soil at various distances beyond small volunteer, non-tilled *Baccharis* plants in 1967 and 1968. This treatment increased the growth, mildew, and rust, almost—but not quite—as much as tillage.

To reduce growth in the absence of weed competition, as well as to produce a gradient of light intensity, plants in tilled and untilled areas were partially covered with white wooden boxes. Mildew on the shaded portions of these tilled plants was more severe than on the unshaded portions of the same plants. In the deep shade, mildew extended to the leaves at the tops of the shoots and apparently killed many leaves, whereas in the full light, mildew usually did not extend to the tip leaves, and even the heavily mildewed lower leaves were usually not killed. To what extent the death of the leaves in shade was due to mildew and to what extent it was due to the shade *per se* could not be decided since the test showed no mildew-free leaves in the shade.

Dosages of ammonium nitrate, sodium phosphate, and potassium chloride of up to 5 grams per plant, were applied to small non-tilled *Baccharis* plants in sod to test the effect of nitrogen, phosphorus and potash on disease development. There was no clear response to these nutrients, and no mildew was observed on any of the fertilized plants.

To produce succulent growth without tillage, large (about 30 lbs) uncultivated plants that had suppressed the adjacent vegetation were cut off near the ground level. Such plants produced a succulent sucker growth with large leaves which became heavily mildewed.

To observe the effect of controlled competition, *Baccharis* plants were set at distances of from 5 to 30 inches between plants in both directions, and kept free of weeds. Growth and mildew increased with space per plant, but even plants with 5-inch spacing had more mildew than wild plants in competition with grass at any spacing observed. After one season, half the plants in the spaced plot were cut off about 1 inch above the soil level. In the next season, the vigorous new growth from these cut-off plants—especially those with the larger spacing—developed large leaves with luxurious mildew, whereas plants allowed to grow for two seasons without being cut back—including those by now large plants with the wide spacing—had relatively small leaves (most of the large leaves of the previous season had dropped), and little mildew.

FUNGI AND INSECTS FOUND MORE ABUNDANT ON TILLED THAN NON-TILLED PLANTS IN CALIFORNIA

Host plant	Pathogen or insect
Coyote brush (Baccharis pilularis) (var. consanguinea)	**Powdery mildew** (Erysiphe cichoracearum)
	Rust (Puccinia evadens) **especially uredinial and tilial stages on leaves**
	Leaf spot (Phyllosticta baccharidis)
	Gall insect (Rhapalomyia baccharis)
	Aphid (Brachycaudus helichrysi)
Buckeye (Aesculus californica)	**Leaf spot and stem canker** (Phoma paviae)
Barley (Hordeum vulgare)	**Powdery mildew** (Erysiphe graminis)
	Leaf rust (Puccinia hordei)
	Scald (Rhynchosporium secalis)
Self heal (Prunella vulgaris)	**Powdery mildew** (Sphaerotheca sp.)
Live oak (Quercus agrifolia)	**Powdery mildew** (Sphaerotheca lanestris)
California poppy (Eschholtzia californica)	**Powdery mildew** (Erysiphe polygoni)
Skunkweed (Navarretia squarrosa)	**Powdery mildew** (Sphaerotheca sp.)
Plantain (Plantago hirtella)	**Leaf spot** (Ramularia sp.)
Hop* (Humulus lupulus)	**Canker** (Fusarium sp. and Phytophthora sp.)

***Hops were not grown with and without tillage. Canker was more abundant on the base of vines from which the lateral shoots were removed, the soil hilled over the fresh wound, and the plants irrigated, than where any one of these normal cultural operations was omitted.**

A fortunate chance observation was made following a fire on July 4, 1968, which burned over an area of Coyote Hills Regional Park (Alameda County) dominated by grass and *Baccharis.* The above-ground parts of both kinds of plants were killed, but the dead stems and many of the leaves of *Baccharis* were left in place. Succulent adventitious water sprouts developed at the base of most of these plants, and by October 5 these water sprouts were heavily mildewed, while mildew could not be found on adjacent *Baccharis* outside the fire area.

Results of the six treatments indicate that tillage, nutrients, shade, or even the elimination of competition, were not in themselves singly responsible for the high mildew infection of *Baccharis* observed in this study. Mildew was favored by tenderness of foliage usually associated with large leaves, and these in turn were favored by tillage, wide spacing of plants, forcing of sucker growth, shade, and probably other cultural operations not yet adequately understood. These results are believed to apply to commercial agriculture, but how closely is uncertain. The disease-favoring effect of tillage may be a major cause of the generally greater incidence of disease in cultivated than in wild plants.

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OBSERVATIONS of water repellency in soils made over the past 10 years throughout the world have indicated that this particular problem is more important than had previously been thought. There have been reports that water repellency in golf greens and lawns is responsible for drought conditions even though the grass has had sufficient watering. This condition of water repellency has often been associated with thatch buildup. Nurserymen have noted that many of the soil mixes they use for potting plants are hard to wet.

"Fairy rings" are often associated with drought conditions. There are many varying explanations of their cause. The most commonly held theory is that the fungal hyphae are water repellent and prevent water from getting to the feeding roots of the grass. The dark green ring around the periphery of the dead grass is probably caused by the fact that water moves from the water repellent center of the ring into the more wettable area.

It has been estimated that between 1/30 to 1/60 of the watersheds in southern California are consumed by wildfire each year. From many surveys it appears that about 60 per cent of this burn area is water repellent. During rain storms —even mild storms of low intensity—these areas are more subject to increased runoff and erosion. To reduce the damage to the watershed it has been necessary to find a method which modifies the water repellency of the soil. One such method is through the use of a broad classification of organic chemicals described as "surfactants" or "wetting agents."

The application of wetting agents to water repellent soils allows water to enter into the profile at a faster rate than in the soils not treated. This technique was demonstrated during an experiment in cooperation with the staff of the Pacific Southwest Forest and Range Experiment Station, U.S. Forest Service, near Glendora, Los Angeles County. A water repellent soil, which had previously been burned by a wildfire, was treated with a solution of one part wetting agent to 3,000 parts water. A measurement of runoff and erosion caused by each storm and tabulation of the results at the end of the rainy season revealed that erosion was reduced by 90 per cent, runoff was reduced 30 per cent, and there was a four-fold increase in vegetation on the plots treated with wetting agent.

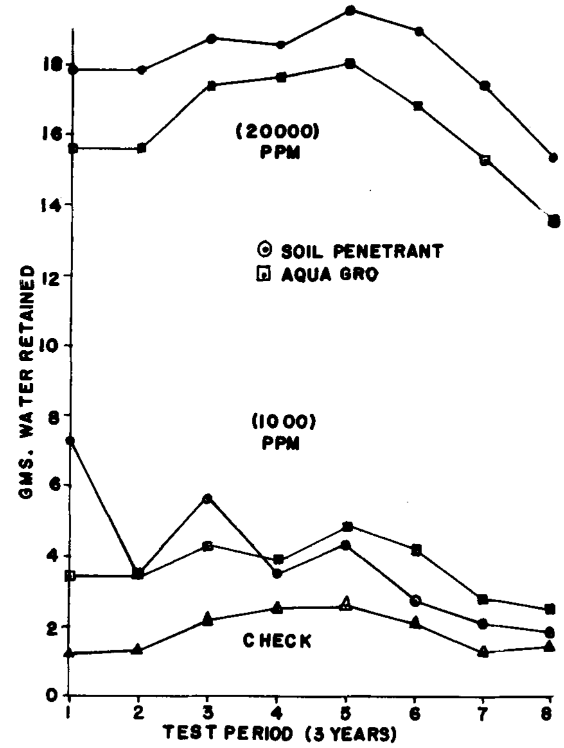
Many uses for wetting agents are being found in agriculture and therefore further investigation of their various effects

SURFACTANT LONGEVITY

and wetting characteristics

J. F. OSBORN · J. LETEY
N. VALORAS

GRAPH 1. RESIDUAL WETTING ABILITY OF TWO WETTING AGENTS AT TWO CONCENTRATIONS OVER A THREE YEAR PERIOD.



is required. They have been used to help spread insecticides and fungicides, and many soil amendments have been treated with wetting agents by the manufacturers to overcome any water repellent conditions.

Several important questions remain to be answered before any general applications of wetting agents can be recommended. Health and safety must be considered along with economic factors. The prime interest of this study was to determine the wetting efficiency and long-term residual effects of the various wetting agents used.

Water repellent peat pots were treated with various wetting agents and dilutions by pouring 50 ml of the test solution into the pot. After 15 seconds, the solution was poured out and the pots were weighed. The increase in weight was used as an index of wetting. More water was retained by those pots which were wet as compared with the water repellent pots.

SURFACTANTS USED

Trade name	Chemical name	Concentration
	NONIONICS	
Soil Penetrant	alkyl polyoxethylene ethonal	100%
Peercol	———	—
Aqua Gro	polyoxyethylene esters of cyclic acid	50%
	polyoxyethylene ether of alkylated phenols	50%
Water In	alkyl polyethylene glycol ether	25%
Morgans Thin Water	polyoxyethylene esters of dialkyl phenols	49%
	IONICS	
Petro Ag Special	alkyl naphthalene sodium sulfonate	98%
Petro S	complex sulfonated mono-dimethyl naphthalene	98%

Pot treatments

All pot treatments were triplicated and water was used as a standard treatment. The pots were allowed to air-dry between test periods. The technique described previously was used in each test period, except water was used on all pots for test after the initial treatment. There were eight test periods covering three years. The seventh test was at the end of the second year and the last was at the end of the third year. The pots were periodically leached with water. A total of 1,300 ml were used to leach each pot. This volume of water was approximately 40 times the solid volume of the pot.

The surfactants used, including the trade names, chemical names, and effective concentrations are listed in the table. In general, the nonionics are divided into ether and ester groups. Soil Penetrant, Water In, and possibly Peercol are ether types. Morgans Thin Water is an ester type. Although Aqua Gro is listed as 50 per cent ether, 50 per cent ester, it was placed in the ester group. Only anionics were tested in the ionic classification. Fire Guard was not included in the table because of its unknown chemistry but it is thought to belong in the ionics group.

Graph 1 shows a sample of the behavior of the two nonionic types. The ether type, represented by Soil Penetrant, had initially better wetting than the ester wetting agent represented by Aqua Gro. The residual efficiency was not as good for the ether group and generally fell below the residual efficiency of the ester group at the end of the three-year period. However, at high concentrations, above 8,000 ppm, the ether performed better throughout the test period. This high concentration would not be considered for actual application because of the possibility of phytotoxic effects. The behavior pattern indicates that the ether groups have better wetting characteristics but offer less residual efficiency. The esters, however, are more tightly adsorbed and are less likely to be leached out over a period of time.

Wetting efficiency

The initial and final wetting efficiency for the wetting agents tested are presented in graphs 2 and 3. Various concentrations were tested for the percentage by which they were more or less efficient than water. The hollow bar represents the first test and the dark bar the last test at the end of the three years. All the wetting agents used were shown to be better than water alone by the end of the three-year period. It appears that the major loss in wetting ability over the three-year period was due to leaching.

When choosing wetting agents, it is

important to know whether initial wetting is sufficient, or if a long-term residual effect is needed. In general, if initial wetting is required to prevent erosion and increase infiltration, the most efficient nonionic would be one of the ether group. If long-term efficiency is required, the ester group would be better. There are many requirements between these limits and the selection of the wetting agent will depend on which is the most important.

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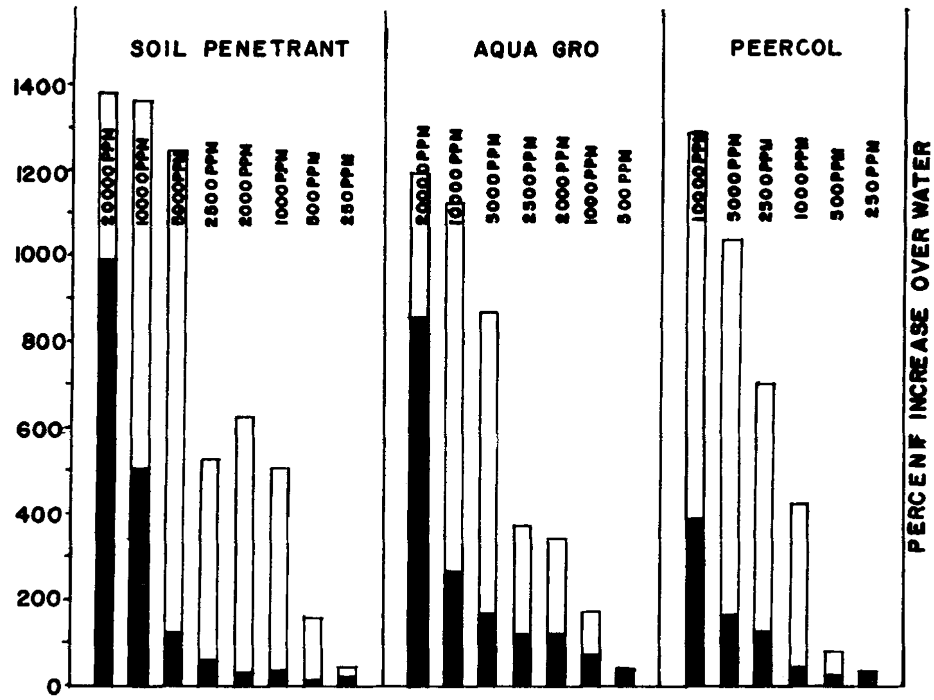
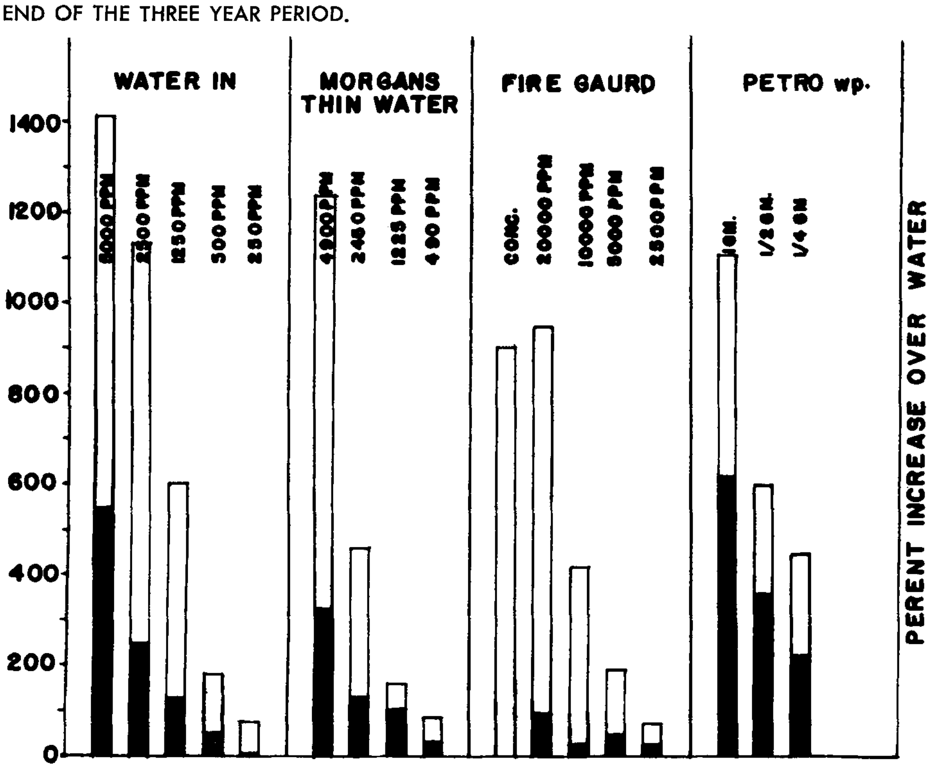
GRAPH 2. WETTING EFFICIENCY OF VARIOUS WETTING AGENTS. HOLLOW BAR REPRESENTS THE EFFICIENCY FOR FIRST TEST PERIOD. SOLID BAR REPRESENTS THE EFFICIENCY AT THE END OF THE THREE YEAR PERIOD.



GRAPH. 3. WETTING EFFICIENCY OF VARIOUS WETTING AGENTS. HOLLOW BAR REPRESENTS THE EFFICIENCY FOR FIRST TEST PERIOD. SOLID BAR REPRESENTS THE EFFICIENCY AT THE END OF THE THREE YEAR PERIOD.



Effects o

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Trunk growth studies of almonds at Davis have given new information about the need for spring irrigation. A lever-type dendrometer developed at the University of Idaho was used to follow trunk growth patterns for four consecutive years under widely varying conditions of soil, water, and crop density. The study has shown that the need for early irrigation increases when there is a heavy crop. In the spring, trunk growth rates were increased by irrigation even when as much as 40 per cent available water still remained in the top 4 ft of soil. After mid-season, trunk growth rates were not increased by irrigation unless the soil water content had dropped to the plant wilting percentage before irrigation. These studies also showed that trunk growth rates were reduced as the crop density increased.

THIS IRRIGATION study began in the spring of 1963 and was conducted for four seasons in a 20-year-old almond orchard at University of California, at Davis. Lever-type dendrometers were installed, one instrument per tree, in four differentially irrigated rows. End trees were not instrumented, leaving eight instrumented trees per row. Two guard rows separated the irrigation treatments.

Dendrometers always show maximum trunk expansion attained since the last