CAN ALL PROBLEMS WITH APPLICATION METHODS BE RESOLVED WITH HIGHER GLYPHOSATE RATES?

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Introduction

Glyphosate has proven to be the most reliable herbicide for providing consistent, effective weed control in numerous sites. However, just because glyphosate applications are more dependable than other herbicide applications does not mean the herbicide is bulletproof. The number of annual applications of glyphosate continues to increase with greater adoption of glyphosate-resistant corn in addition to the near complete adoption of glyphosate-resistant soybean. Variable performance from glyphosate applications in some regions has been observed more in 2006 than in any prior year. Is this the result of the vast range in glyphosate application methods implemented by producers and commercial applicators? Certain application parameters such as carrier volume, nozzle selection, and spray coverage can be refined to ensure maximum glyphosate activity. However, applicators must also consider *when*and *what*they are spraying since even the best application methods under sub-optimal conditions may not produce acceptable results.

Carrier Volume

Carrier volumes for glyphosate applications range from 5 to 20 gallons per acre (GPA) with 12 to 18 GPA being the most common for commercial applications. Numerous research studies have demonstrated that relatively low carrier volumes are preferred for glyphosate applications to optimize herbicide efficacy. Applicators cite concern with low carrier volumes and the potential for increased spray drift or reduced spray coverage on target weeds as justification for using carrier volumes above 10 GPA. Indeed, spray coverage at the top of the weed canopy will increase with greater carrier volumes, but spray coverage and glyphosate efficacy are not directly related. Spraying glyphosate at 20 GPA on redroot pigweed and common lambsquarters resulted in greater spray retention on leaves compared with using only 5 GPA (Ramsdale and Messersmith, 2001). Contrary to popular belief, the greater spray retention did not result in greater herbicide efficacy. In fact, glyphosate applied with only 5 GPA resulted in greater control of both weed species than 20 GPA even though less spray retention was observed. Similar research conducted at Southern Illinois University has documented this same trend for control of common waterhemp. Glyphosate applied at 5 GPA provided 85% control of common waterhemp compared with only 61% control for 15 and 20 GPA.

In addition to improved weed control, lower carrier volumes will reduce the time spent mixing and loading for glyphosate applications and reduce the impact of hard water supplies used as the spray carrier. A lower carrier volume translates to fewer hard water cations being present to antagonize glyphosate on a per acre basis. This may result in less water conditioning necessary for low carrier volumes versus relatively greater carrier volumes. Another viewpoint is from the amount of ammonium sulfate (or a water conditioner) necessary for each spray tank. The recommended rate for ammonium sulfate in glyphosate applications is 8.5 to 17 pounds per 100 gallons of spray solution. Lower carrier volumes will result in the same rate of ammonium sulfate treating more acres, which reduces chemical costs.

Application Time of Day

The time of day when the glyphosate application is performed has been cited in many research trials as a significant factor that influences weed control with glyphosate. Glyphosate may provide the best weed control in late morning and afternoon applications with reductions in control being observed with early morning and evening applications. Recent research has demonstrated that the presence of dew on weed leaves may contribute to the time-of-day effect with glyphosate. When heavy dew was present, adjusting the carrier volume or nozzle type did not alter control of common waterhemp with glyphosate (unpublished SIU data). The net result was approximately 20% less control of common waterhemp when glyphosate was applied at 7 a.m. compared with 1 p.m. Conversely, no difference in glyphosate efficacy was observed for some glyphosate applications performed at 7 a.m. and 1 p.m. when no dew was present at the early morning applications.

Spray Coverage

As mentioned previously, we expect that greater spray coverage will result in greater herbicide efficacy. Although this may be true with other herbicides, the efficacy of glyphosate applications cannot be predicted solely by the level of spray coverage achieved with any spray configuration. The only level of confidence comes from the fact that little to no spray coverage will result in little to no weed control, even for glyphosate. Of course, the lower carrier volumes suggested earlier have resulted in greater weed control with glyphosate, which corresponds to lower spray coverage. What is the minimum level of spray coverage necessary for glyphosate applications? Since each glyphosate application presents a unique combination of weed species, density of the foliar canopy, droplet size, time of day, carrier volumes, herbicide rate, and environmental conditions, it is impractical to develop a minimum spray coverage guideline suitable for all situations. However, it may be easier to think of optimizing glyphosate activity, not as it relates to spray coverage, but by making sure the effective dose of glyphosate is delivered to the entire weed canopy with the lowest carrier volume possible. In addition, this should be achieved with a spray droplet size in the medium, coarse, and very coarse droplet categories (300 to 600 microns). This will help mitigate physical drift of spray droplets even at lower carrier volumes.

The use of glyphosate in glyphosate-resistant corn may be slightly different from applications in soybean. The corn row is full of expanded corn leaves waiting to block the spray from hitting the weed canopy. This is especially true for late postemergence applications when the corn is beyond 20 inches tall. In some instances, the level of weed control for these late glyphosate applications is less within the corn row versus the row middle. Although there has not been any research to address this phenomenon, a sprayer with 15-inch nozzle spacing may reduce the likelihood of this occurring since the nozzles would be spaced evenly over a 30-inch corn row.

Summary

The most consistent application factor that can increase glyphosate efficacy is lower carrier volumes. The common fear in commercial applications is that lower carrier volumes will provide inconsistent spray coverage and weed control. The best recommendation is to spray weeds with glyphosate much earlier than we have been over the past decade. Glyphosate can be applied to weeds that are 4 inches tall or lower with lower carrier volumes without the worry of the spray solution not reaching some plants buried deep in the canopy.

So what application factors can’t be fixed by increasing the rate of glyphosate? If a sprayer is configured to produce droplets that are too small they are not only likely to drift in any measurable wind, but also are prone to evaporation or turbulence that prevents them from hitting weed targets. Droplets that are too large will result in a spray cloud with a low droplet density per unit of area and risk having insufficient droplets to deliver an effective dose throughout the canopy. Thus, if the spray droplets produced are not suitable to deliver the herbicide solution to the target, then the rate of glyphosate applied will not matter. In the case of carrier volume, an applicator can likely increase the rate of glyphosate applied in higher carrier volumes to counteract any disadvantage over lower carrier volumes. However, glyphosate is cheap, not free. So why use more glyphosate than necessary, especially if spraying lower carrier volumes has other advantages such as time efficiency?

References Cited

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