

Effect of Glyphosate on Foliar Diseases in Roundup Ready Alfalfa.

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Foliar diseases are a serious problem for alfalfa management in all areas where alfalfa is grown. Defoliation due to foliar diseases varies from 3-71% depending on time of year, environmental conditions, and locale. In addition to yield loss, foliar diseases can reduce seed yields and forage quality. Fungicide treatments are cost-effective in only some years and locations. Glyphosate, the active ingredient in the herbicide Roundup, is effective in reducing rust diseases in glyphosate-resistant wheat and soybean (1, 2). Also, glyphosate was shown to control dodder on Roundup Ready alfalfa in greenhouse experiments (3). Both rust and dodder are biotrophic pathogens; they require a living host for growth and reproduction. The effects of glyphosate on foliar necrotrophic pathogens, which kill plant tissues and reproduce in dead and dying material, has not been reported. Glyphosate inhibits 5-enol-pyruvyl shikimate 3-phosphate synthase (EPSPS), an enzyme found in plants, fungi, and bacteria. Plants engineered for glyphosate resistance with a glyphosate-insensitive EPSPS take up and translocate the herbicide throughout the plant. In greenhouse experiments we found that application of glyphosate at the 1x recommended field application rate completely controlled alfalfa rust (*Uromyces striatus*) on 90% of 4-week-old seedlings when plants are inoculated with the fungus 3 days after glyphosate treatment. In addition, excellent control of rust was obtained when glyphosate was applied 4 days after rust spores, indicating that the herbicide has protective and curative activity. Protection of plants from powdery mildew (*Erysiphe pisi*) was also observed when plants were treated before pathogen inoculation. However, no significant control was observed for spring black stem and leaf spot, caused by *Phoma medicaginis*, a necrotrophic pathogen. To simulate weed control in the field, glyphosate was applied at the 1x rate to plant stubble 8 days after removing foliage. Preliminary results showed that this treatment provided excellent protection from rust infection when plants were inoculated up to 10 days after glyphosate treatment. These results indicate that glyphosate could be used to help manage some foliar diseases in Roundup Ready alfalfa.

References

1. Anderson JA, Kolmer, JA. 2005. Rust control in glyphosate tolerant wheat following application of the herbicide glyphosate. *Plant Dis.* 89:1136-1142.
2. Feng PCC, Baley GJ, Clinton WP, Bunkers GJ, Alibhai MF, Paulitz TC, Kidwell KK. 2005. Glyphosate inhibits rust diseases in glyphosate-resistant wheat and soybean. *Proc. Natl. Acad. Sci. USA* 102:17290-17295.
3. Reisen P, Johannsen N, McCaslin, M. 2002. Dodder control in Roundup Ready alfalfa. *Proceedings of the 38th North American Alfalfa Improvement Conference*, p. 50.