

any other oat ever grown in this region. This means that windrowing will not generally be necessary for grain harvest. Both plant and seed are distinctive in appearance and the name choice was mindful of both its history and appearance. Farmers cooperating in the testing program generally have been enthusiastic about its potential for hay or grain production.

The leaves are large and broad, stems large and strong, and panicles compact. Plants are generally similar to those of Ventura in height and maturity. They mature with, and support, purple vetch better than Kanota. Sierra has grey seeds, shorter and wider than other California varieties, with test weights only slightly higher than those of Indio. Crown and stem rust resistance of Sierra is genetically different from that in the other California oat varieties. This helps insure against a general rust epidemic on all our varieties at the same time. Yellow dwarf virus resistance is not equal to that of Kanota, our oat variety with the highest degree of tolerance.

Sierra oats produced 30 per cent higher grain yields than either Kanota, Ventura, or California Red in state-wide California tests, 1958-61 with local farm advisors cooperating. Hay yields, although not significantly better than these other varieties, have been more consistent. The statewide tests have shown it to be adapted wherever oats generally are adapted. Whereas the Curt variety is primarily a grain type, Sierra will be useful for forage or feed grain.

#### OAT VARIETY GRAIN YIELDS— 37 TESTS (1958-1961)

Variety	Yield as per cent of Kanota
Kanota .....	100
Sierra .....	138
Curt .....	132
Ventura .....	108
California Red .....	99

Many useful characters in Sierra obviously came from its wild oat parent—indicating that perhaps the best hope for the increased adaptation of oats to the arid regions of the world lies in other similar species crosses.

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# PEAR DECLINE RESEARCH

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High summer temperatures appear to be an important contributing factor—in combination with psylla feeding—adding to tree losses from pear decline. Thus far, none of the sprays, ground applications, injections, or scoring treatments have had any discernible effect on the progress of pear decline. None of the treated or control trees improved, a few apparently held their own, but most have deteriorated.

**T**HE DEVELOPMENT of pear decline was studied during 1960-61 in 627 trees in three orchards. The orchards were in the Sacramento River district near Ryde, and in the Sierra-Nevada foothills near Gold Hill and Camino. Before the onslaught of pear decline, each

orchard was outstanding for its district and had a long record of consistently high yields. The trees in each orchard were known to be on oriental rootstocks, and many had typical *Pyrus pyrifolia* (*serotina*) root suckers for verification. Various stages of decline were found in all three orchards at the beginning of the study (October 1960), but very few had died in the Camino orchard.

Trees were indexed for amount of terminal growth (1 to 4, normal to none), amount of crop (1 to 4, heavy to poor), reddening of foliage (0 to 3, none to most leaves red), the presence of a brown line on the cambial face of the bark at the graft or bud union, and date of collapse if tree died.

Treatments were applied to normal-appearing trees as well as trees in various stages of decline. Some were given dilute

PROGRESS OF PEAR DECLINE IN MATURE BARTLETT TREES ON PYRUS PYRIFOLIA (SEROTINA) ROOTSTOCKS, 1960-61.

Trees with brown line at graft union October 1960					Trees with no brown line at graft union October 1960									
Number of trees	Growth Status <sup>a</sup>		Crop <sup>b</sup>	Leaf color <sup>c</sup>		Trees dead Oct. 1961 (%)	Number of trees	Growth Status <sup>a</sup>		Trees with brown line Oct. 1961 (%)	Leaf color <sup>c</sup>		Trees dead Oct. 1961 (%)	
	Oct. 1960	Oct. 1961		July 1961	Oct. 1960			Oct. 1961	Oct. 1960		Oct. 1961			
<b>Ryde</b>														
Elev. 19 ft. ..														
37	3.5	4.0	3.7	..	1.6	48.6	142	1.8	2.0	2.2	35.9	..	0.4	13.4
<b>Gold Hill</b>														
Elev. 1900 ft. ..														
117	1.3	1.9	2.7	..	0.9	26.5	36	1.3	1.6	2.3	50.0	..	0.0	11.1
<b>Camino</b>														
Elev. 3000 ft. ..														
185	1.9	3.1	3.4	1.8	2.0	1.1	110	1.8	2.1	2.7	36.4	0.4	0.6	0.0

<sup>a</sup> 1, normal growth; 2, reduced terminal growth; 3, two to four inches of terminal growth; 4, no terminal growth.

<sup>b</sup> 1, heavy crop; 2, good crop; 3, fair crop; 4, poor crop.

<sup>c</sup> 0, green leaves; 1, some red leaves; 2, more red leaves; 3, most leaves red.

AVERAGE MAXIMUM TEMPERATURES AT STATIONS NEAR ORCHARDS UNDER STUDY<sup>a</sup>

Station	June		July		August		September	
	1960	1961	1960	1961	1960	1961	1960	1961
Walnut Grove (near Ryde orchard) .....	90.5	90.2	93.4	94.0	92.2	91.3	87.5	85.4
	4*	8*	9*	8*	2*	4*	0*	0*
Placerville (near Gold Hill orchard) ..	92.6	90.6	97.5	96.1	93.2	92.0	88.4	82.9
	6*	10*	9*	8*	8*	2*	0*	0*
Camino (near Camino orchard) ....	85.2	83.8	90.1	88.3	87.3	85.5	79.8	76.8
	0*	1*	1*	0*	0*	0*	0*	0*

<sup>a</sup> From climatological data of the U. S. Dept. of Commerce Weather Bureau and University of California, Department of Pomology.

\* Number of days temperature reached 100° F. or higher.

nutrient sprays of either phosphorus, phosphorus plus zinc, or phosphorus plus zinc plus iron during the dormant season of 1960-61, and three times during the 1961 growing season. Others were sprayed with zinc chelate (Zn EDTA, 14.2 per cent zinc as metallic) at 5 pounds in 100 gallons of water on October 17, 1960 and again May 5, 1961. Others received 1.5 or 3 pounds of iron chelate (Fe EDDHA, 6.0 per cent iron as metallic) broadcast from the trunks out about 8 feet and raked into the soil on October 25, 1960, or March 24, 1961. Still others were injected with 2,400 ml of iron chelate at a concentration of 360 ppm (iron as metallic) on October 19-20, 1960.

#### **Bark scoring**

During October 1960 and March 1961, 362 trees were scored vertically to stimulate callus formation and possibly provide an avenue for food and water movement through the area near the graft union, where plugging of the sieve tubes had caused the girdling effect associated with decline. Six to eight score wounds were made through the bark down to the wood on each tree, with either a heavy knife or a blight scraper. Short score wounds (4 to 6 inches above and below the graft unions) were made on half of the trees, and long score wounds (from 4 to 6 inches below the unions to 4 to 6 feet above) on the others. Two-thirds of the scored trees had their wounds filled with asphalt emulsion grafting compound, and a third were untreated.

Thus far, none of the sprays, ground applications, injections, or scoring treatments have affected the progress of pear decline. None of the treated or control trees improved, a few apparently held their own, but most deteriorated.

The relative severity of decline in the three locations at the beginning of the study was shown by the number of trees with brown lines at their graft unions (see Table): 20.7 per cent in the Ryde orchard, 76.5 per cent at Gold Hill, and 62.7 per cent at Camino. Trees with a brown line October 1960 had made less growth during 1960 at Ryde than at Gold Hill and Camino. In all three locations, however, trees with a brown line at the beginning of the study made less growth, bore less fruit, developed more red foliage, and had a higher death rate than those lacking a brown line at that time.

The steady progress of decline is shown by the percentage of trees lacking a brown line in October 1960 that developed one by October 1961. These percent-

ages (respectively 35.9, 50.0, and 36.4 for Ryde, Gold Hill, and Camino) were rather consistent for all three locations.

#### **Pear psylla**

During November 1961, workers in Washington presented evidence that pear decline is caused by a systemic toxin introduced by pear psylla (*Psylla pericola*, Forester) feeding on the foliage. They found that the number of psylla per leaf was directly related to the amount of phloem injury, but that the toxin is so potent that relatively few psylla can cause great damage to pear trees on susceptible rootstocks. They reasoned that psylla alone may cause slow decline and that psylla coupled with adverse cultural environmental conditions (e.g., hot dry periods) causes collapse or quick decline.

If psylla are the cause of decline, the death rate and steady deterioration of trees in the Ryde orchard substantiate the conclusion that heavy populations are not required for severe damage. Surveys by University entomologists showed that psylla populations are much lighter in Sacramento River orchards than around Placerville and Camino. In the three orchards under study, psylla control has been adequate to permit the production of fruit suitable for fresh shipment.

#### **Present study**

The present study points to high summer temperatures as an important adverse condition that, in combination with psylla feeding, can cause the death of trees. This is shown by the low death rate of declining trees at Camino (3,000 feet elevation) compared with those at Gold Hill (1,900 feet) and Ryde (19 feet). At Camino, there were only two days during the two-year period (1960-61) when the temperature reached 100 degrees F. or above, whereas Walnut Grove (Ryde) had 35 days and Placerville (Gold Hill) had 43 days (see weather table). High temperatures seem to be the most logical factor causing stress in the trees near Ryde, since for many years the trees have been carefully irrigated under a system providing unlimited water. At Gold Hill, where tree losses have been heavier than in the other two orchards, additional stress may have been caused by lack of moisture for short periods in late summer.

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## **PLUM ROOT**

### ***Incompatibility***

An apparent mix-up within commercial sources of the vegetatively-propagated Marianna plum stocks with some other similar plum stocks has been revealed. Myrobalan plum seedlings, several vegetatively propagated myrobalan selections and two Marianna clones (2623 and 2624) have been commercially propagated for rootstocks of stone fruits for a number of years. Of these, only the two Marianna stocks can be used successfully for almonds, and then only for certain varieties. Marianna 2624 is the more important because of its resistance to oak root fungus and is the one most often propagated for almond rootstock.

**J**ORDANOLO, Ne Plus Ultra, Peerless and Texas (Mission) varieties will make a satisfactory graft combination with Marianna stocks. Mature trees are somewhat smaller, however, than almond trees on peach or almond rootstocks and some overgrowth appears at the union. On the other hand, Nonpareil, Davey and Drake do not normally make a satisfactory graft combination with Marianna stocks. Trees of these latter combinations usually die within a few years although individual trees will occasionally make reasonably good growth for a longer period.

#### **Incompatibility indicated**

Incompatibility with Marianna 2624 rootstock was recently indicated by Texas, Peerless and, to a lesser extent, Ne Plus Ultra trees in newly planted commercial orchards. These varieties have usually made satisfactory combinations on this stock. One of two symptoms observed was the yellowing of the leaves and prema-