

vineyard from irrigated lands up the slope.

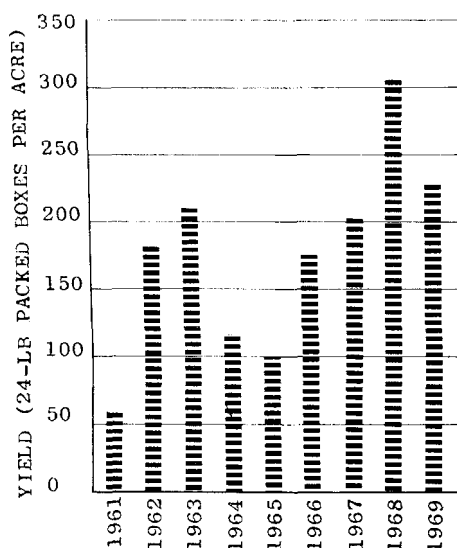
After salinity levels were reduced, and normal irrigation was resumed, vine condition slowly improved and it became possible to get replants to grow in those areas where the vines had died. The leaves no longer burn in the autumn, and in most areas there is no premature abscission of leaves (table 3). The yields have surpassed those achieved before the salt damage occurred (see graph).

Summary

In summary, the procedures believed to have brought about reclamation of this vineyard are: (1) leaching of salts by reducing the irrigation slope, flooding the water over the root zone and holding it there until the salts were washed below the root zone or into the tile lines; (2) switching from high salinity Colorado River water to well water of much better quality; (3) eliminating a leaky reservoir which contributed to the drainage problem; (4) achieving greater irrigation efficiency by avoiding night irrigation and applying the water more rapidly; and (5) reducing the frequency of irrigation during the growing season—but adding a very heavy leaching irrigation in the fall when vineyard traffic was at a minimum.

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YIELD HISTORY, THOMPSON SEEDLESS DRAINAGE TEST VINEYARD
(Planted in 1959)



DEAN D. HALSEY

Construction and OBSERVATION is critical in TILE DRAIN

AUGER HOLES (over the top of the drain) have been used to study the apparent failure of tile lines to drain soil properly in the Coachella Valley. Two disadvantages of this system include: (1) surface water, soil, and animals can fall into them. Therefore the auger holes can be relied upon only immediately after they are drilled; and (2) as the water table rises, mud can flow into the hole which then must be cleaned before measuring while the water table is falling.

Black iron pipes have also been used for piezometers. These have been jetted or driven into the desired location. The pipes effectively prevent water or debris from falling in from the surface, but they do not stop the flow of mud from beneath, and they are more difficult to clean than auger holes in some locations.

Fiberglass

Recently, 1-inch plastic pipe wrapped with fiberglass was used. The fiberglass is about 1/2-inch thick and has a moisture-resistant binder which meets the specifications of the Agricultural Conservation Program for use as a filter around drain lines. In some cases perforations have been made in the sides of the pipe. In others only the hole in the end is left open. The fiberglass wrapping effectively prevents the flow of mud into the pipe while allowing for free flow of water in and out of the well. Some of these have been in use for a number of years without failure.

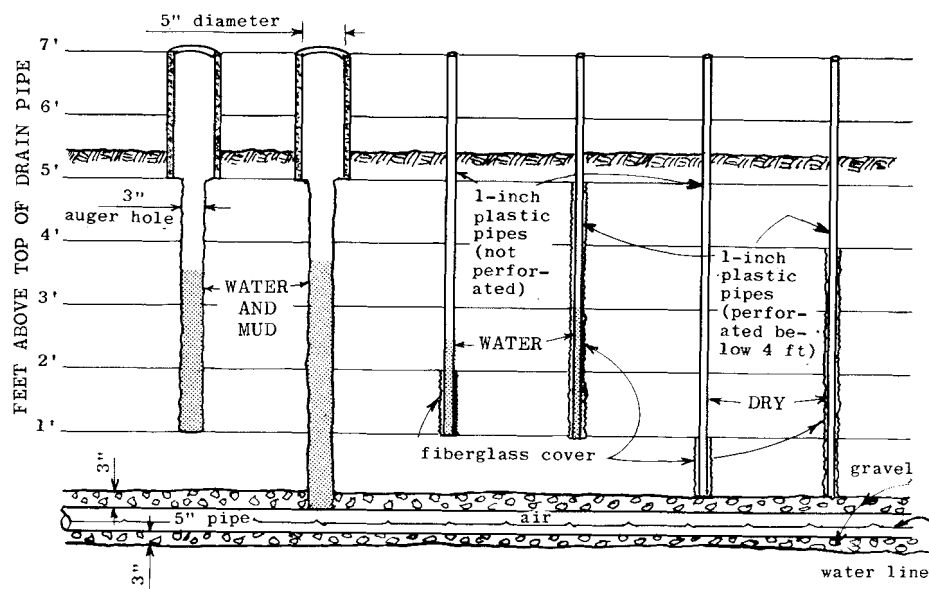
Studies reported in the accompanying article of possible causes of poor drainage (despite tile line installations), have also shown that great care must be taken in the construction and location of observation wells used to measure the water table. Open auger holes may be useful to the farmer in determining the water table at one specific time, but are not satisfactory for repeated measurements, especially in unstable soil. Perforated and wrapped plastic wells are desirable for this purpose. For determining the causes of drain failure, however, a wrapped piezometer is recommended because pressures must be determined at specific points. This article discusses the proper construction and placement of observation wells.

In some cases, however, there have been substantial differences in apparent water table readings from wells in close proximity and presumably sampling similar conditions. To determine the cause of such variation, six different types of wells were installed over each of two adjacent tile lines at a vineyard location where troubling differences had been observed. The tile lines at this location produced very little water while the water table was often near the ground surface during, and for some time after, a heavy irrigation. The soil was classified as Indio very fine sandy loam in the surface

placement of WELLS evaluation of LINES

DIAGRAM OF VARIABLE WATER TABLE READING RESULTING FROM DIFFERENT METHODS OF OBSERVATION

(Each reading is the mean of two identical wells over adjacent tile lines)



8-inch layer of soil, which was underlain by a stratified silt loam to below tile line depth.

The vineyard was flood-irrigated by using an earth levee in each row middle to confine the water. Since the tile line was also in the middle, the levee covered the trench containing the tile so that no irrigation water was applied directly over the ditch and tile. The soil in the trench had been fairly well mixed—at least to the extent of breaking up soil layers which may have existed prior to disturbance.

Six types

The six different types of wells were spaced 2 ft apart on a line about 10 ft long, precisely over the top of the drains. The first well was an unlined hole, made with a three-inch soil auger and extending to a point 1 ft above the drain top. The next was a similar hole but reaching to the top of the drain. Both of these were cased at the top with a 2-ft length of 5-inch concrete pipe to prevent any surface water or debris from falling into the well.

The other four wells were all constructed with 1-inch plastic pipe. They differed with respect to the depth of installation and perforations. All four wells were open ended. However, two of the pipes were perforated with a $\frac{1}{4}$ -inch drill every 6 inches to a height of 4 ft above the lower end of the pipe. The other two pipes were not perforated. All perforations, and the open pipe ends,

were wrapped with fiberglass about 1 inch thick before compacting. One perforated, and one unperforated well extended to, and rested upon, the top of the drain while the other two extended to a depth one foot above the drain. Each was installed in a 3-inch auger hole. The backfill was packed carefully against the pipe, or against the fiberglass matting material.

All wells were installed in February, two months after the last irrigation. The soil was wet when the installation was made, but there was no water in any of the holes—indicating that the trench in which the tile had been laid was drained to the tile line level at that time. The grower then irrigated heavily with about 6 acre-inches of water per acre. The slow infiltration rate caused water to stand on the surface for about a week (the diagram shows the average water table as measured in the different wells at maximum height the day following completion of the water application).

The results of the tests showed that the depth of well installation, and the method of its construction, are important factors in determining the water level within. The auger holes, whether extending to the gravel or not, both filled with water and mud and showed a water table close to the soil surface. The wrapped plastic pipes also showed a high water table if the lower end did not extend into the gravel around the drain. Wrapped plastic pipes extending into the gravel remained

dry. Under these conditions the perforations did not seem to have much effect on the readings.

Pressures

Results show that substantial differences in pressure exist within a few inches in the area of these drains. In this unstable soil, auger holes tended to reflect the area of highest pressure intersected since the mud flowed in and prevented drainage of the hole even when it was drilled into the gravel around the drain. This may lead to the unreliable conclusion that the drain was blocked or overloaded. Perforated and wrapped-pipe wells tend to reflect the area of lowest pressure they intersect since water can drain in and out freely. An unperforated well, wrapped only at the open end and with the backfill well-compacted around it, should indicate the pressure only at the open end of the pipe—and is therefore useful in studying pressure differences around the drain. A typical installation might include a piezometer ending within the drain, another outside the drain in the gravel envelope, a third in the backfill within the trench, and another outside the trench. Strata of soil differing markedly with respect to texture or permeability may also affect the performance of the drain and are therefore worth studying with the piezometer.

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