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Evaluation of Cool Season Cover Crops in the Central Plains

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ABSTRACT

Cool season annuals provide multiple benefits to production agriculture when planted as a cover crop such as suppressing weeds, controlling soil erosion, adding nitrogen, increasing soil organic matter and other soil health improvements. However, success of the cover crop planting depends on selection of the best adapted cultivar or variety that meets the planting objective. The purpose of this study was to evaluate fifty-nine commercially available cultivars and varieties of eight common annual, cool season species for their adaptation to the Central Plains. Oats (*Avena sativa* L. and *Avena strigosa* Schreb.), cereal rye (*Secale cereal* L.), Austrian winter pea (*Pisum sativum* L.), daikon radish (*Raphanus sativus* L.), crimson clover (*Trifolium incarnatum* L.), red clover (*Trifolium pretense* L.), balansa clover (*Trifolium michelianum* Savi), and hairy vetch (*Vicia villosa* Roth) and [*Vicia villosa* Roth ssp. *varia* (Host) Corb] were evaluated for field emergence, winter hardiness, plant height, days after planting to 50% bloom, and disease and insect resistance at the Manhattan, KS Plant Materials Center in 2016-2017 and 2017-2018. Balansa clover had no emergence and warrants further studies to determine its adaptability. 'Cosaque' black seeded oats and 'Soil Saver' black oats suffered from disease and did not grow well either year of the study. Cereal rye varieties emerged and exhibited excellent winter hardiness except for 'FL 401' and 'Merced' which suffered from winter kill both years. Crimson clover had acceptable emergence and over wintered in 2017 and did not emerge in the fall of 2017 due to soil crusting conditions. Red clover followed a similar pattern with some emergence in 2016 and over wintering into the spring of 2017 and then had poor emergence in 2017 and did not overwinter into 2018. Hairy vetch cultivars were slow to emerge but overwintered well both years. Daikon radish emerged well in both years but did not overwinter in 2017 or 2018. Austrian winter pea emerged well both years with 'Lynx' being the only variety that overwintered in 2017 and 2018. Additional research is needed to understand biomass production and growth patterns of cover crops for the central Plains.

INTRODUCTION

Cover crops are commonly planted for a multitude of purposes when addressing conservation resource concerns. Each species of cover crop has been shown to have strengths and weakness with more realization of these happening every day. A noted concern for several years was the performance of different variety within the same species in the Central Plains. A study was designed to evaluate the differences within species to help seek out strengths and weaknesses of individual varieties within a given geographic location.

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MATERIALS AND METHODS

The study at the Manhattan Plant Materials Center (PMC) was conducted from 2016-2017 to 2017-2018. Seeding rates for all cover crop species are listed in Table 1. Target seeding rates were based of Kansas 340 Cover Crop Specification found in the Field Office Technical Guide (USDA-NRCS, 2019).

Table 1. Cover crop species, cultivars, seeds per pound, and seeding rates used in the 2-year trial at the Manhattan, KS Plant Materials Center.

Species	Common Name	Cultivar	Seeds/lb	Seeding Rate* (seeds/ft^2)	Seeding Rate (lb/ac)	Year Planted
Avena sativa	oat, black-seeded	Cosaque	12,000	42	152	2016, 2017
Avena strigosa	black oat	Soil Saver	30,000	42	60	2016, 2017
Secale cereale	cereal rye	Aroostook	23,000	42	79	2016, 2017
Secale cereale	cereal rye	Bates RS4	22,000	42	84	2016, 2017
Secale cereale	cereal rye	Brasetto hybrid	21,000	42	86	2016, 2017
Secale cereale	cereal rye	Elbon	32,000	42	57	2016, 2017
Secale cereale	cereal rye	FL 401	24,000	42	76	2016, 2017
Secale cereale	cereal rye	Guardian	15,000	42	122	2016, 2017
Secale cereale	cereal rye	Hazlet	13,000	42	138	2016, 2017
Secale cereale	cereal rye	Maton	21,000	42	88	2016, 2017
Secale cereale	cereal rye	Maton II	22,000	42	85	2016, 2017
Secale cereale	cereal rye	Merced	30,000	42	61	2016, 2017
Secale cereale	cereal rye	Oklon	20,000	42	89	2016, 2017
Secale cereale	cereal rye	Rymin	19,000	42	97	2016, 2017
Secale cereale	cereal rye	Wheeler	21,000	42	86	2016, 2017
Secale cereale	cereal rye	Wintergrazer-70	23,000	42	79	2016, 2017
Secale cereale	cereal rye	Wrens Abruzzi	19,000	42	94	2016, 2017
Pisum sativum	Austrian winter pea	Arvica 4010	3,300	6	78	2016, 2017
Pisum sativum	Austrian winter pea	Dunn	3,000	6	86	2016, 2017
Pisum sativum	Austrian winter pea	FrostMaster	2,800	6	94	2016, 2017
Pisum sativum	Austrian winter pea	Lynx	3,500	6	75	2016, 2017
Pisum sativum	Austrian winter pea	Maxum	2,300	6	113	2016, 2017
Pisum sativum	Austrian winter pea	Survivor 15	3,800	6	68	2016, 2017
Pisum sativum	Austrian winter pea	Whistler	2,800	6	95	2016, 2017
Pisum sativum	Austrian winter pea	Windham	3,100	6	85	2016, 2017
Raphanus sativus	daikon radish	Big Dog	27,000	5	8	2016, 2017
Raphanus sativus	daikon radish	Concorde	40,000	5	5	2016, 2017
Raphanus sativus	daikon radish	Control	45,000	5	5	2016, 2017
Raphanus sativus	daikon radish	Defender	27,000	5	8	2016, 2017

Table 1 (cont). Cover crop species, cultivars, seeds per pound, and seeding rates used in the 2-year trial at the Manhattan, KS Plant Materials Center.

Species	Common Name	Cultivar	Seeds/lb	Seeding Rate* (seeds/ft^2)	Seeding Rate (lb/ac)	Year Planted
Raphanus sativus	daikon radish	Graza	30,000	5	7	2016, 2017
Raphanus sativus	daikon radish	Groundhog	27,000	5	8	2016, 2017
Raphanus sativus	daikon radish	Lunch	27,000	5	8	2016, 2017
Raphanus sativus	daikon radish	Nitro	27,000	5	8	2016, 2017
Raphanus sativus	daikon radish	Sodbuster Blend	27,000	5	8	2016, 2017
Raphanus sativus	daikon radish	Tillage	27,000	5	8	2016, 2017
Trifolium incarnatum	crimson clover	AU Robin	142,000	62	19	2016, 2017
Trifolium incarnatum	crimson clover	AU Sunrise	90,000	62	30	2016, 2017
Trifolium incarnatum	crimson clover	Contea	73,000	62	37	2016, 2017
Trifolium incarnatum	crimson clover	Dixie	129,000	62	21	2016, 2017
Trifolium incarnatum	crimson clover	Kentucky Pride	129,000	62	21	2016, 2017
Trifolium michelianum	Balansa clover	Fixation	319,000	26**	3	2016, 2017
Trifolium michelianum	Balansa clover	Frontier	482,000	57	5	2016, 2017
Trifolium pratense	red clover	Cinnamon Plus	232,000	56	11	2016, 2017
Trifolium pratense	red clover	Cyclone II	247,000	56	10	2016, 2017
Trifolium pratense	red clover	Dynamite	247,000	56	10	2016, 2017
Trifolium pratense	red clover	Freedom!	196,000	56	12	2016, 2017
Trifolium pratense	red clover	Kenland	222,000	56	11	2016, 2017
Trifolium pratense	red clover	Mammoth	246,000	56	10	2016, 2017
Trifolium pratense	red clover	Starfire II	211,000	56	12	2016, 2017
Trifolium pratense	red clover	Wildcat	258,000	56	9	2016, 2017
Vicia villosa	hairy vetch	CCS-Groff	20,000	7	15	2016, 2017
Vicia villosa	hairy vetch	Lana	12,000	7	25	2016, 2017
Vicia villosa	hairy vetch	Purple Bounty	17,000	7	18	2016, 2017
Vicia villosa	hairy vetch	Purple Prosperity	16,000	7	19	2016, 2017
Vicia villosa	hairy vetch	TNT	18,000	7	17	2016, 2017
Vicia villosa	hairy vetch	Villana	14,000	7	22	2016, 2017

*pure live seed; **initial seed count for 'Fixation' balansa clover was incorrect, so plots were mistakenly seeded at 26 seeds/ft^2 rather than 57.

Soil type at the Kansas Plant Materials center is a Belvue silt loam with 0-1 percent slope which is well drained and shows artifacts of past flooding (Soil Survey Staff 2017). Plots were planted on a different area each year. Soil tests were taken and nutrients amended as needed or considered non-limiting. Fields were prepared by disking, field cultivating and culti-packing prior to planting. Plots were arranged in a Randomized Complete Block Design with 4 replications.

Each plot measured 5 x 20 feet and sown with a Kincaid Cone Drill (Kincaid Manufacturing, Haven, KS). Plots were planted 20 September 2016 and 22 September 2017. Legumes were inoculated with appropriate rhizobia day of planting. Plots did not receive any irrigation for both years of the study. Plots were hand weeded as necessary. Mean and standard deviation were used to determine variation among varieties within a species. Analysis was performed using SAS (Statistics Analysis Software, Cary, NC).

Emergence was visually rated in each plot every 7 days for the first month after planting using the following rating scale: 0 = (0-25% emergence), 1 = (26-64% emergence), 2 = (65-85%), 3 = (86-100%). All plots were evaluated for disease during fall growth as well as spring growth. Winter survival was evaluated by taking plant counts in 3-foot sections of an interior row of the plot in the fall before senescence and then in spring after regrowth. Bloom period was noted when the plants had reached 50% bloom. Plant height of lush green canopy was also taken at the 50% bloom period.

RESULTS AND DISCUSSION

Monthly rainfall and temperature data can be found in Figure 1, Figure 2 and Figure 3. Planting conditions were fair in both 2016-2017 and 2017-2018 planting years. Adequate rainfall was received in both years of the study therefore no irrigation was applied. Winter temperatures were cold enough in both years of the study to provide winter killing conditions.

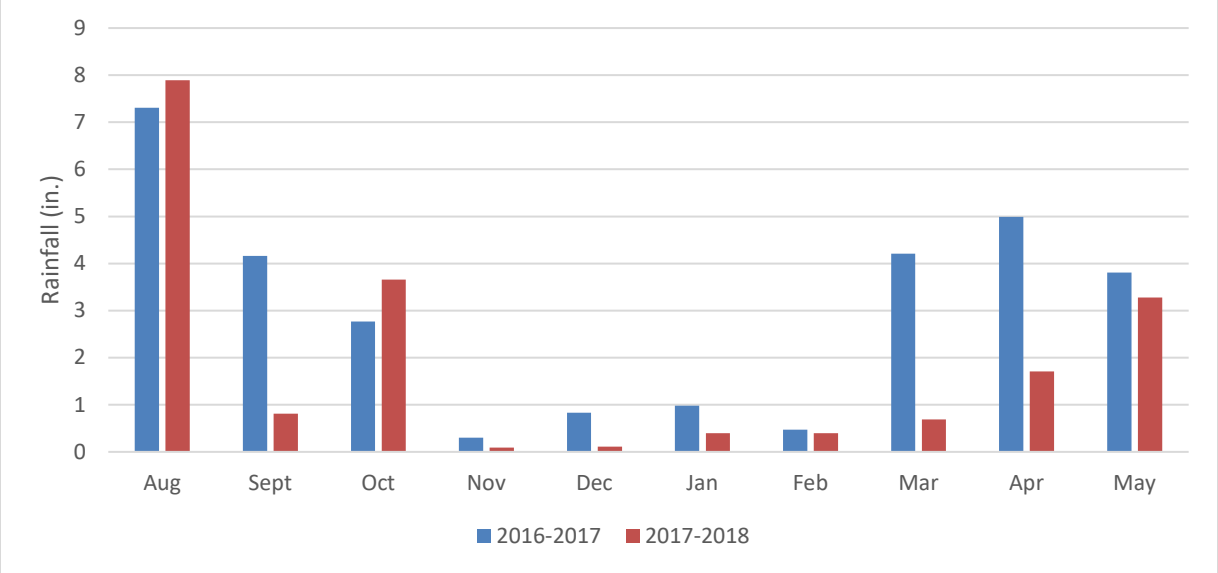

Figure 1. Monthly rainfall for Aug-May 2016-2017 and 2017-2018 Manhattan, KS.

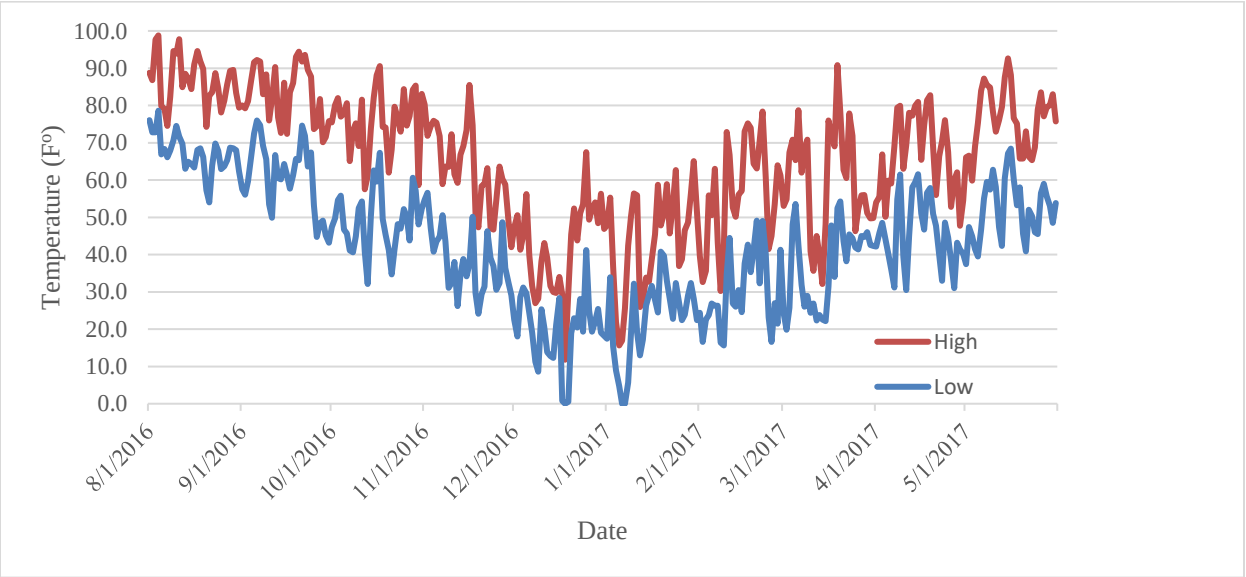

Figure 2. High and low temperature for 2016-2017 Manhattan, KS.

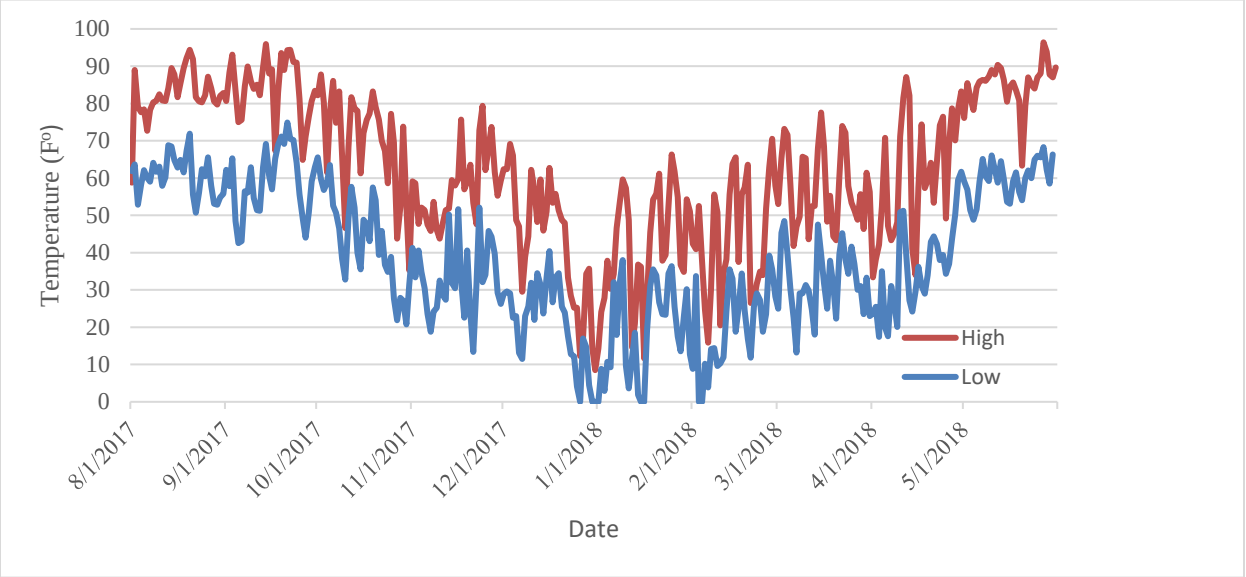

Figure 3. High and low temperatures for 2017-2018 Manhattan KS.

Balansa Clover

After planting both years, there was no observed emergence of balansa clover through 28 days after planting. This could be due to a soil moisture level lower than balansa clover needs for emergence or from soil crusting after planting. Our current recommendation is that more work is needed to evaluate the adaptability of balansa clover to the Central Plains region.

Black Oats

Oats are a common and readily available small grain used for cover cropping. For this study, 'Cosaque', a black seeded oat, and 'Soil Saver' black oat were chosen. Germination of both varieties were 65% or greater by 21 days after planting in both years. Both varieties however suffered from crown rust in both the fall of 2016 as well as the fall of 2017. 'Cosaque' did overwinter into 2017 though it suffered from disease until flowering (Table 2). These results

may not represent the region well and more evaluations are needed to verify their performance in the Central Plains.

Table 2. Mean values and standard deviations for field emergence of emergence groups[1/] (see below) of oat cultivars at 7, 14, 21 and 28 days after planting in 2016-2017. USDA-NRCS Manhattan, KS Plant Materials Center.

Cultivar	Days after planting							
	7		14		21		28	
	2016	2017	2016	2017	2016	2017	2016	2017
Cosaque	2	0	3	1	3	2	3	2
Soil Saver	2	1	3	2	3	2	3	2
Mean	2	1	3	2	3	2	3	2
SD[2/]	0	0	0	0	0	0	0	0

[1/] 0 = poor (<25% emergence); 1 = moderate (26-64% emergence); 2 = good (65-85% emergence); 3 = excellent (86-100% emergence). SD[2/] standard deviation.

Table 3. Mean values and standard deviations for % winter hardiness, plant height and days after planting to 50% bloom for black oat cultivars in 2017 – 2018. USDA-NRCS Manhattan, KS Plant Materials Center.

Cultivar	% Winter hardiness		Plant height (in.)		DAP to 50% bloom	
	2017	2018	2017	2018	2017	2018
Cosaque	67	0	12	0	250	0
Soil Saver	21	0	0	0	0	0
Mean	44	0	12	0	250	0
SD[1/]	23	0	0	0	0	0

[1/] Standard deviation

Daikon Radish

Daikon Radish has shown to have several purposes in a cover crop system. It has been shown to be a useful forage, an aide to help alleviate surface soil compaction as well as to provide the following crop root channels to penetrate compacted layers (Williams and Weil, 2004). Emergence was even for all varieties in the trial for both years and obtained greater than 86% emergence after 21 days (Table 4). The exception to this is the variety 'Graza'. Both years 'Graza' had poor to zero emergence and was due to a seedling disease that is being evaluated. The seed for both years of the study came from the same seed lot, therefore both years had similar poor emergence. None of the radish varieties in the study overwintered. Due to favorable growing conditions the radishes in the fall of 2016 were able to grow a considerable tap root and above ground vegetative material versus the fall of 2017 where conditions were not as favorable and the plants had less growth. There is anecdotal data of some radish varieties flowering when planted in the fall however none of the varieties planted in the study flowered.

Table 4. Mean values and standard deviations of emergence groups[1/] (see below) of daikon radish varieties at 7, 14, 21 and 28 days after planting in 2016 – 2017. USDA-NRCS Manhattan, KS Plant Materials Center.

Cultivar	Days after planting							
	7		14		21		28	
	2016	2017	2016	2017	2016	2017	2016	2017
Big Dog	2	1	2	2	3	2	3	3
Concorde	2	1	2	2	2	2	2	3
Control	1	1	2	2	3	2	3	3
Defender	1	0	2	2	2	2	3	3
Driller	1	1	2	2	2	3	3	3
EcoTill	2	1	2	2	3	3	3	3
Graza	0	0	0	0	0	1	0	1
Groundhog	1	1	2	2	2	2	2	3
Lunch	1	1	1	2	2	3	3	3
Nitro	2	1	2	2	2	2	3	3
Sodbuster	2	0	2	2	3	2	3	3
Tillage	1	1	1	2	2	3	3	3
Mean	1	0.5	2	2	2	2	2	3
SD[2/]	0.4	0.5	0.5	0.6	0.7	0.6	0.8	0.6

[1/] 0 = poor (<25% emergence); 1 = moderate (26-64% emergence); 2 = good (65-85% emergence); 3 = excellent (86-100% emergence). SD[2/] standard deviation.

Austrian Winter Pea

Austrian Winter Pea is a commonly planted cover crop in the Central Plains for grazing and nitrogen fixation (Caddel et al, 2017). Peas are also grown in parts of Kansas as a grain crop. In general, most peas are planted in the same season they are intended to be utilized. Table 5 shows pea emergence until 28 days after planting. Winter survival in Kansas is possible and was found with the variety 'Lynx' for both years of the study and produced flowers as shown in Table 6. 'Lynx' was considerably shorter in 2017 and is due to an unknown cause. In 2016-2017, the pea varieties overwintered and produced flowers. It is important to consider inoculating peas before planting for maximum nodulation.

Table 5. Mean values and standard deviations of emergence groups[1/] (see below) of winter pea cultivars at 7, 14, 21 and 28 days after planting in 2016-2017. USDA-NRCS Manhattan, KS Plant Materials Center.

Cultivar	Days after planting							
	7	14	7	14	7	14	7	14
	2016	2017	2016	2017	2016	2017	2016	2017
Arvica	2	1	2	2	3	2	3	2
Dunn	2	1	3	2	3	2	3	2
Frost Master	1	0	1	1	2	1	3	2
Lynx	1	1	1	1	1	2	2	3
Maxum	1	1	2	2	2	2	3	2
Survivor 15	2	0	3	2	3	2	3	2
Whistler	2	0	2	2	2	2	2	2
Windham	1	1	2	1	2	1	2	1
Mean	1	1	2	1	2	2	3	2
SD[/2]	0.3	0.3	0.3	0.5	0.5	0.4	0.4	0.3

[1/] 0 = poor (<25% emergence); 1 = moderate (26-64% emergence); 2 = good (65-85% emergence); 3 = excellent (86-100% emergence). SD[2/] standard deviation.

Table 6. Mean values for % winter hardiness, plant height and days after planting to 50% bloom for winter pea cultivars in 2017 – 2018. USDA-NRCS Manhattan, KS Plant Materials Center.

Cultivar	% Winter hardiness		Plant height (in)		DAP to 50% bloom	
	2017	2018	2017	2018	2017	2018
Arvica	55	0	15	0	220	0
Dunn	53	0	14	0	222	0
Frost Master	44	0	14	0	220	0
Lynx	36	74	9	32	220	238
Maxum	31	0	15	0	220	0
Survivor 15	69	0	16	0	220	0
Whistler	45	0	16	0	223	0
Windham	48	0	14	0	223	0
Mean	47	0	14	0	221	0
SD[/1]	11	0	2	0	1.2	0

[1/]SD - Standard deviation.

Cereal Rye

Cereal rye has been shown to be winter hardy and be able to regrow vigorously in the spring (Krueger et al., 2011). All rye varieties had 100% emergence by 14 days after planting, except for 'Guardian' (Table 7). Poor field emergence may have been attributed to seedling disease. The plant pathology laboratory at Kansas State University is investigating the seedling disease issue and will provide a diagnosis of the disease. All but two of the varieties were shown to have excellent over wintering characteristics and survived both winters of the study. The varieties 'FL401' and 'Merced' overwintered poorly (Table 8). These two varieties were also noted to have more fall growth than any of the other varieties. It may be important to note the poor winter survival and increased fall growth may be advantageous for placing these rye varieties where there is a concern with rye maturing seed in the spring and becoming a weed issue in cropland as well as areas that may need increased soil cover in the fall for soil erosion

control. ‘Brasetto’ was shown to be the shortest rye while ‘Elbon’ was the tallest. More research is needed to better understand days after planting to 50% bloom as it is environmentally related.

Table 7. Mean values and standard deviations for field emergence of emergence groups[1/] (see below) of cereal rye cultivars at 7, 14, 21 and 28 days after planting in 2016-2017. USDA-NRCS Manhattan, KS Plant Materials Center.

Cultivar	Days after planting							
	7		14		21		28	
	2016	2017	2016	2017	2016	2017	2016	2017
Aroostock	3	2	3	3	3	3	3	3
Bates	2	2	2	3	3	3	3	3
Brasetto	2	2	2	3	2	3	2	3
Elbon	3	2	3	3	3	3	3	3
FL 101	2	2	2	3	3	3	3	3
Guardian	0	0	0	0	0	0	0	0
Hazlet	2	2	2	3	3	3	3	3
Maton	2	2	3	3	3	3	3	3
Maton II	2	2	2	3	3	3	3	3
Merced	2	2	3	3	3	3	3	3
Oklon	2	2	2	3	3	3	3	3
Rymin	3	2	3	3	3	3	3	3
Wheeler	2	2	3	3	3	3	3	3
Wintergrazer	2	2	2	3	2	3	3	3
Wrens Abruzzi	2	2	3	3	3	3	3	3
Mean	2	2	2	3	2	3	3	3
SD[/2]	0.4	0	0.3	0	0.2	0	0.2	0

[1/] 0 = poor (<25% emergence); 1 = moderate (26-64% emergence); 2 = good (65-85% emergence); 3 = excellent (86-100% emergence). SD[2/] standard deviation.

Table 8. Mean values and standard deviations for % winter hardiness, plant height and days after planting to 50% bloom for cereal rye cultivars in 2017 – 2018. USDA-NRCS Manhattan, KS Plant Materials Center.

Cultivar	% Winter hardiness		Plant height (in.)		DAP to 50% bloom	
	2017	2018	2017	2018	2017	2018
Aroostock	99	99	52	50	213	238
Bates	99	100	52	49	213	238
Brasetto	100	100	27	33	210	230
Elbon	94	100	50	52	213	242
FL 101	0	6	0	0	0	0
Guardian	0	0	0	0	0	0
Hazlet	100	99	37	50	226	238
Maton	92	100	52	51	213	242
Maton II	100	100	51	49	213	242
Merced	0	4	0	0	0	0
Oklon	96	100	46	48	216	238
Rymin	99	100	42	50	204	238
Wheeler	98	99	43	53	218	238
Wintergrazer 70	95	100	45	50	213	242
Wrens Abruzzi	97	100	46	49	213	238
Mean	84	86	46	43	214	239
SD1/	32	32	14	13	5	3

[1/]SD - Standard deviation.

Crimson Clover

Crimson clover is a popular legume in cover crop mixes. Crimson clover varieties had good establishment in 2016 but due to environmental conditions had poor establishment in 2017 (Table 9). Establishment was slow and variable in 2016. All crimson clover varieties bloomed in the spring of 2017. All varieties showed a similar height and bloom in 2017, but due to poor fall establishment no survival data was collected in 2018 (Table 10).

Table 9. Mean values and standard deviations of emergence groups[1/] (see below) of crimson clover cultivars at 7, 14, 21 and 28 days after planting in 2016-2017. USDA-NRCS Manhattan, KS Plant Materials Center.

Cultivar	Days after planting							
	7		14		21		28	
	2016	2017	2016	2017	2016	2017	2016	2017
AU Robin	1	0.5	1	1	1	1	1	1
AU Sunrise	2	0.3	2	0.8	0.8	1	2	1
AU Sunup	0	0.3	0	0.3	0.3	0.3	1	0.5
Contea	1	0	1	0.3	0.3	0.3	1	1
Dixie	1	0.3	1	0.8	0.8	1	1	1
Kentucky Pride	2	0.5	2	1	1	1	2	1
Mean	1	0.3	1	0.8	0.8	0.9	1	0.9
SD[2/]	0.6	0.2	0.6	0.3	0.6	0.3	0.5	0.2

[1/] 0 = poor (<25% emergence); 1 = moderate (26-64% emergence; 2 = good (65-85% emergence); 3 = excellent (86-100% emergence). SD[2/] standard deviation.

Table 10. Mean values and standard deviations for % winter hardiness, plant height and days after planting to 50% bloom for crimson clover cultivars in 2017 – 2018. USDA-NRCS Manhattan, KS Plant Materials Center.

Cultivar	% Winter hardiness		Plant height (in.)		DAP to 50% bloom	
	2017	2018	2017	2018	2017	2018
AU Robin	99	0	11	0	209	0
AU Sunrise	93	0	11	0	209	0
AU Sunup	100	0	11	0	209	0
Contea	99	0	11	0	209	0
Dixie	98	0	12	0	209	0
Kentucky Pride	95	0	12	0	209	0
Mean	97	0	11	0	209	0
SD[1/]	2.4	0	0.4	0	0	0

[1/]SD - Standard deviation.

Red Clover

Red clover had similar germination patterns as the crimson clover with slow establishment in 2016-2017 and very poor establishment in 2017-2018 (Table 11). The poor establishment was attributed to soil crusting after planting. All varieties survived the winter and bloomed in May in 2017 (Table 12).

Table 11. Mean values and standard deviations of emergence groups[1/] (see below) of red clover cultivars at 7, 14, 21 and 28 days after planting in 2016-2017. USDA-NRCS Manhattan, KS Plant Materials Center.

Cultivar	Days after planting							
	7		14		21		28	
	2016	2017	2016	2017	2016	2017	2016	2017
Cinnamon Plus	0	0	0	0	1	0	2	1
Cyclone II	0	0	0	0	1	1	1	1
Dynamite	0	0	0	1	1	1	1	1
Freedom	0	0	0	1	1	1	2	1
Kenland	0	0	0	0	0	1	0	1
Mammoth	0	0	0	1	0	1	1	1
Starfire II	0	0	0	1	1	1	1	1
Wildcat	0	0	0	0	1	1	1	1
Mean	0	0	0	0	1	1	1	1
SD[/2]	0	0	0	0.2	0.4	0.2	0.5	0.2

[1/] 0 = poor (<25% emergence); 1 = moderate (26-64% emergence; 2 = good (65-85% emergence); 3 = excellent (86-100% emergence). SD[2/] standard deviation.

Table 12. Mean values and standard deviations for % winter hardiness, plant height and days after planting to 50% bloom for red clover cultivars in 2017 – 2018. USDA-NRCS Manhattan, KS Plant Materials Center.

Cultivar	% Winter hardiness		Plant height (in.)		DAP to 50% bloom	
	2017	2018	2017	2018	2017	2018
Cinnamon Plus	94	0	14	0	247	0
Cyclone II	94	0	16	0	247	0
Dynamite	100	0	15	0	247	0
Freedom	91	0	14	0	247	0
Kenland	100	0	15	0	247	0
Mammoth	100	0	15	0	247	0
Starfire II	100	0	15	0	247	0
Wildcat	89	0	15	0	247	0
Mean	96	0	15	0	247	0
SD[/1]	4.3	0	0.6	0	0	0

[1/]SD - Standard deviation.

Hairy Vetch

Hairy vetch is an annual legume commonly planted as a cover crop. All hairy vetch varieties emerged by 14 days after planting (Table 13). Winter survival, height and bloom date were similar for all vetches both years (Table 14). Bloom date is important for hairy vetch grown in Kansas due to its ability to produce hard seed and cause problems with small grains production (Jacobsen et al., 2010). More research is needed on the bloom period and seed maturity of these varieties under different environmental conditions in the Central Plains.

Table 13. Mean values and standard deviations of emergence groups[1/] (see below) of hairy vetch cultivars at 7, 14, 21 and 28 days after planting in 2016-2017. USDA-NRCS Manhattan, KS Plant Materials Center.

	Days after planting							
Cultivar	7		14		21		28	
	2016	2017	2016	2017	2016	2017	2016	2017
CCS Groff	0	0	1	1	2	2	3	2
Lana	0	0	1	1	1	2	1	2
Purple Bounty	0	0	1	1	2	2	3	2
Purple Prosperity	0	0	1	1	2	2	2	2
TNT	0	0	1	1	1	2	2	2
Villana	0	0	2	1	2	2	3	2
Mean	0	0	1	1	2	2	2	2
SD[/2]	0	0	0.2	0	0.2	0	0.4	0

[1/] 0 = poor (<25% emergence); 1 = moderate (26-64% emergence); 2 = good (65-85% emergence); 3 = excellent (86-100% emergence). SD[2/] standard deviation.

Table 14. Mean values and standard deviations for % winter hardiness, plant height and days after planting to 50% bloom for hairy vetch cultivars in 2017 - 2018. USDA-NRCS Manhattan, KS Plant Materials Center.

Cultivar	% Winter hardiness		Plant height (in.)		DAP to 50% bloom	
	2017	2018	2017	2018	2017	2018
CCS Groff	100	97	22	25	208	223
Lana	100	90	23	24	208	223
Purple Bounty	95	100	23	26	208	223
Purple Prosperity	100	93	23	25	208	223
TNT	95	95	25	25	208	223
Villana	100	96	24	26	208	223
Mean	95	95	23	25	208	223
SD[1/]	2	3	0.9	0.6	0	0

[1/]SD - Standard deviation.

CONCLUSION

This study shows there may be a difference within variety of the same species of cover crop. Some of these differences may be useful in strategically placing a cover crop where it best addresses a resource concern. One item that was shown in the study was the importance of seed quality as some of the varieties had disease issues that may not have been due to the variety but the environment in which it was grown or stored. It is important to have purity and germination information available on cover crop seed prior to planting. This study is used as a guide to help direct future cover crop work. Because some of the growth parameters are environmentally driven it is important to further evaluate these varieties of interest in as many environmental conditions as possible. Future results may vary or even contradict these results due to environmental impact.

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