



# RESEARCH REPORT

## Trials find drip irrigation most efficient for peach trees

Colleges of  
Agriculture at

*David Bryla, Research Horticulturist*  
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### Executive Summary

**P**each production in California requires approximately 93 billion gallons of water per year. Because this is a significant portion of the state's agricultural irrigation water allotment, even a small reduction in water use by the industry could bring considerable savings to the state water budget. We conducted a three-year study in Parlier, California to identify irrigation practices with high water use efficiency in newly planted 'Crimson Lady' peach trees. Four irrigation methods were compared: furrow, microjet, surface drip, and subsurface drip. Results indicated that trees irrigated by surface and subsurface drip required less than half the water to attain the same growth and production as trees irrigated by microjets, while those irrigated by furrow had intermediate water requirements. For young trees, the best placement of drip tubing was either one surface lateral placed directly beneath the trees or two subsurface drip laterals buried on each side of the tree row. The California State University Agricultural Research Initiative has funded the study for three additional years to determine the effects of these irrigation methods on water use and productivity of mature trees.



*A California State University, Fresno student harvests fruit during 2001.*

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## Major Accomplishments

- 1) Surface and subsurface drip irrigation significantly reduced the water requirements for establishing a peach orchard over more common microjet and furrow irrigation methods. During the first 3 years following planting, trees irrigated by surface and subsurface drip required less than half the water to achieve the same growth and yield as trees irrigated by microjets. The water requirements of trees irrigated by furrow, in comparison, were intermediate.
- 2) High-frequency irrigations using surface and subsurface drip also increased the size of the fruit at harvest over the other irrigation methods. When irrigation intervals were longer than a few days, as typically occurs with furrow or microjet irrigation but not with drip, trees were exposed to short periods of water stress (between irrigations), and fruit development was consequently reduced.



*Student technician measures fruit size by hand during the 2001 harvest.*

- 3) Lateral placement was an important factor influencing the success of the drip irrigation systems. Young trees irrigated with only one drip lateral buried between rows were less vigorous, although not less productive, than trees irrigated with laterals buried on each side of the tree row, or one lateral placed on the soil surface near the base of the trees.
- 4) Whether trees were irrigated by furrow, microjet, or drip, growth and production increased as irrigation was increased from 70 percent to 150 percent of the estimated crop water requirement. Vegetative growth was particularly responsive when irrigation was increased from 100 percent to 150 percent of the estimated requirement, while reproductive growth responded more when irrigation was increased from 70 percent to 100 percent. This indicates that, regardless of the irrigation system used, growth of young trees can be maximized during initial orchard establishment with heavy irrigation.

However, increased irrigation appears to have less effect on early production and profitability.

- 5) Other useful findings included the following:
  - ◆ “Top hat” throw limiters used on microjets during the first four months after planting had no lasting benefit on tree development compared to trees irrigated by microjets without throw limiters.
  - ◆ Trees irrigated by microjet were not affected by irrigation intervals ranging from every two to three days to every two weeks.
  - ◆ Trees irrigated by furrow were significantly smaller when irrigated every three weeks than when they were irrigated every one or two weeks.

## Impact Statements

- 1) Benefits of the research include potential irrigation water savings, lower production costs, and reduced water contamination for peach production. Peach and nectarine growers in California require an average of 2.8 acre-ft of irrigation water for their crop each year. This study determined that irrigation with surface or subsurface drip increased water use efficiency for peach production. This information could also be applied to other stone fruits grown in California, including nectarines, apricots and



*Students measure size and color of fruit on automatic fruit sorter.*

plums, and eventually to other tree and vine crops. Water savings could be considerable. For example, if subsurface drip irrigation reduced crop water requirements of mature trees by 10 percent over conventional methods (a conservative estimate – see above), and only 10 percent of the peach and nectarine growers converted their systems from micro-sprinklers to subsurface drip (a relatively inexpensive conversion), we estimate that 929 million gallons of water could be conserved each year, which equals enough water to supply a town of 12,000 people. This value would grow as more and more growers converted their irrigation systems to subsurface drip. Additional benefits gained by using subsurface drip may include higher irrigation distribution uniformity, improved nutrient management (fertigation), reduced weed growth, and reduced surface water, allowing more opportunity for implement traffic while irrigation is in progress. Coupled with proper nutrient management

practices, subsurface drip irrigation may also help reduce nitrate groundwater contamination.

- 2) We tested several water management practices to identify those that reduce on-farm water and fertilizer use while increasing yields and fruit quality in peach. The results will help San Joaquin Valley farmers select irrigation systems and management strategies that have high potential for increasing profitability of growing peaches in California. They will also help irrigation manufacturers and consultants make better recommendations to their customers regarding peach irrigation.
- 3) Information gathered during the proposed research will be used to advise peach and other stone fruit growers on the advantages and disadvantages of using various types of microirrigation systems and management practices for reducing production costs and increasing harvestable yields during early stages of tree development. Specific recommendations on placement of irrigation systems, irrigation scheduling, and water and nutrient application rates will be possible. Because soil water and nutrient distributions will be related to root development, recommendations for reducing ground water leaching will also be possible.

## Dissemination

### 1) Trade journal/popular press publications:

- a. The Wall Street Journal. "Plump peaches that require less water to grow are the goal of research," Nov. 2, 2000, p.1.
- b. The Fresno Bee. "Scientist's hard work bears fruit," Nov. 9, 2000, pp. C1 and C4.
- c. Produce News. Nov. 17, 2000.
- d. Western Fruit Grower. "Putting down roots," April 2001, p. 40.
- e. The Good Fruit Grower. "How much water and fertilizer do young trees need?" July 2001, p. 11.
- f. California Agriculture Technology Institute Update. "Getting to the roots..." Summer 2001, pp. 1 and 8.
- g. California Farmer. "Eye in the dirt," February 2002, cover photo and pp. 8-13.
- h. Capital Press. "Camera exposes tree root behavior for peach producers," Apr. 5, 2002.
- i. Agricultural Research. "The best of both worlds?" October 2004.

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### 2) Refereed journal publications:

- a. Bryla, D.R., T.J. Trout, J.E. Ayars, R.S. Johnson. 2003. Growth and production of young peach trees irrigated by furrow, microjet, surface drip, or subsurface drip systems. *HortScience* 38:1112-1116.
- b. Bryla, D.R., E. Dickson, R.S. Johnson T.J. Trout. Surface and subsurface drip irrigation reduces water limitations and enhances fruit development when compared to furrow and microjet irrigation in peach. *Journal of the American Society for Horticultural Science* (submitted).

### 3) Presentations at meetings

- a. Bryla, D.R., T.J. Trout, J.E. Ayars, R.S. Johnson. Irrigation management practices for improving water and nutrient use efficiency and crop productivity in young peach trees. National Irrigation Symposium. Proceedings of the 4th Decennial Symposium (Addendum), Phoenix, AZ, Nov. 14-16, 2000.
- b. Bryla, D.R., T.J. Trout, R.S. Johnson, J.E. Ayars. Improving growth in young trees by subsurface drip irrigation. ASHS Annual Conference, Sacramento, California, July 17-20, 2001.
- c. Bryla, D.R. Water requirements and yield of peach trees irrigated by microjet and subsurface drip. 4th International Conference on Irrigation of Horticultural Crops, Davis, California, Sept. 1-5, 2003.

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## For More Information

This research report contains summarized results of David Bryla's study entitled "Irrigation Management Practices for Improving Water and Nutrient Use Efficiency and Crop Productivity in Peach," ARI Project No. 00-2-021 (Research Focus Area: *Water and Irrigation Technology*). To view and/or obtain a copy of the complete final report, or to obtain additional information about this or other research projects, visit the ARI website at [ari.calstate.edu](http://ari.calstate.edu).

The Agricultural Research Initiative (ARI) is a California State University (CSU) multiple campus collaborative partnership between the CSU colleges of agriculture and the state's agriculture and natural resources industries and allied business communities. ARI provides public funds that are matched with industry resources to fund high impact applied agricultural and natural resources research, development, and technology transfer, as well as related public and industry education and outreach. ARI projects and programs improve the economic efficiency, productivity, profitability, and sustainability of California agriculture while providing for consumer sensitive and environmentally sound food and agriculture systems and fostering public confidence in food safety and agricultural research and production systems.