IMPLICATIONS OF THE GENE GDHA FOR HERBICIDE TOLERANCE IN PLANTS. Scott A. Nolte, Bryan G. Young and David A. Lightfoot, Graduate Research Assistant, Assistant Professor and Professor, Department of Plant, Soil, and General Agriculture, Southern Illinois University, Carbondale, IL 62901.

Plants convert inorganic nitrogen into organic compounds through the process of ammonium assimilation. This occurs in plants by two possible pathways. The first and primary pathway involves a reaction with glutamate to form glutamine which is catalyzed by glutamine synthetase (GS) and requires an energy source of adenosine triphosphate. This glutamine is then involved in a reaction catalyzed by glutamate synthase (GOGAT) to form glutamate. The second pathway also results in the formation of glutamate through a reaction catalyzed by glutamate dehydrogenase (GDH), but does not have the energy requirement. An isolated *gdh*A gene from *E.coli* which encodes for a more active GDH pathway was used to transform plants which resulted in an increase in ammonia detoxification. The proposed mode of action of the herbicide glufosinate is to block the GS pathway, thereby causing ammonia toxicity in the susceptible plants. Therefore, it was speculated that the *gdh*A transformed plants may exhibit a novel mechanism of tolerance to glufosinate by detoxifying ammonia via greater activity of the GDH pathway.

Studies were conducted in the greenhouse to evaluate tolerance of tobacco containing the *gdh*A gene to glufosinate on a whole plant level. Six tobacco lines were selected including a commercial variety, a non-transformed control, three transformed lines with varying levels of expression of the gene *gdh*A, and one transformed with the bialaphos resistance (bar) gene, isolated from *Streptomyces hygroscopicus*. These lines were subjected to 10 rates of glufosinate ranging from 1/256 to 256X of the recommended field use rate of 351g ai/ha and then evaluated for herbicide efficacy. Comparisons of dry weights revealed that transformed plants were expressing tolerance to glufosinate. Upon further analysis, the level of expression of the *gdh*A gene was found to be highly correlated ($r = 0.9903$) to the level of herbicide tolerance. At the highest level of gene expression the *gdh*A transformed plants exhibited a 6X greater tolerance to gulfosinate than the non-transformed control plants. Thus, this research demonstrated the use of the *E. coli gdh*A gene in plant transformations can indeed produce a plant that has a novel mechanism for tolerance to glufosinate.