Low Intake Rates and
Rising Perched Water Tables Hinder

GROUND WATER RECHARGE

in Southwestern Fresno County

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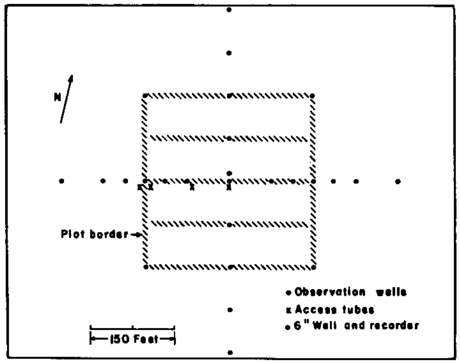

FIG. 1—Experimental spreading pond layout and instrumentation.

FARMLANDS OF southwestern Fresno County are in great need of ground water recharge. Most irrigation pumping occurs from below a confining layer of diatomaceous clay, 500 to 700 feet below the ground surface. However, a shallow water table is perched on layers of heavy-textured sedimental soils occurring 75 to 100 feet below all the experimental locations. This zone of water is not pumped for irrigation purposes at present because of high salinity.

These observations on the buildup and dissipation of a ground water mound were obtained by spreading water on a two-acre square test plot at the University of California's West Side Field Station. This experiment, and others, were designed to furnish information on the response of specific soil profiles to recharge operations. Observations on the shape of the ground water mound will be used to test existing theoretical derivations as to their practical application in the field.

The West Side Field Station site consisted of a Panoche clay loam with an open profile to the water table at 24.5 feet, and an impeding layer at 70 feet.

A two-acre square plot was laid out in a fallow field which had been in safflower. The borders and cross checks were made with a bulldozer and shaped with a grader. Small observation wells 31 feet deep were placed into the water table in a pattern as shown in figure 1. Other installations consisted of four neutron probe access tubes and a 6-inch observation well and recorder. Water was metered onto the ponded plot through a pipeline and distributed to each check by gated pipe.

Observations began on November 13, 1962, when the plot was flooded and continued until the ground water mound had dissipated, after spreading. Water was continuously ponded for 52 days, during which 16.45 acre feet per acre entered the soil surface, giving an average intake rate of 0.32 foot per day.

The neutron probe, a device for measurement of soil moisture, was used to follow the advancing wet front to the water table. Figure 2 shows volume moisture measurements vs depth, as determined by the neutron probe located at the center of the plot. The line on the left represents the moisture distribution with depth before flooding and on the right, after the front had reached the water table. Intermediate lines connecting these

Installation of deep neutron probe tubes for the in-place measurement of soil moisture.

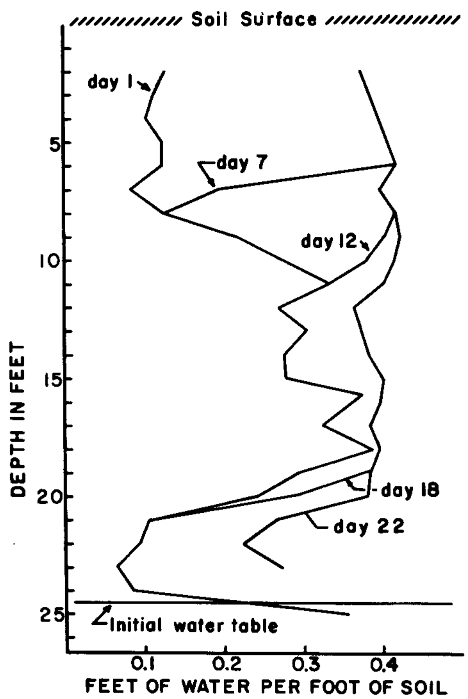

FIG. 2—Probe measurements showing moisture distribution with depth as wet front advanced.

A two-acre experimental plot used in studying surface spreading for ground water recharge.

Instrumentation at center of recharge plot including observation wells, water stage recorder and neutron probe tubes.

extremes show the position of the wet front at the elapsed time indicated.

The front first advanced into a relatively dry soil profile from which moisture had been extracted by safflower grown the previous season. The rate of advance of the wet front was less in this part of the profile than below, where there was not as great a moisture deficit. Figure 2 shows the greatest deficit in the profile to be above 10 feet.

After 14 days, water in the well at the center of the plot began to rise (fig. 3). The hydrograph shows the maximum rise of the mound was 5.5 feet after 39 days, when the center of the mound ceased to rise. An equilibrium had been reached between the vertical flow or intake rate and the rate that water moved away within the water table. After 51 days, ponding

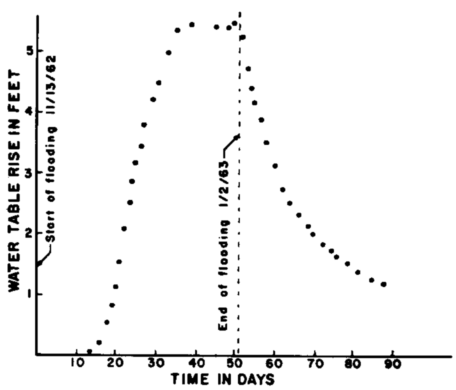

FIG. 3—Hydrograph of well at center of plot.

of water on the surface was stopped, and the mound began to dissipate.

Water has been ponded at other sites in southwestern Fresno County for ground water recharge studies. Observations and measurements of intake rates, profile characteristics, and water tables were made near Huron, Cantua Creek and Five Points. Intake rates ranged from 0.32 to 0.47 foot per day—which were low for recharge purposes. Some of the areas have a rising water table which could point to a potential drainage problem if recharge were practiced. A shallow water table (6 to 9 feet) exists 9 miles north of the West Side Field Station near Five Points. This high water table extends 10 miles west near Cantua Creek and at isolated locations has been observed within 3 feet of the surface. Other observation wells on the Field Station and five miles to the west, show the water table to be within 37 feet of the soil surface and rising at a rate of approximately 1 foot per year—owing to recharge incidental to current irrigation practices.

The quality of perched water at these sites is relatively poor for irrigation purposes. At the West Side Field Station, soluble salts totaled over 4,000 ppm. Water quality at the other sites ranged between 2,000 and 4,000 ppm. If water from this zone is to be used for future irrigation, dilution with better quality water will be necessary.

Water intake rates of the soils in southwestern Fresno County are low for recharge purposes. However, extending the period of flooding will allow the movement of considerable depths of water through these profiles to a perched water table. But pumping from this shallow water table is now limited, and water table elevations are continuing to rise. This threatening water table situation, together with the poor quality of the perched water at these sites, makes the practice of surface spreading for artificial recharge undesirable.

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COTTON BREEDING METHODOLOGY AND QUALITY

THE COTTON BREEDING Methodology and Quality Project within the Cotton Variety Improvement Program at the U. S. Cotton Research Station, Shafter, was begun in 1961. The purpose of this project is to improve breeding procedures through the development of more accurate, precise, and economical methods and techniques and to assist in obtaining and interpreting fiber property and spinning data.

The three broad areas of interest include the following activities:

1. breeding techniques, population genetics, and statistical genetics;
2. estimation procedures, experimental design, and sampling design; and
3. supervision of station fiber laboratory activity, acting as liaison between the ARS spinning laboratory and station projects, and assisting in the interpretation of fiber property and spinning data.

Under the first category, these phases will be investigated: (a) development of crossing and selfing methods, and flower, boll and plant identification (tagging) techniques; (b) prediction of the agronomic and quality performance of bulks and bulk-synthetics; (c) detection and evaluation of interplant competition and cooperation; (d) estimation of genetic variance and covariance parameters in breeding populations; (e) development of selection indices and breeding and varietal maintenance schemes based upon such estimates; and (f) development of a suitable control to serve as a standard for measuring selection advance.

Under the second category, these phases will be investigated: (a) development and evaluation of procedures for estimating test plot lint yields adjusted for moisture and trash contents; (b) development of methods for increasing the accuracy of agronomic and fiber property measurements; (c) development of methods for sampling individual plants and populations of plants for agronomic, fiber and spinning properties; (d) establishment of the number of individual property determinations and statistical control of measurement variation on fiber properties determined in the station fiber laboratory; (e) evaluation of experimental designs, test layouts, number of replications, number of locations and number of years for agronomic and quality traits; (f) assistance in the statistical design and analysis of experiments; and (g) determination of the number of miniature skein break determinations required for certain levels of precision on miniature spinning samples obtained in various ways from various types of material.

While much of this research is long term, some results have been incorporated into the improvement program. These include an improved cross-pollination and identification (tagging) procedure; a method of estimating test plot lint yields adjusted for moisture and trash contents; suitable experimental designs for desired levels of precision; and procedures for sampling test plots for fiber and spinning properties and gin "turnout."—*Robert J. Miravalle, Research Geneticist, CRD, Agricultural Research Service, USDA, U. S. Cotton Research Station, Shafter, California, and Research Associate in the Agricultural Experiment Station, Department of Agronomy, University of California, Davis.*