Arkansas Wheat Promotion Board

Annual and Quarterly Report

Title: Hoelon-Resistant Ryegrass in Wheat

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Period of Progress Report: January 2002 to December 2002

Update: The fifth year of field research has been harvested and DNA fingerprinting of ryegrass accessions is being conducted. This years' wheat and ryegrass biotypes have been planted. Falcon and Clearfield (IMI) wheat studies were expanded to evaluate the control of other problem weeds.

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

To evaluate alternative herbicide programs for control of Hoelon-resistant perennial ryegrass (*Lolium perenne*), experiments were conducted at Willow Beach and Fayetteville. Prowl (pendimethalin) + Glean (chlorsulfuron), or Finesse (chlorsulfuron + metsulfuron) were the most effective preemergence treatments. Sequential applications with a postemergence were needed to maintain control throughout the season. Sequential postemergence applications of Achieve (tralkoxydim) and Sencor/Lexone (metribuzin) or Axiom (flufenacet + metribuzin) + Everest (MKH 6562) provided control. Preemergence followed by postemergence treatments of the previously mentioned herbicides were the most effective. The most consistent control programs

involved sequential treatments. The important concept to obtain wheat yield equivalent to the weed-free check was maintaining 80% ryegrass control for the first 5 months following emergence. However, the most outstanding resistant ryegrass control during the past 4 years has been the new experimental herbicide Falcon (mesosulfuron) which should be labeled within the next year. Our testing has shown Falcon controls 96 to 100% of 3-leaf to 2-tiller ryegrass.

A Clearfield wheat cultivar production system was evaluated in Keiser, Pine Tree, Kenset, and Fayetteville. Beyond (imazamox) is the best herbicide treatment applied at 1- to 2-leaf wheat or with a repeat application at 3- to 4-leaf wheat. The imidazolinone herbicides have 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).

A field experiment was conducted at the Agricultural Experiment Station, Fayetteville, to determine morphological differences among 35 ryegrass accessions. Ryegrass seeds collected from Craighead, Crittenden, Cross, Desha, Faulkner, Independence, Lawrence, Lee, Lonoke, Monroe, Perry, Poinsett, Prairie, Randolph, St. Francis, White, Woodruff, and Marshall counties in Arkansas, and Dunkin, Premiscot, and Stoddard counties in Missouri. Ryegrass accessions from Yorktown, Pinnacle, 84TX223-005 and four populations from overseas were included. During the growing season, plant height, plant growth habit, and plant and node color were recorded. At maturity, plant height, tiller number, and spike number were recorded. Two spikes from each plant were collected to measure spike length, spikelet number, number of spikelets per spike, distance between two spikelets, awn length, and number of seed per spikelet.

In general, in terms of growth habit there were three growth characteristics: erect, prostrate, and moderately prostrate (or spreading ascending). Three color characteristics were

noted: reddish for prostrate and moderately prostrate ryegrass; less reddish (red at the node and at the base of the plant) for erect and moderately prostrate; and greenish for erect ryegrass. There were two node colors, red and green. The ryegrass accession from Lonoke was the tallest (83 cm). Ryegrass from Pinnacle (35 cm) and Yorktown (30 cm) were the shortest plants. The Woodruff county accession had the highest number of tillers (288). Pinnacle and Yorktown had only 188 tillers. However, ryegrass 84TK223-055 with 58 tillers had the lowest number of tillers among ryegrass accessions. Plants from St. Francis and Stoddard counties, with 261 and 226 spikes, respectively, had the highest number of spikes. The ryegrass accessions from Pinnacle, Yorktown, and 84TK223-055 had lowest number of spikes. There were significant differences in terms of spike length (ranging from 18 to 32 cm), spikelet length (ranging form 2.2 to 1.4 cm), number of spikelets/spike (ranging from 14 to 27), awn size (ranging from 0 to 1.2 cm), and number of seed/spikelet (ranging from 3 to 13). In the Arkansas accessions, Independence and White county accessions had 71,234, and 28,063 seed/plant the highest and lowest, respectively. Yorktown, Pinnacle, and 84TK223-055 accessions produced 18,453, 17,626, and 4,224 seed/plant. Most of the ryegrass accessions in this study were identified as *Lolium perenne* L. ssp. *multiflorum*. However, the populations from Yorktown and Pinnacle were identified as *Lolium perenne* L. ssp. *perenne*, and the population 84TK223-055 was identified as *Lolium temulentum* L.

Objective 3: Genetic analysis of resistant ryegrass populations (Burgos and Talbert).

In 2002, two ryegrass accessions from Forest, LA and two accessions from Rohwer, AR were received. Both accessions from Rohwer and one accession from LA confirmed resistant to Hoelon. Hoelon-resistant ryegrass is still a prevalent problem in Arkansas wheat fields, but many

producers are now aware that once they see failure in ryegrass control by Hoelon after years of use, they have a resistance problem. Genetic fingerprinting of 66 Hoelon-resistant and -susceptible accessions of ryegrass, using 17 informative AFLP primer pairs, is completed. Seven other primer pairs used did not give useful information. The accessions fingerprinted include ryegrass species from Australia, Turkey, and Russia. Data analysis are on-going. Pertaining to the search for molecular markers associated with resistance, crosses had been made between purified accessions of 98-2 (resistant) and Marshall (susceptible). More than 1,000 F1 progenies were grown in the greenhouse and selfed. The progenies were resistant to eight times the recommended rate of Hoelon. We are now screening for ALFP primers that will produce a DNA marker that will confirm whether all these progenies were indeed hybrids. Seed of the non-hybrids (if any) will be discarded. Resistant and susceptible individuals should segregate in the F2 generation and the DNA profile of these individuals will be compared.