Impact of Sprayer Technology on Weed Management

Richard Stoltz, Patchen Selective Spray Systems

There are a number of methods used to manage weeds in vineyards and orchards. They include manual labor, mechanical cultivation, flaming, continuous sprays of herbicides, controlled droplet applicators (CDA), and selective spraying of weeds by light activated sprayers.

The two methods discussed here are the CDA and light activated sprayers. Both are relatively new methods being used for vegetation management in permanent crops.

The CDA applicator atomizes the spray droplets and places uniform, fine droplets on the weeds. The nozzle is contained within a spray hood that contains the spray drift and protects the crop foliage from spray contact. This equipment can be mounted on various spray platforms. Typically, it is mounted on ATV type vehicles. The application rate can be as low as two gallons per acre. The amount of herbicide applied per acre is based on the manufacturers recommendations. Normally, glyphosate is the only material applied as certain other herbicides require higher application rates of water to achieve proper control than can be achieved with a CDA applicator.

Work by Tim Prather at The UC Kearney Agricultural Center in Parlier, California has shown that the CDA type equipment can be an effective tool in vegetation management in vineyards. Preliminary data from a 1998 Biologically Integrated Vineyard System (BIVS) trial in Kingsburg, California (conducted by T.S. Prather) indicates that the CDA system gave better weed control than flaming. Control was equal to glyphosate applied as a broadcast treatment but not as good as some cultivation treatments or the Patchen selective spray system.

The CDA type equipment can be effective in controlling unwanted vegetation, can reduce the amount of spray drift that leaves the target area, can reduce labor costs by reducing the amount of time needed to refill spray tanks, and smaller, less expensive spray platforms can be used.

The Patchen system is a light activated sprayer that responds to light reflected off of the surface of a chlorophyll producing plant. The system consists of a silicon receptor lens that picks up reflected light wave lengths, two light emitting diodes, and a spray cartridge that contains a solenoid valve that is opened when the reflected light from the plant is read. The result is spraying only where there are weeds. Bare ground is not treated and thus herbicide use is reduced, material is not wasted, and chemicals are not unnecessarily placed in the environment.

The two emitted wave lengths are at 600 (red) and 770 (far red) nanometers. The combined reflection from these two wave lengths are picked up by the silicon receptor and an electrical impulse is sent to the solenoid. The solenoid action then allows the weed to be sprayed. The internal light allows the system to operate at night, as well as in the day time. The solenoid

reacts fast enough to allow spraying at speeds of up to 10 miles per hour. Each sensor has a field of view of 12 inches and can see at a distance of up to 30 inches.

Early work by Prather showed that by using the Patchen system when a weed cover of 5% existed, a reduction of spray volume of 86% could be achieved when compared to a broadcast spray or waiting until ground cover was on the order of 80 – 100%. He also determined that when ground cover was 5%, spot spraying would not be efficient or practicable. Typical herbicide use reductions are in the range of 50 – 75%.

Work done by Patchen, in an almond orchard, showed a savings of 87% in total spray usage when compared to the grower's practice. This resulted in a dollar savings of $36.00 per acre and required only the initial fill up as compared to 3.3 fill ups by the grower.

In the BIVS trial mentioned above, three applications were made. The first application was made in mid March when the weed cover approached 100%. The grower uses cultivation only and no herbicide treatments. The second application was made on April 22 when weed cover was almost non-existent. The third application was made on June 6. Marestail was thick and about 6 to 9 inches tall. The total reduction in spray usage with the Patchen system was 37% when compared to a calibrated broadcast rate of 31 gallons per acre. Savings were 74% at the second application and lesser amounts of use reduction were achieved at the first and last applications.

The weed ratings taken on 4/22 showed that the Patchen system gave the best control of any of the methods employed when considering the total weed population. It performed equal to or better than all methods in the control of annual sowthistle, marestail, and outperformed the CDA, glyphosate control, and flaming in control of perennial willowweed.

The Patchen WeedSeekers may be mounted on a wide variety of spray platforms. Typically, small tractors are used but the system can also be mounted on self propelled sprayers. Standard herbicide spray tips are used and most tanks, pumps, plumbing, etc. can be adapted.

Various herbicides can be used in the systems. Roundup, Prism, Goal, Gramoxone, Poast, Fusilade, and some liquid fertilizers have all been used in Patchen systems. Wettable powders, solubles, and other formulations may be used, but only after modifications to the spray cartridge have been made.

While the WeedSeeker systems were originally designed for permanent crop applications, other uses have evolved. These include row crop applications, broadcast spray usage, roadside vegetation management, and uses by water agencies for ditch bank spraying.

The Patchen WeedSeeker is effective at controlling weeds, reduces the amount of herbicide used, reduces dollar expenditures by reducing herbicide costs, reducing labor, reducing the size of application equipment needed, and allows less chemical to get into the environment.

Both systems thus reduce the amount of chemical that gets into the environment, reduce labor costs, reduces the size of spray equipment needed, and are effective tools in managing undesirable vegetation in permanent crops.