Weed Management Research
and Publications for Small Grains in South Dakota

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Principle Investigators:

Mike Moechnig, Extension Weeds Specialist, Plant Science Dept., SDSU, Brookings
Darrell Deneke, Extension IPM Specialist, Plant Science, Dept., SDSU, Brookings
David Vos, Project Technician, Plant Science Dept., SDSU, Brookings
Jill Alms, Project Technician, Plant Science Dept., SDSU, Brookings
Rutendo Nyamusamba, Graduate Research Ass't., Plant Science Dept., SDSU, Brookings

Objectives:

A) Print the annual publication "Weed Control in Small Grains and Millet: 2012," FS525A.
B) Evaluate downy brome (or "cheatgrass") control with the new ClearField wheat varieties that have greater tolerance to Beyond.
C) Evaluate spring wheat tolerance to glyphosate burndown applications after wheat planting but prior to emergence.
D) Quantify the effect of herbicide carryover on forage cover crops planted after wheat harvest.
E) Measure the benefits of including small grains in crop rotations to manage glyphosate resistant kochia seed banks.

Justification:

Herbicide fact sheet: This fact sheet provides updated information on herbicide options, efficacy, and cost for winter and spring wheat, oats, and millet. We printed 2,500 copies which were distributed at winter meetings and we will continue to distribute them during summer at our crop scouting school at the NE Research Station, Dakota Fest, and the SD State Fair. We are requesting funding for 2012 to update, print, and distribute this fact sheet.

Downy brome control in new ClearField wheat: Some agronomists and wheat producers have suggested that Beyond herbicide may control downy brome better than competitive herbicides during stressful growing conditions or late applications. Our previous evaluation of Beyond in 2006 suggested it was equivalent to alternative herbicides when applied in the spring, but the ClearField varieties released since have greater tolerance to Beyond which enables the use of more potent adjuvants, such as MSO rather than NIS. We are proposing to conduct two research trials in Stanley County to determine if ClearField may provide greater downy brome control than competitive herbicides when applied in the fall or spring.

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 immediate 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.

Carryover of wheat herbicides on cover crops: 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. We established two carryover trials last year (at Dakota Lakes and at the Highmore Research Station). The trial at Dakota Lakes resulted in no carryover injury and the results from Highmore were inclusive due to poor cover crop establishment. We recently purchased a new planter which we hope will enable better cover crop establishment. Therefore, we are proposing to conduct another carryover study at Highmore in 2011 to evaluate carryover potential on poorer quality soils than those at the Dakota Lakes Research Farm.

Using small grains to manage glyphosate resistant kochia seed banks: Glyphosate resistant kochia was 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.

Materials and Methods:

A) Downy brome control in new ClearField wheat:

a. *Study 1, Effect of adjuvants on weed control and crop tolerance:*

1. Untreated check
2. Beyond 2 oz/A + NIS + UAN
3. Beyond 2 oz/A + MSO + UAN
4. Beyond 2 oz/A + MSO + AMS
5. Beyond 6 oz/A + MSO + UAN
6. Beyond 8 oz/A + MSO + UAN

b. *Experimental design and measurements:* This study will be established in Stanley County. Herbicides will be applied in the fall (Oct.) on emerged winter wheat and downy brome. Each plot will be replicated 3 times in a randomized complete block design.

c. *Study 2, Beyond programs for downy brome control:*

1. Untreated check
2. Beyond 4 oz/A + NIS + UAN (Fall)
3. Beyond 4 oz/A + MSO + UAN (Fall)
4. PowerFlex 3.5 oz wt/A + NIS + UAN (Fall)
5. Olympus Flex 3 oz wt/A + NIS + UAN (Fall)
6. Beyond 2 oz + PowerFlex 1.75 oz + NIS + UAN (Fall)
7. Beyond 4 oz + MSO + UAN (Fall)
   Beyond 4 oz + MSO + UAN (Spring)

8. Beyond 2 oz + NIS + UAN (Fall)
   Beyond 4 oz + NIS + UAN (Spring)
9. Beyond 2 oz + NIS + UAN (Fall)
   Beyond 4 oz + MSO + UAN (Spring)
10. Beyond 2 oz + MSO + UAN (Fall)
    Beyond 2 oz + MSO + UAN (Spring)
11. Beyond 2 oz + MSO + UAN (Fall)
    PowerFlex 3.5 oz + NIS (Spring)
12. Beyond 2 oz + MSO + UAN (Fall)

d. *Experimental design and measurements:* This study will be established Stanley County. Herbicides will be applied in the fall (Oct.) or spring (May). Each plot will be replicated 4 times in a randomized complete block design. Herbicide efficacy will be measured for approximately 2 months after application.

B) Wheat tolerance to glyphosate burndown applications:

a. *Treatments*

1. Untreated check
2. Roundup WeatherMax 22 oz/A (PRE)
3. Roundup WeatherMax 22 oz/A (Late PRE)
4. Roundup WeatherMax 10 gal. product/A (PRE)
5. Roundup WeatherMax 20 gal. product/A (PRE)
6. Gramoxone Inteon 2 pt/A (Late PRE)
7. Ignite 22 oz/A (Late PRE)
8. PrePare 0.3 oz/A (Late PRE)
9. Sharpen 1.5 oz/A (Late PRE)
10. 2,4-D ester 1 pt/A (Late PRE)

b. *Experimental design and measurements:* This study will be established in spring wheat at the Brookings Agronomy Farm. It will be important to keep this trial close to SDSU campus to ensure timely herbicide applications. The preemergence (PRE) applications will be applied immediately after planting whereas the late preemergence (Late PRE) treatments will be applied approximately 5 days after planting or immediately prior to wheat emergence. Crop injury will be evaluated throughout the growing season and yield will be measured at wheat maturity.

C) Carryover of wheat herbicides on cover crops:

a. *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)
6. Beyond (4oz) + NIS (0.3%v/v) + 28%N (2.5%v/v)
7. Ally (0.1oz) + NIS (0.25%v/v)
8. Huskie (13.5oz) + AMS (0.5lb)
9. WideMatch (1.33pt)

10. Express (0.33oz) + NIS (0.25%v/v)
11. Harmony 50SG (0.9oz) + NIS (0.25%v/v)

b. *Experimental design and measurements:* This study will be established in spring wheat at the Highmore Research Station. All herbicides will be applied in the spring prior to jointing. Immediately after wheat harvest, cover crops (oilseed radish, turnips, hairy vetch, chickling vetch, and canola) will be planted with a 5 ft wide drill perpendicular to the herbicide treatment plots. Cover crop biomass and visible injury will be evaluated in late October. In addition, data loggers will be placed among the different cover crops and bare soil treatment to quantify soil moisture at 6 – 12 inches deep.

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.

Requested funding is approximately 25 percent of the total cost for printing, travel, operating expenses, and labor. Matching costs include professional staff time and additional equipment charges. Budget is established on a per treatment projected cost which reflects a reduction in costs associated with conducting multiple projects at similar locations. The Extension W.E.E.D. Project and the Extension IPM Project provide evaluation and tour expenses as part of the education program.

Summary of past SD Wheat Commission funding:

Twenty-five Hundred copies of "Weed Control in Small Grain and Millet: 2011" were printed. Many have been distributed at winter meetings and at summer events (Crop scouting school, Dakota Fest, State Fair). Field research was conducted on residual herbicides in small grains at the Highmore and NE Research Stations. Results demonstrated poor residual weed control, particularly on downy brome. Consequently, we did not see economical benefits from using tank mix partners with glyphosate for burndown applications for downy brome or residual broadleaf

weed control. Herbicide carryover research on cover crops at Dakota Lakes demonstrated that many different cover crop species where tolerant to most winter and spring wheat herbicides. Results at Highmore were inconclusive because of poor cover crop emergence, but there were no clear indications of serious cover crop injury after using different herbicides with carryover potential, such as Ally, downy brome herbicides, Huskie, and several others.

We greatly appreciate past and future support from the SD Wheat Commission to continue our effort to provide cutting edge weed management information to SD wheat growers. Collaborations among commodity groups, industry, and the university are essential to maintain efficient wheat production in South Dakota. Checkoff support enables us to research new weed management techniques and provide unbiased recommendations to the public.