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AMELIORATION OF ROOT ROT HAZARDS IN GRANITIC SOILS

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An unusual project of soil improvement has recently been completed on a proposed 40-acre planting of avocados on granitic upland soils of the Fallbrook-Vista-Bonsall Association in northern San Diego County. This project provided an opportunity to observe the morphology and distribution of these soils more precisely and in much greater detail than previously possible. This paper is a brief report on the conduct of this work, and its relation to the root rot hazards in these soils.

A preliminary survey indicated that about 3.2 acres of this proposed planting was on soils of the Bonsall series, which are considered to have a high root rot hazard (Soils and root rot hazard are identified in accordance with the Soil Survey of San Diego County, recently published by U.S. Department of Agriculture. (2) The Bonsall soils were identified as Merriam in earlier surveys of this county). These soils have brown, friable, slightly acid sandy loam surface soils, and gray, strong prismatic, mildly alkaline clay subsoils, which are relatively high in exchangeable sodium. The surrounding Fallbrook soils have similar brown, friable, slightly acid surface soils, and reddish brown, moderate prismatic, slightly acid clay loam subsoils. A weak silica-cemented duripan or hardpan was found in the weathered granite underlying the Bonsall soils, and surrounding areas of the Fallbrook soils. These duripans are commonly very difficult to identify in these granitic soils, because they occur largely within the fabric of weathered rock, and differ only slightly in composition and hardness from this material.

In order to eliminate critical barriers to downward water movement, it was decided to completely remove the clay subsoils of the Bonsall soils, and to fracture the hardpans underlying the Bonsall and Fallbrook soils. After an initial discing, to remove the cover crop, additional soil borings were made, and the approximate boundaries of the Bonsall soils were identified and staked. The surface soil was then removed from the staked areas, and stockpiled to one side. This provided an opportunity to observe the precise limits of their clay subsoils, and establish their relationship to the surrounding soils.

These clay subsoils were then ripped and excavated, using a D-8 Caterpillar ripper-dozer and two large LeTourneau scrapers. This material was used as fill in a large barranca which bisected the proposed planting. A combination storm and subsurface tile drain was installed to remove surface and subsurface waters that might collect in the fill material in this barranca. The surface soil was then replaced in areas from which it had been removed, and the entire area ripped and cross-ripped to a depth of approximately 60 inches.

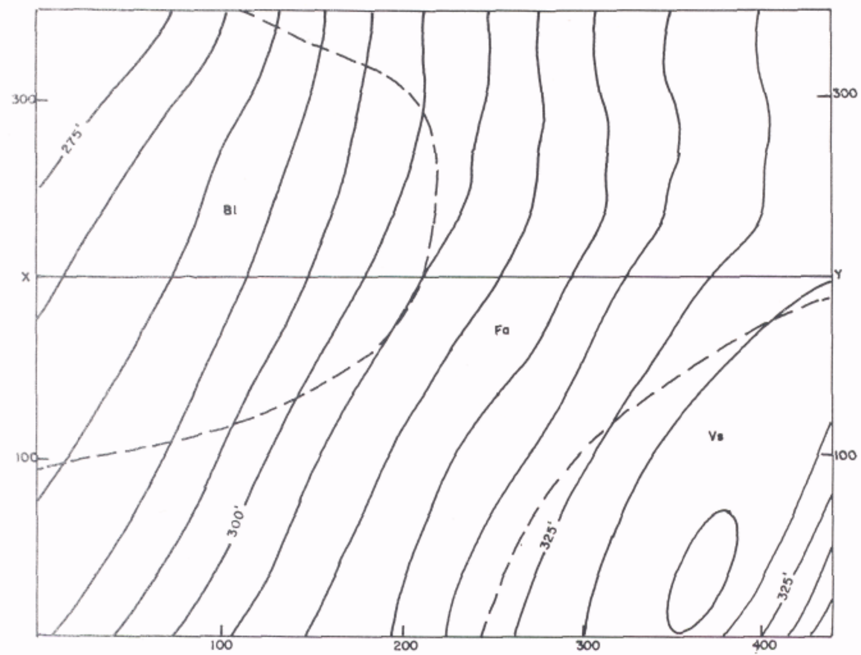

Figure 1. Topographic map of a portion of the project, showing a typical body of Bonsall soils in the upper left. Scale 1 inch=50 feet. Contour interval—5 feet. Soil boundaries shown as dashed lines. Soil symbols—Bl, Bonsall sandy loam—Fa, Fallbrook sandy loam—Vs, Vista coarse sandy loam.

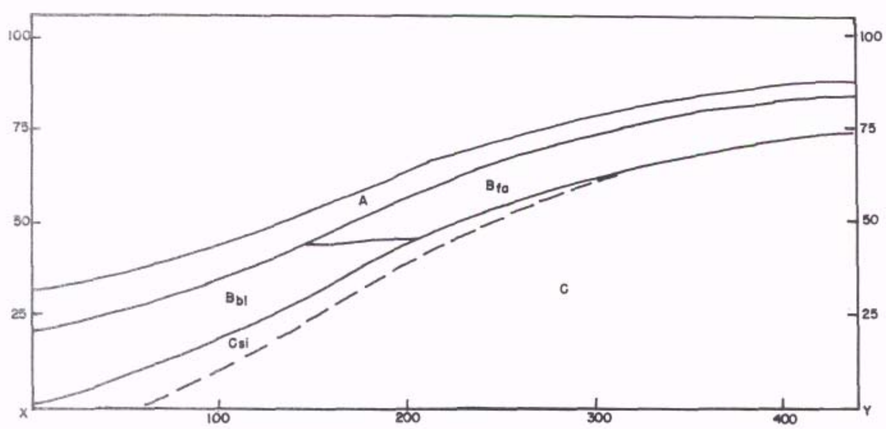

Figure 2. Diagrammatic representation of soil horizons along line X-Y, Figure 1. A—Surface soil, Bbl subsoil, Bonsall sandy loam, Bfa—subsoil, Fallbrook sandy loam, Csi—hardpan (weak duripan), C—weathered granite.

While the cost of this earthmoving and ripping probably exceeded the cost of equivalent land suitable for avocados, it was considered an economic investment because it eliminated areas of high root rot hazard, and made it possible to plant the entire project area on a uniform, rectangular pattern. Experience has shown that root rot is nearly always initiated at sites in Bonsall soils, or along the contact between the Bonsall and Fallbrook soils. This appears to be due to water which moves down slope above the duripan in the Fallbrook soils, and which is forced toward the surface where it encounters the clay subsoil of the Bonsall soils. This appears to be typical of many of the upland soils on which avocados are planted in Southern California. Similar relationships have been observed in soils of the Carlsbad-Chesterton, Las Posas-Wyman, and Friant-Escondido Associations, where duripans occur in underlying material.

Since conditions affecting water movement along the Fallbrook-Bonsall boundary were drastically altered, it is considered that the probability of the initiation of root rot at these sites was correspondingly diminished. Removal of the high sodium clay horizon from the Bonsall soils also seems likely to diminish the hazard of root rot. Sodium injury to avocado roots appears to be one of the major contributing factors to the occurrence of root rot in these soils.

Figure 3. Tractor ripping subsoil of Bonsall sandy loam, after removal of topsoil, approximately along Line X-Y, Figure 1, preparatory to removal by scrapers. Stockpiled topsoil in foreground and beyond the ripped area.

LITERATURE CITED

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2. BOWMAN, R. H. 1973. Soil survey of the San Diego Area, California. U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Washington, D.C.