

## **ALS-Tolerant Johnsongrass in Kentucky**

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### **INTRODUCTION**

Johnsongrass (*Sorghum halepense* L.) remains a common weed found throughout Kentucky crop fields. Prior to the early 1990's tillage was required to incorporate herbicides which were marginally effective for control of this troublesome weed in corn. The introduction of nicosulfuron (i.e. Accent) and primisulfuron (i.e. Beacon) in 1990 provided corn producers with two postemergence herbicide tools to selectively control johnsongrass after crop emergence. These and other ALS (acetolactate synthase inhibitor) herbicides effectively managed johnsongrass in corn fields. In recent years, however, poor control with some ALS-type herbicides was reported. Greenhouse and field studies were conducted to determine if johnsongrass tolerance to ALS-type herbicides had developed in Kentucky.

### **MATERIALS AND METHODS**

Poor johnsongrass control was observed in two corn fields; one located in Marion county and another in Adair county. Both fields were in continuous corn production for the past several years (>5 years) and the field in Adair County was frequently used for corn silage production. Accent, or other nicosulfuron containing herbicides, was applied each year for johnsongrass control.

Johnsongrass seeds collected from problem fields in Marion (2004) and Adair (2005) along with seed from a population known to be susceptible to Accent were planted in the greenhouse. All three sources of johnsongrass seeds were planted into cups containing a soil:sand mixture and after emergence seedlings were thinned to 3 plants/cup. Pots containing the three different johnsongrass populations were allowed to grow for 25 days before treatment with Accent at 0, 1, 5, and 10 times the standard application rate of 0.67 oz/A. At time of treatment, johnsongrass plants were 8 to 12 inches in height. Accent treatments were applied with crop oil concentrate at 1 qt/A at a spray volume of 25 GPA. Each herbicide rate was replicated four times for each of the three johnsongrass populations. Johnsongrass plants were evaluated and harvested 14 days after treatment for fresh and dry weight measurements.

A field study was conducted at the Adair County site in 2006 to evaluate Accent and other ALS-type herbicides along with three non- ALS herbicides. Corn was planted April 27 into a conventional tilled seedbed and treated with Bicep II Magnum at time of planting. After crop and johnsongrass emergence, field plots were established to evaluate 1x and 2x rates of Accent (0.67 oz/A), Steadfast (0.75 oz/A), Option (1.5 oz/A), Beacon (0.75 oz/A), Lightning (1.28 oz/A), Select (8 oz/A), Assure II (5 oz/A), and Roundup (2 pt/A, 0.75 acid equivalent of glyphosate). Treatments were replicated four times with an individual plot size 10 ft wide by 30 ft long. Herbicides were applied on May 19 with a small plot back-pack sprayer at a 20 GPA spray volume. Johnsongrass plants, seedling and rhizome, ranged in size from 3 inches to 12 inches in height at time of treatment. Visual ratings of percent johnsongrass control were taken approximately 3 weeks after treatment on June 12.

## RESULTS

**Greenhouse study:** For both johnsongrass populations (Adair and Marion), seedling johnsongrass (8 to 12 inches tall) was not controlled when Accent was applied at 1x, 5x, or 10x of the normal application rate of 0.67 oz/A (Figure 1). Fresh weight or dry weight (data not shown) of treated johnsongrass plants were not reduced even at the 10x rate with plants grown from seed collected from these two sites. Whereas, plant biomass was reduced by 70% or more with plants from a susceptible population of johnsongrass, even when treated with the lowest rate of Accent (0.67 oz/A).

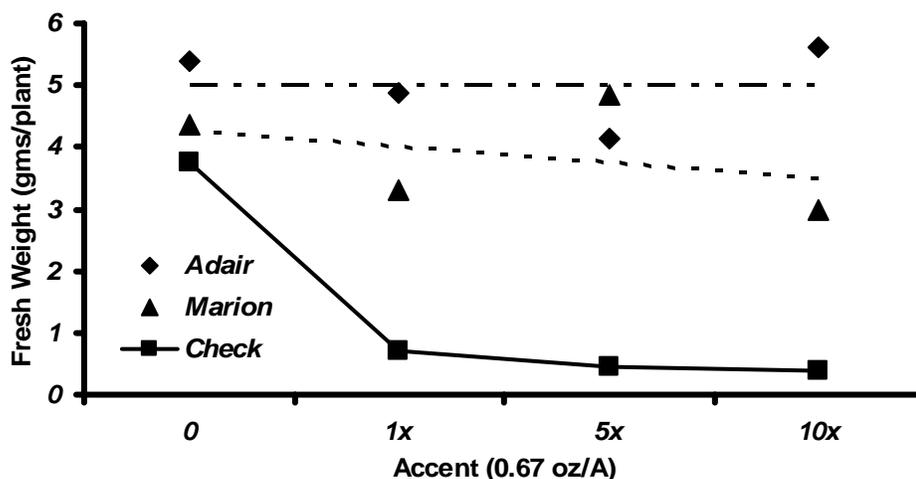


Figure 1. Johnsongrass control with Accent herbicide in greenhouse studies.

**Field study:** Johnsongrass control at the Adair field site was poor with all ALS-type herbicides (Figure 2). Little or no control of johnsongrass was observed with Accent (nicosulfuron) and Option (foramsulfuron) at both the 1x and 2x application rates and Beacon (primisulfuron) at the 1x rate. Beacon at the 2x rate and other ALS-herbicides such as Steadfast (nicosulfuron + rimsulfuron) and Lightning (imazethapyr + imazapyr) provided 35 to 45% visual control. Whereas, the three non ALS-herbicides provided good control (80% or more visual control of treated johnsongrass). The exception was 68% control with Assure II when applied at the 1x rate. Best results (90% control) were achieved with the glyphosate (i.e. Roundup) treatment.

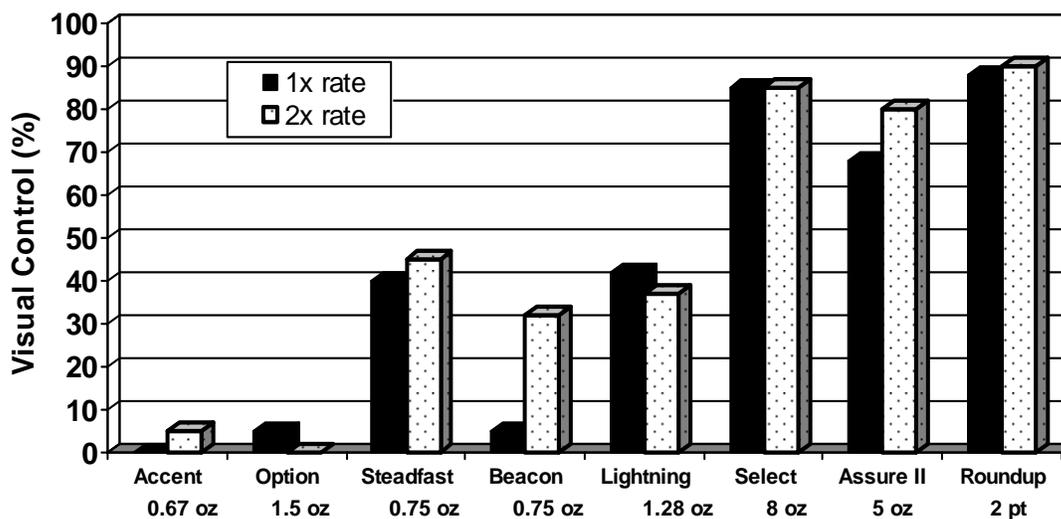


Figure 2. Field study to evaluate johnsongrass control with ALS-type and other herbicides (Adair County 2006)

## SUMMARY

Our results indicate that at least two johnsongrass populations in Kentucky were not effectively controlled by nicosulfuron, and could be cross-resistant with other ALS-inhibitor herbicides. Other herbicide products used for johnsongrass control or suppression which have ALS modes of activity include Beacon, Equip, Exceed, Spirit, Steadfast, Option, and Lightning. Therefore, caution should be used to avoid year to year dependence on these herbicide products for johnsongrass control in corn.

Since the effect on succeeding generations have not yet been conducted to confirm resistance, these findings are not fully conclusive that johnsongrass populations are resistant to nicosulfuron (Accent) or other ALS-herbicides. However, we do know that these two populations were not controlled by nicosulfuron in greenhouse evaluations nor in the field in 2006. Clearly, these are strong indications of resistance.

Management of this problem will require planting corn hybrids which have tolerance to glyphosate (eg. Roundup, Glyphomax, Touchdown, etc.) or use of crop rotations with soybean whereby other herbicide modes of action can be used such as Assure II, Fusion, Select, or glyphosate (i.e. Roundup Ready soybeans). An alternative herbicide program for a minimum of a two- to three-year sequence may be needed to reduce high levels of the ALS-tolerant biotype populations. Johnsongrass seed can remain dormant for 10 years or longer in soil; therefore, complete suppression of the tolerant biotypes may not be achieved within a two to three year rotation to an alternative practice. However, crop producers should always alternate herbicide chemistry to help prevent or minimize future herbicide resistant problems.

These findings are significant since johnsongrass continues to be one of the major weed problems encountered in corn and soybean production. In a 2004 weed survey johnsongrass ranked third as the most frequently observed weed species within Kentucky; thus, johnsongrass continues to be a significant threat each year to grain crop production.

At this time we do not know the full extent at which poor johnsongrass control is occurring throughout Kentucky following the use of ALS-type herbicides. We are interested in knowing about other fields in which johnsongrass was not effectively controlled by Accent, Beacon, Equip, Exceed, Spirit, Steadfast, Option, Lightning, or other ALS-based herbicides. The development of widespread resistance to these herbicides by johnsongrass (or other weeds) would have an enormous impact on corn production. Please notify us through your local county Extension office if you are aware of any fields in which lack of johnsongrass control could be attributed to continuous use of the above mentioned herbicides.

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