

Cover Crop Variety Trial 2013-2014

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- Jerry Depew – Pocahontas
- Jeremy Gustafson – Boone
- Chad Ingels – Fayette
- Clarke McGrath – Crawford, Pottowattamie, Ringold, Union

- Steve McGrew – Mills
- Mark Peterson – Montgomery
- Myron Rees – Washington
- Dave & Meg Schmidt – Audubon

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In a Nutshell

Cover crop entries were hand seeded at locations into standing corn and soybeans and evaluated for fall ground cover, spring ground cover, and spring biomass production.

Key findings

- Cereal rye and mustard tended to produce the most amount of fall ground cover.
- Sufficient rainfall following cover crop seeding is necessary for fall cover crop growth and overwintering potential.
- Cereal rye was the only entry to successfully overwinter and produce spring growth and remains a strong cover crop candidate even in the face of a challenging winter.

Project Timeline:

Fall 2013-Spring 2014



Mustard grows in cover crop test plots on Jeremy Gustafson's farm in Boone County near Boone, Iowa.

Background

This was the third year of trials screening cover crop varieties conducted by the Practical Farmers of Iowa Cooperators' Program. Previous reports, "Twenty Cover Crop Variety Trial – Final Report" (Carlson and Gailans, 2013) and "Cover Crops Double Duty: Cover and Small Grains" (Carlson and Anderson, 2012), are available on the Practical Farmers website. As adoption of cover crops has increased to nearly 400,000 acres in Iowa (NASS, 2014), farmers are increasingly interested in which cover crop species to use in corn and soybean fields.

The current study screened 18 cover crop entries – grasses, legumes, brassicas, and

some in mixtures – to determine which entries would have the greatest success if established by aerial seeding into standing corn and soybean crops.

Method

Planting

Nine cooperators across 13 locations in Iowa (**Table 1**) seeded 18 cover crop entries in the fall of 2013 (**Table 2**). Cover crops were hand-seeded by cooperators into a standing cash crop in two randomized, replicated blocks. Cover crops were planted into standing corn in nine fields across the locations and into standing soybeans in nine fields across the locations. Five grasses, seven legumes, three brassicas and three two-species

mixtures were evaluated (**Table 2**). Legume seeds were inoculated with appropriate *Bradyrhizobium* species prior to seeding. Each plot was 7.5 ft wide and 25 ft long.

Cover crops were seeded when the first soybean leaves yellowed or when corn reached black layer (physiological maturity). Seeds were not incorporated into the soil. Cash crops were harvested using standard practices, and the cover crops were left undisturbed.

Seed Source

Cover crop seeds were supplied by: Green Cover Seeds, DLF International Seeds, Mighty Mustard and Albert Lea Seedhouse.

Table 1

Project Cooperators					
Cooperator	Location (Co.)	Standing Cash Crop(s)	Cover Crops Seeding Date	Fall Measurement Date	Spring Measurement Date
Jerry Depew	Pocahontas	Corn	9/3/2013	11/15/2013	N/A
Jeremy Gustafson	Boone	Soybean	9/4/2013	11/19/2013	4/21/2014
Chad Ingels	Fayette	Soybean	9/14/2013	N/A	5/10/2014
Paul Kassel	Clay	Soybean	8/29/2013	10/31/2013	4/23/2014
Clarke McGrath	Crawford	Soybean & corn	9/4&5/2012	11/27/2013	4/17/2014
	Pottawattamie	Soybean & corn	8/30/2013 & 9/4/2013	11/20/2013	4/22/2014
	Ringgold	Corn	8/27/2013	11/25/2013	4/22/2014
	Union	Soybean & corn	9/2&3/2013	11/25/2013	4/22/2014
Steve McGrew	Mills	Soybean	9/4/2013	11/9/2013	N/A
Mark Peterson	Montgomery	Soybean & corn	9/10/2013	11/22/2013	5/11/2014
Myron Rees	Washington	Soybean & corn	9/16/2013	N/A	5/5/2014
Dave & Meg Schmidt	Audubon	Soybean	9/1/2013	11/8/2013	4/21/2014

Table 2

Cover crop entries and seeding rates (lb/ac)			
Grass	Legume	Brassica	Mix
Cereal rye – 'VNS' (125)	Common vetch – 3 varieties (62.5)	Mustard – 'Kodiak' (17.5)	Spring wheat (105)/ hairy vetch (32.5)
Spring wheat – 'Soren' (105)	Crimson clover – 'Dixie' (26)	Rapeseed – 'Dwarf Essex' (11)	Spring wheat (105)/ lentil (50)
Oat – 'Rockford' (125)	Hairy vetch – 'Vallana' (32.5)	Radish – Nitro Radish™ (17.5)	Cereal rye (125)/ radish (17.5)
Annual Ryegrass – two varieties (25)	Lentil – 'Richlea green' (50)		
	White clover – 'Ladino' (9.5)		

Data Collection

Cooperators determined ground cover of each cover crop using a pre-marked 16-ft rope placed diagonally across each cover crop entry's plot, and counting how many marks lay on top of cover crop biomass at 6-in. increments. These counts were used to calculate the percent coverage of the soil by the cover crop. A fall measurement was taken within a few days of the first predicted hard freeze, and a spring measurement was taken just prior to any field work preceding cash crop planting in 2014. Where sufficient spring growth had occurred, samples of the aboveground cover crop biomass were collected, dried and weighed.

Statistical Analysis

Data were analyzed using JMP Pro 10 statistical software (SAS Institute, Inc., Cary, NC). Cover crops established in standing corn and soybeans were analyzed separately for each location. Mean separations were conducted using an LSD test with significance reported at the $P \leq 0.05$ level.

Results and Discussion

Vegetative cover in the fall

Vegetative ground cover by the cover crops was assessed at locations in the fall after corn or soybeans had been harvested and just prior to a killing frost. These measurements were not made at the Fayette and Washington County locations. Fall vegetative cover is presented for cover crops established in either standing corn (**Table 3**) or standing soybeans (**Table 4**).

When cover crops were established in corn, the cereal rye or cereal rye/radish entries provided the most or among the most cover in the fall at four locations: Crawford, Pottawattamie, Ringgold, and Montgomery (**Table 3**). Fall cover provided by cereal rye established in corn ranged from 0% cover at Pocahontas, where very little cover was provided by any entry due to little precipitation occurring after seeding on September 3, to as much as 36% cover at Montgomery by the November 22 sampling date. The cereal rye/radish

mix provided 73% cover by November 25 at the Ringgold County location. At Crawford, Pottawattamie, Ringgold, and Union, mustard established in corn was among the top entries providing fall cover (**Table 3**). Mustard established in standing corn provided as much as 64% cover by November 25 at the Union County location. The entries featuring legumes (either solely or in a mix) tended to provide the least amount of fall cover. Spring wheat and oats, entries expected to winterkill and only provide fall cover, tended to provide equal amounts of fall cover across locations when established in corn.

When cover crops were established in soybeans, the cereal rye or cereal rye/radish entries provided the most or among the most cover in the fall at all of the locations (**Table 4**). Cereal rye provided as much as 80% cover at Montgomery and as little as 8% cover at Pottawattamie and Mills where little precipitation occurred in the fall. Mustard was the next best entry and provided the most or among the most cover at six locations: Boone,

Table 3

Fall ground cover provided by cover crop entries established in standing corn

		Depew Pocahontas	McGrath Crawford	McGrath Pott.	McGrath Ringgold	McGrath Union	Peterson Montgomery	Mean All Locations
Entry		% Ground cover						
Grass	Cereal rye	0.0 b	4.7 ab	9.4 a	43.8 ab	32.8 b	35.9 a	18.1
	Spring wheat	0.0 b	0.0 b	3.1 ab	21.9 b	12.5 bcd	14.1 bcd	7.4
	Oats	0.0 b	0.0 b	3.1 ab	21.9 b	9.4 bcd	12.5 bcd	6.7
	Ryegrass DLF-LWD 9	0.0 b	0.0 b	0.0 b	31.3 b	6.3 bcd	1.6 abc	5.6
	Ryegrass Winterhawk	0.0 b	0.0 b	0.0 b	14.1 b	7.8 bcd	20.3 d	6.0
Legume	Common vetch Cristal	4.7 a	0.0 b	0.0 b	10.9 b	6.3 bcd	7.8 cd	4.2
	Common vetch Pepite	0.0 b	0.0 b	0.0 b	7.8 b	6.3 bcd	7.8 cd	3.1
	Common vetch VNS	1.6 b	0.0 b	0.0 b	14.1 b	3.1 cd	9.4 cd	4.0
	Crimson clover	0.0 b	0.0 b	0.0 b	9.4 b	3.1 cd	3.1 d	2.2
	Hairy vetch	0.0 b	0.0 b	0.0 b	10.9 b	7.8 bcd	9.4 cd	4.0
	Lentil	0.0 b	0.0 b	0.0 b	9.4 b	3.1 cd	1.6 d	2.0
	White clover	0.0 b	0.0 b	0.0 b	9.4 b	0.0 d	1.6 d	1.6
Brassica	Mustard	0.0 b	9.4 ab	6.3 ab	40.6 ab	64.1 a	4.7 cd	17.9
	Rapeseed	0.0 b	10.9 ab	1.6 b	20.3 b	23.4 bcd	1.6 d	8.3
	Radish	0.0 b	0.0 b	4.7 ab	35.9 ab	29.7 bc	1.6 d	10.3
Mix	Cereal rye/ radish	0.0 b	4.7 ab	4.7 ab	73.4 a	29.7 bc	31.1 a	20.5
	Spring wheat/hairy vetch	0.0 b	1.6 b	3.1 ab	20.3 b	14.1 bcd	26.6 ab	9.4
	Spring wheat/lentil	0.0 b	1.6 b	4.7 ab	18.8 b	17.2 bcd	28.1 ab	10.0
MEAN		0.3	1.8	2.3	23.0	15.4	12.2	7.8
LSD		0.2	7.7	7.5	41.0	29.2	15.6	

By column (location), values followed by the same letter are not significantly different. Though statistical analysis could not be performed on means across all locations, they are provided for reference.

Clay, Crawford, Pottawattamie, Union, and Audubon (**Table 4**). Once again, the legume entries provided the least amount of fall cover with the common vetch, crimson clover, hairy vetch, and lentil entries providing approximately 20% at Boone but much less at the other locations where cover crops were established in soybeans. As with the locations where cover crops were established in corn, fall cover provided by spring wheat and oats established in soybeans was similar at each location.

Vegetative cover and biomass in the spring

In the following spring, vegetative ground cover and aboveground biomass of the cover crops was assessed. Only the cereal rye and cereal rye/radish entries resulted in any spring growth across the locations (**Figures 1 and 2**). An especially hard winter with periods of several days of subzero temperatures coupled with little to no snow cover at the locations likely resulted in the lack of spring growth by any

of the cover crop entries other than cereal rye. As the radish does not overwinter, any spring growth from cereal rye/radish mix was that of the cereal rye. Amount of ground cover and aboveground biomass varied across locations. At each location, however, spring vegetative cover and biomass did not differ between cereal rye by itself and cereal rye established the previous fall with radish. Similar levels of ground cover among locations did not necessarily translate to similar amounts of aboveground biomass. For instance, ground cover by cereal rye established in corn was similar at the Ringgold and Montgomery locations yet approximately 1,600 more pounds of biomass per acre were observed at Montgomery (**Figure 1**). At the Crawford location, there was some ground cover provided by the cereal rye but not enough to register any substantial biomass when sampled (**Figures 1 and 2**). None of the cover crop entries, including cereal rye, survived when established in corn at three locations: Pocahontas, Pottawattamie, and Washington.



Oats grow in a cover crop test plot on Mark Peterson's farm in Montgomery County, near Stanton, Iowa.

Table 4

Fall ground cover provided by cover crop entries established in standing soybeans

		Gustafson Boone	Kassel Clay	McGrath Crawford	McGrath Pott.	McGrath Union	McGrew Mills	Peterson Montgomery	Schmidt Audubon	Mean All Locations
Entry		% Ground cover								
Grass	Cereal rye	43.8 ab	21.9 ab	14.1 ab	7.8 ab	29.7 b	7.8 a	79.7 a	54.7 a	32.4
	Spring wheat	39.0 ab	21.9 ab	10.9 abcd	1.6 ab	12.5 bcd	1.6 a	26.6 bcde	14.1 bcd	16.0
	Oats	39.0 ab	23.4 a	7.8 abcd	1.6 ab	14.1 bcd	0.0 a	4.7 e	46.9 ab	17.2
	Ryegrass DLF-LWD 9	17.2 ab	3.1 cd	0.0 d	0.0 b	1.6 d	0.0 a	0.0 e	6.3 cd	3.5
	Ryegrass Winterhawk	35.9 ab	10.9 abcd	0.0 d	0.0 b	4.7 d	0.0 a	7.8 cde	4.7 cd	8.0
Legume	Common vetch Cristal	26.5 ab	9.4 abcd	1.6 cd	0.0 b	4.7 d	0.0 a	6.3 de	1.6 d	6.3
	Common vetch Pepite	21.8 ab	4.7 cd	1.6 cd	0.0 b	6.3 d	3.1 a	6.3 de	1.6 d	5.7
	Common vetch VNS	21.8 ab	7.8 bcd	0.0 d	0.0 b	7.8 cd	0.0 a	4.7 e	3.1 cd	5.7
	Crimson clover	15.6 ab	1.6 cd	1.6 cd	0.0 b	3.1 d	0.0 a	0.0 e	0.0 d	2.7
	Hairy vetch	15.6 ab	6.3 cd	0.0 d	0.0 b	6.3 d	0.0 a	10.9 bcde	23.4 abcd	7.8
	Lentil	18.8 ab	9.4 abcd	0.0 d	0.0 b	3.1 d	0.0 a	3.1 e	6.3 cd	5.1
	White clover	1.6 b	0.0 d	0.0 d	0.0 b	1.6 d	0.0 a	0.0 e	0.0 d	0.4
Brassica	Mustard	67.2 a	15.6 abc	15.6 a	7.8 ab	70.3 a	0.0 a	0.0 e	37.5 abc	26.8
	Rapeseed	35.9 ab	7.8 bcd	17.2 a	3.1 ab	26.6 bc	0.0 a	0.0 e	6.3 cd	12.1
	Radish	40.7 ab	15.6 abc	6.3 abcd	0.0 b	26.6 bc	4.7 a	0.0 e	15.6 bcd	13.7
Mix	Cereal rye/radish	42.2 ab	21.9 ab	12.5 abc	9.4 a	57.8 a	3.1 a	39.1 bc	29.7 abcd	27.0
	Spring wheat/hairy vetch	45.3 ab	15.6 abc	9.4 abcd	1.6 ab	18.8 bcd	6.3 a	40.6 b	43.8 ab	22.7
	Spring wheat/lentil	56.3 a	23.4 a	3.1 bcd	1.6 ab	10.9 bcd	1.6 a	37.5 bcd	28.1 abcd	20.3
MEAN		32.5	12.2	5.7	1.9	17.0	1.6	14.8	18.0	13.0
LSD		53.7	15.4	11.2	8.2	19.2	11.9	32.3	35.4	

By column (location), values followed by the same letter are not significantly different. Though statistical analysis could not be performed on means across all locations, they are provided for reference.

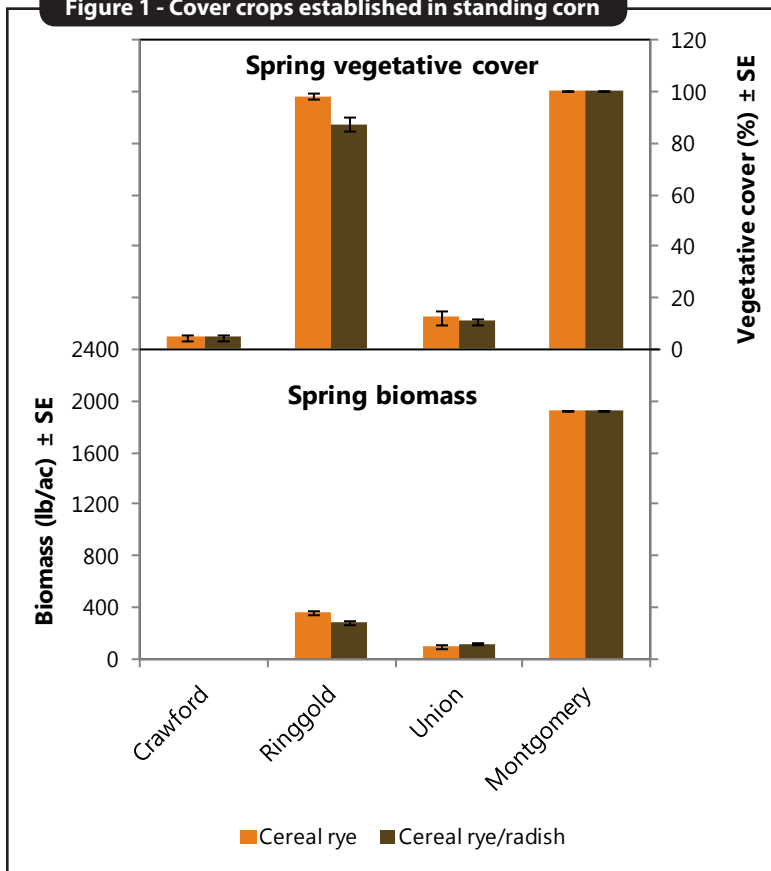
Conclusions and Next Steps

Winter cereal rye, grown alone or in a mix with radish, continues to provide the greatest coverage in the fall and spring and the most spring biomass, of all cover crop entries tested in Iowa. In terms of non-grass species, mustard (and rapeseed) showed promise with respect to ground cover in the fall but legumes generally provided the least amount of cover. Where fall growth and ground cover did not occur, this was a result of insufficient soil moisture conditions due to lack of rainfall after cover crop seeding. Across locations, cereal rye was the only entry that provided ground cover and biomass in the spring. Extreme cold conditions were likely the cause. "Temperatures got down to 20 degrees Fahrenheit below zero a few nights in a row and that was at the same time we had no snow on the ground," cooperator Mark Peterson of Montgomery County explained. It appears that cereal rye is the best choice for ensuring both fall and spring cover crop growth due to its ability to withstand these kinds of winter conditions. It is conceivable that fall growth of cereal rye could serve as a "nurse" crop for other cover crop species. This trial included an entry consisting of a cereal rye/radish mix and future trials will pair cereal rye with cover crop species that have the potential to overwinter in Iowa.



Meg Schmidt measures spring biomass at Troublesome Creek Cattle Company in Audubon County, near Exira, Iowa.

Figure 1 - Cover crops established in standing corn



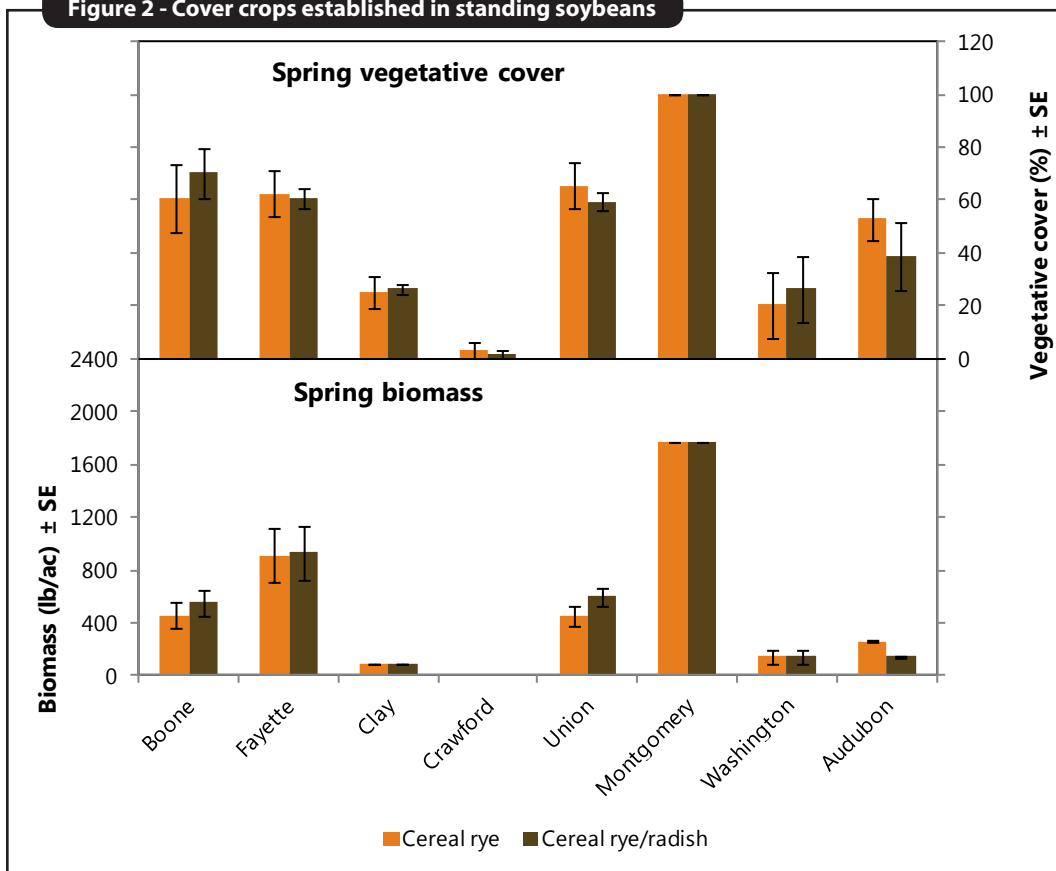
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Figure 2 - Cover crops established in standing soybeans



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