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**2015 Southeastern Peanut Research Initiative**
**Final Report** - Summary

*Title*: Determining purple nutsedge sensitivity to foliar and soil applied residues

*Investigators*: Jason Ferrell, Univ. of Florida; jferrell@ufl.edu; 352-392-7512.

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Imazapic continues to serve as the foundation to many peanut weed management programs. Of late, the utility of imazapic appears to be decreasing. In particular, reports are becoming more common that purple nutsedge is not being reliably controlled – even when two applications have been made. Therefore, it is important to screen these suspect populations to determine if herbicide resistance has occurred, or if other factors are facilitating the reduced efficacy. The objectives of this study were to explore the response of purple nutsedge to imazapic applied to the foliage vs applications made only to the soil.

**Materials and Methods**

This experiment was conducted in the greenhouse using two populations of purple nutsedge: 1) tubers collected from suspect fields in central FL that have a history of imazapic usage, and 2) tubers collected from an area in south Georgia that has no history of imazapic or other ALS-inhibiting herbicides. Tubers were rolled in wet paper towels and placed in the greenhouse for 5-10 days to elicit germination. The germinated tubers will be sorted by size and planted in 6" pots containing commercial potting mix. Potting mix was used since it has a high organic matter fraction that will readily bind all herbicide residues and make them unavailable for plant uptake. This will effectively isolate the herbicidal activity to foliar absorption. When the populations were sprayed when they reach approximately 5" in height with either glyphosate or imazapic. The inclusion of glyphosate served as an internal check for the two populations. The known susceptible population was treated with the herbicide rates of 2x, 1x, 0.5x, 0.25x, 0.125x, 0.0625x, and 0x. The suspected resistant population was treated with these same rates, plus a 4x and 8x rate. The 1x rate was 1 lb ae and 0.063 lb ai, for glyphosate and imazapic, respectively. Fresh weight biomass of above ground tissue was collected at 21 days.

*Soil Dose-Response*

As stated above, tubers from two populations were pre-germinated in the greenhouse. The two populations were planted into pots containing field soil collected from a site with known imazapic history as well as soil collected from the same site without history of imazapic. This was to determine if the history soil has a microbial population that is degrading the imazapic too quickly for adequate control to be achieved. The two soils

were treated with imazapic or sulfentrazone. As stated above, the sulfentrazone will serve as an internal check for the reference nutsedge population. The same rate structure mentioned above will be employed. The entire soil sample will be mixed with the respective herbicide to ensure that the germinating tubers were exposed throughout the entirety of the experiment. Fresh weight biomass of above ground tissue will be collected at 30 days.

*Statistical Analysis*

Four replications will be used for each herbicide dose. The fresh weight data will be analyzed using multiple non-linear regression. The model will be a 4-parameter logistic equation with reverse interpolation to determine the EC50 for each population. An EC50 is the effective dose of herbicide required to reduce plant biomass by 50%. The EC50 values will be compared using 95% confidence intervals.

**Results**

Soil Bioassay

Experiments were conducted using imazapic and sulfentrazone applied to the soil to determine if soil-borne microbe populations were influencing imazapic activity. Unfortunately, the results of this experiment were highly variable. Pre-germinated tubers (roots extending from the tuber) to ensure that healty, live tubers were used in the experiment to minimize variation between pots. Although pre-germinated tubers were used, they would often not develop sprouts, even in the untreated pots. Because of the high variability in planted material, data from this experiment will not be shown.

Foliar Bioassay

The standard field use rate of imazapic is 0.063 lb ai/A. From the results in Table 1, the Citra population (suspected resistant) required an almost 2X rate to reduce growth by 50%. This is significant considering that the Tifton population (known susceptible) only required 0.027 lb ai/A (less than a ½X rate) for a 50% reduction in biomass. This essentially translates to a 10X difference in imazapic rate to elicit the same response from the susceptible and suspected resistant populations. Furthermore, the comparison of these two populations to glyphosate revealed statistically similar $EC_{50}$ values of 1.34 and 1.01 lb ai/A. This indicates that there is likely a physiological mechanism within the plant that is conferring the tolerance/resistance to imazapic alone.

Though not included in the original proposal, the Citra tubers were shared with a collaborator at USDA. He tested this population in outside mesocosms and sprayed with dose-rates of imazapic. At this location, the $EC_{50}$ value for the Citra population was 0.012 lb ai/A (Figure 1). These data suggest that the Citra population IS NOT demonstrating increased tolerance to imazapic.

The reason for the great difference between the two test sites is unknown. It is possible that the Citra population is a mixture of resistant and susceptible and that the USDA location received a disproportionate number of susceptible tubers. Other reasons for this

vast difference between locations are unknown. Additional research will need to be conducted to confirm or deny these results.

Table 1. Dose response experiment conducted under greenhouse conditions in Gainesville, FL using suspected resistant (Citra) and known susceptible (Tifton) populations of purple nutsedge.

| Herbicide | Placement | Population[1] | $EC_{50}$[2] |
|---|---|---|---|
| Imazapic | Foliage | Citra | 0.11 ±0.03 |
| Imazapic | Foliage | Tifton | 0.027 ±0.005 |
| Glyphosate | Foliage | Citra | 1.34 ±0.17 |
| Glyphosate | Foliage | Tifton | 1.01 ±0.21 |

[1]The Citra population is suspected resistant while the Tifton population is known susceptible.
[2]EC50, reported in lb ai/A, is the dose required to reduce plant biomass by 50% of the untreated control. The 1x field rate for imazapic is 0.063 lb ai/A.

Figure 1. Dose response experiment conducted at USDA location using the Citra population of possible resistant purple nutsedge tubers. $EC_{50}$ for imazapic was 0.012 lb ai/A.