

Weed Management Research and Publications for Small Grains in South Dakota (Approved July 2012)

Principle Investigators: Mike Moechnig, Extension Weeds Specialist, SDSU
Darrell Deneke, Extension IPM Specialist, SDSU
David Vos, Project Technician, SDSU
Jill Alms, Project Technician, SDSU
Rutendo Nyamusamba, Graduate Research Assistant, SDSU

Objectives:

- Print the annual publication “Weed Control in Small Grains and Millet: 2013,”
- Evaluate spring wheat tolerance to glyphosate burndown applications,
- Burn-down herbicides in wheat stubble prior to cover crop planting,
- Evaluate tumble grass control in winter wheat, and
- Determine the benefits of including small grains in crop rotations to manage glyphosate resistant kochia seed banks.

Justification:

Herbicide fact sheet: “Weed Control in Small Grain and Millet: 2011” provided information on herbicide options, efficacy, and cost for winter and spring wheat, oats, and millet. We printed approximately 1,500 copies which were distributed at winter meetings and we will continue to distribute them. The fact sheet has a new design with a color cover and heavier paper. We continue to include the SD Wheat Commission logo on the cover to acknowledge your support. We are requesting funding for 2013 to update, print, and distribute this fact sheet.

Spring wheat tolerance to glyphosate burndown applications: Although glyphosate is usually a very safe herbicide for burndown weed control in no-till spring wheat, there are some potential concerns regarding wheat productivity. There have been accusations among some agricultural professionals that continuous glyphosate use may be degrading soil microbial populations, tying up micronutrients, and making wheat more susceptible to disease injury. There is often little or no research to support these accusations, but occasional articles in the popular press perpetuate these theories. A more practical concern is the potential for wheat injury if glyphosate is applied immediately before or during wheat emergence. This situation occurs when people intend to make a glyphosate burndown application after wheat planting, but adverse weather conditions delay the application. We propose to establish a research trial to evaluate these concerns regarding potential wheat injury after glyphosate burndown applications.

We conducted the first year of this research last summer (2011). Results were a little concerning as yield loss was nearly 20 percent in the treatment with Roundup WeatherMax applied at a 1X (22 oz/A) rate applied after wheat planting but prior to emergence (although variability was high enough that this response was not statistically significant). In addition, August glyphosate residue in the soil was nearly 10X greater than what we measured in soybeans. These results are not highly reliable as wheat growth was inhibited due to wet conditions resulting in a maximum yield of 30 bu/A and weed pressure increased later in the season. Consequently, additional research is needed to verify these preliminary results.

Burn-down herbicides prior to cover crop emergence: Several wheat growers have become interested in growing cover crops after wheat harvest to gain extra forage and improve soil quality. However, there is little known about the tolerance of common cover crops to wheat herbicide residues in the soil. Glyphosate is the recommended burn-down herbicide in most situations, but I have received some questions regarding the potential to use tank mix partners to control difficult weeds, such as dandelions, field bindweed, wild buckwheat, and others prior to cover crop emergence.

We conducted one trial last year that demonstrated several cover crop species tolerated most burn-down herbicides, such as 2,4-D ester or amine (up to 1 qtr./A), Express, Buctril, and others. To verify these results, we are proposing to repeat that research one more year.

Evaluate tumble grass control in winter wheat: I have been getting several questions over the past couple years regarding tumble grass control in wheat. We have a potential research site in a field near Wall. Since it is a warm season perennial grass, we may have to look at options for controlling it after harvest in the stubble.

Using small grains to manage glyphosate resistant kochia seed banks: Glyphosate resistant kochia has been identified at several locations in north-central South Dakota. Resistance was first identified in a field when planted to soybeans in 2008, but seeds from kochia plants collected in wheat stubble in 2009 were still testing positive for glyphosate resistance. Previous research at other Universities indicated kochia seed may be relatively short-lived in the soil. Consequently, there has been some speculation that farmers could rotate to grass crops such as small grains or corn to aggressively manage kochia and deplete the seed bank thus enabling future rotations to Roundup Ready soybeans without have to apply much additional herbicide. A Ph.D. graduate student will be conducting field research and developing a model to predict the effect of including small grains in crop rotations to manage kochia seed banks.

Preliminary results are indicating that wheat residue may reduce kochia seed survival more than corn or soybean residue or perhaps even in fallow. We will focus more on this aspect in 2012.

Materials and Methods:

A) Spring wheat tolerance to glyphosate burn-down applications:

a. *The treatments will be designed to generate a dose response curve that will enable us to identify an approximate glyphosate rate that will cause yield loss in spring wheat. Rates will range from those that cause no injury to those we know will cause severe injury.*

Rates applied pre-emergence will include:

- 1.No Roundup
- 2.Roundup WeatherMax 22 oz/A
- 3.Roundup WeatherMax 500 oz/A
- 4.Roundup WeatherMax 1,000 oz/A
- 5.Roundup WeatherMax 2,000 oz/A
- 6.Roundup WeatherMax 3,000 oz/A

All treatments will be kept weed-free throughout the growing season using similar conventional herbicides in each treatment. Each treatment will be replicated 4 times in a randomized complete block design. Measurements will include visual estimates of wheat growth response and soil glyphosate residues in August immediately after harvest for yield measurements.

b. *Wheat tolerance to burn-down herbicides:* A related study will be conducted where herbicide treatments are applied just as wheat is beginning to emerge from the soil.

Treatments will include:

1. Untreated
2. Roundup WeatherMax 22 oz/A + AMS
3. Gramoxone Inteon 2 pt/A
4. Ignite 22 oz/A + AMS
5. Pre-Pare 0.3 oz/A
6. Sharpen 1.5 oz/A
7. 2,4-D ester 1 pt/A
8. GoldSky 1 pt/A

Observations will include visual estimates of wheat growth reduction and grain yield at maturity. Treatments will be replicated 3 times in a randomized complete block design. Each treatment, including the untreated check, will be kept weed free using conventional herbicides.

B) Burn-down herbicides prior to cover crop establishment:

a. *Treatments*

1. Untreated check
2. 2,4-D ester 1 qt/A
3. 2,4-D amine 1 qt/A
4. Sharpen 1 oz/A
5. Pursuit 2L 3 oz/A
6. Harmony 50SG 0.5 oz/A
7. Flexstar 0.75 pt/A
8. Status 5 oz/A
9. Express 50SG 0.5 oz/A
10. Buctril 4EC 0.8 pt/A

Herbicides will be applied after cover crop planting but prior to emergence. Cover crop species will include oilseed radish, chickling vetch, forage turnip, lentil, and winter canola. Measurements will include visual estimates of cover crop injury or growth reduction. Treatments will be replicated 3 times in a randomized complete block design.

C) Tumble grass control in winter wheat:

a. *Spring treatments*

1. Untreated check
2. Olympus (0.9oz) + NIS (0.5% v/v)
3. Maverick (0.66oz) + NIS (0.5% v/v)
4. PowerFlex (3.5oz) + NIS (0.5% v/v)
5. Everest (0.61oz) + NIS (0.5% v/v)

b. *Fall (stubble) treatments*

1. Untreated check
2. Roundup WeatherMax 22 oz/A + AMS
3. Roundup WeatherMax 44 oz/A + AMS
4. Olympus (0.9oz) + NIS (0.5% v/v)
5. Maverick (0.66oz) + NIS (0.5% v/v)
6. PowerFlex (3.5oz) + NIS (0.5% v/v)
7. Everest (0.61oz) + NIS (0.5% v/v)

Measurements will include visual estimations of tumble grass control. Herbicide treatments will be replicated 3 times in a randomized complete block design.

D) Managing kochia seed banks with small grain rotations:

- a. *Treatments:* Kochia will be grown in field plots at the Brookings Agronomy Farm with no crop, spring wheat, corn, soybeans, or field peas to quantify the effects of small grains on the growth and seed production of kochia escapes. Some kochia plants will be left in the field over winter and kochia seedlings will be counted the following spring. Since these plots will be established in an area that currently does not have kochia, all kochia seedlings the following year will almost certainly be from the parent plants grown the previous year. In addition, 100 kochia seeds per sq. ft will be placed in each crop at the time of planting to quantify kochia seedling mortality in each crop. An additional study

will be established at the Brookings Agronomy Farm and Highmore to quantify kochia seed survival in the soil if seeds are left on the soil surface, buried 0 - 2 inches below the soil surface, or buried approximately 6 inches below the soil surface. Results from each of these studies will be used to develop a model to predict the effects of including small grains in rotations to manage kochia seed banks.

- b. *Experimental design and measurements:* Crop treatments will be established in 10 ft by 40 ft plots and replicated 4 times in a randomized complete block design. Crop canopy growth will be measured throughout the season and kochia biomass and seed production will be measured at kochia maturity.

Summary of past SD Wheat Commission funding:

Fifteen-hundred copies of “Weed Control in Small Grain and Millet: 2012” were printed. Field research conducted on burn-down herbicides residual herbicides indicated many herbicides were relatively safe when applied as wheat was emerging, but glyphosate may have decreased yield. Research in 2012 will be expanded to include greater focus on the effects of soil-applied glyphosate on wheat yield. Herbicide burn-down applications prior to cover crop planting in wheat stubble were surprisingly safe on many common cover crop species. The study will be repeated in 2012 to verify the results. We also conducted a very interesting trial on foxtail barley control near Harold, SD. Results indicated that there may be no selective grass herbicides that will control foxtail barley plants in wheat. Consequently, people will likely have to rely on glyphosate burn-down applications prior to spring wheat or in the fall prior to winter wheat planting to control foxtail barley. The population dynamics study regarding kochia seed bank depletion is progressing. Perhaps one of the more interesting results from last year was that spring wheat seems to reduce kochia seed survival more than other crop residues. Research in 2012 will be expanded to evaluate this in greater detail.