COMPREHENSIVE PROJECT REPORT
1990-91

Project No. 90-N3: Prediction of Successful Amelioration of Water Infiltration Problems in Almond Orchards

Project Leader: Terry L. Prichard, Water Management Specialist
University of California
420 S. Wilson Way, Stockton, California 95205
(209) 468-2085

Cooperating Personnel: Wesley Asai, Farm Advisor, Stanislaus County

Objectives: (1) Evaluate a number of soil series in which almonds are grown as to their tendency to crust and impede water infiltration. (2) Develop guidelines as to the likelihood of success when using cover crops in ameliorating the effects of crusting in various soil types.

Interpretive Summary:

During FY 1988-89, Almond Board Project No. 88-N1 evaluated water infiltration characteristics of a soil under several orchard floor vegetation management systems. Significant differences in water infiltration characteristics were found between orchard floor management systems. In general, the cover crop treatments (resident vegetation, clover and brome) were significantly higher in both infiltrated volume after 120 minutes and steady state infiltration than in the chemical mowing and residual herbicide treatments. Twice the water volume was infiltrated over a 120-minute irrigation period in the brome versus the residual chemical treatments.

In order to evaluate the effects of treatments in early season, subsequent measurements were taken in late May and compared to those made in late season. Results indicate water infiltration characteristics are: (1) not significantly different between treatments in early season, and (2) cover treatments preserve water infiltration late season while residual chemical and chemical mowing result in reduced cumulative and steady state infiltration rates.

This study was conducted in a Hanford sandy loam soil. Through research and experience, Hanford soils are known to exhibit a crusting of the surface, impeding water infiltration. The cover crops seem to ameliorate the water infiltration problems caused by crusting. Some of the probable causes of crusting are reportedly due to impact of rain and sprinkler drops, low electrolyte/high sodium irrigation waters, swelling and dispersion of soil colloids, soil particle orientation, and compaction from farm machinery and cultural practices. Soil surface crusting has been reported in coarse as well as fine textured soils.

Since soils vary in their native ability to resist crusting, some are more likely to suffer crusting than others. It is, therefore, important to link the success of enhancing water infiltration by cover crops in a soil that is prone to crusting to the probability of success in other soil types.

To accomplish the objectives of this study, a testing procedure was developed to evaluate the water infiltration characteristics of soils under the following conditions.

1. native soil, undisturbed surface
2. disturbed surface (raked to 2" depth)
3. disturbed surface recrusted with high energy water droplets

Comparison of the results of these treatments on soils series common to almond production indicate:

1. Disturbed soil is effective in removing any pre-existing soil crust which would limit infiltration.

2. The infiltrometer does not form a depositional crust impeding infiltration to the degree requiring the use of anti-crusting polymers.

3. The methodology to determine a crusting index for soils seems valid. This is determined by the ratio of accumulated infiltration after 120 minutes for disturbed versus crusted.

4. It was apparent that marked differences in clay mineralogy and aggregate binding agents exist which may be directly related to the crusting ratio of soils (Table 2 + Table 3).

Work is continuing to determine the mechanism and relative quantity effects responsible for infiltration reduction. Once determined, appropriate remedial amendments will be applied and evaluated on these soils.

Table 1.
Ratio of disturbed to crusted infiltrated water volumes.

Soil Series	Crusting Ratio
Hanford sandy loam	1.37
Wyman clay loam	1.13
Delhi loamy fine sand	1.30
Wyo clay loam	1.43
Vina clay loam	1.10
San Joaquin loam	1.47
Archerdale clay loam	1.15
Denverton clay loam	1.31

Table 2.
Particle size analysis and clay mineralogy of three sites at 0 - 6 in. soil depth

	Particle Size Analysis			Clay Mineralogy			
Site	% Sand	% Silt	% Clay	Mica	Vermiculite	Kaolin	Smectite
Merced	76.8	12.8	10.4	++++	+++	++	+
Ceres	76.8	17.2	6.0	++++	+++	++	+
Linden	35.0	41.8	23.2	+		+	+

+	=	trace
++	=	minor
+++	=	moderate
++++	=	major

Table 3.
Soil analysis of 0 - 1 in. soil depth of three sites

						Amorphous	
Site	Soil Type	Aggregate Stability %	pH 1:1	Organic Matter %	Organic Carbon %	Fe %	Al %
Merced	Delhi	24.7	7.88	1.99	1.16	0.26	0.05
Ceres	Hanford	76.1	8.08	3.34	1.94	0.16	0.04
Linden	Wyman	14.3	7.53	4.85	2.82	0.60	0.14