

# Orchard Sprinkler Irrigation

studies show supply of readily available soil moisture more important for fruit growth than type of irrigation

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**Sprinkler irrigation** has many advantages in deciduous orchards, but also presents problems not found with surface irrigation.

In general, sprinkler irrigation is well adapted to areas of sandy or shallow soils, and where the hilly nature of the area makes it difficult to secure uniform distribution of water by surface methods. It is useful in some areas where erosion presents a serious problem. Sprinkling is advantageous in almond and walnut orchards, where it can smooth and firm the soil surface for mechanical harvesting.

One problem encountered with a sprinkling system is the moving of the pipe on some soils, where the surface layer tends to remain wet and soft for a considerable time after sprinkling. Low-hanging branches which interfere with uniform distribution of water with under-tree sprinklers present another problem. Where the sprinklers are above the level of the tree tops wind is a factor that tends to prevent uniform water distribution.

Incidence of fungus diseases has not been serious even where the sprinklers



Low-hanging branches prevent uniform distribution of water.

wet a considerable portion of the foliage.

Up to the present time, the tendency—among users of sprinkler irrigation—has been to apply too little rather than too much water at each irrigation. Many problems dealing with the rate of application and the length of the sprinkling

period remain to be worked out. Experimental results, however, indicate that the growth and fruiting of sprinkled trees are the same as those where surface applications are used, provided the supply of readily available moisture is maintained in the soil containing most roots.

Growth of fruit is a sensitive index of soil-moisture conditions because a decrease in the rate of growth of the fruit coincides with the exhaustion of the readily available soil moisture.

Experiments with Santa Rosa plums and Bartlett pears were carried out in sprinkled and in furrow irrigated orchards. The soil, a Holland sandy loam, with a field capacity of 12% and a permanent wilting percentage of five, was the same in all of the plots. The interval between irrigation was 12 days which was short enough to maintain a supply of readily available moisture. Neither the furrow irrigated nor the sprinkled plots reached the permanent wilting percentage before the fruit was picked.

The results obtained with the Santa Rosa plums on peach root showed that increases in fruit size were essentially equal under both furrow and sprinkler irrigation. The fruits in both plots grew rapidly from about the middle of April until the middle of May when they slowed down slightly during the pit-hardening period, and then resumed rapid growth until picked.

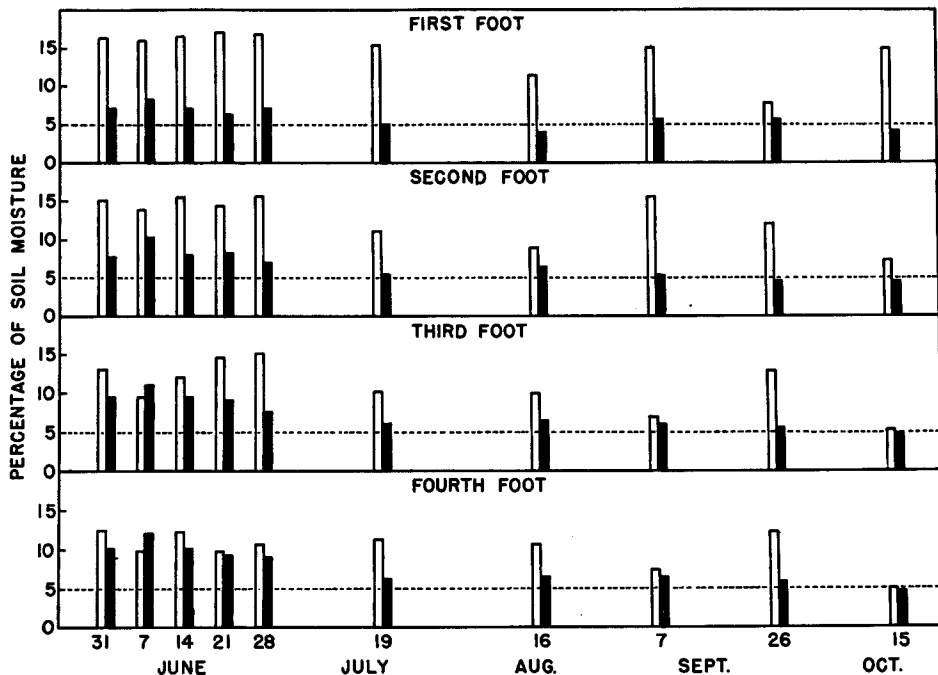
The Bartlett pears in the furrow and sprinkler plots grew at the same rates from late in May until picked shortly after the middle of July.

The results from the tests with the Santa Rosa plums and the Bartlett pears show that the method of applying the water is without effect on the growth of the fruit—provided the soil moisture is not reduced to the permanent wilting percentage during the growing period.

Ideal irrigation practice consists of the maintenance of readily available moisture in the root zone.

The soil moisture record of a mature Duarte plum orchard, on a Holland sandy loam—represented by the bar graph on page 3—shows how this ideal program was approximated in 1951.

The trees were about 15 years old at the time the record was obtained. They are planted on 20-foot triangles and in



Soil moisture contents in a mature Duarte plum orchard, showing an excellent irrigation program. The available soil moisture, shown by the portion of solid bars above the dotted line, representing the wilting percentage—5%—indicate some moisture left from rain and previous irrigations, when water was applied.

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## SPRINKLER

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a healthy vigorous condition with the branches of adjoining trees coming together in many cases. The orchard is in a permanent cover crop, principally grass which is mowed several times a year. The sprinklers are supplied from an underground pipe system and are moved in a regular rotation that provides each tree with a watering every 12 days. The sprinklers are run about 12 hours and apply a little over 3" of water at each setting. The soil holds about 1.25" of available water per foot of depth.

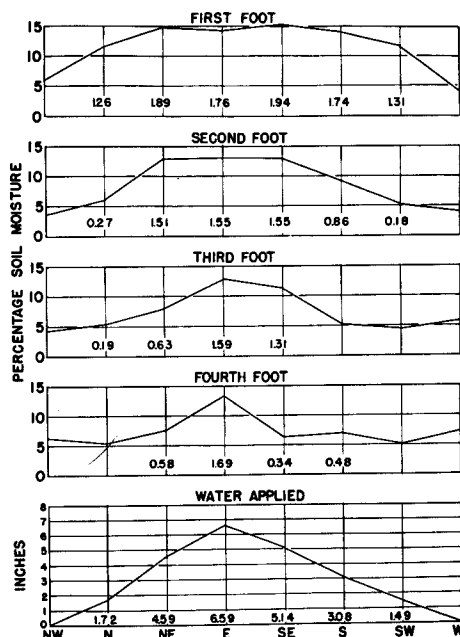
The bar graph shows the percentages of soil moisture around a recently irrigated tree, and one just before the water was applied. The open bar of each pair shows the average soil moisture content a few hours after sprinkling, and the solid bar, the moisture content a few hours before the end of the 12-day interval. The dry tree—solid bar—was brought up to about the same moisture content as the sprinkled one within the next 24 hours.

The length of the solid bar indicates that, in the early part of the season, while there was some moisture left from the winter rains and the previous irrigations, the soil moisture could be maintained above the permanent wilting percentage easily. Later in the season, however, the amounts of water applied were barely adequate to maintain readily available moisture during the 12-day interval. The last irrigation—October 15—wet down only about 2'.

The difference between the amount of moisture found at the end of each 12-day period and the amount applied at the beginning, indicates that the average daily use of a mature plum orchard in permanent cover crop in the foothills of central California is closer to 0.3" per day than to 0.2"—the amount sometimes used.

A study of the distribution of water by sprinkling was made in a pear orchard where many branches hung down and touched the ground. The orchard was left unirrigated for several weeks until the soil moisture was reduced to the permanent wilting percentage—5%—to a depth of 4'. The orchard was then irrigated.

Soil samples were taken to a depth of 4' at eight compass points about 8' from the trunk of a tree with low-hanging branches. The sprinkler position was on the east side of the tree. No water reached the northwest and the west sides of the tree in the top foot of soil. Water penetrated the second foot in four of the sampling places, the third foot in three, and the fourth foot in only one sample. The total amount of water at the eight sampling points is shown in the bottom unit of the diagram on this page.



Distribution of soil moisture from sprinklers in a pear orchard where low branches interfered with uniform delivery.

Observation throughout the orchard showed dry areas behind each tree when the position of the low-hanging branches interfered with the distribution of water. Moving the pipeline to change the relative position of the sprinklers with regard to the trees would change the position of the unsprinkled area, so that the same area would not remain dry all season.

These studies showed that whether irrigation of deciduous orchards is by sprinklers or by surface methods, the growth of the fruit is the same—provided the supply of readily available soil moisture is maintained.

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## LEAFHOPPERS

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yards were killed after 43-hour exposure to DDT-treated leaves. On leaves treated with malathion—dipped in a suspension one fifth as concentrated as the DDT-treated leaves—the leafhoppers from both vineyards were all dead in 24 hours. In this test the cages were cloth covered on opposite sides. This lessened the possibility that malathion killed leafhoppers by fumigant action.

Malathion is a new organic phosphate insecticide of much lower toxicity to humans and animals than most of the other organic phosphates. It is less persistent than DDT—especially in warm weather—and part of its effectiveness appears to result from its fumigant action.

Probably the fumigant effect is less during the cooler weather of spring, so in the pre-bloom dust applications good coverage is most important.

As compounded during the 1952 season, malathion dusts possessed an unpleasant odor which, however, could not be detected in the vineyard the day after treatment. Taste tests conducted with grapes either sprayed or dusted with normal dosages have shown no off-flavors. As presently licensed for use on grapes, malathion may be applied not later than two weeks before harvest.

Although field tests and grower experience during the 1952 season showed malathion to be outstanding for leafhopper control where DDT resistance is present, some questions as to dosage and timing still await solution. Further tests with malathion are planned for 1953.

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## STRAWBERRY

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be high enough to prevent serious infestations of cyclamen mite. In most fields, however, TEPP applications against red spider destroy the predators and early-season or mid-season infestations of cyclamen mite are the natural result. Populations of these predators recover fairly soon from a single early spring treatment but applications of TEPP—where no real red-spider threat exists—are likely to do more harm than good. Three or more repeated applications over an interval of time may so reduce the predator population that it will not reappear in sufficient numbers to regain control of the cyclamen mite until serious loss has resulted.

Pesticide applications to adjoining crops may drift into fields under natural predator control and destroy the predators throughout a wide margin of a field and disrupt an achieved control. This has been observed where dust applications of adjacent crops by airplane were made.

Research is in progress to develop methods of mass-rearing this predator or of harvesting it from clipped strawberry tops, cold-storing them, and distributing them in developing infestations of early-season 2nd-year, or late-season 1st-year fields.

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