Die-Back of Blackberries

study of causes and prevention of disease affecting Boysen and Young trailing blackberries

Stephen Wilhelm, C. Emlen Scott, and Richard A. Break

A die-back disease affecting primarily the Boysen and Young trailing blackberries was prevalent in nearly all berry-growing regions of California during the winters of 1947–48 and 1948–49. It did not occur, or was much reduced in severity during the 1949–50 and 1950–51 winters.

In general, berries in the interior valley and southern interior counties were affected more seriously than berries in the coastal counties.

This disease condition was characterized by dying back—during the dormant season—of the terminal portions of the canes, and by the occasional dying of leafy shoots after growth started in the spring. Most frequently, just those portions of the canes wound around the trellising wires died.

Study of Causes

The fact that this disease occurred suddenly and in severe intensity in widespread areas of California, and that the distal portions only of the canes were typically affected, made it improbable that the cause was an infectious agent such as a bacterium, fungus, virus, or nematode. Notwithstanding, studies were undertaken to investigate the possibility of the infectious nature of this disease.

First, a cultural study of dead and dying portions of canes failed to reveal the presence of organisms known to be plant pathogens. Species of the fungus genus *Cladosporium* were isolated most consistently. These widely spread fungi occur in nature as organisms living on dead or dying plant parts, and may be capable of entering bramble tissues through superficial prickle—thorn—injuries or other wounds. They are not primary fungus pathogens of brambles.

Second, studies ruled out the Verticillium wilt fungus as the cause. Although the Boysen and Young varieties are susceptible, this die-back was a completely different problem.

Third, when transplanted from the field and grown in pots in a greenhouse in fumigated compost soil, die-back affected plants invariably recovered and remained healthy. Such recovery is substantial evidence that the die-back disease was not caused by a virus. Such transplanted plants also recovered when grown in the soil taken from the field in which they were dug. This recovery would tend to rule out soil or root disease pathogens as the cause, and is also substantial evidence that a nutrient deficiency was not involved. Leaf analyses made by the Division of Pomology failed to indicate deficiencies of potassium or phosphorus. They also failed to reveal evidence of nutrient excesses.

In most, or all of its aspects, the die-back disease suggested natural pruning such as would result from inability of the roots to obtain sufficient water during the winter to adequately supply all parts of the plant. It would appear then, that the cane extremities—the plant parts most distant from the roots—would suffer first. The most severe die-back in Fresno County occurred during the 1947–48 and 1948–49 winters of low rainfall. The die-back was slight in 1946–47 when winter rainfall was less than 1″ below average; and there was no die-back in the winters of 1949–50 and 1950–51 when rainfall was ample.

The information obtained thus far indicated that lack of winter rainfall and irrigation together possibly with certain poor cultural operations caused the die-back. A number of experiments were inaugurated at the peak of the trouble to investigate the relation between die-back and the number, length and amount of lateral growth of trellised canes. In a typical experiment, two, three, four, six, and eight canes only were put up on the wires. In one series the canes were pruned short—eight to 10 feet—and in another left long—12 to 18 feet. This trellising was done in July. In January, the lateral growth arising from the trellised canes was either pruned back to eight to 10 buds, or put up in its entirety.

Die-back did not occur during either the 1949–50 or 1950–51 winters in the localities where these experiments were conducted, consequently specific data relative to the problem were not obtained. There was a lesser tendency, however, for plants with canes pruned short to suffer during hot, windy periods such as the one which occurred in June 1950. This probably reflects some plant-water relationships.

Inches of Winter Rainfall in Fresno County, 1946–1951, Inclusive, and Severity of Die-Back Disease.

	1946–47	1947–48	1948–49	1949–50	1950–51	Average since 1900
Nov.	1.94	0.43	0.02	0.46	1.85	0.93
Dec.	1.95	0.42	1.23	0.76	1.60	1.45
Jan.	0.20	trace	0.60	3.01	1.94	1.73
Feb.	0.60	0.77	0.73	1.84	1.60	1.47
Totals	4.69	1.62	2.58	6.07	6.99	5.58
Die-back	slight	severe	severe	none	none	

Evidence indicated that injury from cold was not responsible for the die-back. In the 1949–50 winter—when there was virtually no die-back—there were two more days in which a temperature below 32° F was recorded than in the 1947–48 winter in which die-back was severe. Also, a low of 21° F was recorded for the 1949–50 winter as compared to a low of 25° F for the 1947–48 winter. If weather permits, berries often make growth rather late into the fall season. Such growth, not properly hardened off, could be injured by a sudden cold period. However, the extensive die-back which occurred during the 1947–48 and 1948–49 winters is not attributable to any such short cold periods.

Suggested Prevention

Results of studies and indications from other observations permit certain general recommendations that are believed to be safeguards against winter die-back. These suggestions apply primarily to the Fresno area where the fruit crop matures within a relatively short period.

A close planting of 3½ to 4½ feet in the row makes unnecessary much of the winding of canes around the wires during trellising. In such rows, only the most

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ROOTSTOCK

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sweet orange or sour orange roots. Trifoliate orange grows well as a replant and some strains are fairly resistant to nematodes. It grows best in acid sandy loam soils, but is fairly susceptible to injury by high salt content in the soil.

Present use of trifoliate orange as a rootstock should be restricted to oranges and for limited replanting purposes only.

Cleopatra Mandarin

The Cleopatra mandarin is a stock which has done well with all species and varieties in experimental trials of the Citrus Experiment Station.

Oranges and grapefruit budded on Cleopatra stock are tolerant to quick decline. Cleopatra root is equally as resistant as sour orange to gummosis. No other diseases are known to be a factor. Lemon shellbark seems to be less severe on trees budded on Cleopatra than on Rough lemon, grapefruit or sour orange stock. Lemon decline is less pronounced in trees budded on Cleopatra than on other stocks observed.

Yields of all varieties budded on Cleopatra have been equally as good as those varieties budded on sweet orange. Fruit quality of varieties budded upon it is comparable to that of fruit from trees budded on sweet orange or sour orange. Fruit sizes are average. Trees budded on Cleopatra are equally as hardy as trees budded on sour orange stock. It makes a good growth as a replant. Cleopatra does well on heavy soils and is better adapted for saline soils than sour orange or Rough lemon.

Use of this stock in California for all scion varieties is recommended for commercial trial.

Sampson Tangelo

Use of the Sampson tangelo as a rootstock in California has not been extensive except for lemons. Eureka lemons are less prone to shellbark and lemon decline when budded upon Sampson tangelo than on most other stocks. Yields of lemons have been as good or better on trees budded on Sampson tangelo than of trees budded on sweet orange and have increased as the trees become older.

In California, because of quick decline, Sampson tangelo stock should be used only for lemons.

Troyer Citrange

Troyer citrange rootstock is so new that its ultimate value is somewhat speculative.

The Troyer citrange is a hybrid of sweet orange and trifoliate orange and apparently has inherited some of the good qualities of both. It is highly resistant to gummosis.

Oranges budded on it appear to be tolerant to quick decline. The trees come into bearing early and bear good crops of large fruit of excellent quality. The trees are more resistant to cold than trees budded on sweet orange or sour orange. Its ability to grow as a replant in old citrus soils has been outstanding.

Use of this stock should be restricted to oranges and grapefruit. Lisbon lemons are growing well on it, but Eurekas have not as yet proved adapted to it.

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BLACKBERRIES

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vigorous five to seven canes per plant need be trellised.

Trellising should be done soon after harvest, and with as little breakage of canes as possible. If tip-pruned to eight to 10 feet at the time of trellising, the supporting canes will force lateral growth over much of their length. Such lateral growth can either be pruned back to eight to 20 buds in the winter, when the plant is fully dormant, or trellised on the wires. The pruning saves labor and results in larger, more uniformly sized berries, the trellising perhaps gives a greater total yield of fruit. Water must be applied during the fall and winter months, and post-harvest fertilization with nitrogen is desirable. Attempts should be made to control the raspberry horned-tail insect. This insect kills the terminal growth of new canes early in the spring. Lateral growth which arises from such canes is always weaker than the original and is believed more subject to die-back.

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CANTALOUPE

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The experiment showed that fruit which drop do so soon after full bloom, though some ovaries may grow several-fold before dropping.

These drops which showed early growth frequently lengthened at the same rate as fruits which continued on to maturity. They cease to grow suddenly but remain green, turgid, and firmly attached for several days. Finally many of the fruits turn yellow, shrivel, and drop from the vine.

In fruits which drop, abscission always occurs several days after the ovary ceases to grow, and thus appears to have a secondary role in preventing fruit set.

Embryo sac development, pollen-tube growth, and the early stages of seed development were studied in growing fruits and in drops. For the insect-pollinated flowers on unthinned vines, there was no evidence that fruit drop was caused by the misfunction of any of these processes.

The changes which bring about fruit drop apparently first affect the growth of the fruit as a whole and then the development of structures within the ovule. The sequence is just the reverse of what could be expected if processes associated with fertilization or embryo or endosperm development were the cause of fruit drop.

Fruit set in this test did not appear to be limited by the number of ovules fertilized. Counts of fertilized and nonfertilized ovules were made from sections of 13 growing fruits, and from sections from 13 comparable drops.

Of 78 ovules in the fruits growing normally, 13% were not fertilized; of 116 ovules observed in the drops, 10.2% were not fertilized. Although more extensive data are needed, there is no present indication that drops have fewer ovules fertilized.

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CHICKEN

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chickens which would meet specifications for USDA Grade A and most of those which would be included in the USDA Grade B classification.

A grading system at retail would focus consumers' attention on quality as one aspect of their buying and would serve to reduce the price spread noted for each grade.

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