Spring-Seeded Nurse Crop and Fall-Seeded Cover Crops in Sugarbeet

Thomas J. Peters

Sugarbeet Agronomist and Weed Control Specialist

North Dakota State University and University of Minnesota

NDSU EXTENSION SERVICE

UNIVERSITY OF MINNESOTA EXTENSION


Spring 2017, east of Moorhead
On I-94

Replant acres frequency* in the Red River Valley, 1980 to 2015

Year	Areas Planted	Acres Replanted	Percent Replant Acres
1980	279,219	43,819	15.7%
1990	401,349	17,042	4.3%
2000	502,728	4,837	1.0%
2010	421,812	1,833	0.4%
2015	400,072	8,441	2.1%

- *Data from American Crystal Sugar, Tyler Grove, General Agronomist
- Less moldboard plowing and summer fallow fields
- Increased spring rainfall compared to the 1980s
- Increased adoption of cover crops

Spring-seeded cereal cover crops offer several purposes to sugarbeet growers

- Reduce stand loss from wind and blowing soil
- Phosphorus credits in exchanging for processing facility capacity, SMBSC
- Improve soil health
- Protect against freezing temperatures
- Suppress weeds

Producer field, Norman, County

Image Credit: Tyler Grove, ACS

Wheat seeded as a nurse crop with sugarbeet, Wilkin County, 2014


Waterhemp in soybean, 2014
Renville County, MN

Impact of soil-applied herbicides on spring-seeded cereal cover crops

Materials and Methods

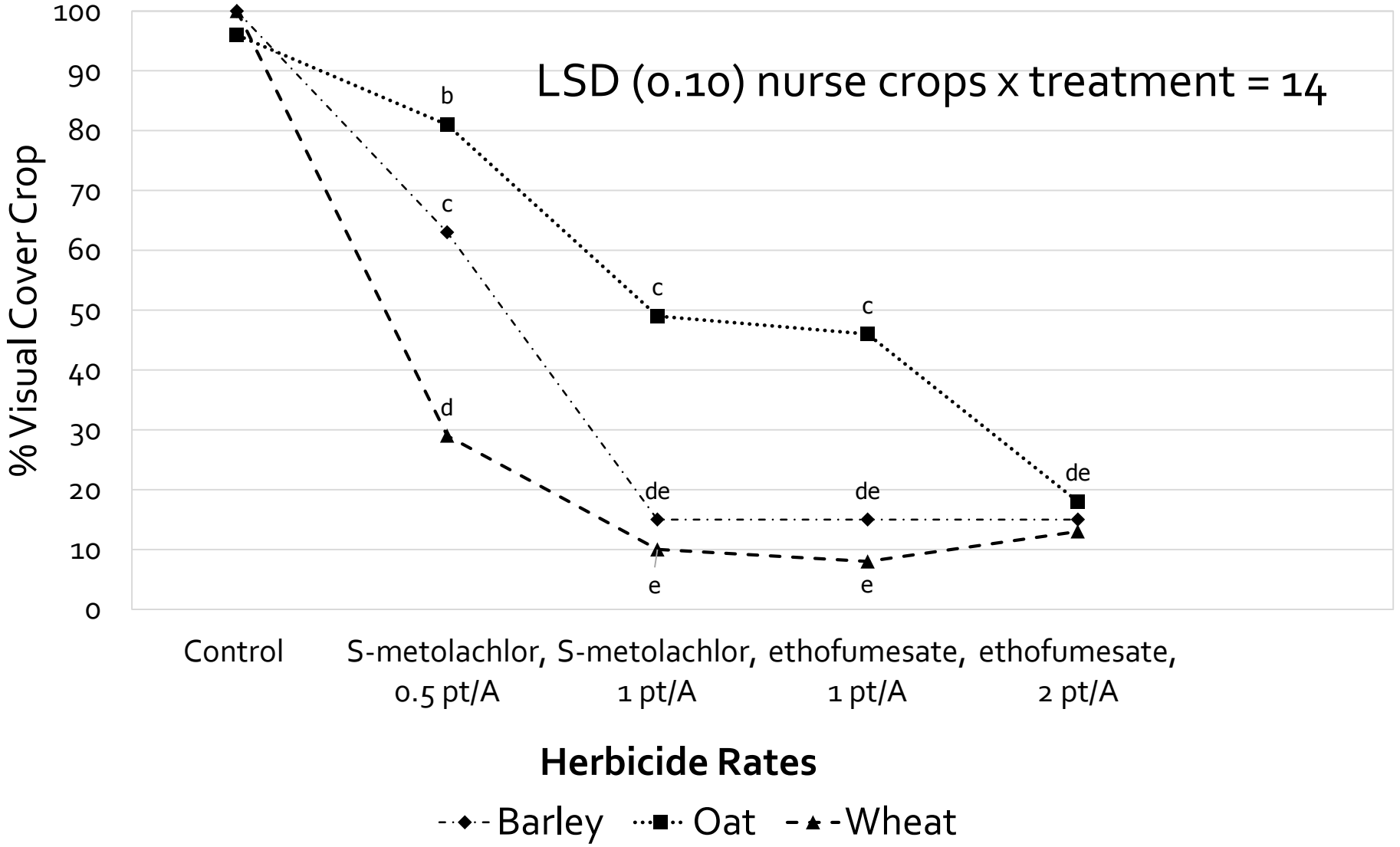
- Year: 2015
- Location: Foxhome, Lake Lillian, and Prosper,ND
- Experimental Design: Split plot, 4 replications
  - Whole plot is cover crop, barley, oat and wheat
  - Sub-plot is herbicide and herbicide treatment
- Tillage: Spring cereals distributed over the experimental area using a fertilizer spreader; shallow incorporated with tillage
- Visual percent ground cover, sugarbeet stand counts, cereal counts per meter square, yield (Lake Lillian and Foxhome)

Ground cover as a percent of counts per square meter, 36 days after planting, Prosper, ND, 2015

	Rate	Barley Cover	Wheat Cover	Oat Cover	Average
	(pt/A)	%	%	%	%
S-metolachlor	0.5	116	92	104	104
S-metolachlor	1	70	99	114	94
ethofumesate	1	102	91	93	95
ethofumesate	2	92	99	90	94
Average		95	95	100	

- Herbicides did not effect cereal crops
- Insufficient precipitation to activate herbicides
- 1.1 inch during the 3-week interval, April 17 to May 8

Effect of soil-residual herbicide on barley, oat, and wheat ground cover 35 days after planting, Foxhome, MN, 2015



Discussion
Selectivity or Placement?

- Water solubility and sorption may partially explain herbicide response
  - S-metolachlor is more water soluble than ethofumesate
  - S-metolachlor is taken up by cereals through the shoot, just above the seed
  - Precipitation moves S-metolachlor past the shoots of developing cereals
  - Ethofumesate requires more precipitation to move it from the seeding zone
  - Ethofumesate is taken up by both cereal roots and shoots, thus, increasing its potential for injury
- Herbicides are more easily activated in course textured soils

Summary

- Oat tolerates soil-applied herbicides the best followed by barley and then wheat
- S-metolachlor is safer to barley and wheat than ethofumesate
- apply S-metolachlor at 0.5 to 1 pt/A and/or ethofumesate at 1 pt/A with oat and S-metolachlor at 0.5 pt/A with barley and wheat
- soil-applied herbicides are more injurious to cover crops on course textured soils than fine or medium textured soils
- rainfall within 48 to 72 hours after planting may influence herbicide response to cover crops, regardless of soil texture

Actively manage cover crops

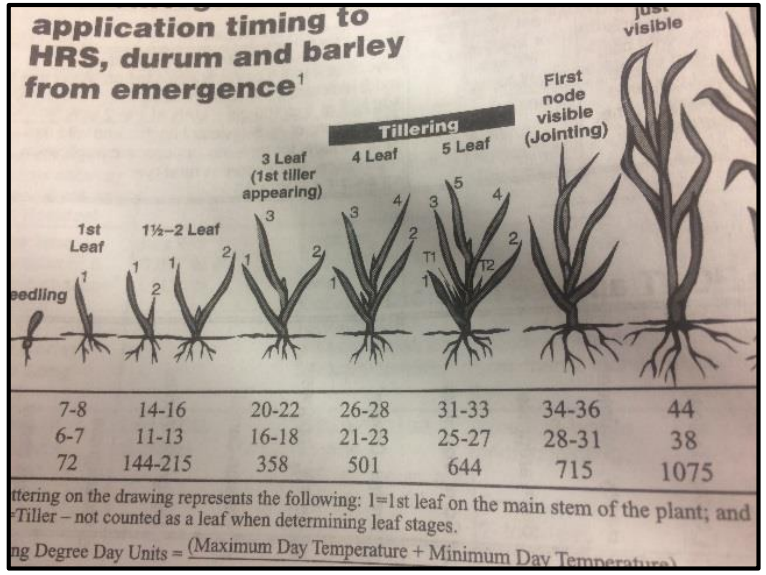
- Cover crops thrive in early spring moisture and temperature conditions
- Cover crops reflect light energy from sugarbeet when they get too big
- Cover crops have a massive root system that takes moisture and nutrients from sugarbeet
- Cover crops benefit sugarbeet after they have been terminated

Timing of wheat cover crop removal, sugarbeet yield, percent sugar, and extractable sucrose, Prosper, ND, 2015

Sugarbeet stage at wheat termination	Wheat height at termination	Yield	Sugar	Extractable sucrose
no. of **leaves**	**(inches)**	(ton/A)	(%)	(lb/A)
No Cover Crop	n/a	35.3 ab	17.0	11,051 ab
2	**2**	36.0 a	16.9	11,253 a
3	**4**	36.6 a	16.5	11,173 ab
4	**6**	35.5 ab	16.8	10,929 abc
5	**8**	33.8 b	16.7	10,373 c
6	**10-12**	34.0 b	16.9	10,644 bc
LSD (0.10)		1.6	NS	542

Nurse crop best management practices

- Seed wheat and barley at ¾ to 1 bu/A with spinner spreaders
- Terminate nurse crops at 4 to 5-leaf stage (tillering)
- Nurse crops that are 'Jointing', (8 inches or greater) reduced sugarbeet extractable sugar in 2015 (>4-lf sugarbeet)
- Nurse crops do not effect % sugar

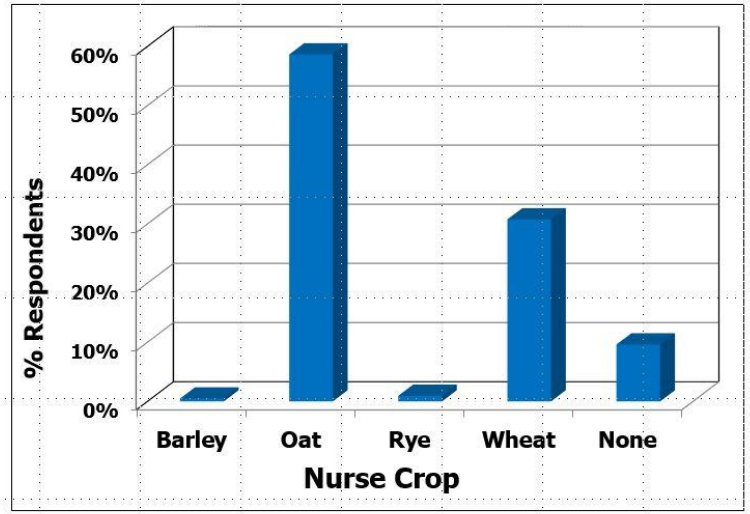


Acres with nurse crop has increased from 40% to 55% since 2014

Cooperative	2017 Nurse Crops	
	acres	%
ACS[1]	143,588	36
Minn-Dak[2]	83,864	88
SMBSC[2]	114,233	90
Total	**341,685**	**55**

[1]Data from Tyler Grove and Kathy Wang
[2]Data from Turning Point Surveys conducted at 2017 Grower Seminars

90% seeded nurse crops as a companion crop with sugarbeet, SMBSC[1]



[1]Results from Turning Point Survey conducted at 2017 Grower Seminar

There is interest in fall-seeded cover crops

Potential benefits

- Scavenge nitrogen
- Produce nitrogen
- Reduce erosion
- Build soil health
- Suppress weeds
- Recycle nutrients
- Protect water quality
- Enhance wildlife habitat

An April view of cereal rye that was planted into corn stalks in the fall

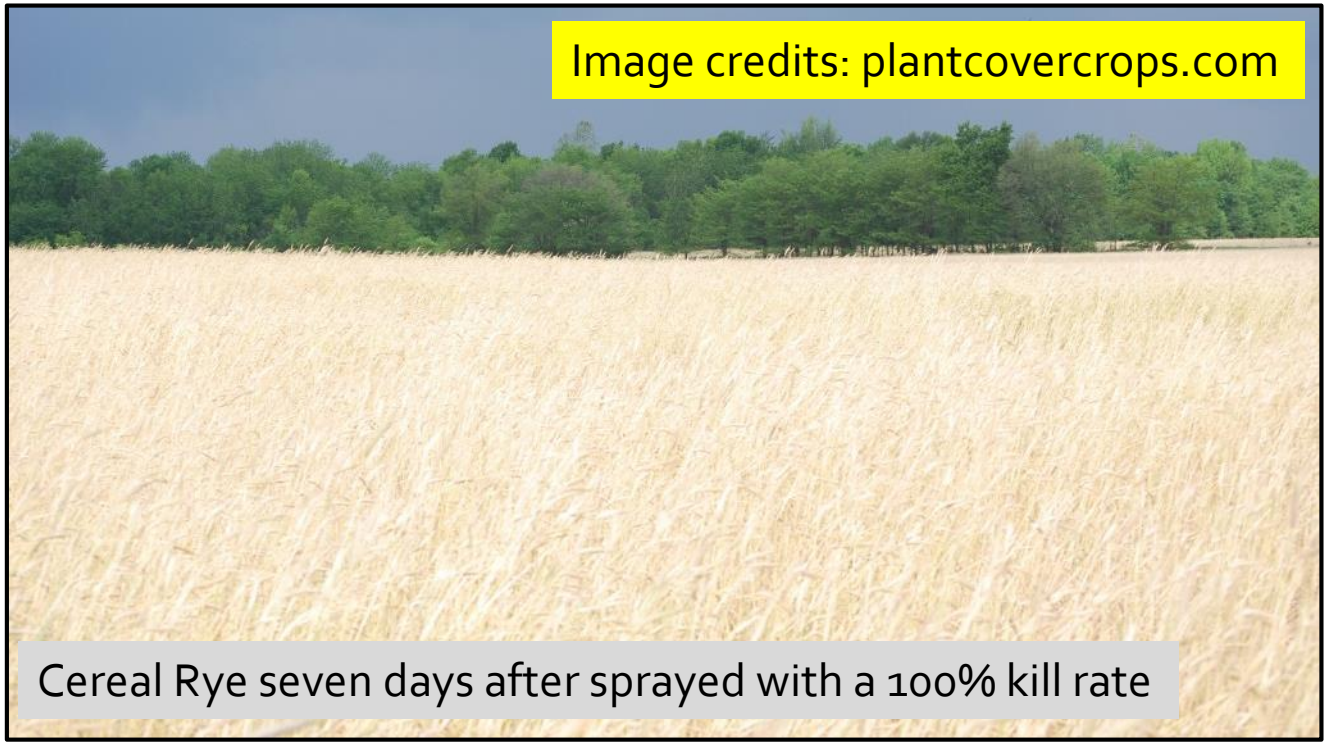


Image credits: plantcovercrops.com

Cereal Rye seven days after sprayed with a 100% kill rate

Planting soybeans into standing rye in Mid-May

The soybean stand is “perfect” after being planted into standing cereal rye

Experiment Objectives

- How effective is spring-applied Roundup PowerMax (glyphosate) or Select Max (clethodim) for killing fall-seeded cover crops
- When should herbicides be applied to optimize cover crop control and sugarbeet stand establishment
- Do cover crops provide additional benefits, for example, weed suppression?

The goal was to better understand how and when fall-seeded cover crops must be terminated so that sugarbeet can be planted in mid- to late April.

Materials and Methods

- Wheat stubble was chisel plowed following wheat harvest at the Prosper Experiment Station
- Split plot design with 4 replications, whole plot was fall seeded cover crop; the subplot was herbicide, herbicide rate, and timing of herbicide application
- Winter wheat at 60 lb/A, cereal rye at 50 lb/A, and a mixture of oat at 40 lb/A and tillage radish at 5 lb/A were seeded on September 6, 2017.
- Select Max at 6 fl oz/A + MSO and Roundup PowerMax at 28 fl oz/A + NIS with N-Pak-AMS
- Treatments applied April 17, April 21, and April 25, 2017
- Treatments applied in 17 gpa spray solution through 110002 Turbo TeeJet nozzles pressurized with CO_2 at 40 psi

Visual ground cover and range of visual ground cover control across replications, October 2016, Prosper, ND

Cover Crop	Ground Cover	Range of Ground Cover Visual Observations
	%	%
Winter Wheat	60	40-70
Cereal Rye	85	80-90
Oat and Tillage Radish	68	50-80
No Cover Crop[1]	38	30-40

[1]Block contained volunteer wheat from previous crop


Volunteer wheat


Oat and tillage radish


Cereal rye

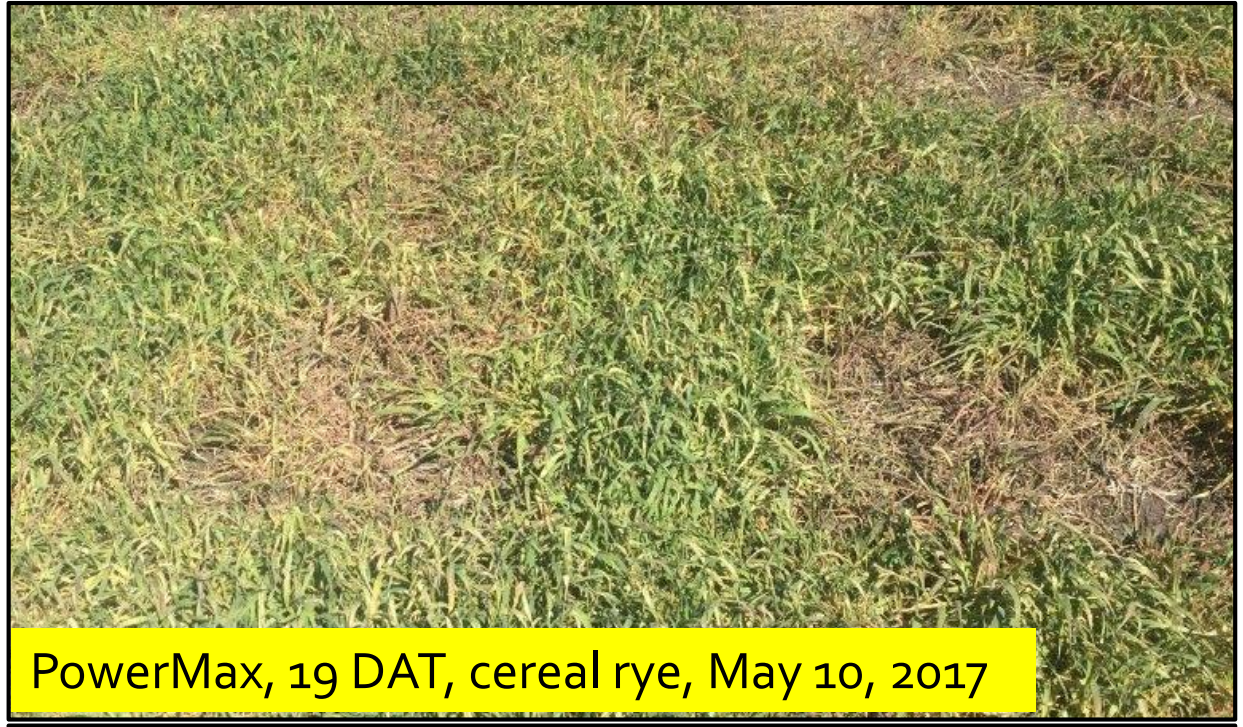

Winter wheat


Cereal rye, April, 13, 2017

Percent visual cereal rye and winter wheat control, across herbicide, application timing, and evaluation date, Prosper, ND

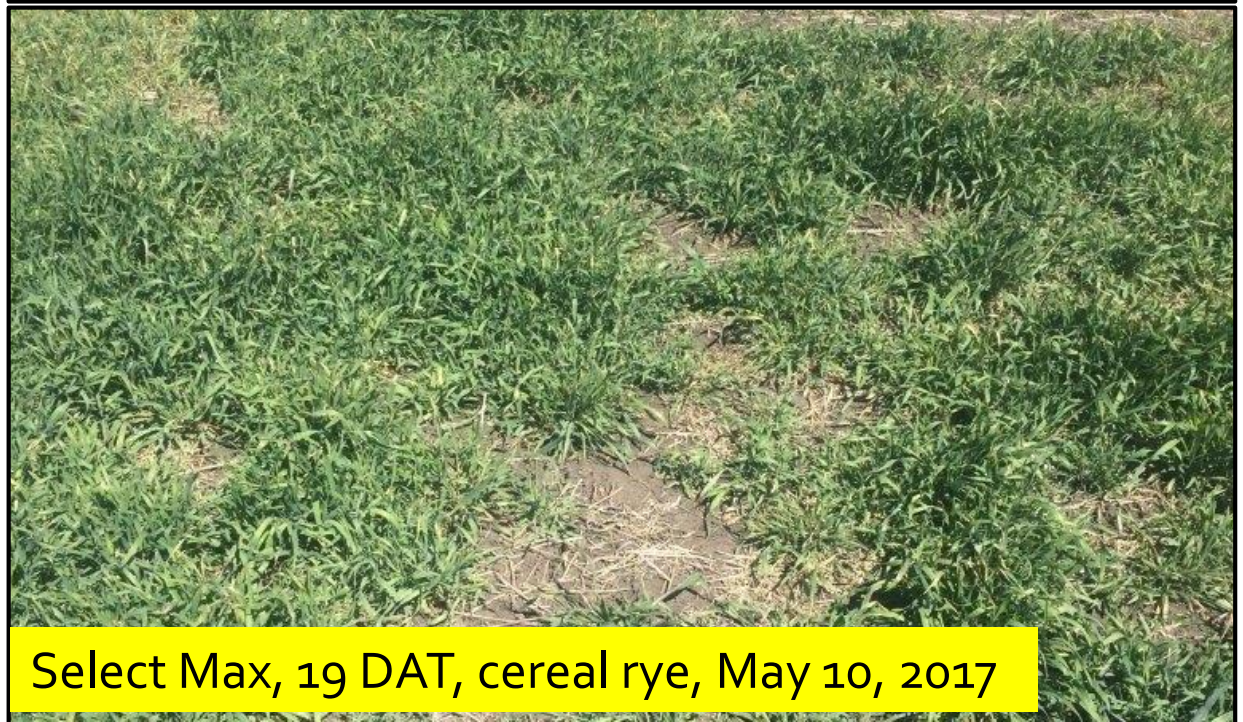
		May 12		May 23	
		c rye	w wheat	c rye	w wheat
Herbicide[1]	Appl Date	%	%	%	%
PowerMax	April 17	65 c	83 b	75 c	85 b
Select Max	April 17	5 f	60 c	0 g	20 f
PowerMax	April 25	70 c	88 b	98 a	100 a
Select Max	April 25	20 e	25 e	20 f	45 e
LSD (0.05)		**7**		**7**	

[1]Roundup PowerMax at 28 fl oz/A + Prefer 90 NIS at 0.25% v/v + N-Pak AMS at 2.5% v/v; Select Max at 6 fl oz/A + Noble MSO at 1.5 pt/A

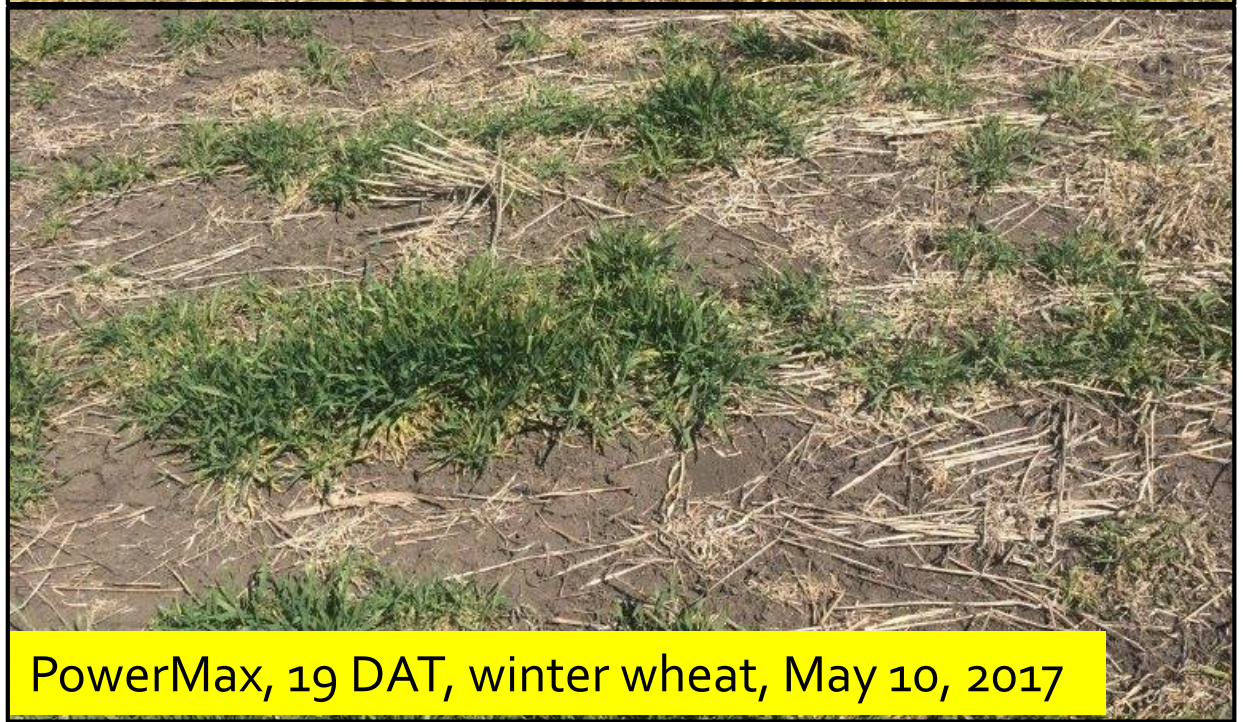


PowerMax, 19 DAT, cereal rye, May 10, 2017

PowerMax, 19 DAT, winter wheat, May 10, 2017



Select Max, 19 DAT, cereal rye, May 10, 2017



PowerMax, 19 DAT, winter wheat, May 10, 2017

Percent visual cereal rye control, across herbicide, herbicide rate, and evaluation date, Renville, MN

Herbicide[1]	Herbicide Rate	April 17	April 21	April 28
	fl oz/A	----------% Control----------		
PowerMax	22	41 b	61 b	76 b
PowerMax	32	41 b	73 a	85 ab
PowerMax	64	69 a	86 a	95 a
SelectMax	6	10 c	17 c	31 c
LSD (0.05)		**16**	**12**	**10**

[1]Roundup PowerMax at 28 fl oz/A + Class Act NG at 2.5% v/v; Select Max at 6 fl oz/A + Class Act NG at 2.5% v/v

Summary

- Seed cereal rye at no more than 25 pounds per acre
- Winter wheat is easier to kill than cereal rye in the spring
- Use full herbicides rates. Apply Select Max at 12 to 16 fl oz/A or PowerMax at 32 to 64 fl oz/A.
- Apply herbicides as early as possible following cover crop green-up with consideration to the weather forecast 5 to 7 days after application.
- Herbicides work much slower in early spring and may require 2 to 3-weeks to reach 85% burndown control.
- Cereal rye stubble may suppress emergence and development of broadleaf weeds including nightshade, lambsquarters, and pigweed.

Thank you for your Support

Tom Peters

- Extension Sugarbeet Agronomist and Weed Control Specialist
- thomas.j.peters@ndsu.edu

BeetWeedControl @tompeters8131

- 701-231-8131 (office)
- 218-790-8131 (mobile)

NDSU EXTENSION SERVICE

UNIVERSITY OF MINNESOTA EXTENSION