

Controlled Environment Agriculture

Greenhouses feature high-tech hydroponics

by Joanne Littlefield



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A 1998 state mandate and subsequent funding made it possible for the College of Agriculture and Life Sciences (CALs) to begin building a new hydroponic greenhouse facility at the Campus Agricultural Center in Tucson. The facility, with 5000 square feet of floor area, was completed just weeks before school started in August 2000 when Gene Giacomelli came on board as director of the program. He has been researching hydroponic tomato production at Rutgers University since 1980. He says his unique 'hybrid' background (plant science and agricultural engineering) gives him the right balance in developing a program for tomorrow's greenhouse employees, and in researching new alternative production technologies.

Besides Giacomelli, other CALs faculty active in the CEA Program include Pat Rorabaugh, assistant research scientist, and Merle Jensen, assistant dean for sponsored research. An additional plant sciences faculty member with expertise in CEA plant physiology will be hired in 2001. Plant Science 217 (Hydroponic Greenhouse Production) is the first class to be offered through the program at the new facility. Rorabaugh and Jensen developed and taught the course to 15 new students in fall 2000.

Gene Giacomelli
(520) 621-1607
giacomel@ag.arizona.edu

An increase to the bottom line is the goal of agricultural producers today, and they do that by continually seeking new and better ways to achieve peak performance and top yields from their crops. In many Arizona communities where prime agricultural land is being developed for housing or industrial use, agricultural production is sometimes forced out to locations with potentially poor soil, more expensive land and increased water costs.

Getting the most out of the plants by controlling such things as humidity, light and temperature has been achieved for years through the use of row crop covers, mulching and greenhouse production. Greenhouse production in the extreme is what the Controlled Environment Agriculture Program (CEA) at the University of Arizona is all about. Every aspect of a plant's environment is analyzed and adjusted as needed. These include irrigation, nutrient uptake, lighting, carbon dioxide and humidity.

Students are cultivating and harvesting tomatoes, peppers and cucumbers. Additional classes are being developed in cooperation with faculty from other College of Agriculture and Life Sciences (CALs) departments including entomology, plant sciences and agricultural and biosystems engineering.

Gene Giacomelli, director of the CEA program, says that by combining sound plant science training with the

technology of the future, CALs students will be an asset to Arizona employers. "We hope to teach and send to the workforce employees better able to solve production problems in a hydroponic growing situation where the environment is controlled through the marvels of engineering," Giacomelli says. Emphasis is placed on the design of cost-effective systems, processes and equipment that will generate high yields of quality produce.

Because bees are used to pollinate the crops, pest control strategies in the greenhouse emphasize natural methods. These include proper sanitation and cleaning, pest exclusion with barriers, and the use of beneficial insect predators, such as parasitic wasps.

There is an increased capital outlay in intensive greenhouse operations for buildings and hydroponic crop production systems. Economics are often the bottom line in the decision to build. Giacomelli notes that the profit differences between hydroponic production and traditional field cultivation are astounding. "Yield data show that tomato production is 600,000 pounds per acre in the greenhouse versus 60,000 pounds per acre in the field, or 60 pounds per plant in the greenhouse versus 6 pounds in the field."

Canada and Mexico have thousands of acres under greenhouse-protected cultivation, but it is a relatively new industry in Arizona. The state has only 200 acres of greenhouses, primarily in Cochise County. It has been estimated that more than \$100 million has been added to the Arizona economy during the last eight years from the greenhouse hydroponic crop production industry.

Giacomelli says that in addition to classroom instruction and research, information will be provided to local growers through extension agents statewide, as well as through newsletters, workshops and an interactive web site.❖