I. PRODUCTION AGRICULTURE

The construction of Elephant Butte Dam in 1916 made it possible to provide the stable source of water for irrigation. However, the steady supply of irrigation water induced drainage problems in the El Paso Valley. This problem was controlled through the construction of extensive open drain systems, but it did not correct salt problems. The El Paso Valley Experiment Station was established in March 1942 (Fig. I-1). At the time, the Nation was at war, and the production of cotton (to manufacture parachutes) was promoted by the War Department. The need to deal with salt problems led to the appointment of Dr. Don Longnecker in 1954 as an assistant agronomist. He has studied irrigation and salinity control until his retirement in 1972. Dr. Miyamoto was then appointed as Agricultural Engineer and Soil Scientist in 1976 at the new center facility on I-10.

Irrigation of Pecans

Irrigation of cotton had been thoroughly studied, thus the research focus was on a new tree crop, pecans. The water requirement to grow this crop was poorly known. In 1983, we published a paper entitled ‘Consumptive Use of Irrigated Pecans’ in J. Am. Soc. of Hort. Sci., and it became the first credible information on the subject. This work was then followed by irrigation scheduling study, which appeared in 1984 in Trans. Amer. Soc. of Agr. Engi. under a title of “A Model to Schedule Pecan Irrigation with a Microcomputer.”

Salt Tolerance of Pecans, Pistachio and Vegetables

Since salt tolerance of cotton was previously studied, we focused on pecans, pistachio, and vegetable crops. By 1980, some of the pecan orchards were 20 years old, and began to show ailing. Plant pathologists made an attempt to isolate pathogens which may be attacking pecan roots, but without success. We discovered in 1982 that tree ailing is a result of salt accumulation in soils (Fig. I-2). This finding was further validated through controlled experiments as reported in 1985 and 1986 in Irrig. Sci. The interest in pistachio (Fig. I-3) has emerged partly due to the concern that pecan production may exceed the market demand, and/or the water needed to grow pecans may run out. Pistachio can survive drought and is more salt tolerant than pecans. In 1990, we organized a regional conference on pistachio, and produced a series of technical papers on salt tolerance in J. Am. Hort. Sci.

Vegetable crops are difficult to establish under furrow irrigation in saline areas. We found that poor stand establishment of most vegetable crops is caused primarily by hypocotyl mortality, but not by poor seed germination. Under furrow irrigation, dissolved salts accumulate at the skin of the soils, and cause mortality of hypocotyl (Fig. I-4). These findings were reported in 1985, 1986, and 1987 in Irrig. Sci. and Agron. Journai.

Reclamation of Salt-Affected Pecan Orchards

Growers in the El Paso Valley have used a backhoe or a deep ripper to improve soil permeability for leaching salts during winter months after field crops have been harvested. This type of mechanical means of improving soil permeability was also used in pecan orchards, but only in the middle between tree rows away from a tree trunk to avoid root damage. In the spring of 1982, we tried trenching closer to tree driplines where feeder roots are most active. This simple attempt to shift the location of the trench resulted in good tree response, and pecan trees regenerated roots in one season after the roots were pruned. This technique then became a common practice among the pecan growers in the El Paso Valley, and probably have saved more than half of the pecan orchards in the valley (Fig. I-5).

Trenching with a backhoe is a slow operation. We are currently experimenting with subsoliling chisels which crack clayey soils (Fig. I-6). The cracks are subsequently filled with sand to maintain permeability for an extended period. We have also tried several chemical amendments, but the results were not long-lasting in orchard floors subjected to soil compaction.

Soil and Water Management Guidelines: Irrigated Pecan

Extensive soil salinity measurements were made in local pecan orchards in order to understand the cause of salt accumulation. The single most important factor was soil type. The relationship between salinity of irrigation water and soil salinity was also established. Combined with the information on irrigation, salt tolerance, and soil treatment measures, the guidelines for soil and water management were prepared for pecans in 2002 and 2006 (Fig. I-7).

Pecan Rootstock Selection

Nut-producing pecan cultivars are grafted on pecan rootstocks which are usually vigorous. This practice provides an opportunity to use rootstocks which are salt-tolerant. We have been evaluating a number of pecans native to the U.S. as well as to Mexico for their salt tolerance (Fig. I-8). Some of these selections may become a rootstock of the next generation.