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THE AVOCADO DRIP IRRIGATION EXPERIMENT

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Irrigation is the most important, cultural practice in the commercial growing of avocados. The cost of water is high, and water costs will continue to rise. Labor costs, likewise, will increase. There is an urgent need for the development of an economical, efficient and dependable irrigation system.

A "new philosophy" of irrigation, called drip irrigation, has been developed in Israel. Under the leadership of Professor Dan Goldberg, Head, Department of Irrigation, Hebrew University, this system has been tested for nine to ten years and developed to its present stage. Over 2,000 acres of commercially grown vegetables, field crops, and fruit trees are irrigated by drip irrigation in that country.

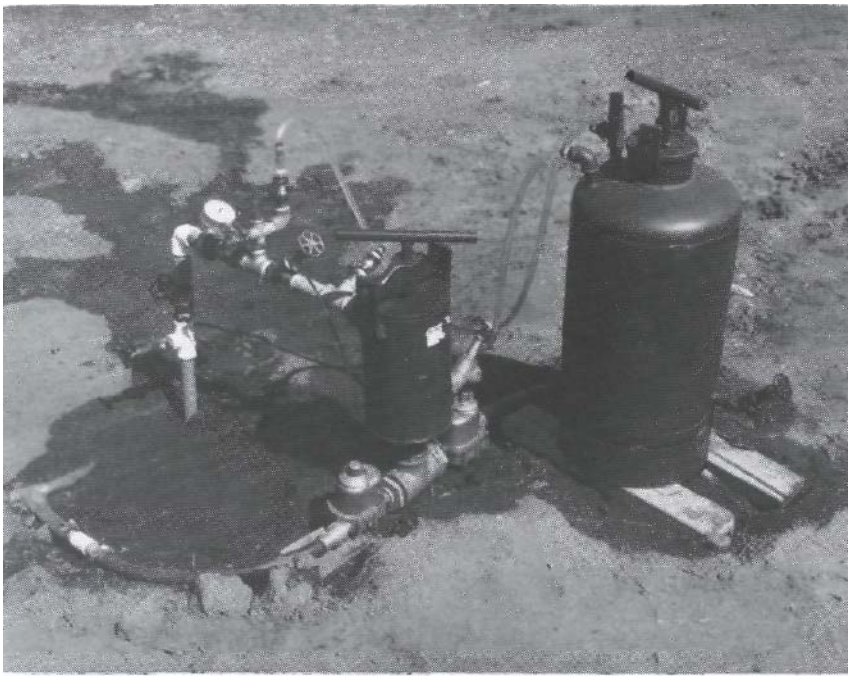
Due to the good results with drip irrigation in Israel, it was decided to attempt an irrigation project on avocados in San Diego County. The irrigation system was designed by an Israeli engineer, Dr. Baruch Gornat, who was visiting and studying in California. During his stay in San Diego, he designed the drip irrigation system. Upon returning to Israel, further refinements in the system's design were made and work was started with the manufacturer for assembling the entire system. The system was imported into this country and installed in June 1970 on an avocado grove located near Bonsall in northern San Diego County.

Purpose of the test is to compare drip irrigation with the standard sprinkler system now commonly used in avocado orchards. Comparison of the two systems will include evaluation of: (1) Measuring the growth and productivity of a young avocado orchard irrigated by the drip method as compared with that irrigated by the conventional sprinkler method, (2) Learning if maintenance of satisfactory soil salinity for avocado growth can be achieved by drip irrigation, (3) Comparing total annual costs for drip and sprinkler irrigation, (4) Determining if avocado trees are less susceptible to avocado root rot (phytophthora cinnamomi) under drip irrigation than under sprinklers. (5) Determining if the drip irrigation equipment will perform properly and will satisfactorily wet the soils in which avocados are growing.

The experiment is a replicated field plot, established on a newly planted avocado orchard offered for the test by the Trendel Brothers. The soil is a combination of Vista sandy loam soil and Fallbrook fine sandy loam. The orchard was a permanent P.V.C. irrigation system for sprinkling with a riser to each tree. The trees were planted on June 1, 1970, and consisted of two varieties, Hass and Reed. Management of the orchard is by Bill Johnson, W. L. Johnson Farm Management Company.

The five-acre test plot is divided into eight blocks and replicated, four under drip irrigation and four under spitters. The two varieties Hass and Reed, are evenly divided in each block. The trees are planted 15' x 20' and total about 670 trees. There are 335

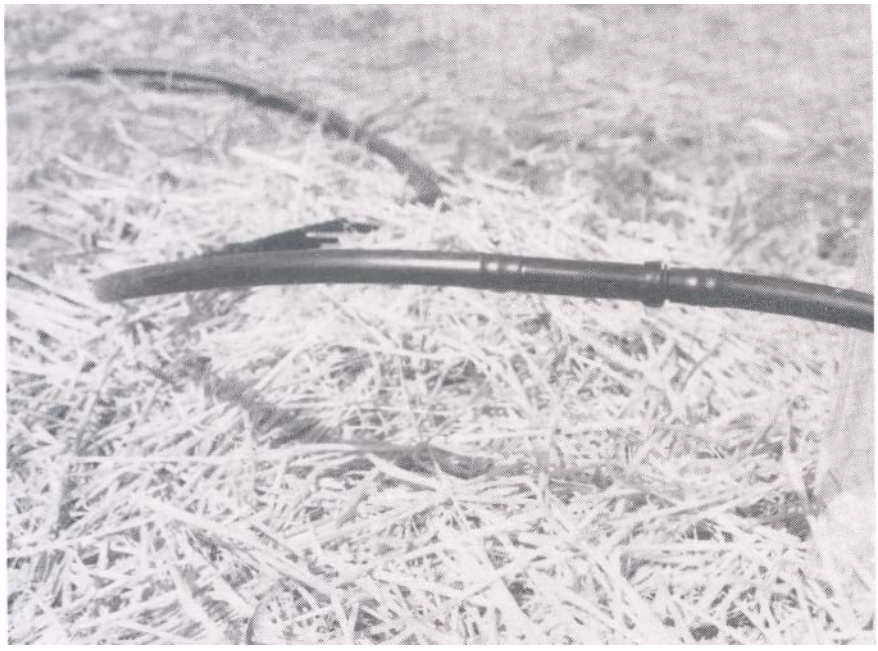
in the dripper experiment, and 335 with spitters. Within each block there are two tensiometer stations. At each station there is a 12-inch instrument inserted directly into the ball of the newly planted tree, and a 24-inch instrument placed alongside of the ball into the surrounding soil. The 32 instruments are uniformly distributed throughout the eight blocks. The tensiometers were provided by Sheldon Pooley, Irrometer Company, Riverside.

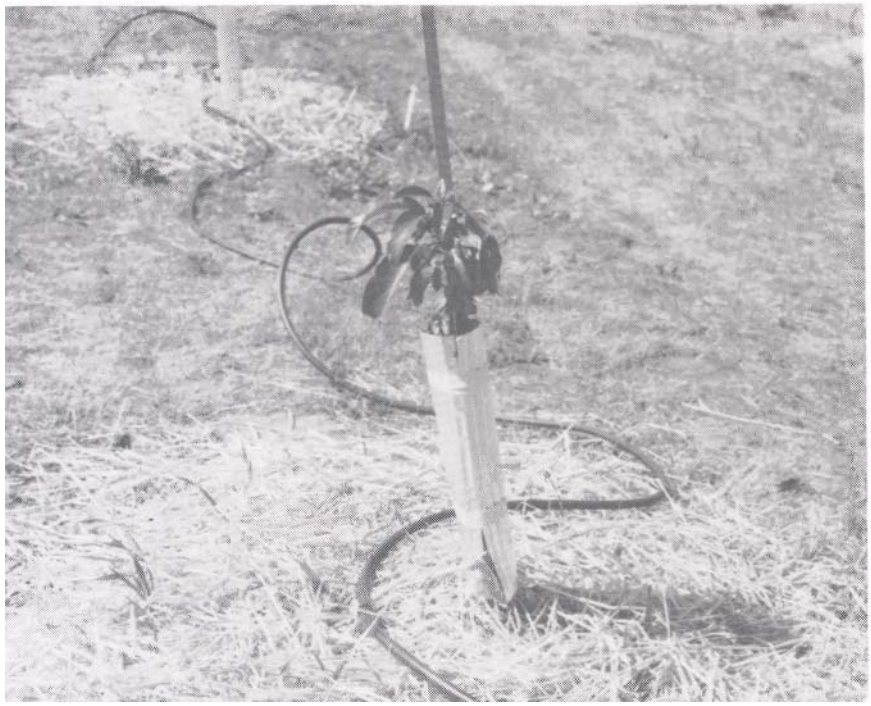


The drip-irrigation system was purchased by Bruce Brown, Browning Sprinkler Company, La Mesa, and donated to the project. The equipment includes a fertilizer tank, filter, water metering valves, water control unit, pressure regulators, pressure gauges, flexible hose for sub-mains and laterals, and the drippers. The system operates at 15 pounds per square inch and each dripper discharges approximately one gallon per hour. Three drippers are placed at each tree—one at the trunk and the other two on either side, two feet away from the trunk.

At the beginning of the test, irrigation was done weekly, half hour for the spitters, and four hours for the drippers. The discharge rate of the spitters was .8 of a gallon per minute. The dripper with approximately one gallon per hour per dripper supplied approximately three gallons per hour to the trees. The comparative amounts of water, therefore, were 12 to 15 gallons per week for the trees with drippers, and approximately 24 gallons for the trees with spitters. As summer weather caused temperatures to rise, there appeared to be a need to increase the amount of water to the trees with spitters. The amount of water applied increased to between 36 and 48 gallons, delivered in 45 minutes to one hour. By fall the spitters were turned on for an hour, while the drippers were still being run for four hours a week. This program of four hours per week for the drippers, and one hour per week for the spitters, continued into October. In October the

drip irrigation plot was automated by an electronic device donated to the project by the Toro Manufacturing Company of Riverside. The spitters were continued on manual operation and the amount of water applied was reduced from one-hour application to 30-minute application each week. The automatic system provided a 45-minute application of water every other day through the automatic time clock. This program will be continued through the winter months unless heavy rainfalls occur.





Fertilization is done each week with the drippers. Urea fertilizer is placed in the fertilizer tank and applied through the irrigation water. The trees under spitters receive urea twice a month by hand application. The total amount of fertilizer applied is the same for all trees.

For the duration of the project, which is expected to last for at last five years, many measurements will be made on the trees, the soil and water use by each system. On the tree, the height and width of the tree will be measured plus the trunk growth below and above the bud union. The root system will be observed periodically to determine its pattern of growth in relationship to the water pattern under the drip system. The soil will be analyzed for nutrient content, salinity buildup, the pattern of salt buildup, and the effect of nutrients and salinity on the tree's growth. The pattern of water movement in the soil will be measured and observed. Accurate meter readings on water use will be made. Tensiometer records will be kept to learn of the water use pattern. Once the orchard has begun to bear fruit, yields will be kept on individual trees. Each tree is numbered individually within the block, and each riser is color coded for identification as to tree variety, and type of irrigation regime.

The hoped-for results that each researcher would like to see come from these plots are: (1) Water saving, (2) Increased yields, (3) Labor costs reduced, (4) Better salinity control, (5) Young tree vigor increased, and (6) Fertilizing while irrigating for better tree response. Even though there appears to be many advantages with the drip system, it is yet too early to give a good appraisal of the work. The possible problems that must be considered are: (1) Orifice blockage, (2) Filtration breakdown, (3) Detrimental salt buildup, (4) Disease factors, and (5) Proper engineering design.

Members of the research team include: Dr. Al Marsh, Irrigation Specialist, UCR; Dr. Roy L. Branson, Salinity Specialist, UCR; Sterling Davis, Agricultural Engineer. USDÁ, Riverside; Don Gustafson, AES Farm Advisor, San Diego County; Bruce Brown, Browning Sprinkler Company, La Mesa; and Bill Johnson, Johnson Farm Management Company, Bonsall. A special acknowledgement goes to the Trendel Brothers for permitting the project to be conducted on their property; to Sheldon Pooley, Irrometer Company, for donating 32 tensiometers: and to the Toro Manufacturing Company, Riverside, for donating the automation unit. Special recognition is given to Professor Dan Goldberg and Dr. Baruch Gornat, Department of Irrigation, Hebrew University, Rehovot, Israel for their encouragement, assistance and consultation as we progressed on this project.