

sively high following potatoes, and lowest following barley.

Tillage practices had little effect on yield or grain protein percentage of Hannchen barley. The results of a three-year study, in a cooperative project with the U.S. Fish and Wildlife Service, involving 4-acre, replicated plots comparing disking, plowing, and chiseling are summarized in table 4. Following the basic spring disking or plowing or chiseling, all plots were similarly fertilized, harrowed, and then drill-seeded.

Although not statistically significant, there was a small but consistent yield advantage for cultipacking following seeding. This was especially true in the case of the plowed or chiseled plots. There was considerably less plant injury from frost at stand establishment time in the cultipacked, as compared to the non-cultipacked plots.

In these trials, four different seeding rates were superimposed on the disked treatment. Yield was not affected within the range of seeding rates used in the experiment (table 5). However, excessive weed and wild oat growth was evident at the lower rates (32 lbs and 52 lbs per acre)—and consequently, these rates are not recommended for commercial practices.

Although final yield was not affected by any of the rates used, varying the seeding rate had a significant effect on individual yield components. Despite increased tillering at the lower rates (6.9 versus 3.3 tillers per plant at the 32-lb and 127-lb rates per acre, respectively), the number of tillers per unit area was smallest at the lightest rate, and greatest at the highest rate. The increase in tiller number was offset by fewer kernels per head and significantly lighter kernels at the higher rates. It appears that excessive seeding rates, resulting in smaller kernels, can have a deleterious effect on quality, as measured by lower test weight and greater clean out. Lodging was highest at the higher seeding rates.

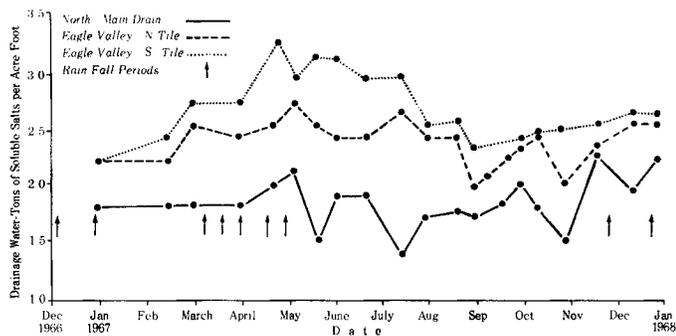
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Cooperation in the malting quality determinations was received from USDA Barley and Malt Laboratory, Madison, Wisconsin; Joseph Schlitz Brewing Co., Milwaukee, Wisconsin; Great Western Malting Co., Vancouver, Washington; and Newell Grain Growers Association, Tulelake, California.

SOLUBLE SALTS

in drainage waters and soils of recent citrus plantings in southern California

TONS OF SALT PER ACRE-FOOT OF EAGLE VALLEY DRAINAGE WATERS AT SAMPLING PERIODS DECEMBER 29, 1966, TO DECEMBER 27, 1967—AND RAINFALL PERIODS IN RELATION TO SALT.



R. B. HARDING

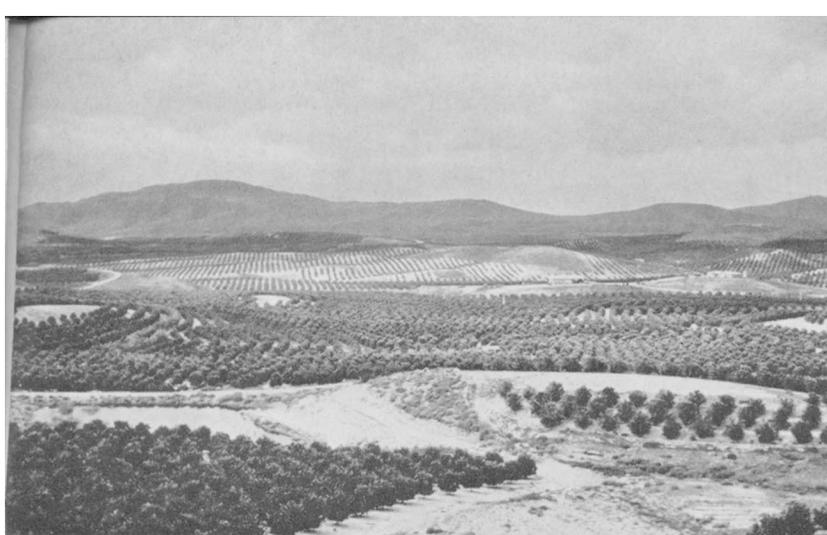
APPROXIMATELY 350 acres of alluvial valley soils in southern California are being lost to urbanization each day according to estimates by the University of California Agricultural Extension Service. Whether or not this loss of the better agricultural lands continues at the same rate, it is a fact that less desirable upland soils are already being developed for citrus as well as for other crops. Much of the area being planted in Riverside and San Diego counties includes rolling soils underlain at various depths by bedrock. The type of topography characteristic of these upland areas is shown in the photos.

The soils of three districts north, west, and south of Lake Mathews are typical, having been developed on: (a) granitic, or closely associated light colored rock; (b) gabbro, or rock in which dark minerals predominate; and (c) sedimentary rock which was deposited by water and later hardened into stratified, fine-

grained material such as sandstone or shale. The soils developed from these various rocks have different physical and chemical properties and, therefore, each one must be managed somewhat differently. Studies now in progress are being made to determine, over a period of years, what management practices are most desirable. Each of the three districts uses Colorado River water which contains about one ton of salt per acre-foot.

Drainage problems in the area west of Lake Mathews, generally known as Eagle Valley, are likely to be more critical than those of the area north of the lake. In the area south of the lake, drainage appears to be satisfactory and soil salinity has actually declined over the short period (four years) since trees have been planted.

The soils north of Lake Mathews include a few locations where excessive salts have occurred. No tile has been



Looking west into Eagle Valley, Riverside County. Trees are from four to 10 years of age. Young trees west of Lake Mathews where excessive soluble salts have accumulated in the soil.

installed in Woodcrest or areas south to Eagle Valley. Most of these soils have been classified as Fallbrook sandy loam. Below about 18 inches, the soil has some increased amounts of clay. On this type of topography, small acreages have been "salted out." Trees growing on soil at higher elevations do well, but water and salts moving down the steep incline at the interface of the soil and bedrock have accumulated in relatively flat locations, as shown in the photo.

Small plantings spotted throughout the Fallbrook soil have died due to excessive salts and high water tables. Inspection of the soil in these affected areas has shown shallow soils no more than 20 to 22 inches deep, and usually a calcareous cemented layer overlies the bedrock. For owners with about 10 to 20 acres, such areas would represent a significant percentage of the total producing orchard.

These areas should be delineated before trees are planted and proper steps taken to cope with the problem. The grower has two choices: (1) refrain from planting trees in these problem locations or (2) provide sufficient drainage by tiling and/or ripping before planting.

Eagle Valley now has about 3,000 feet of tile lines located up two principal swales. Some laterals feed into the two main drains. Since the installation of the tile in recent years, considerable improvement has been observed in lowering water tables along with reducing soluble salts. However, it appears that additional tiles will be needed. As the trees increase in size, demand for water as well as for leaching will become greater.

The microclimate of the area is another important factor. In the western section of the valley, a typical late-fall or early-winter rain usually results in about 0.75 inch of precipitation in about 36 hours. Three to four miles east, in the same period, about 1.75 inches will be

recorded. This is a result of the movement of storms coming from the west over the Santa Ana Mountains. The rising air is cooled and precipitation of about 2 inches usually results. Then as the storm moves across Temescal Canyon the air mass descends and precipitation lessens rapidly with warming of the air.

The low-lying hills bordering the western part of Eagle Valley do not lift the air of the moving storm sufficiently to cool it, and produce more than the amount of rain noted above. Then, as the storm moves, the hills bordering the eastern rim of the valley raise the air sufficiently to cool and produce the larger amount of rain. These differences in rainfall within short distances are not uncommon in the mountainous, rolling, upland areas of western United States. Lake Mathews, with a surface area of 3,000 acres and depth to 185 ft in some places, has also modified the climate of the land in close proximity.

Periodic samples have been taken of the main drainage way in the northern area and the two tile drains discharging water out of Eagle Valley. No surface water is available from the recent plantings south of Lake Mathews. The graph shows the amount of salt discharged in tons-per-acre-foot of water as plotted from December 29, 1966, through December 27, 1967. Dates of the general rainfall periods are also shown. Eagle Valley drains show a higher concentration of soluble salts than the northern area drains. Some surface water comes into the drains in Eagle Valley during irrigation. During the winter, the peak load of salt discharged usually follows a period of general rain. Soluble salts accumulate during summer periods. Winter rains leach out some of the excess salts.

Considering the total amount of water discharged, however, the northern drain average was about 100 acre-feet per

month while the amounts from the Eagle Valley tile drains were about 15 and 10 acre-feet per month for the north and south, respectively. The average amounts of salt discharged per month for the three sampling sites were: north of Lake Mathews, 178 tons; north tile drain of Eagle Valley, 36 tons; and for the south tile drain, 28 tons. These amounts (for the period graphed) are in addition to 242 tons of salt being discharged into the Santa Ana basin above Prado Dam.

Fertilizer practices in the past have consisted primarily of adding nitrogen only. This has been usually introduced into the water as liquid aqua ammonia, or urea, or combinations of both. While the amount varies with the age of the tree, about 1 lb of actual nitrogen per tree has been the maximum. In most areas, production has been encouraging except for areas where soluble salts in the soil have been excessive. Analyses of leaf samples have shown no excesses or deficiencies except where salinity has affected trees. In such locations, as much as 10 times the amount considered excessive for chloride and sodium have been found in the leaves of damaged or dying trees.

Studies will continue in the areas of this project including mineralogical studies of the soil as well as cultural practices and their effect on production. Drainage water and leaf analyses will be continued. Most of the area now uses dragline sprinklers and this method appears the most practical.

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