

**2001 RESEARCH SUMMARY  
ARKANSAS CORN AND GRAIN SORGHUM BOARD**

**TITLE:**            **Alternative Weed Control Programs in Arkansas Corn with Transgenic Cultivars**

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**CROP:**            Field corn

**STATUS:**         Funded 1999, 2000, and 2001; see new request for 2002 (combining with Ken Smith).

**OBJECTIVES AND ACCOMPLISHMENTS:**

The funding allowed Jason Bond, a half-time Graduate Assistant, and the Weed Science crew to conduct eight excellent field trials in 2001 (five at the Northeast Research and Extension Center, Keiser, and three at the Main Experiment Station, Fayetteville). Transgenic corn cultivars have the potential to be a replacement for, or supplement to, the traditional weed control systems based on triazine herbicides, which may be unavailable in the future because of environmental concerns. Specific objectives to be answered in field trials are:

- 1. To determine efficacy of glyphosate (Roundup UltraMax) applied alone and with residual herbicides for season-long weed control in Roundup Ready® field corn and continue to evaluate new herbicides for alternative weed control systems.**

Sequential applications of Roundup UltraMax provided season-long control of most weed species. However, atrazine (AAtrex and others) in some form or multiple applications of Roundup UltraMax at rates greater than 0.75 lb ai/A on two-leaf or smaller morningglory are needed if morningglory species are present. Sequential applications of Roundup UltraMax will provide good control of large crabgrass, broadleaf signalgrass, prickly sida, velvetleaf, Palmer amaranth, and pitted and entireleaf morningglory when applied by 2 to 3 weeks after emergence. In fact, the sequential applications of Roundup UltraMax at 0.375 lb/A provided control of all weeds evaluated. There were no significant yield differences among treatments of mesotrione (Callisto), AAtrex, or flufenacet/metribuzin (Axiom) followed by (**fb**) Roundup UltraMax and sequential applications of Roundup UltraMax. The short-term gross margins using Roundup Ready (glyphosate-resistant) corn are highly dependent upon the yield potential of the cultivar. Gross margins equivalent to the competitive standard [s-metolachler (Dual II) + AAtrex **fb** AAtrex] can be achieved from multiple applications of Roundup UltraMax and sometimes from single applications.

Callisto applied preemergence (PRE) or postemergence (POST) has shown excellent potential for weed control and high corn yields. Preemergence control was not influenced by soil texture. Callisto PRE or POST controls velvetleaf, prickly sida, and Palmer amaranth 95% or better, pitted and entireleaf morningglory 90%, and provided initial annual grass control. Tank mixing Callisto with Dual etc. improved grass control. A 4 to 6 oz/A rate of Callisto resulted in approximately 200 bu/A of corn regardless of method of application. Thus, results indicated that weed control in Arkansas corn can be obtained without atrazine.

**2. To compare performance of glufosinate (Liberty) to standard weed control practices in Liberty Link® corn.**

Season-long weed control in Liberty Link (glufosinate-resistant) corn is a combination of timely herbicide application and crop canopy closure. Sequential applications of Liberty at 0.27 lb ai/A provided season-long control equal to the competitive standard for all weed species present; however, the addition of AAtrex POST to Liberty increased control of larger entireleaf morningglory as compared to sequential applications early in the season. An application of Liberty at 1- to 4-leaf regrowth of weeds following a reduced PRE rate of AAtrex or less active herbicide gave reduced control of pitted and entireleaf morningglory. However, corn yield was not reduced. Sequential applications of Liberty controlled species that are usually hard to control, such as morningglory species, broadleaf signalgrass, prickly sida, and velvetleaf. Yields and gross margins equal to the competitive standard can be achieved with two applications of Liberty.

**3. To evaluate imazethapyr + imazapyr (Lightning®) in imidazolinone-resistant (Clearfield) corn.**

Lightning at 0.056 lb ai/A is best when applied to small weeds. Weeds, such as broadleaf signalgrass, 1 to 3 inches tall are controlled better than 4- to 6-inch weeds. The addition of Dual II PRE also improved control of broadleaf signalgrass. It is possible to obtain season-long control of velvetleaf with Lightning when applied to small velvetleaf. The addition of dicamba (Clarity) to Lightning improved season-long control of prickly sida, entireleaf morningglory, and pitted morningglory. The residual activity of Lightning is a definite advantage in preserving yield that would otherwise be compromised by weed competition between and after herbicide applications. Weeds were not always killed with POST applications of Lightning; however, they were definitely suppressed and probably non-competitive after application. The acceptance of Lightning-only herbicide systems will depend on the presence of ALS-resistant weeds, cost of seed and herbicide, and yield potential of the hybrid in which the gene is placed.

**4. To evaluate sethoxydim (Poast Plus®) in Poast-resistant corn.**

Not evaluated due to cultivar availability. Seed producers have stopped production.

**5. To determine costs of transgenic weed control systems and compare with cost of standard herbicide programs.**

The herbicide-resistant technologies will have an immediate fit in those locations that have banned the use of AAtrex because of high water tables, problem weeds, and soil texture. The herbicide-resistant technology used will depend on cost and weed spectrum, although the most economical system tends to be a PRE application of AAtrex fb an application of Liberty, Roundup UltraMax, or Lightning. However, excellent control using only herbicide-resistant technologies can be achieved, but sequential applications of Roundup UltraMax or Liberty are necessary. Problem species may include velvetleaf and prickly sida for Liberty, pitted and entireleaf morningglory for Roundup UltraMax, and broadleaf signalgrass and morningglory species for Clearfield. Nevertheless there are effective weed control systems in which AAtrex can be eliminated. The adoption of herbicide-resistant hybrids will be pushed mainly by the economics of each system. The yield potential of the hybrid is another driving force that could influence acceptance.

**VALUE TO GROWER:** The research is substantially increasing the data base for determining if atrazine can be omitted from herbicide programs in corn. Our results indicate that the transgenic cultivars (Roundup Ready, Liberty Link, and Clearfield) will allow herbicidal control of weeds equivalent to or superior to weed control programs with AAtrex. However, cultivar selection will be critical in terms of corn yield potential vs conventional corn cultivars. Callisto is an excellent replacement for AAtrex.

**Publications:**

Sparks, O.C. and L.R. Oliver. 2000. Weed control with ZA 1296 (mesotrione) in field corn. Abstr. Res. Conf. Ark. Crop Protection Assoc. 4:4.

Sparks, O.C. 2000. Alternatives to atrazine for weed control in glufosinate-, glyphosate-, and imidazolinone-resistant corn hybrids. Master of Science Thesis, University of Arkansas. 208 pp.

Sparks, O.C. and L.R. Oliver. 2001. Weed control in corn using ZA 1296 (mesotrione). Proc. South. Weed Sci. Soc. 54:10.