

Bartlett Pears

the possibilities of 2,4-D sprays in controlling preharvest drop

F. W. Allen

Experimental application of 2,4-D—2,4-dichlorophenoxyacetic acid—to Bartlett pear trees for the control of drop at Davis was first made on July 3, 1947, to determine the effectiveness of the material in retarding drop, the necessary and critical concentrations and the influence upon ripening and storage quality.

Bartlett pear growers in California have used naphthaleneacetic acid sprays since 1942 to control the preharvest drop of fruit.

As a result dropping has been reduced greatly—in some instances practically eliminated—and a materially greater tonnage has been harvested.

These naphthaleneacetic acid sprays have become standard orchard practice even though the materials, applied in weak concentrations, are relatively expensive; have a limited period of effectiveness which makes the time of application an important factor; and have a direct as well as an indirect effect in hastening the ripening and subsequent breakdown of the fruit.

In the first experimental tests at Davis with the less costly 2,4-D, two trees each were sprayed with concentrations of 2½, five, 10 and 15 ppm—parts per million. The crystals of the pure chemical were dissolved in alcohol before adding to 50 gallons of water containing approximately an ounce of Vatsol as a wetting agent. The spray was applied at 350–400 pounds pressure.

Influence Upon Dropping

At the time the experimental trees at Davis were sprayed, the only pears on the ground were a very few small ones which had dropped several weeks before. These were picked up and discarded. Subsequent counts on dropping were made on August 7, five weeks after spraying, and 12 days later—August 19—at which time the fruit was practically ripe and was showing breakdown on the trees.

Results of Preliminary Test with 2,4-D as Preharvest Drop Spray

| Spray treatment | Ave. No. drops per tree | | Total drops July 3–Aug. 19 |
|----------------------|-------------------------|---------|----------------------------|
| | Aug. 7 | Aug. 19 | |
| 2,4-D 2½ ppm .. | 3 | 11 | 14 |
| 2,4-D 5 ppm .. | 1 | 2 | 3 |
| 2,4-D 10 ppm .. | 4 | 0 | 4 |
| 2,4-D 15 ppm .. | 0 | 0 | 0 |
| Check (unsprayed) .. | 32 | 68 | 100 |

Concentrations of five ppm and above, practically eliminated dropping. At 2½ ppm the spray was very effective for a period of five weeks, at which time the fruit would normally be harvested and was moderately effective for an additional 12 days.

The cumulative drops between July 3 and August 19 were only 14% of those from the nonsprayed trees.

Effect Upon Ripening

On August 7, when the fruit would normally have been harvested, the color of the pears from the different trees was quite uniform and no significant differences were noted in firmness. Twelve days later the pears on the sprayed trees were noticeably of more yellow color and breakdown in them was much greater than in the unsprayed fruit.

The percentage of yellow color and of breakdown also increased with the spray concentration.

Condition of Bartlett Pears on the Trees 12 Days after the Beginning of Normal Commercial Harvest

| Spray treatment | Per cent of fruit yellow | Per cent showing breakdown |
|---|--------------------------|----------------------------|
| 2,4-D 2½ ppm | 50 | 20 |
| 2,4-D 5 ppm | 60 | 33 |
| 2,4-D 10 ppm | 75 | 55 |
| 2,4-D 15 ppm | 85 | 50 |
| Check (unsprayed)—Color variable—greenish yellow to light yellow. | | |

The same relative condition as noted above on the trees at harvest was observed also eight weeks later when the greener, firmer pears from each set of trees had been removed from storage.

Concentrations Tested

The most important consideration in these preliminary trials—aside from determining something of the possibilities of 2,4-D in preventing fruit drop—was to determine the concentration which might be used without injury to the trees.

Concentrations of 2,4-D greater than five ppm have been found by other research workers to result in noticeable injury to leaves and buds of Bartlett pear trees. No tree injury was observed in the Davis trials during the growing season in which the spray was applied.

Concentrations of 10 and 15 ppm, how-

ever, showed injury later. At the time of pruning in March, 1948, severe damage was noted on the previous season's growth and on the fruit spurs. Most of the new wood was killed.

By April 15, when the unsprayed trees were in leaf and in bloom, the sprayed trees were still largely dormant. Growth was just beginning from many latent buds from the two- and three-year wood.

A very slight amount of the killing injury was noted on one of the trees receiving the spray at five ppm concentration but this was not serious. No injury occurred on the trees sprayed with 2,4-D at 2½ ppm.

By the middle of May it was evident that all injured trees were putting out new growth and 30 days later they appeared normal except for the pruning necessary to remove most of the previous season's wood and for the very light bloom due to fruit bud injury.

When no injury became evident during the same season the spray was applied it seemed quite possible that 2,4-D might be used on California Bartlett pears in concentrations equal to those applied to apples and citrus as reported by other research workers. This definitely proved to be not the case.

Similar to the observations elsewhere with apples—the Davis results with pears indicated that 2,4-D sprays are relatively slow in their action and considerable time may elapse between their application and any possible injurious effects.

1948 Trials

During the past season the trials were extended to three commercial orchards—one near Walnut Grove in Sacramento County and two in the Santa Clara Valley.

In each orchard the materials used consisted of 2,4-D, its sodium salt and the isopropyl ester, applied at concentrations of one and two ppm only.

In the Walnut Grove orchard the crop was light and no drop occurred even from the unsprayed trees.

In the Santa Clara Valley orchards, dropping was generally reported as being heavier than for several seasons and in one of the two test orchards, dropping from the 2,4-D sprayed trees was as much as 70% of that from the unsprayed.

In the other Santa Clara Valley orchard, dropping from the sprayed trees—where the spray was applied at one ppm—was 32% of that from the unsprayed. Where the spray was applied at two ppm, the drop was 24% of the nonsprayed. In the same orchard, where naphthaleneacetic acid was used, at the normal strength of 10 ppm, the drop was only 15% of that from the check trees.

The usual influence of the naphthaleneacetic acid in hastening ripening and

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Gypsum in Irrigation

effective use governed by application and ratio of salts in the water

L. D. Doneen

Certain types of irrigation water may be harmful eventually to plant growth.

One of these types constitutes an unfavorable sodium-calcium ratio which may cause a sealing of the surface soil preventing the water from penetrating into the lower root zone. This dry condition results in wilting of the plants between irrigations. Even if wilting is prevented by frequent irrigations, the growth of the plant is somewhat retarded due to the limited volume of wet soil from which plant nutrients may be absorbed.

Well water, or underground water, contains minerals in varying proportions, depending upon the type of material through which the water percolates. If the minerals dissolved are in the form of calcium and magnesium salts, the water is known as hard water, and common soaps do not form suds in it readily. This type of water usually is considered good for irrigation purposes, as only occasionally do the calcium and magnesium salts reach a concentration toxic to plant growth.

On the other hand, the so-called soft water may come from either of two sources: (1) rain water that contains very few minerals, which usually will include runoff waters from melting snow or excessive rains which have not had sufficient contact with soil or rock to dissolve appreciable quantities of minerals; and (2) water containing a high percentage of sodium salts. These salts may reach a concentration toxic to plants, but even at low concentrations they cause deterioration of the soil structure, and with their continued use the surfaces of all but extremely sandy soils will seal and prevent the wetting of deeper layers. To counteract this condition, gypsum is applied to the land, and in some localities it is a general practice to apply one to 15 tons per acre.

A study was made with irrigation waters of low salt content, but with most of the salts in the form of sodium, in an area of extremely low infiltration rates. In other words, the rate of water intake by the soil was very slow. Even with half-mile furrows and small flows, a large percentage of the irrigation water was run off at the lower end of the field.

A large number of infiltration tests were made by continuously dissolving varying quantities of gypsum in the irrigation water. Upon adding the gypsum, the irrigation showed only a small increase but continued to increase with succeeding irrigations, and gave an over-all increase of 40% to 160% over the untreated irrigation water. This work was carried on over a number of soil types but the principal ones were Delano, Hesperia and Madera sandy loams.

The infiltration rate of the high sodium waters can be increased by dissolving gypsum in the water. The addition of calcium in the form of gypsum decreases the proportion of sodium salts to the total salt content. Only a small quantity of gypsum is required as compared to amounts customarily applied directly to the soil.

Application

Direct application to the soil should be beneficial for the first few irrigations early in the season. While being effective in increasing penetration of water, the gypsum will be dissolved and leached from the bottom and sides of the furrows. After dissolving and removing the gypsum from the surface of the furrow, the high per cent sodium water again will cause this soil to seal and prevent deep percolation.

Even though the mass of soil between the furrows contains large quantities of

gypsum, it will be of little use in preventing sealing adjacent to the furrows. To increase infiltration, it will be necessary to rework the soil and refurrow the land to bring soil containing gypsum in contact with the water.

Gypsum applied directly to the land should be a pulverized dust. Coarse, lumpy gypsum, even the size of a pea, is not as effective as the finely ground material. Gypsum is slowly soluble in water and the coarse, lumpy materials do not dissolve sufficiently to be very beneficial. When lumps of gypsum are plowed up several years after application, they have not been active in promoting penetration of water.

Gypsum dissolved in irrigation water containing a high percentage of sodium before the water reaches the irrigation furrow corrects the trouble at its source. This should be more economical and efficient than adding large quantities of gypsum to the land.

Quantities

The correction of high sodium water is limited to relatively low salt concentrations. A high total salt and high sodium percentage require a large amount of gypsum to make the correction. Difficulty will be experienced in dissolving the gypsum at these higher concentrations and the cost of such large quantities will be high.

It is desirable that a water analysis be made before the addition of gypsum is made a common practice. The analysis should show both the amount and the percentage of sodium present in the water. This will prevent the use of excess gypsum, and make it possible to calculate the gypsum required to reduce the sodium percentage a definite amount.

A grower with a water penetration problem should consult the local farm advisor as to whether the area is suspected of having a high percentage sodium water; for advice on the soil conditions and analysis of the water; and the quantity of gypsum to apply in the case of a water high in sodium.

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breakdown in fruit after midharvest season was observed. During the past season's trials, the naphthaleneacetic acid spray was considerably more effective than one and two ppm of 2,4-D.

The results of the low concentrations of 2,4-D sprays upon ripening and early

breakdown were less marked and inconclusive but in one of the three orchards late picking of the sprayed fruit showed considerably more breakdown after 30 days in storage than did the unsprayed.

Somewhat more breakdown occurred in pears sprayed with the solution of two ppm than those sprayed with half this concentration.

No significant differences appeared in

the results from the use of the three forms of the 2,4-D used.

At least another year's work is regarded as necessary before any recommendations are justified for the use of 2,4-D on Bartlett pears.

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