

# Blackline in Walnut

delayed failure of unions killing many walnut trees in central coastal counties

E. F. Serr

**Killing** of a narrow strip of cambium and bark at the union of the Persian—*Juglans regia*—or English, walnut tree top and its rootstock is causing increasing losses of individual trees—even abandonment of entire mature orchards—in the walnut producing areas adjacent to San Francisco Bay.

Studies of the trouble, serious also in Oregon and France, indicate that it is basically a delayed incompatibility between the tree top and rootstock. No trouble develops until the trees are in full production and growth has slowed down. Then, in some unions, cells begin dying and turn dark brown or black in

a paper thin band—hence the name, blackline—which advances around the union at the rate of about 3" per year. Often additional blacklines start on the same union, thus hastening the complete girdling of the limb or trunk. When the girdle is complete the top above deteriorates and dies. In the meantime the rootstock below usually sends out numerous sprouts.

## Rootstocks

Blackline is most common in trees grown on the standard Northern California black walnut—*J. hindsii*—root-



Top of tree killed by blackline.

stock. Study of one orchard with numerous trees on Paradox hybrid roots indicates that trees on the Paradox stock are about as susceptible to the trouble as trees on *J. hindsii*. Similarly, cases of blackline have been found in trees on Eastern black—*J. nigra*—Southern California black—*J. Californica*—and Royal hybrid roots. No cases have been found in trees propagated on the Persian—English—species.

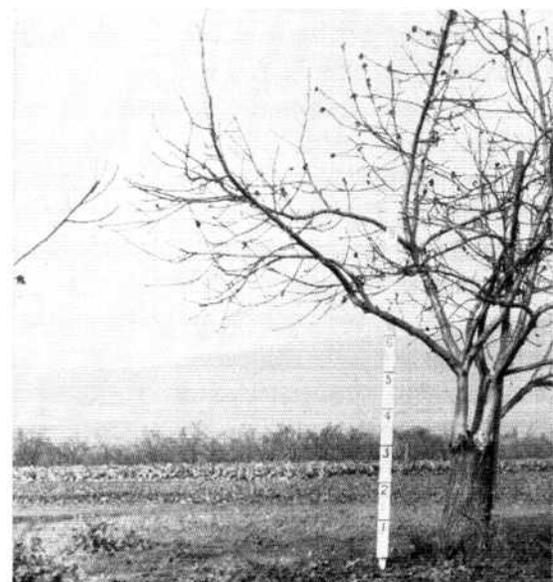
Advanced case of blackline with the top of tree dying.

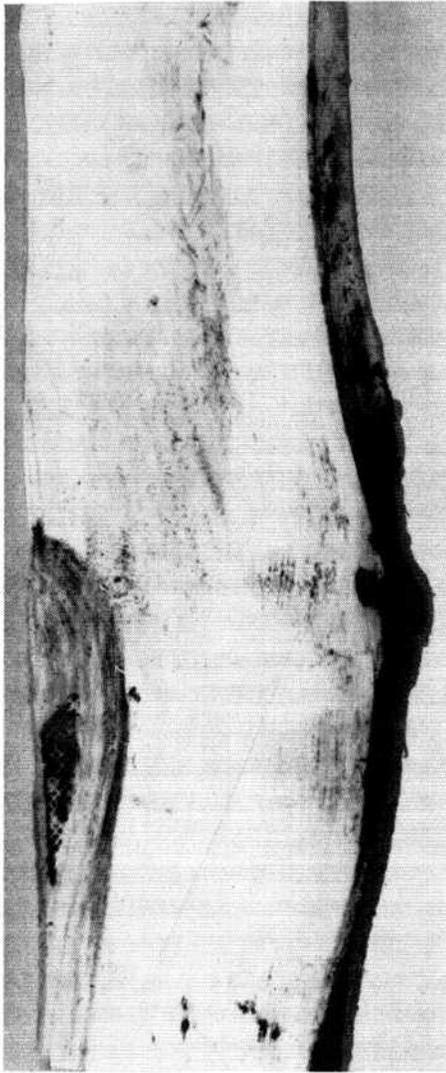


## Varieties

Blackline attacks Payne, trees of which mature and come into production quickly, much earlier in life than varieties which mature and come into production slowly, such as Franquette. Concord and Eureka are attacked only a little later than Payne, corresponding to their intermediate age of physiological maturity. Studies of Contra Costa Persian—C. C.

Six years' growth on blackline tree cut o  
completel





Radial section through trunk of tree, with—upper portion—Persian walnut on—lower portion—Northern California black walnut rootstock. Blackline, which has been present for two years, is shown at the union, in the center of the photograph.

Persian—an old Contra Costa variety, indicate that it is actually much less susceptible to attack than Concord although C. C. Persian trees mature at least as early as Concord. This gives prospect of success with C. C. Persian as an interstock, although tests have not yet matured.

### Virus and Nutritional Studies

An extensive search has been made during the past 10 years for positive evidence of any secondary factors which

Comparison of Incidence of Blackline in Concord and Contra Costa Persian Varieties Orchard near Walnut Creek, grafted in 1910

	C. C. Persian	Concord
Single union trees examined . . . . .	49	13
Two-union trees examined . . . . .	4	3
Total unions examined . . . . .	57	19
Blackline found 1950 . . . . .	2*	6
Blackline found 1958 . . . . .	10*	16
Blackline found 1950 . . . . .	4%	32%
Blackline found 1958 . . . . .	18%	84%

\* Difference from Concord variety significant at .01.

would account for blackline being worse in some areas than others. Relatively few cases have been found in the lower Sacramento and San Joaquin valleys and

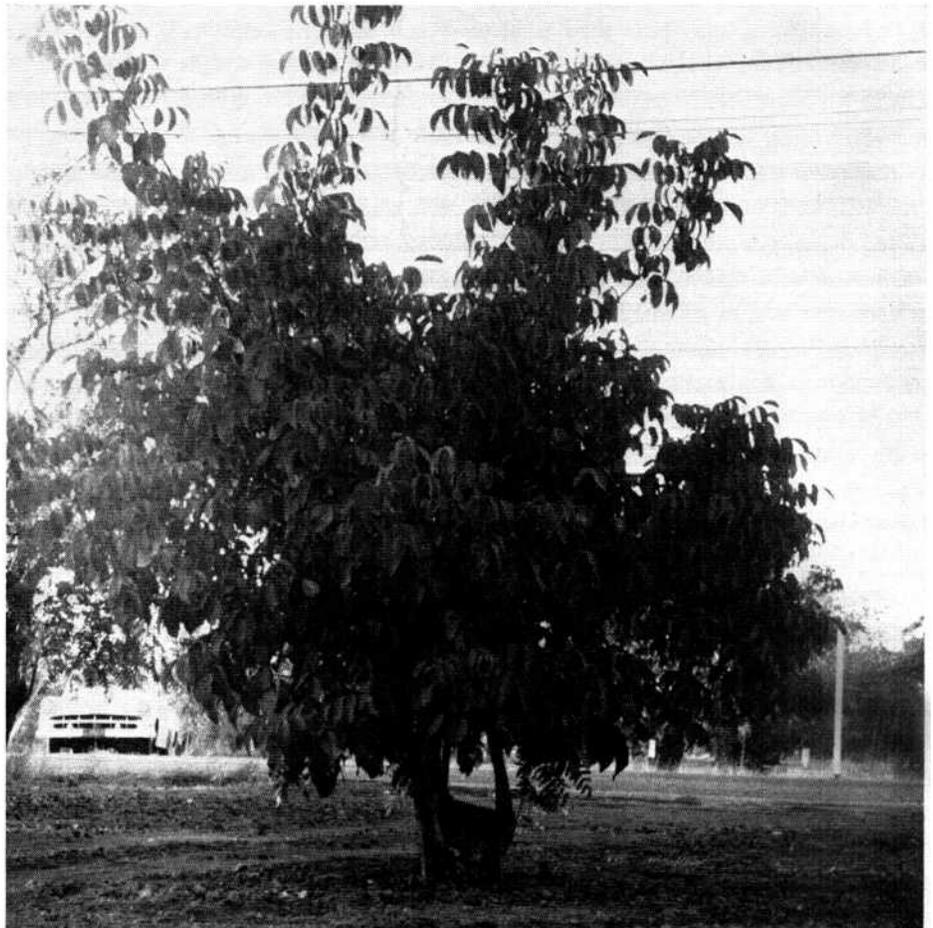
none in the upper valleys or in southern California. Tree injection and soil application tests with 51 different nutritional chemicals gave no consistent results. Likewise, applications of seven plant growth regulators or hormones failed to affect the rate of blackline advance. A virus test was started near Martinez in 1944. After 14 years no significant difference in number of blackline cases has developed in the two groups of trees, one grafted with Concord scions taken from trees having blackline and the other with Concord scions from the Davis orchard where no blackline ever has been found. This indicates that no virus which can be carried in the scions is involved.

### Number of Unions Per Tree

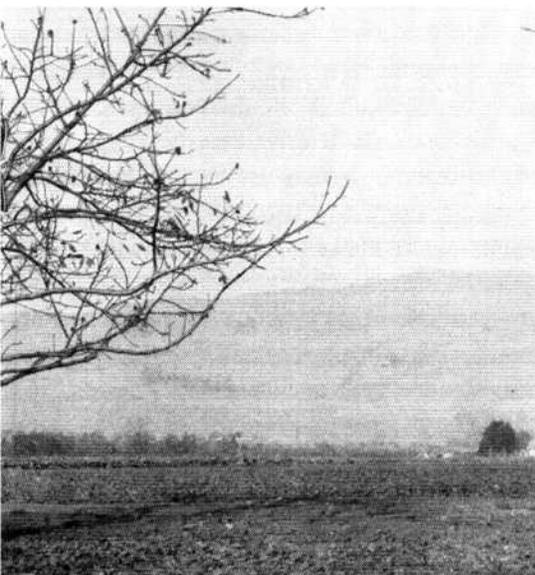
Yearly examinations of many trees in a San Jose Payne orchard indicate that in unions of trees having several graft unions per tree blackline does not start, on the average, until six or eight years later than in unions of trees having only one graft union. Also after the trouble has started there is much more likelihood of secondary blacklines appearing in the single unions than in unions of four-union trees. In 124 single union

Continued on page 14

Original top killed by blackline. Sprouts allowed to grow from rootstock and regrafted after top was removed.



ff and regrafted in trunk before tree was y gridled.



## SORPTIVE DUSTS

Continued from preceding page

domen and over the legs, with particular attention to the placement of the dust between the toes of the animals. For comfort's sake the dust should be kept away from an animal's face when dusting his body. However, no animals treated with the dust have ever exhibited any ill effects from it; this includes the cats, who, naturally, always ingest the powder when they lick themselves clean.

If a dust gun is not available, small quantities of the dust may be placed in the palms of the hands and the dust worked into the fur of the animals with the hands.

One dusting is all that is necessary for any breed of cat or a short haired dog. For the longer haired dogs—such as collies and cocker spaniels—two dustings may be necessary, particularly if the hair is matted down with dirt. When the matting is too severe the dogs' hair should be clipped and then the dust applied.

Shortly after the dust has been applied to an animal's body, great numbers of fleas will start coming out from beneath the hair of the animal. The fleas will be

covered with the dust, their movements will be very erratic and within minutes they will start falling off the treated animal. The dust-covered fleas will die within an hour after falling from the animal's body.

The dusted animal should be placed on a leash for several hours following treatment to allow time for all fleas to come in contact with the dust before it is partially removed through the normal activities of the animal. The dust should be left on the animal for as long as possible—at least a week—before bathing him.

If there is more than one animal in the house, all animals should be dusted. It would be inadvisable for dusted animals to play or sleep with untreated, infested animals.

Once a dog or cat has been treated and placed on a leash, the animal's play and sleeping areas should be dusted, including the ground where the animals roam—or, on the runways if in a kennel, the entire sides and insides of shelters—particularly wall cracks, floors and between floor boards. All sides of pillows and blankets and whatever is used for bedding should be dusted thoroughly. If a wooden box is used as a dog or cat house,

the dust should be applied on the outside as well as the inside and the under part of the box. Particular attention should be given to putting the dust in all cracks in the wood where fleas might lodge once off the animal.

Homes infested with fleas may be treated by dusting rugs, upholstered furniture, bedframes, mattresses, springs, drapes, curtains, and in all places which might offer refuge to the fleas. Lawns, garages, and children's play houses also may be dusted. One half to three quarters of a pound of the dust is generally sufficient for treating an average size home. Research is planned for this coming spring on the treatment of flea-infested lawns and gardens. In inconspicuous places the dust may be left indefinitely, but in the more conspicuous places the dust should be left for several days and then may be swept up or picked up with a vacuum cleaner.

The results of treating dogs and cats with SG 67 and SG 77 are shown in the table on the preceding page.

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## BLACKLINE

Continued from page 9

trees the average total yearly rate of advance of blackline was 4.63" per year as compared with 3.55" in 87 unions in four-union trees affected. In another Payne orchard studied near San Jose where there were five to eight union trees in significant numbers the trend toward decreasing percentages of blackline with increasing numbers of unions per tree is also evident.

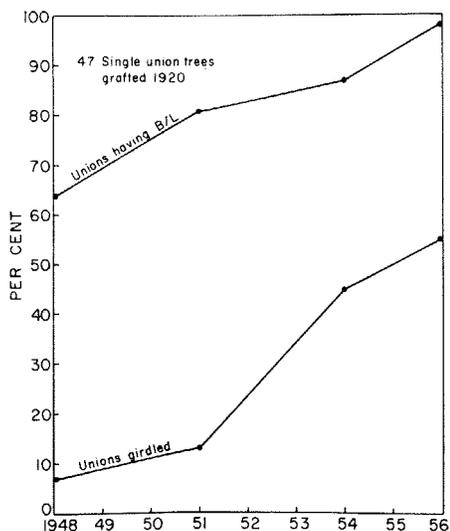
Young trees on black walnut rootstock

planted where old walnut trees were removed or interplanted in an old walnut orchard usually make poor growth. Seedling black walnuts grow better than nursery worked trees but in such situations growth rates are still generally unsatisfactory. In an interplanting test near San Jose at the end of six years Paradox seedlings were approximately six times as large as nursery budded trees of the same age on Northern California black walnut rootstock.

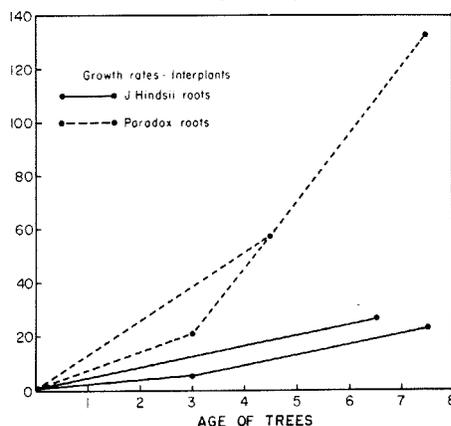
Trunks not over about 18" in diameter or limbs topworked high so that new grafts will get sufficient light can be re-

grafted successfully. The work must usually be done before the original union is not more than about 75% girdled. In another salvaging method sprouts from the rootstock can be left to grow and these rebudded or regrafted after the top dies. In a Contra Costa orchard where 33 sprouts were regrafted to Concord

Progress of blackline in single union trees in San Jose orchard. Payne variety.



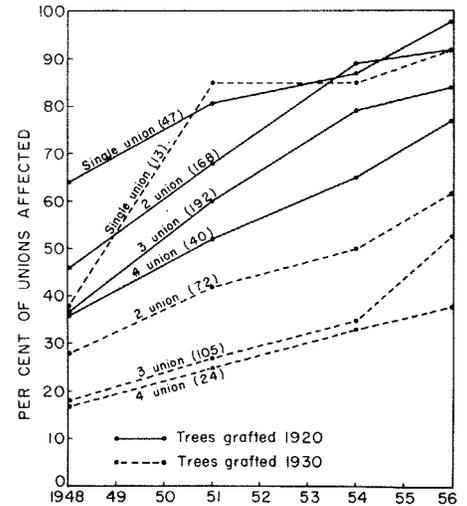
Growth rates of Paradox hybrid seedlings compared to nursery grafted Payne trees on Northern California black walnut rootstocks. All interplanted in a San Jose orchard severely injured by blackline. Differences at 3 years significant at .05. Differences at 7 years significant at .01.



Incidence of blackline in single union trees compared to multiple union trees. San Jose orchard. Payne variety. Significance of differences:

	1948	1951	1954	1956
Trees grafted 1920				
1-union vs 4-union...	*	**	*	*
Trees grafted 1930				
1-union vs 4-union...	NS	**	**	**

\* Significant at .05.  
\*\* Significant at .01.  
NS Not significant.



**The ladybird beetle**—*Hippodamia convergens*—has the unusual habit of congregating in large masses for hibernation in mountain canyons. The times of migration from the valleys in the early summer and the return from the mountains in the following spring have an important bearing upon the effectiveness of the beetle in controlling aphid infestations. Recent research has shed much light on the several factors influencing this migration habit. After the development of one or more generations in the field during the spring, the food supply usually becomes deficient and this provides the stimulus for migration to the mountains, which may be 50 miles or more away. On arrival in the mountains in June, the beetles feed for some time on pollen, plant exudations and other noninsect food and their weight may be

## Migration habits of The Ladybird Beetle

Recent research by Kenneth S. Hagen, Assistant Entomologist in Biological Control, University of California, Berkeley, has provided additional information on the migrations of this important natural enemy of many aphid pests of agricultural crops in California.

doubled during this period. They first assemble in small aggregations along creeks, and later consolidate in the forest litter into larger aggregations which may be as great as 500 gallons. Here they remain from October to February, usually deeply covered by snow during the winter.

During the first warm days of Febru-

ary or March, when temperatures exceed 55°F, the beetles again become active. These warm periods are associated with high pressure areas over the northwestern states, creating easterly winds over the Sierra. The beetles take off vertically, ascending up to several thousand feet above the point of origin, and then ride the prevailing winds to the valleys below. A specially designed trap on an airplane was used to check the flight patterns of the beetles in both directions. Catches have been made at elevations up to 3,500' as the beetles leave the mountains, and up to 5,000' as they return. It is becoming apparent that the primary destination in the migrations of *H. convergens* is governed by wind direction and temperature, and that the extended flights are triggered by nutritional factors.

variety 74% of the new unions had blackline and 37% were completely girdled 15 years after the reworking was done. In a San Jose test orchard five old trees with blackline were regrafted below the original union in 1951. They came back into bearing in five years but one case of blackline was found in one of the new unions at the end of the sixth year. These results indicate that regrafts are likely to get blackline much more quickly than the original unions.

Surveys and tests indicate the advisability of following certain practices for walnut growing in areas where blackline is prevalent. For new walnut plantings—where no oak root fungus is present—vigorous seedlings of Persian walnut can be used as rootstocks. Where oak root fungus is present or suspected, Northern California black walnut rootstocks can be used to obtain at least partial resistance to the fungus. These trees can be topworked at 12'-14' with 6-12 unions to delay blackline and allow for

reworking of individual branches so that trees can be kept in production indefinitely.

Where blackline is known to be present or indicated by sprout growth, all unions can be examined by making small V-shaped cuts through the bark and cambium at intervals of about 4". Affected unions and extent of girdling can be marked. Plot maps can then be made of the orchard and a program of replanting or interplanting and salvaging decided upon and started as soon as the amount of blackline in the orchard warrants. For replanting or interplanting, vigorous Paradox hybrids can be used—except in areas known to be infected with oak root fungus—where vigorous Northern California black seedlings can be planted. Where Northern California black walnuts make unsatisfactory growth because of root lesion nematode—*Pratylenchus vulnus*—or for other reasons, Paradox hybrids can be planted. Some may be killed by oak root fungus because their resistance to this fungus is variable. Seedlings in permanent tree locations can be topworked high with multiple unions to delay blackline and to allow reworking individual branches when they are eventually being girdled by blackline.

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The above progress report is based on Research Project No. 1385.

## COTTON

Continued from page 3

be tested and evaluated in 1959. Should either of these hybrids prove superior to our standard variety, the seed of its parental strains can be increased for

large-scale field testing of the synthetic hybrid and the same seed multiplications could serve as parents for use in the one-variety program. If none of the hybrid combinations show promise, new combinations will be made using parentage of wider genetic background.

John H. Turner is Director of the U.S.D.A. Cotton Experiment Station, Shafter, and Associate in the Experiment Station, University of California.

Frank M. Eaton, Research Chemist in Soils and Plant Nutrition, University of California, Riverside, conducted the greenhouse experiments in 1955 at College Station, Texas.

R. J. Miravalle, Geneticist, and V. T. Walhoad, Plant Physiologist, U.S.D.A. Cotton Field Station, Shafter, and Marvin Hoover, Extension Cotton Specialist, University of California, Shafter, participate in the continuing Hybrid Cotton Breeding Program.

## CHLOROSIS

Continued from page 6

and bicarbonates. Evidence is thus accumulating that organic acids and amino acids may be directly related to the causal mechanism of lime-induced chlorosis.

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Arthur Wallace is Associate Professor of Horticultural Science, University of California, Los Angeles.

Evan M. Romney is Assistant Research Soil Scientist in Nuclear Medicine and Radiation Biology, University of California, Los Angeles.

The above progress report is based on Research Project No. 851, in cooperation with the Department and Laboratories of Nuclear Medicine and Radiation Biology, School of Medicine, University of California, Los Angeles.

Research on chlorosis in Germany and Venezuela was conducted by W. S. Iljin.

Distribution of blackline in California walnut districts.

