

1972 - 1973

SUCCESS STORY

BIOLOGICAL AND AGRICULTURAL ENGINEERING EXTENSION

APPLE IRRIGATION

Everyone has heard the expression: "An apple a day keeps the doctor away." While this may not be true from a medical standpoint, North Carolina apple producers are striving to insure that the apple a day is available. One of the tools the growers are using to insure production is irrigation.

In the 1969 growing season an experiment was begun in the orchard of E. Lutz and Son of Cleveland County, North Carolina to study the response of apples to irrigation and to evaporative cooling using sprinkler irrigation. This project was under the leadership of Dr. C. R. Unrath, Associate Professor, Department of Horticultural Science, with assistance from Dr. R. E. Sneed, Extension Assistant Professor, Department of Biological and Agricultural Engineering. Frost and freeze protection using sprinkler irrigation was added as another variable in 1972. The experiment was concluded after the 1972 growing season when the owners installed a 10-acre automated permanent sprinkler irrigation system designed for frost and freeze protection, evaporative cooling, and irrigation. The experiment was conducted on 14-18 year-old "Red Delicious" apple trees.

For the evaporative cooling study, the irrigation system was designed to begin operation at a shaded air temperature of 87° F. While the amount of heat stress and the irrigation system run-time varied from year to year, evaporative cooling consistently resulted in fruit temperature reductions while the system was operating. For the 4-year period the system operated a total of 509 hours and reduced fruit temperature an average of 10.1° F. In each of the four years, evaporative cooling resulted in a positive fruit quality response with the average quality response being 8% additional total

reddish color, 13% additional solid red color, 1% greater soluble solids content, 0.2 pound less fruit firmness, an additional fruit weight of 22 grams, 8% less corking and 7% less bitter pit development on fruit sampled at the start of the harvest season. Due to the greater color, an average additional 33% of the cooled fruit was harvested, with sufficient solid red color to meet "extra fancy" U.S. grade during the first two weeks of the season as compared to non-irrigated fruit. The results from irrigation to reduce soil moisture stress was intermediate between evaporative cooling irrigation and no irrigation.

Assuming a yield of 600 bushels per acre and an irrigation system initial cost of \$600 per acre, evaporative cooling irrigation returned a net of \$583 per acre per year as compared to no-irrigation.

In 1972, at two locations an overtree sprinkler irrigation system was used to frost and freeze protect 8 and 15 year-old Starkrimson Delicious apple trees from a radiation freeze. During the 12-hour freezing period the temperature remained below 25° F for 6 hours and reached a minimum of 19° F for some 2 hours. At this minimum temperature of 19° F, protection of 54° F was obtained with a 0.12-inch per hour application rate. This amount of protection was sufficient to obtain 80% and 90% flower survival versus 38% survival in the non-irrigated plot. There was no bending over or limb breakage with the "central leader" trained trees from the ice load.

For temperatures of 19° F, an application rate of 0.12-inch per hour is insufficient to maintain blossom temperature at 32° F. Normally the frost and freeze protection system should be designed for an application rate of 0.15-inch per hour which will give close to 100% protection to 21-22° F with no wind. Where a grower is installing an overtree sprinkler irrigation system for evaporative cooling, he should consider including in his design

specifications the capability for frost and freeze protection. The added cost will be some \$200 per acre.

In some areas growers are not subjected to excessive heat stress or low temperatures, but do have a problem of soil moisture stress. Also some growers have a limited water supply that rules out sprinkler irrigation. A study was begun in 1973 to evaluate two trickle irrigation systems for apple irrigation. These systems were placed on 18 year-old "Red Delicious" and "Golden Delicious" producing trees and newly transplanted trees. While it is too early to obtain final results, from visual observation, it appears that trickle irrigation is very feasible for supplying soil moisture for apple irrigation. The principle of trickle irrigation is to supply small quantities of water over an extended period each day and to maintain the available soil moisture in a portion of the root zone close to 100%. A major requirement is a source of clean water. For the grower with a limited water supply, trickle irrigation appears to be the answer. Water requirement will be from 0.6 to 1.2 gallons per minute per acre. Cost of trickle irrigation including pump and motor, filters, pressure regulating valves, main and supply line laterals and emitters will be \$350 to \$400 per acre.