Characterization of the thermal dependence of bioengineered glufosinate resistance in cotton. Dawson, K.R.[1,*], P.A. Dotray[2], and J.R. Mahan[1]. [1]USDA-ARS, Lubbock, TX 79415 and [2]Texas Tech University, Lubbock, 79409-2122.
Glufosinate resistance has been developed in rice (*Oryza sativa* L.) and tobacco (*Nicotiana tabacum* L.) and is commercially available in corn (*Zea mays* L.) and soybean (*Glycine max* L.). Resistance was achieved by insertion and expression of the bialaphos resistance gene (*BAR* gene) isolated from *Streptomyces hygroscopicus*. The *BAR* gene, which codes for the phosphinothricin acetyl transferase (PAT) enzyme, detoxifies glufosinate into an inactive acetylated derivative. Previous research has demonstrated that environmental temperature can affect herbicide efficacy through the thermal dependence of the kinetics of herbicide/target enzyme interactions. Since glufosinate resistance is dependent on PAT activity, thermal limitation of kinetic constants could reduce the level of resistance. The observed resistance at a given temperature will be a combination of the efficacy of the herbicide metabolism and the inhibition of glutamine synthetase (GS), the target site enzyme. PAT and GS have been isolated from glufosinate resistant cotton. The thermal dependencies of the Km of PAT for glufosinate and the inhibition constant of glufosinate for GS have been determined. The kinetics of both enzymes are thermally dependent over the range of environmental temperatures at which the herbicide can be applied in a production environment. For example the Km of PAT for glufosinate varied 6 fold from 15-45°C. Based on these results the thermal dependence of the bioengineered glufosinate resistance in cotton will be determined.