OPTIMIZING GLYPHOSATE WICK-WIPING IN CRANBERRY PRODUCTION

Jed B. Colquhoun
Dept. of Horticulture, University of Wisconsin-Madison

Glyphosate, sold as Roundup and several other trade names (not all registered on cranberry), is one of few herbicides in cranberry production that will control perennial weeds. However, growers report that weed control when wick-wiping can be quite variable. Several factors should be considered to optimize the use of glyphosate in wick-wiping, including water source and condition, application timing relative to weed growth stage, and adequate weed coverage, uptake, and translocation. Additionally, glyphosate-resistant weeds have been observed in some cropping systems. The factors that favor resistance development in cranberry production should be considered so that this valuable tool will be viable well into the future.

Glyphosate mode of action

The first step in efficiently using any herbicide is to gain a basic understanding of how the herbicide works. Glyphosate is rapidly taken up by shoots, stems, and leaves of emerged plants. The herbicide binds to soil, and therefore will not control weeds prior to emergence. Once the herbicide is absorbed by the above-ground tissue, glyphosate is translocated or moved in the plants "piping system" with carbohydrates. The "piping system" transports carbohydrates from roots to the above-ground growth in the spring and from the green tissue to the roots in the late summer and early fall.

The target site for glyphosate is the EPSP-synthase enzyme. This enzyme is involved in converting raw materials into amino acids that are the building blocks for protein. Seventy percent of the carbon captured by a plant flows through this one enzyme system. Glyphosate blocks the production of amino acids, and thus inhibits protein production. Glyphosate is considered a non-selective herbicide – it will severely injure or kill most plant species.

Optimizing herbicide performance relative to the seasons

The ability to control perennial weeds with glyphosate and other herbicides is based on the growth stage and time of year. In the spring, perennial plants export carbohydrates from roots to new shoots. During the summer, weeds assimilate energy by capturing sunlight with foliage. In the late summer, from about the first bloom on a perennial weed to the first hard frost, carbohydrates from the energy captured during summer are translocated to the root system for storage. The optimal general perennial control strategy takes advantage of this seasonal cycling of energy within the plant. In the spring, limit new vegetative growth and eliminate new seedlings. In the summer continue to prevent new energy capture by limiting vegetative ("green") growth. The late summer and early fall provide a time to attack the root storage system by "tagging along" an herbicide with the carbohydrates that are moved below-ground from foliage. **Keep in mind, though, that the application timing must coincide with the pre-harvest interval and other timing restrictions for the herbicide!**

Considerations of the target weed that affect glyphosate performance

There are several factors involving the target weed that will affect herbicide performance. Although glyphosate is a translocated herbicide that can be "piped" to the target site, adequate plant coverage when wick-wiping is necessary for optimum control. The use of an appropriate spray-tracer can improve and ensure coverage. Herbicide penetration through plant leaves is also affected by weather conditions. Weed control can be reduced when glyphosate is applied during prolonged hot, droughty weather. In these climates, plants develop a thick, waxy leaf cuticle and shut the stomata or leaf openings, thus decreasing herbicide uptake.

Considerations of the spray carrier water that affect glyphosate performance

Minerals, organic matter and other dissolved solids in carrier water sources can affect glyphosate performance. Hard water contains high concentrations of calcium, magnesium and other ions. These ions can bind to the salts of some herbicides, such as glyphosate, and reduce the effectiveness of the herbicide by limiting plant uptake. The additives that can be used to overcome hard water vary by pesticide label, so be sure to check your particular formulation prior to use. Ammonium sulfate is a common additive that adjusts pH and binds hard water ions.

Organic matter and other dissolved solids in the carrier water will rapidly bind glyphosate, thus reducing plant uptake and weed control. This often occurs with water drawn directly from ponds and streams. Choose a clean water source for your carrier water.

Glyphosate resistant weeds

Glyphosate has been used in several cropping systems for many years, and until recently, resistance was not observed. However, in the past few years, resistance has been confirmed in 9 weed species worldwide and is suspected in others. Resistance has been observed in Palmer amaranth, common ragweed, hairy fleabane, horseweed, goosegrass, Italian ryegrass, rigid ryegrass, and buckhorn plantain. While resistance is still fairly rare given the extent of glyphosate use, the recent increase warrants careful observation and consideration of the factors that increase risk for resistance.

Unfortunately, several of the factors that increase the risk for resistant weed selection are common in cranberry production. Herbicide resistance is observed where the use of an herbicide or herbicide mode of action is repeated often, such as in a perennial cropping system. Resistance is also favored by a heavy reliance on a single herbicide to control target weeds, such as perennial weed wiping in cranberry production. Weed species that reproduce prolifically (primarily through seed production) are more likely to become resistant. Also, application systems where the herbicide rate is difficult to control, such as in wick-wiping, increases the risk for resistance development.

With this increased risk in mind, it is important to recognize the signs of resistance development. Resistant weeds should be managed similar to a new invasive weed species; early detection and eradication of a localized infestation is more feasible than containing a widespread population. Herbicide resistance in weeds is often confused with other factors that affect herbicide performance, such as misapplication (poor timing

or rate) or weather conditions before, during or after application. Consider the following questions if herbicide resistance is suspected:

1. Is it only one weed species that survived herbicide application, or are other species that are normally susceptible to the applied herbicide also not controlled? Multiple species surviving an herbicide application often suggests reasons other than resistance for poor control.
2. Is there an obvious pattern, such as a sprayer skip or poor herbicide coverage that could explain weed control failure? Weed resistance often occurs in irregular patches where seed spread from a plant that survived a previous herbicide application.
3. Are there herbicide symptoms on the surviving plants? Resistant plants often, but not always, show no symptoms related to the herbicide application.
4. Is there a record of repeated use of the herbicide mode of action, and has the rate required for adequate control increased over time?