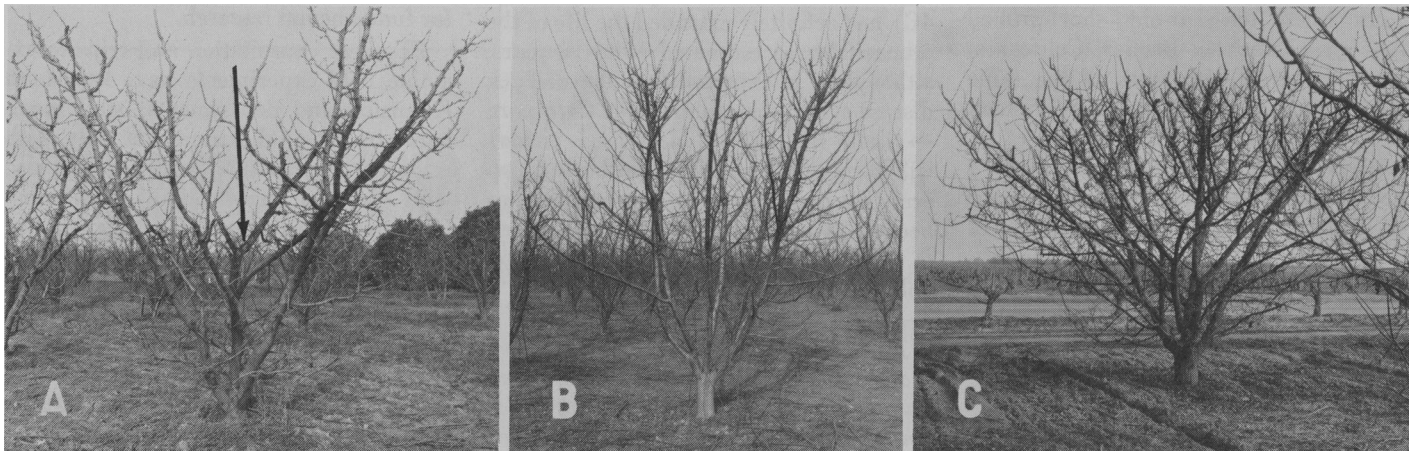

Photo 4. Effect of pruning systems on sunburn and **Cytospora** cankers in President plum trees. A. Ten-year-old short-pruned tree with open center and scaffolds exposed to sunlight. Sunburn and **Cytospora** are already evident on the tree (see arrow). B. Ten-year-old long-pruned tree with fewer scaffolds, causing tree to grow very long and upright until a crop is set. With heavy crops the tree spreads quite widely exposing scaffolds to sun and leading to **Cytospora** problems. C. Ten-year-old tree pruned to promote numerous interior branches, in addition to normal spreading scaffolds.

Santa Rosa (*Prunus salicina*) are more resistant to *Cytospora* than President and other European plum varieties. It appears that the vitamin, myo-inositol, which is more freely available in the bark of the President trees than in the bark of the Japanese plum varieties, may influence development of disease, as *Cytospora* requires this vitamin in combination with thiamin and biotin for optimum growth.

Inoculations of trees with *Cytospora* in March caused cankers which were larger than those caused by inoculations in September when measured after one year. In California, *Cytospora* cankers develop most extensively during the warmest periods of the summer—in sharp contrast to the activity of *Cytospora* in orchards in Idaho, New York, Colorado, and other areas with cold winters, where infections and canker development are more active in the spring months.

Efforts to control the dieback disease of President plums caused by *Cytospora* cankers in California have included sprays of fungicidal materials, use of wound dressings, whitewash of limbs at different times of the year, and various pruning methods. Least effective have been fungicidal sprays such as Bordeaux mixture. Moderately effective were whitewash treatments applied in the early spring months. In an experiment begun in fall 1960, only 8% of the whitewashed trees had developed cankers seven years later, while 20% of the untreated control group had cankers.

Most effective was a modified pruning method developed by M. Gerdts. The method, which strengthens the inner scaffold limbs and partially shades the branches, achieves satisfactory reduction of the disease without loss of fruiting wood from shading of inner branches. The advantages of the method were obvious when ten-year-old short-pruned trees on a ranch in Parlier, California, were compared with trees of the same age pruned according to Gerdts' system. Of the short-pruned trees, 35 out of 37 were affected by sunburn and *Cytospora* cankers. Of those trees pruned by the Gerdts method, 38 out of 41 were free of sunburn damage and none had cankers.

The Gerdts method is shown in photo 4C, where the tree has been pruned to promote numerous interior branches in addition to the normal spreading scaffolds. Lower fruit wood has not been shaded out under this system because the tree has been topped after harvest each year. Without topping, the lower wood probably would shade out. There has been almost no sunburn problem on the tree, and yields have been extremely high. Harvest costs are a little high on the inside of the tree, but the overall cost is about the same. This tree has many more limbs than usually advocated in a typical pruning situation. Although it is difficult to see in the photo, the tree has been roped to prevent further spread.

In a 1971 yield comparison, 13-year-old short-pruned trees yielded an average of 235 lbs per tree, while trees of the same age pruned by the modified method yielded an average of 504 lbs per tree. In August 1974 the figures were 174 and 433, respectively. By that time, the short-pruned trees were severely affected by the dieback disease; some trees had only one or two main scaffolds. New vigorous shoots are being used to fill in the voids, but it is expected that these trees will be removed in two to four years.

Trees pruned with Gerdts' system are now starting to show sunburn near the tops of the scaffolds. Generally there may be one or two sunburned areas per tree on the east or northeast side where the inside of a limb is exposed to the afternoon sun. The sunburn is mainly on small wood (wrist size or smaller), which is being pruned out after harvest. Approximately 50% of the trees in the block with the Gerdts system of pruning had some sunburn by August 1974, and about 5% of the trees had sunburned areas infected by *Cytospora*.

It is often difficult to cure diseased trees by pruning out diseased limbs since this frequently causes increased exposure and sun injury of other limbs. However, if pruning cuts are made, they should be several inches below existing cankers, otherwise the fungus will continue to spread (photo 5) into the remaining limb or branch.

The Gerdts system of pruning (photo 4C) has definitely extended the life of the orchard for an estimated 10 to 12 years, although it is expected that the dieback disease syndrome (sunburn → *Cytospora* → limb removal → decreased yields) will eventually be a major problem. However, in the meantime, production has been increased and orchard life extended to a reasonable or economically acceptable length.

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Early Research

(Cont. from page 3)

simple system. Ed Parker of the Citrus Experiment Station developed methods of treating citrus by zinc sprays. Other crops, as Chandler found, were cured by driving metallic zinc into trees, and still others by strong dormant-season sprays.

The study still goes on as a part of multi-campus research, since it is necessary to develop treatment practices crop by crop, not only for zinc but also for other micronutrients. In fact, the newest project of the Kearney Foundation of Soil Sciences will deal with micronutrient deficiencies and their control.

When the Agricultural Experiment Station was established in 1874, much of its work was field studies and extension teaching. Twenty years later the Agricultural Extension began its work, which was limited to meetings, farm calls, demonstrations of known facts and simple tests to determine the local applicability of these facts. Research was a jealously guarded function of the federal and state experiment stations, and was further discouraged by the Federal Extension Service.

The studies reported above, however, were all cooperative efforts of Agricultural Extension and departmental research. This cooperation has grown to the point where most of the field research involving farmer cooperation and some of the research at Experiment Station field stations is done by Extension personnel. University departmental laboratories have been relieved of burdensome routine tests by establishment of Extension regional laboratories at Berkeley, later moved to Davis, and Riverside, as well as 13 county laboratories, conserving the time and facilities of the departments for fundamental research.

Frequent consultation and trips to examine field experiments have kept both Extension and departmental staff members abreast of the times not only with respect to fundamental principles but also with practical application. The many jointly-authored articles appearing in *California Agriculture* attest to the fact that early, sometimes jealous, rivalry has become whole-hearted cooperation. I believe this has made the University of California's total agricultural research system a unique and highly successful service to California and its farmers.

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