Dissolving gypsum in irrigation water using a trough filled with rock gypsum in tests at Fresno State College vineyard.

Improving IRRIGATION PENETRATION VINEYARDS

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Irrigation water infiltration tests were conducted on two typical, slowly permeable vineyard soils on the east side of Fresno County. Furrow water intake was increased by soil applications of gypsum and sulfur and by adding dissolved gypsum in the irrigation water. These soil treatments were only of temporary benefit and gave no improvement in late summer. However, a grass culture or sod treatment, once well established, improved water intake during midsummer and late-summer irrigations.

FURROW WATER INFILTRATION RATES IN VINEYARD STUDY
(Averages of four replications)

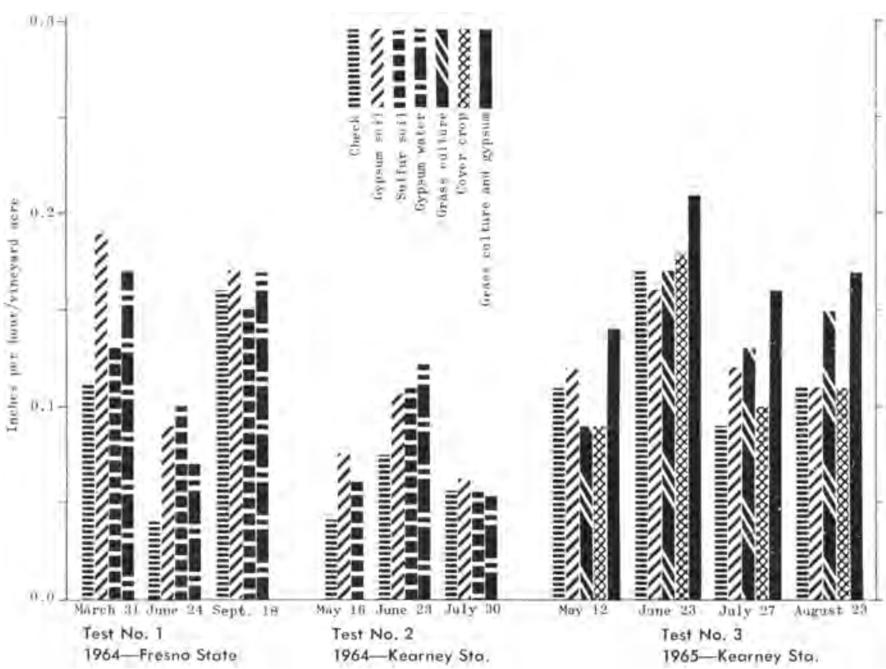

TABLE 1. ANALYSIS OF SOILS IN EXPERIMENT
(0- to 6-inch depth)

	pH	E.C. x 10^3	Saturation extract Sodium	Cation total	Sodium
			m.e./liter	m.e./liter	%
Fresno	7.2	0.63	1.52	6.36	24
Kearney	6.9	0.47	1.33	4.88	27

TABLE 2. ANALYSIS OF WELL WATERS

	E C. x 10^3	Bicarbonate	Sodium	Cation total	Sodium
		m.e./liter	m.e./liter	m.e./liter	%
Fresno	0.41	3.45	0.82	4.44	19
Kearney	0.21	1.49	0.54	1.94	28

TABLE 3. ANALYSIS OF WATER SAMPLES TAKEN AT GYPSUM TROUGH OUTLETS
(average of four replications)

	Dissolved calcium
Fresno	m.e./liter
March 31	3.25
June 24	1.74
Sept. 18	2.60
Kearney	
June 23	1.46
July 30	0.68

WATER

IN

POOR WATER INTAKE is one of the most serious irrigation management problems in Fresno County's east-side vineyards. If the problem is not overcome, dry subsoils may develop by midsummer to late summer, and show typical water-stress symptoms of leaf burn as well as premature leaf fall.

The problem exists most commonly in the soils customarily described as "white-ash soils" (Ripperdan, Dinuba, and Hanford soil series) and "red hardpan soils" (San Joaquin, Madera, and Ramona soil series). Soil-surface sealing, because of poor soil structure, appears to add to the well-known compaction problems in these soils.

Vineyardists employ various measures to help overcome this condition, including winter covercropping, grass culture in furrows, undervine irrigation, and the practices of subsoiling, cultivating between irrigations, and flattening irrigation runs. Some vineyardists have also reported promising results from use of gypsum and soil sulfur.

The benefits of using gypsum and sulfur in reclaiming alkali soils are well known. However, field data on the effects of these amendments to the near-neutral pH (non-alkali or low sodium) east-side soils are still quite limited. The soils in Fresno County are irrigated with San Joaquin River and Kings River canal water and/or well water—generally low in total salts and sodium, and containing some bicarbonate. Such characteristics of water may contribute to poor water intake problems, depending upon analysis.

Two vineyard trials were conducted in 1964 and one in 1965 to evaluate various water- or soil-amendment and management practices on representative, slowly permeable soils. Only the amendments were evaluated the first year, but the second-year study involved soil-management practices as well.

1964 soil amendment tests

Identically designed trials were established on two different soil series. One was established on a San Joaquin sandy loam soil in the Fresno State College vineyard. The other was in a vineyard on a Dinuba fine sandy loam soil at the University of California Kearney Horticultural Field Station near Reedley. Three water- and- soil-amendment treatments in addition to a check were evaluated. Each treatment was replicated four times. Treatments included mid-February applications of gypsum (97% pure) at 2700 lbs per vineyard acre and soil sulfur (99½% pure) at 500 lbs, confined to a 5-ft-wide strip between the vine rows.

In another treatment, gypsum was dissolved in the irrigation water during each irrigation. This was accomplished by running the water for each furrow through a wooden trough 96 × 8 × 6 inches deep, filled with rock gypsum broken to walnut size.

Both vineyards were irrigated with well water, using two wide, flat furrows down the rows. A permanent furrow system was established at Fresno State after the first irrigation. Annual grasses had become well established in the furrows by July and were mowed as necessary. At Kearney, cultivation between each irrigation was practiced except for the second measurement.

Water infiltration rates in furrows were measured during three irrigations for each trial. Measurements were made by setting tube-orifice plates at the top and bottom of a 300-ft irrigation run. The head loss at each plate was measured with an electric-point gauge developed by B. L. Grover, formerly at U. C., Riverside. The difference in rate of water flow between the two plates was then calculated as infiltration rate (in inches per hour) into furrow surfaces.

The analysis of the trial soils in table 1 indicates neutral pH values and lack of an alkali (high sodium) problem. Both irrigation waters (table 2) were low in salts and sodium and had moderate bicarbonate levels, especially at Fresno State College. The analysis of irrigation waters

Measuring furrow flow with orifice plate and electric point gauge at Kearney Field Station during studies of water penetration in vineyards.

before and after gypsum addition shows considerable variation in the dissolving rate of gypsum. This was more of a problem at Kearney where the gypsum had not been so well crushed into smaller sizes.

All three water- or soil-amendment treatments gave temporary improvement in furrow water intake rates. At Fresno State College this improvement was noted in both the March and June measurements (see graph, test 1). However, by Sept. 18, the gypsum and sulfur treatments no longer showed benefits. Results from the sulfur treatment showed considerable improvement in the June measurement. The delay may be explained by a lag in microbial change of the sulfur to the soluble sulfate form.

Somewhat similar responses to gypsum and soil sulfur were shown in the Kearney measurements (graph, test 2). However, it is not known whether the gypsum-in-water treatment could have been of benefit during the last irrigation had more gypsum been dissolved. The temporary-only benefit of soil applications might be explained by the eventual leaching, or loss of much of the soil amendment, from the soil surface through a succession of irrigations.

1965 tests

Only the Kearney station vineyard was used in 1965. Several cultural practices commonly used to improve water infiltration were compared along with gypsum treatments in this test.

The five treatments included gypsum soil application, grass culture, grass culture plus gypsum, Merced rye winter covercrop, and a check. The grass-culture treatment consisted of annual rye grass planted in the furrow bottoms on March 2 and mowed as needed thereafter. The rye winter covercrop treatment was planted in November 1964 and disked-under March 18, 1965.

Results of this trial (see graph, test 3) also showed benefits from the gypsum applied earlier in the summer. The reverse was true of the grass, which gave benefit only later in the summer. The combination treatment was the best throughout the season.

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F. W. ZINK

Coated ... aids

SIX TO SEVEN THOUSAND acres of direct-seeded celery are grown each year in the central coastal districts of California. Thinning celery requires approximately 50 man-hours per acre—roughly 40% of the labor necessary to produce a crop. Increasing labor costs and uncertainties concerning quality and supply of labor have prompted growers to look for methods to reduce the time required for thinning. Coated seed appears to possess many attributes which warrant evaluation in mechanized celery production.

The irregularly shaped and extremely small celery seeds (approximately 70,000 seeds per ounce) can be covered with a coating of finely divided Bentonite clay and built up into pellets containing a single seed each. Coating the seed permits the use of precision planting equipment, which results in a more even distribution of seeds and in a reduction of the number of seeds required to plant a given area than is the case with usual planting methods.

Two coatings

The two degrees of coating studied (as illustrated) included: minimum coating (B), seed coated to a somewhat irregular shape 4/64 to 5/64 inch in diameter, increasing the weight about 10 times; and spherical coating (C), seeds coated into a spherical shape 6/64 to 7/64 inch in diameter, increasing the weight nearly 40 times.

Tests were made to determine whether the coating process lowers the capacity of the seeds to germinate. In these tests, the coating was removed by placing the seeds on a sieve and washing away the coating with a stream of water. Both coated and noncoated seeds were germinated on moist filter paper in petri dishes at temperatures fluctuating between 60° and 70°F. The results indicated that the coating process had no harmful effect upon the seeds—and that the significant depression in germination of the spherical-coated seed (table 1) could be attributed to the presence of the clay coating itself.

Emergence

To determine the effect of seed coating on rate and percentage of emergence, a greenhouse planting was made in soil that had been pasteurized to eliminate soil insects and pathogenic fungi. The seeds were planted ½ inch deep and ½ inch apart in the row. Daily soil temperatures at the seeding depth fluctuated between 58° and 72°F. The percentage of emergence of spherical-coated seeds was significantly lower than that of either noncoated or minimum-coated seeds. No significant difference was found in percentage of emergence between noncoated and minimum-coated seeds. Rate of emergence (graph A), here given as the mean emergence period, was adversely affected by the two coating treatments. The mean emergence periods were 18.7 days for noncoated, 21.8 days for minimum-coated, and 22.3 days for spherical-coated seeds.

Three emergence tests, one each in April, May, and June, were conducted in

Celery seed appearance in tests: A, noncoated; B, minimum-coated; and C, spherical-coated.