

GLUTAMINE SYNTHETASE AND AMMONIA ACCUMULATION IN RESPONSE TO TIME OF GLUFOSINATE APPLICATION. Brent A. Sellers and Reid J. Smeda, Graduate Research Assistant and Assistant Professor, Department of Agronomy, University of Missouri, Columbia, MO 65211.

Previous research has shown that time of glufosinate application has a large impact on weed control. This is especially true for weeds that exhibit diurnal leaf movements such as velvetleaf. Velvetleaf leaf angle has been shown to negatively impact glufosinate efficacy. However, leaf angle is not the sole reason for reduced glufosinate efficacy when applications are made near or after sundown. In addition to leaf angle, a physiological mechanism may account for reduced glufosinate efficacy. Glutamine synthetase (GS) activity has been shown to sharply decline within 5 h of application, and results in an increase in ammonia accumulation. Experiments were established to determine if GS activity and ammonia accumulation were dependent upon the time of glufosinate application. Plants were established in pine seedling containers in a sand:peatmoss (1:1) soil mixture with a 14 h light period ending at 8 pm. Velvetleaf seedlings were thinned to one plant per container at the cotyledon stage. Plants were watered and fertilized to optimize growth, and were transferred to a growth chamber 3 d prior to glufosinate application. Growth chamber conditions were 26 C with 80-90% RH and 230 $\mu\text{moles/s/m}^2$. A track sprayer, calibrated to deliver 187 L/ha at 167 kPa, was used to apply glufosinate at 160 or 320 g ai/ha to 10 cm tall plants at 2 and 10 pm. Leaf angles were fixed using pipe cleaners. Glutamine synthetase activity and ammonia accumulation were determined 0 to 72 hours after treatment (HAT). Velvetleaf GS activity for plants treated at 2 pm, regardless of rate, was reduced to less than 20% compared to 0 h control plants within 8 HAT. In contrast, GS activity following 10 pm applications did not decline below 20% until after 24 HAT for both rates. GS activity was not significantly different between application times for either rate at or after 48 HAT. Ammonia accumulation, regardless of rate, increased throughout the experiment, after applications at 2 pm, and after an 8 h lag after applications at 10 pm. Ammonia accumulation was significantly higher by 72 HAT when 160 g/ha glufosinate was applied at 2 pm compared to applications at 10 pm. There were no differences in ammonia accumulation between application times at the 320 g/ha rate, except at 4, 8 and 24 HAT. Ammonia accumulation may explain why reduced activity resulting from late-day applications may be overcome by increasing the herbicide rate. At lower herbicide rates, ammonia accumulation does not increase to the same extent for glufosinate applied at 10 pm versus 2 pm, even though GS activity is severely inhibited. It is possible that glutamate dehydrogenase, another enzyme capable of incorporating ammonia, is responsible for the reduction in ammonia accumulation in 10 pm treated plants. This will be investigated in future experiments.