Arkansas Wheat Promotion Board
Yearly Report

Title: Hoelon-Resistant Ryegrass in Wheat
Principle Investigator: Dick Oliver, Ron Talbert, Nilda Burgos, and Jim Barrentine, Fayetteville, and Ford Baldwin, Little Rock
Period of Progress Report: January 2001 to December 2001

Update: The fourth year of field research has been harvested and laboratory procedures are being conducted. The integrated weed management study was not continued after 3 years but the IMI wheat study was expanded to evaluate the control of other problem weeds in wheat

Objective 1: To develop an Integrated Weed Management system for Hoelon-resistant ryegrass in wheat (Oliver, Baldwin, and Barrentine).

An integrated weed management study at Willow Beach evaluating cultural, mechanical, and chemical control of perennial ryegrass (*Lolium perenne*) was conducted for three years. A population of Hoelon (diclofop)-resistant perennial ryegrass was reduced 90% for 2 years by fallowing for a wheat growing season. The third year after fallowing, ryegrass was reduced only approximately 50% but still at least twice the reduction of conventional or no-till tillage practices. A no-till production system had the highest ryegrass emergence and least control. Of the four herbicide programs evaluated only Axiom (flufenacet + metribuzin) at 2- to 3-tiller wheat provided greater than 90% control the third year of treatment in no-till plots. Axiom and Prowl (pendimethalin) + Glean (chlorsulfuron) preemergence, or Sencor/Lexone (metribuzin) at 2- to 3-leaf and 2- to 3-tiller wheat were equally effective (>95% control) under conventional and fallow production systems A 10 to 15% increase in control was observed when wheat seeding rate was doubled from 90 to 180 lb/A No differences were observed between burn and no-burn stubble management treatments

To evaluate alternative herbicide programs for Hoelon-resistant perennial ryegrass, experiments were conducted at Willow Beach and Fayetteville the past 3 years. Prowl (pendimethalin), Prowl plus Glean (chlorsulfuron), Finesse (chlorsulfuron/metsulfuron), and Axiom (flufenacet + metribuzin) provided the highest preemergence control. Postemergence applications of Finesse, Achieve (tralkoxydim), Sencor/Lexone (metribuzin), and Everest (MKH 6562) were the most effective. However, sequential treatments were needed to maintain resistant ryegrass control and wheat yield at harvest. Effective sequential treatments were Prowl followed by (fb) Achieve, Sencor/Lexone fb Sencor/Lexone, Finesse fb Sencor/Lexone, and Axiom fb Everest The most consistent control programs have been the sequential treatments

The experimental IMI (Clearfield) wheat cultivar production system was evaluated. Our study is one of the few in the U.S. to evaluate potential of four imidazolinone herbicides to control Hoelon-resistant ryegrass. Of the IMI herbicides evaluated Raptor (imazamox) proved to be the most effective. Raptor applied at 2- to 3-leaf wheat, Prowl + Gleam preemergence fb Raptor, or Prowl + Raptor preemergence were the best treatments. The imidazolinone herbicide Raptor has proven to be another valuable option for control of resistant ryegrass in wheat

Objective 2: To conduct weed biology studies on Hoelon-resistant ryegrass (Oliver).

Suspected resistant samples of ryegrass (*Lolium* spp) sent to Dr. Talbert from 1996 to 1999 have been identified as Italian ryegrass (*Lolium multiflorum*), poison ryegrass (*Lolium temulentum*), and perennial ryegrass (*Lolium perenne*) Of 58 resistant samples that have been evaluated since 1996, 26 have been planted in a study to evaluate morphological and reproductive difference under a common

environment at Fayetteville. Every two weeks after transplanting, plant height and tiller number were recorded. At flowering, plant height and tiller number, and spike and spikelet length were measured Three growth characteristics were noted: an erect and highly tillered; completely prostrate; and moderately prostrate with less tillers. Plant color characteristics were reddish for prostrate and less prostrate growth habit, less reddish (red at nodes and base) for erect or less prostrate, and greenish for erect. Ryegrass spike length ranged from 10 to 26 cm and spikelet length ranged from 0 8 to 2.5 cm depending on ecotype. The study has been reestablished with 40 samples of which ten are from single plant sources.

Objective 3: To determine the mechanisms of Hoelon-resistance in ryegrass species and biotypes (Burgos and Talbert).

Genomic DNA have been extracted from 70 resistant and susceptible ecotypes and accessions of ryegrass from Arkansas and the world ryegrass germplasm collection. A total of 64 amplified fragment length polymorphism (AFLP) primer pairs were screened on ryegrass cultivar Marshall (susceptible) and accession 98-2R (resistant) to determine which primer pairs produced the most number of amplified DNA fragments that are clearly detectable. Amplified DNA fragments appear as 'bands' in a polyacrylamide gel, which segregate according to fragment size. The number of bands produced among 64 primer pairs on Marshall and 98-2R ranged from 1 to 42. The top 20 primer pairs that produced the most bands (31-42 on Marshall and 9 to 34 on 98-2R) were chosen to analyze the genetic relatedness of 70 resistant and susceptible ryegrass samples. In addition, it is hoped that genetic data will show molecular markers linked to diclofop resistance. DNA fingerprinting using AFLP technique is on-going

Publications:

Barber, L.T 2000. Alternative control practices for diclofop-resistant ryegrass (*Lolium perenne*) in wheat. M.S. Thesis, University of Arkansas, 103 p.

Payne, Scott, Thomas Barber, Dick Oliver, and Ford Baldwin. 2000. Integrated weed management for Hoelon resistant ryegrass in wheat. Abstr. Arkansas Crop Protection Assoc. 4:11-12.

Barber L.T., L.R. Oliver, F.L. Baldwin, and R.C. Scott. 2001. Diclofop-resistant ryegrass control with imazamox in Clearfield wheat. Proc. South Weed Sci Soc. 54:10.