

Fighting weeds in lemon orchards

Weed-sensing sprayer could be the key

By Susan McGinley



Bill McCloskey

An optical chlorophyll-detecting spray system triggers spot spraying of herbicide only where needed.

Weeds covering an orchard floor compete with the trees for water and nutrients, reducing the number and size of fruit at harvest. Growers have alternately tried mowing, disking and spraying the weeds, but mechanical methods can damage the trees, and chemical use can be costly and increase the herbicide load in the environment. Cover crops among the trees reduce the weeds, but yields may not be as high.

A comprehensive series of weed control studies in lemons conducted by faculty in the University of Arizona College of Agriculture and Life Sciences since 1993 have proven that clean culture, where the orchard floor is kept completely free of weeds using herbicides, still provides the best environment for lemons to yield well, both for the first harvest and for the total harvest.

At university research stations in Yuma and Waddell (Phoenix area), Arizona, disking weed control methods resulted in cut plant rootlets, and trunk wounding that could allow pathogens to enter. Dormant weed seeds were stirred up and later sprouted after irrigation into a flush of new weeds requiring even more treatment. In Yuma, disking also encouraged higher populations of the bothersome eye gnat, which irritates orchard workers.

Broadcast spraying of herbicides killed the weeds, and in the case of glyphosate (Roundup), even stray droplets hitting the base of the trees didn't hurt yields. But most orchards have patches of bare ground that don't need spraying, so this method tends to waste money and uses more chemical than is really needed. To reduce the amount of herbicide in the environment, spot spraying works better, where the herbicide hits only the weeds, but it's labor intensive.

An optical chlorophyll-detecting spray system currently on the market detects weeds on the orchard floor, triggering spot applications of herbicide directly to them, and skips spraying on bare ground. Called the Patchen Weed Seeker, this boom-mounted system is used on commercial orchards in California where it was developed, but it has not caught on in Arizona. By spraying only the weeds, herbicide use in one study was reduced by 60 percent where there was a 20 percent weed cover in the orchard.

The sprayer works by shining a light directly on the ground and using a sensor that can see the wavelength of light reflected by chlorophyll in plants. The infrared optical detectors are connected to a computer that sends signals back to the spray unit to open the nozzle and spray a little spot of herbicide on that particular weed as it passes under the spray nozzle. This happens within milliseconds, so herbicide use is kept to an absolute minimum.

The technology has not been extensively tested on western fruit and nut crops, and it requires a high initial capital outlay, so growers have been hesitant to try it. Patchen Weed Seeker spray units that contain a light source, infrared optical sensor, and computer controlled valve assembly cost about \$1,000 each. The spray unit has a field of view and spray pattern about 12 inches wide so that a sensor-controlled intermittent orchard sprayer might cost \$14,000 to \$25,000, depending on the width of the spray boom, according to Bill McCloskey, a professor in the Department of Plant Sciences. Orchard managers need to know if the Patchen's efficiency is worth the cost.

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McCloskey and UA plant scientist Glenn Wright are conducting a four-year study of the weed sensing sprayer's performance in Arizona tree crops, beginning in 2001. The study is focusing on lemon and pecan orchard weed maintenance, because these two crops occupy the largest tree bearing acreage in Arizona: 30,100 acres of lemons, and 14,500 acres of pecans. UA agricultural economist Trent Teegerstrom will evaluate the method for its economic feasibility in a tree crop production system.

The study includes testing of the sprayer in university and participating commercial orchards. The four goals of the project are 1) to evaluate the sprayer's potential for reducing postemergence herbicide use in Arizona, 2) to evaluate the use of preemergence herbicides in combination with the Patchen sprayer, 3) to collect tree yields and field operational data to develop crop budgets and determine the economics of adopting the spray technology, and 4) conduct a Cooperative Extension education program on using the Patchen sprayer to reduce herbicide use and costs.

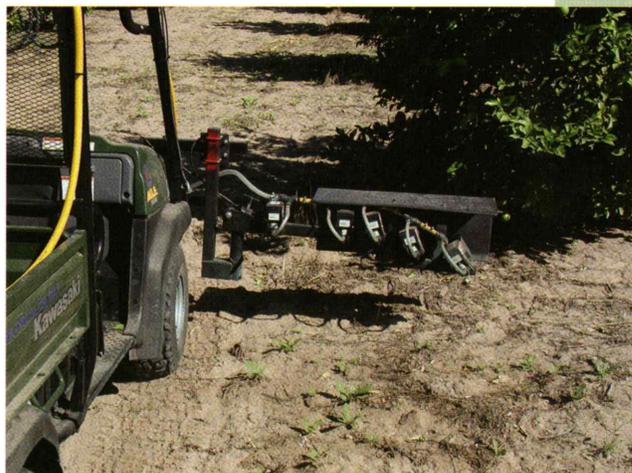
The project is funded by the Yuma Mesa Pest Abatement District, Yuma lemon growers, and UA Integrated Pest Management funding. The Patchen company donated the spray equipment.

For the lemon study in Yuma, McCloskey and Wright are testing the Patchen sprayer against other mechanical and chemical weed control methods on approximately 17 acres of commercially grown lemons on the Yuma Mesa. At this site they are also evaluating the use of a field cultivator

growers have begun to use more widely. Known as the "Perfecta" cultivator, this implement controls weeds in flood irrigated orchards without significantly disturbing tree roots. According to McCloskey and Wright, no studies have been conducted to compare Perfecta use with other weed control methods regarding economics and tree yields.

McCloskey hopes the answers they find during this project will give them extensive information to pass on to growers regarding weed reduction techniques in orchards. That's why he and the entire research team are testing so many combinations of mechanical and chemical methods, using the latest herbicides and equipment. "We need to be able to answer questions regarding this technology," he says. The bottom line is to help producers increase yields, increase profits, and preserve the environment. ☒

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