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Plant Materials Technical Note No. 2

Evaluation of Cool Season Cover Crops in the North Central Region



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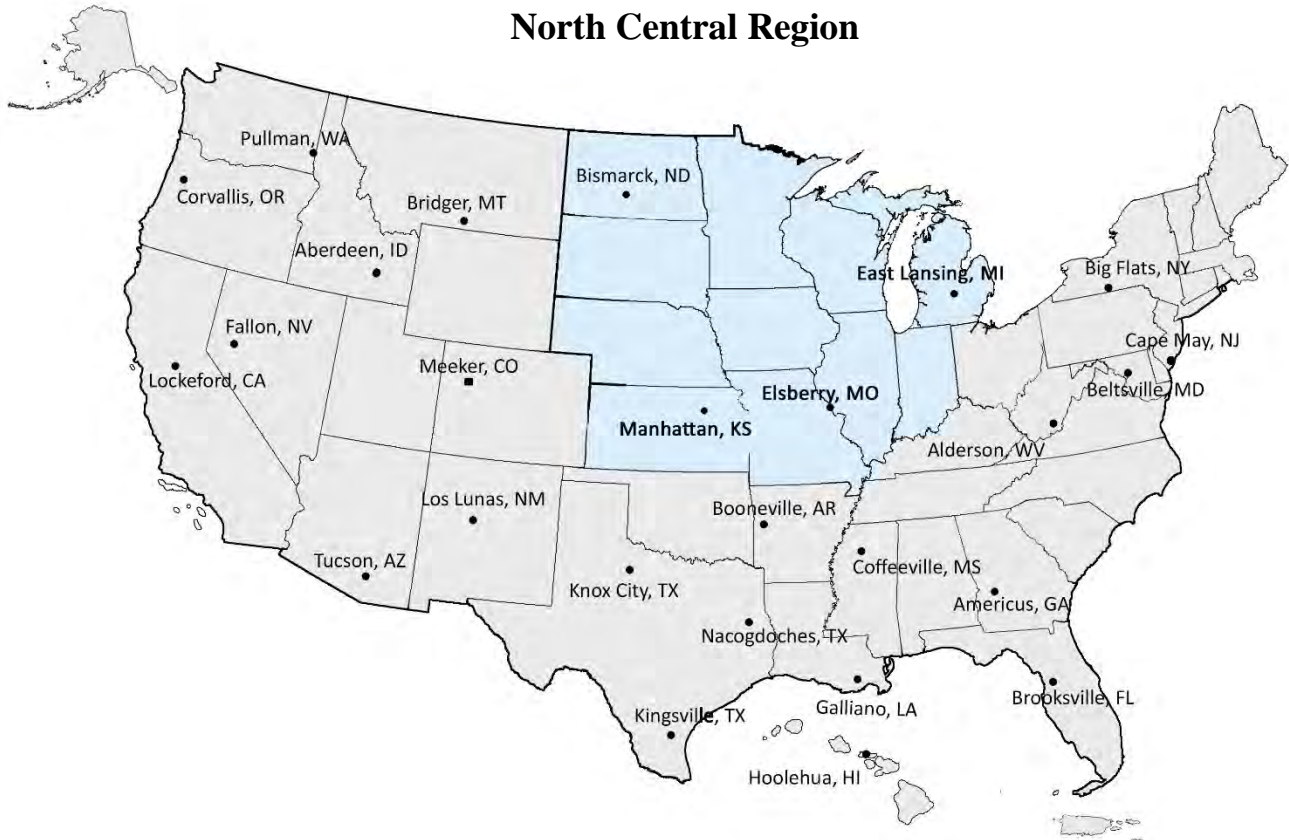
Preface

The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Plant Materials Program has been involved in the evaluation of conservation plants and planting technology for more than 80 years.

Plant Materials Centers (PMCs) in Manhattan, KS; Elsberry, MO; and East Lansing, MI conducted a 2-year evaluation of 56 commercially available varieties of cereal rye, hairy vetch, crimson clover, red clover, winter/field pea, black oats, black seeded oats, and daikon radish to assess their adaptation and performance as cover crops in the North Central PMC region. Information from the study will assist conservation planners and farmers in selecting varieties to meet the cover crop objectives of their production systems.

For additional information on specific species of plants mentioned in this publication, please see the USDA PLANTS database at: (<http://plants.usda.gov/java/>) or contact the nearest Plant Materials Center or plant materials specialist (<http://plant-materials.nrcs.usda.gov/contact/>) and/or the Land Grant Universities that serve the State. For specific information on soils and soil health, please see USDA NRCS soils website at: (<http://www.nrcs.usda.gov/wps/portal/nrcs/site/soils/home/>). Also, see technical resources on the National Plant Materials Program Web site at: (<http://www.plant-materials.nrcs.usda.gov/>).

USDA NRCS Plant Materials Centers North Central Region



INTRODUCTION

Farmers rely on the latest crop variety trials to make informed decisions on planting the best adapted crop variety to maximize yield given their soils and production practices. With the ever-growing interest in planting cover crops, the USDA-Natural Resources Conservation Service (NRCS) Plant Materials Program initiated a nationwide study to identify adapted varieties of cool season annual species for cover cropping. With input from State Agronomists and State Soil Health Specialists, seven cool season annual cover crop species were identified for comparative evaluations using the network of NRCS Plant Materials Centers (PMCs). The PMCs assembled commercially available varieties of black oats, black seeded oats, cereal rye, crimson clover, daikon radish, hairy vetch, red clover, and winter/field pea to evaluate their performance and adaptation to different soils and geographical regions in the U.S. This technical note represents two years of data collected from PMCs in the region, performance may vary in other locations and years. Information from this study along with local research from university extension and other research entities can assist farmers and conservation planners in selecting adapted cool season annual varieties for their crop production systems. Additional information for each PMC location, including plant height and biomass (where collected), can be found in their final study reports hyperlinked at the end of this document.

CHOOSING VARIETIES FOR CONSERVATION PLANTINGS

Commodity crops are chosen to fit local climate and soil conditions, and producers select varieties of commodity crops carefully to maximize performance and returns. For the producer, variety selection is a dynamic process that takes advantage of the many options available when deciding which varietal attributes best meet their needs. When choosing cover crop varieties, the producer may also take advantage of differences among varieties to best meet the goals of their production system.



When a cover crop species is chosen to meet a resource concern, a variety from that species may be selected to meet needs such as: 1) production of early or late cover, 2) early or late maturity, or 3) winter survival. By choosing varieties based on the production system, cover crop plans and systems can be developed to:

- time planting and termination dates to fit within the cropping system,
- develop mixes with species that mature at similar times to facilitate mechanical termination,
- use winterkill as a method of termination,
- use moderate levels of winterkill to manage competition of aggressive species, and
- use maturity dates to regulate the amount of cover crop residue.

Through selection of varieties that fit production systems, producers may overcome obstacles that discourage the use of cover crops.

PROCEDURE

Cool season, annual, cover crop varieties were evaluated at NRCS PMCs in Manhattan, KS and Elsberry, MO in 2016-2017 and 2017-2018 and East Lansing, MI in 2016-2017 (Table 1). Replicated plots were drilled in the fall using the pure live seed planting method (Table 2), and seeding rates were determined by averaging the recommended seeding rates from NRCS cover crop standards and specifications for uniform data analysis (Table 3). Legumes were inoculated with appropriate rhizobia prior to planting. Non-legumes were fertilized with 40 lbs. N/acre, and all entries received 60 lbs. P/acre and 30 lbs. K/acre both years. Cover crop varieties were evaluated for:

- Quick fall cover—Emergence at 14 days after planting: Excellent >90%, Good 61-90%, Fair 25-60%, Poor <25%,
- Fall stand quality—Yes is >65% emergence at 28 days after planting,
- Winter survival—Plant survival rating of Excellent >75%, Good 50-75%, Marginal 25-50%, Poor <25%,
- Maturity date—Days after planting to 50% bloom, data was grouped over the region by <235=Early, 235-250=Mid, >250=Late to identify varietal differences, and
- Disease and insect ranking—Damage observed was None, Low, Moderate, or High.

Table 1. Soil type, long-term yearly rainfall, average frost date, and low temperatures for Manhattan, KS, East Lansing, MI and Elsberry, MO.

Plant Materials Center	Soil type	Average Yearly Rainfall (inches)	Average Frost Date	Low Temperature (F)	
				2016-2017	2017-2018
Manhattan, KS	Belvue silt loam	35	Oct 20	-11	-10
East Lansing, MI	Wasepi sandy loam	32	Oct 5	1	-11
Elsberry, MO	Menfro silt loam	41	Oct 16	-2	-8

Table 2. Planting date/year and planting method at Manhattan, KS, East Lansing, MI and Elsberry, MO.

Plant Materials Center	Planting Date (Year)		Planting Method
	2016	2017	
Manhattan, KS	12 Sept	15 Sept	Drill
East Lansing, MI	16 Sept	Not planted	Drill
Elsberry, MO	20 Sept	22 Sept	Drill

Table 3. Cover crop planting rates at PMCs in Manhattan, KS, East Lansing, MI and Elsberry, MO.

Common Name	Species	PLS lbs./Acre
black oats	<i>Avena strigosa</i>	60
black seeded oats	<i>Avena sativa</i>	60
cereal rye	<i>Secale cereale</i>	100
crimson clover	<i>Trifolium incarnatum</i>	18
daikon radish	<i>Raphanus sativus</i>	9
hairy vetch	<i>Vicia villosa</i>	18
red clover	<i>Trifolium pratense</i>	9
winter/field pea	<i>Pisum sativum</i>	70

COVER CROP PERFORMANCE AND RESULTS

BLACK OATS/BLACK SEEDED OATS

Description: upright, winter annual grass. Height from 2.5 to 5 feet. Black oats are not cold hardy and will winterkill at temperatures less than 19°F depending on growth stage. Black seeded oats are more cold tolerant than black oats, but susceptible to winter damage in northern locations. Prefers sandy or loamy soils but can also grow in heavy clay. It is used as a rotational cover crop either seeded alone or in a mixture.

Benefits: N scavenger, improves organic matter and soil structure, erosion control, weed suppressor, livestock forage.



Black oats

Performance of Black Oats/Black Seeded Oats Varieties

Cover Crop	Quick Fall Cover ^{1/}	Fall Stand Quality ^{2/}	Winter Survival ^{3/}	Maturity Date ^{4/}	Disease Ranking ^{5/}	Insect Ranking ^{5/}
Cosaque	Good	Yes	Good/Poor ^a	Late	Moderate/High ^b	None
Soil Saver	Good	Yes	Poor	WK	WK	WK

^{1/}Quick fall cover—Emergence at 14 days after planting: Excellent >90%, Good 61-90%, Fair 25-60%, Poor <25%; ^{2/}Fall stand quality—Yes is >65% emergence at 28 days after planting; ^{3/}Winter survival—Plant survival rating of Excellent >75%, Good 50-75%, Marginal 25-50%, Poor <25%; ^{4/}Maturity date—Days after planting to 50% bloom: <235=Early, 235-250=Mid, >250=Late; and ^{5/}Disease and insect ranking—Damage observed was None, Low, Moderate, or High. WK=Winterkilled.

^aGood winter survival at all locations, poor in KS and MO in 2017-2018; ^bHigh disease damage in KS.

Expected Adaptation: Soil Saver (black oats) and Cosaque (black seeded oat) rated good for quick fall cover and acceptable stand quality across locations and years. Soil Saver winterkilled at all locations. Cosaque had good winter survival at all locations in 2016-2017 and low to marginal winter survival in Elsberry, MO and Manhattan, KS in 2017-2018. Surviving plants were highly susceptible to foliar diseases in Manhattan, KS. Soil Saver may be a good choice for producers needing a quick growing cover crop requiring no chemical or mechanical termination prior to planting cash crops in the spring.



Soil Saver and Cosaque provided quick fall cover and adequate stand quality but Soil Saver winterkilled in Kansas, Michigan and Missouri.

CEREAL RYE

Description: upright, cool season, annual grass. Height from 3 to 6 feet. Grows in a wide variety of climate and soil conditions but performs best in light loams or sandy soils. It also does well in clay soils.

Benefits: N scavenger, improves organic matter and soil structure, erosion control, weed suppressor, livestock forage.



Cereal rye varieties at the Manhattan, KS Plant Materials Center.

Performance of Cereal Rye Varieties

Cover Crop	Quick Fall Cover ^{1/}	Fall Stand Quality ^{2/}	Winter Survival ^{3/}	Maturity Date ^{4/}	Disease Ranking ^{5/}	Insect Ranking ^{5/}
Aroostook	Excellent	Yes	Excellent	Mid	Low	Low
Bates	Excellent	Yes	Excellent	Mid	Low	None
Brasetto	Excellent	Yes	Excellent	Mid	Low	None
Elbon	Excellent	Yes	Excellent	Mid	Low	Low
FL 401	Excellent	Yes	Poor/Marginal ^d	Early	Low	Low
Guardian	Excellent/Poor ^a	Yes/No ^c	Good/Poor ^e	Mid	Low/Moderate ^g	Low
Hazlet	Excellent	Yes	Excellent	Mid	Low/High ^g	Low
Maton	Excellent	Yes	Excellent	Mid	Low	None
Maton II	Excellent	Yes	Excellent/Good ^f	Mid	Low	Low
Merced	Excellent	Yes	Poor/Marginal ^d	Early	Low	Low
Oklon	Excellent	Yes	Excellent	Mid	Low	None
Rymin	Excellent/Poor ^b	Yes	Excellent	Early	Low	Low
Wheeler	Excellent	Yes	Excellent	Mid	Low	None
Wintergrazer 70	Excellent	Yes	Excellent	Mid	Low	None
Wren Abruzzi	Excellent	Yes	Excellent	Mid	Low	None

^{1/}Quick fall cover—Emergence at 14 days after planting: Excellent >90%, Good 61-90%, Fair 25-60%, Poor <25%; ^{2/}Fall stand quality—Yes is >65% emergence at 28 days after planting; ^{3/}Winter survival—Plant survival rating of Excellent >75%, Good 50-75%, Marginal 25-50%, Poor <25%; ^{4/}Maturity date—Days after planting to 50% bloom: <235=Early, 235-250=Mid, >250=Late; and ^{5/}Disease and insect ranking—Damage observed was None, Low, Moderate, or High.

^aExcellent, quick fall cover in MI, poor in KS and MO; ^b Excellent to good quick fall cover in MI and KS, poor in MO; ^cUnacceptable fall stand quality in KS; ^dPoor winter survival in KS both years and MO in 2017-2018; marginal in MI and MO in 2016-2017; ^ePoor winter survival in KS, good to excellent in MI and MO; ^fGood survival in MO; ^gModerate to high disease in MO 2017-2018.

Expected Adaptation: Most cereal rye varieties exhibited good to excellent fall cover, low disease and insect problems and excellent winter survival except for FL 401 and Merced, which overwintered poorly at all locations both years. For producers seeking a cereal rye variety that produces a quick fall cover with acceptable fall stands that may not require chemical or mechanical termination in the spring, Merced or FL 401 may be good choices for incorporating into a cropping system.



Merced (center) and FL 401 (upper right) had poor winter survival for both years in Kansas, Michigan and Missouri.

CRIMSON CLOVER

Description: cool season annual legume. Plants are generally densely hairy with a rosette of upright, usually unbranched stems, reaching 1 to 3 feet tall supported by a central taproot and many fibrous roots. Flowers produce nectar and pollen that attract European honey bees, as well as a wide variety of native bees.

Benefits: N source, improves organic matter and soil structure, erosion control, weed suppressor, livestock forage, pollinator habitat.



Crimson clover

Performance of Crimson Clover Varieties

Cover Crop	Quick Fall Cover ^{1/}	Fall Stand Quality ^{2/}	Winter Survival ^{3/}	Maturity Date ^{4/}	Disease Ranking ^{5/}	Insect Ranking ^{5/}
AU Robin	Good/Fair ^a	Yes/No ^b	Excellent/Marginal ^c	Early	Low	Low
AU Sunrise	Good/Fair ^a	Yes	Excellent/Good ^d	Early	Low	Low
AU Sunup	Good/Fair ^a	Yes/No ^b	Excellent/Marginal ^c	Early	None	Low
Contea	Good/Fair ^a	Yes/No ^b	Excellent/Poor ^e	Early	Low	Low
Dixie	Good/Fair ^a	Yes/No ^b	Excellent/Good ^d	Early	Low	Low
Kentucky Pride	Good/Fair ^a	Yes/No ^b	Excellent/Good ^d	Early	None	None

^{1/}Quick fall cover—Emergence at 14 days after planting: Excellent >90%, Good 61-90%, Fair 25-60%, Poor <25%; ^{2/}Fall stand quality—Yes is >65% emergence at 28 days after planting; ^{3/}Winter survival—Plant survival rating of Excellent >75%, Good 50-75%, Marginal 25-50%, Poor <25%; ^{4/}Maturity date—Days after planting to 50% bloom: <235=Early, 235-250=Mid, >250=Late; and ^{5/}Disease and insect ranking—Damage observed was None, Low, Moderate, or High.

^aGood to excellent quick fall cover in MI 2016-2017 and MO in 2017-2018, fair to poor in KS; ^bUnacceptable fall stand quality in KS; ^cExcellent to good winter survival in KS and MI 2016-2017; poor in KS in 2017-2018 and marginal in MO; ^dExcellent to good winter survival in KS and MI 2016-2017, poor in KS in 2017-2018, and good in MO; ^eExcellent to good winter survival at all locations except KS in 2017-2018.

Expected Adaptation: Most crimson clover varieties had good, quick fall and acceptable fall stand quality in Elsberry, MO and East Lansing, MI. Winter survival varied among varieties across locations and years but was generally good to excellent. Days to maturity (50% bloom) were similar among varieties across locations. Disease and insect problems were low to none.



Late fall growth of crimson clover plots in Elsberry, MO (left). AU Sunrise blooming in Mid-April in Elsberry, MO (right).

DAIKON RADISH

Description: winter annual with stiff, straight hairs near the base of the leaves. Seed stalks elongate from the rosette. Flowers in the spring with four pink, white, or lavender petals. Fruit resembles small bean pods. Radish develops a unique taproot which may reach depths of 24 inches or more. The upper 12 to 20 inches of the taproot thicken and can grow to 2 inches or more in diameter. Concorde, Control and Defender are oilseed radishes while other radishes are daikon/forage varieties.

Benefits: N scavenger, improves organic matter and soil structure, erosion control, weed suppressor, livestock forage.



Daikon radish taproot

Performance of Daikon Radish Varieties

Cover Crop	Quick Fall Cover ^{1/}	Fall Stand Quality ^{2/}	Winter Survival ^{3/}	Maturity Date ^{4/}	Disease Ranking ^{5/}	Insect Ranking ^{5/}
Big Dog™	Good	Yes	Poor	WK	WK	WK
Concorde	Good	Yes	Poor	WK	WK	WK
Control	Good	Yes	Poor	WK	WK	WK
Defender	Good	Yes	Poor	WK	WK	WK
Driller	Good	Yes	Poor	WK	WK	WK
Eco-Till™	Good	Yes	Poor	WK	WK	WK
Graza	Good/Poor ^a	Yes/No ^b	Poor	WK	WK	WK
Groundhog™	Good	Yes	Poor	WK	WK	WK
Lunch	Good	Yes	Poor	WK	WK	WK
Nitro™	Good	Yes	Poor	WK	WK	WK
Sodbuster	Good	Yes	Poor	WK	WK	WK
Tillage®	Good	Yes	Poor	WK	WK	WK

^{1/}Quick fall cover—Emergence at 14 days after planting: Excellent >90%, Good 61-90%, Fair 25-60%, Poor <25%; ^{2/}Fall stand quality—Yes is >65% emergence at 28 days after planting; ^{3/}Winter survival—Plant survival rating of Excellent >75%, Good 50-75%, Marginal 25-50%, Poor <25%; ^{4/}Maturity date—Days after planting to 50% bloom: <235=Early, 235-250=Mid, >250=Late; and ^{5/}Disease and insect ranking—Damage observed was None, Low, Moderate, or High. WK=Winterkilled.

^aPoor fall cover in KS both years; ^bUnacceptable stand quality in KS both years and MO in in 2016-2017.

Expected Adaptation: Daikon radish varieties exhibited excellent to good, quick fall cover and acceptable fall stand quality except Graza in Manhattan, KS both years and Elsberry, MO in 2016. None of the varieties survived the winters in Manhattan, KS, East Lansing, MI, Elsberry, MO. Daikon radishes are ideal for producers needing a cover crop that provides early fall cover that does not require chemical or mechanical termination.



Daikon radish varieties provided quick fall cover in Kansas, Michigan and Missouri but did not survive the winters.

HAIRY VETCH

Description: trailing or climbing, winter annual, legume with stems 2 to 5 feet. Leaves are terminated by branched tendrils. Stems and leaves are usually covered with soft woolly fuzz. Flowers in clusters of 10 to 40 and usually violet to purple colored. Lana is a variety of woollypod vetch (*Vicia villosa ssp. dasycarpa*) included in this study because of its similarity in usage to hairy vetch.

Benefits: N source, weed suppressor, improves organic matter and soil structure, pollinator habitat.



Hairy vetch flowers

Performance of Hairy Vetch Varieties

Cover Crop	Quick Fall Cover ^{1/}	Fall Stand Quality ^{2/}	Winter Survival ^{3/}	Maturity Date ^{4/}	Disease Ranking ^{5/}	Insect Ranking ^{5/}
CCS Groff	Good/Fair ^a	Yes	Excellent/Good ^d	Mid	None	None
Lana	Good/Fair ^a	Yes/No ^c	Excellent/Good ^c	Mid	None	Low
Purple Bounty	Good/Fair ^b	Yes	Excellent	Mid	None	None
Purple Prosperity	Good/Fair ^a	Yes	Excellent	Mid	None	None
TNT	Good/Fair ^b	Yes	Excellent	Mid	None	None
Villana	Good/Fair ^a	Yes	Excellent/Good ^d	Mid	None	None

^{1/}Quick fall cover—Emergence at 14 days after planting: Excellent >90%, Good 61-90%, Fair 25-60%, Poor <25%; ^{2/}Fall stand quality—Yes is >65% emergence at 28 days after planting; ^{3/}Winter survival—Plant survival rating of Excellent >75%, Good 50-75%, Marginal 25-50%, Poor <25%; ^{4/}Maturity date—Days after planting to 50% bloom: <235=Early, 235-250=Mid, >250=Late; and ^{5/}Disease and insect ranking—Damage observed was None, Low, Moderate, or High.

^aGood to excellent quick fall cover in MI and MO, fair in KS; ^b Good quick fall cover in MO, fair in KS, MI; ^cUnacceptable stand quality in KS in 2016; ^dExcellent winter survival at all locations, good in MI in 2016-2017; ^eExcellent winter survival at all locations, good in MI and MO in 2016-2017.

Expected Adaptation: Hairy vetch varieties provided good, quick fall cover in East Lansing, MI and Elsberry, MO and fair fall cover in Manhattan, KS. All varieties provided acceptable fall stand quality except Lana in Manhattan, KS in 2016. Winter survival was good to excellent for all varieties across locations and years. Varieties were similar in days after planting to maturity (50% bloom) and varied across locations. None to low insect or disease damage was observed on any variety.



Early winter growth of hairy vetch varieties in Elsberry.

RED CLOVER

Description: biennial or short-lived perennial that grows as one of two types: medium (double-cut) or mammoth (single-cut). Plants grow from crowns with hollow, hairy stems and branches. Stem lengths of medium and mammoth types average 18 inches and 24 to 30 inches, respectively. Each leaf consists of a slender stalk bearing 3 leaflets. Flowers borne in compact clusters or heads and are usually rose-pink in color.

Benefits: N source, improves organic matter and soil structure, erosion control, weed suppressor, livestock forage, pollinator habitat.



Red clover

Performance of Red Clover Varieties

Cover Crop	Quick Fall Cover ^{1/}	Fall Stand Quality ^{2/}	Winter Survival ^{3/}	Maturity Date ^{4/}	Disease Ranking ^{5/}	Insect Ranking ^{5/}
Cinnamon Plus	Good/Poor ^a	Yes/No ^c	Excellent/Poor ^d	Late	None	Low
Cyclone II	Good/Poor ^a	Yes/No ^c	Excellent/Poor ^d	Late	None	Low
Dynamite	Good/Poor ^a	Yes/No ^c	Excellent/Poor ^d	Late	None	Low
Freedom	Good/Poor ^a	Yes/No ^c	Excellent/Poor ^d	Late	None	Low
Kenland	Good/Poor ^a	Yes/No ^c	Excellent/Poor ^d	Late	None	Low
Mammoth	Good/Poor ^a	Yes/No ^c	Excellent/Poor ^d	Late	None	Low
Starfire II	Good/Poor ^a	Yes/No ^c	Excellent/Poor ^d	Late	None	Low
Wildcat	Fair/Poor ^b	Yes/No ^c	Excellent/Poor ^d	Late	None	Low

^{1/}Quick fall cover—Emergence at 14 days after planting: Excellent >90%, Good 61-90%, Fair 25-60%, Poor <25%; ^{2/}Fall stand quality—Yes is >65% emergence at 28 days after planting; ^{3/}Winter survival—Plant survival rating of Excellent >75%, Good 50-75%, Marginal 25-50%, Poor <25%; ^{4/}Maturity date—Days after planting to 50% bloom: <235=Early, 235-250=Mid, >250=Late; and ^{5/}Disease and insect ranking—Damage observed was None, Low, Moderate, or High.

^aGood quick fall cover in MI, poor in KS both years and fair in MO in 2016-2017; ^bFair quick fall cover in MI, poor in KS both years and fair in MO in 2016-2017; ^cAcceptable fall stand quality in MI only; ^dExcellent to good winter survival at all locations except poor in KS in 2017-2018.

Expected Adaptation: Red clover varieties generally had good quick fall cover in East Lansing, MI and fair to poor in Manhattan, KS and Elsberry, MO. Fall stand quality of the varieties was only acceptable in East Lansing, MI. Overall winter survival was excellent to good among varieties, but they winterkilled in Manhattan, KS in 2017-2018. All varieties were similar in maturity (50% bloom) but varied across locations. Insect and disease damage was none or low.



Late spring growth of Mammoth red clover in Missouri.

WINTER/FIELD PEA

Description: winter annual, legume with bluish-green waxy vines. Vines can reach 9 ft long, but modern varieties have shorter vines, about 2 feet long. Stems are hollow and leaves alternate, pinnately compound. Flowers white, purple or pink. Winter pea varieties include Frost Master, Lynx, Survivor 15, Whistler, and Windham. Spring pea varieties include Arvica 4010, Dunn, and Maxum.

Benefits: N source, improves organic matter and soil structure, erosion control, weed suppressor, livestock forage, pollinator habitat.



Field pea

Performance of Winter/Field Pea Varieties

Cover Crop	Quick Fall Cover ^{1/}	Fall Stand Quality ^{2/}	Winter Survival ^{3/}	Maturity Date ^{4/}	Disease Ranking ^{5/}	Insect Ranking ^{5/}
Arvica 4010	Good	Yes	Poor/Good ^c	Early ^h	Low/Moderate ⁱ	None
Dunn	Good	Yes	Poor/Good ^c	Early ^h	Low/Moderate ⁱ	None
Frost Master	Good/Fair ^a	Yes	Poor/Marginal ^d	Early ^h	Low/Moderate ⁱ	Low
Lynx	Good/Fair ^a	Yes	Good/Marginal ^e	Early ^h	Low/Moderate ⁱ	Low
Maxum	Good	Yes	Marginal/Poor ^f	Early ^h	Low/Moderate ⁱ	None
Survivor 15	Good	Yes	Good/Poor ^g	Early ^h	Low/High ⁱ	Low
Whistler	Good	Yes	Good/Poor ^g	Early ^h	Low/Moderate ⁱ	None
Windham	Good/Fair ^a	Yes/No ^b	Good/Poor ^g	Early ^h	Low/Moderate ⁱ	Low

^{1/}Quick fall cover—Emergence at 14 days after planting: Excellent >90%, Good 61-90%, Fair 25-60%, Poor <25%; ^{2/}Fall stand quality—Yes is >65% emergence at 28 days after planting; ^{3/}Winter survival—Plant survival rating of Excellent >75%, Good 50-75%, Marginal 25-50%, Poor <25%; ^{4/}Maturity date—Days after planting to 50% bloom: <235=Early, 235-250=Mid, >250=Late; and ^{5/}Disease and insect ranking—Damage observed was None, Low, Moderate, or High.

^aGood to excellent quick fall cover at all locations, fair to poor in KS both years; ^bUnacceptable in KS 2017-2018; ^cGood winter survival in KS in 2016-2017 only; ^dPoor winter survival in KS in 2017-2018 and MI, marginal to poor in MO and KS 2016-2017; ^eGood winter survival in KS 2017-2018 and both years in MO; marginal survival in KS 2016-2017; ^fMarginal survival in KS 2016-2017 only; ^gMarginal to good winter survival in KS 2016-2017 and MO both years; ^hMaturity date is only for KS; ⁱModerate to high disease rankings in KS 2016-2016.

Expected Adaptation: Field pea varieties had good to excellent quick fall cover and acceptable fall stand quality across locations and years, except for Windham in Manhattan, KS in 2017. All varieties winterkilled in East Lansing, MI and varied in survival at other locations and years. Days after planting to maturity varied among surviving varieties in Manhattan, KS and Elsberry, MO. Disease damage was greatest on surviving plants in Manhattan, KS. Insect damage was low on surviving plants in Manhattan, KS and Elsberry, MO.



Arvica 4010 (yellow) had poor winter survival in Missouri both years. Survivor 15 (red) had the highest winter survival in Kansas and Missouri. Early spring growth of Survivor 15.

Comparison of Cool Season Cover Crops and Varieties in the North Central Region

Cover Crop	Quick Fall Cover ^{1/}	Fall Stand Quality ^{2/}	Winter Survival ^{3/}	Maturity Date ^{4/}	Disease Ranking ^{5/}	Insect Ranking ^{5/}
BLACK OATS						
Soil Saver	Good	Yes	Poor	WK	WK	WK
BLACK SEEDED OATS						
Cosaque	Good	Yes	Good/Poor ^a	Late	Moderate/High ^b	None
^a Good winter survival at all locations, poor in KS and MO in 2017-2018; ^b High disease damage in KS.						
CEREAL RYE						
Aroostook	Excellent	Yes	Excellent	Mid	Low	Low
Bates	Excellent	Yes	Excellent	Mid	Low	None
Brassetto	Excellent	Yes	Excellent	Mid	Low	None
Elbon	Excellent	Yes	Excellent	Mid	Low	Low
FL 401	Excellent	Yes	Poor/Marginal ^d	Early	Low	Low
Guardian	Excellent/Poor ^a	Yes/No ^c	Good/Poor ^e	Mid	Low/Moderate ^g	Low
Hazlet	Excellent	Yes	Excellent	Mid	Low/High ^g	Low
Maton	Excellent	Yes	Excellent	Mid	Low	None
Maton II	Excellent	Yes	Excellent/Good ^f	Mid	Low	Low
Merced	Excellent	Yes	Poor/Marginal ^d	Early	Low	Low
Oklon	Excellent	Yes	Excellent	Mid	Low	None
Rymin	Excellent/Poor ^b	Yes	Excellent	Early	Low	Low
Wheeler	Excellent	Yes	Excellent	Mid	Low	None
Wintergrazer 70	Excellent	Yes	Excellent	Mid	Low	None
Wren Abruzzi	Excellent	Yes	Excellent	Mid	Low	None
^a Excellent, quick fall cover in MI, poor in KS and MO; ^b Excellent to good quick fall cover in MI and KS, poor in MO; ^c Unacceptable fall stand quality in KS; ^d Poor winter survival in KS both years and MO in 2017-2018; marginal in MI and MO in 2016-2017; ^e Poor winter survival in KS, good to excellent in MI and MO; ^f Good survival in MO; ^g Moderate to high disease in MO 2017-2018.						
CRIMSON CLOVER						
AU Robin	Good/Fair ^a	Yes/No ^b	Excellent/Marginal ^c	Early	Low	Low
AU Sunrise	Good/Fair ^a	Yes	Excellent/Good ^d	Early	Low	Low
AU Sunup	Good/Fair ^a	Yes/No ^b	Excellent/Marginal ^c	Early	None	Low
Contea	Good/Fair ^a	Yes/No ^b	Excellent/Poor ^e	Early	Low	Low
Dixie	Good/Fair ^a	Yes/No ^b	Excellent/Good ^d	Early	Low	Low
Kentucky Pride	Good/Fair ^a	Yes/No ^b	Excellent/Good ^d	Early	None	None
^a Good to excellent quick fall cover in MI 2016-2017 and MO in 2017-2018, fair to poor in KS; ^b Unacceptable fall stand quality in KS; ^c Excellent to good winter survival in KS and MI 2016-2017; poor in KS in 2017-2018 and marginal in MO; ^d Excellent to good winter survival in KS and MI 2016-2017, poor in KS in 2017-2018, and good in MO; ^e Excellent to good winter survival at all locations except KS in 2017-2018.						
^{1/} Quick fall cover—Emergence at 14 days after planting: Excellent >90%, Good 61-90%, Fair 25-60%, Poor <25%; ^{2/} Fall stand quality—Yes is >65% emergence at 28 days after planting; ^{3/} Winter survival—Plant survival rating of Excellent >75%, Good 50-75%, Marginal 25-50%, Poor <25%; ^{4/} Maturity date—Days after planting to 50% bloom: <235=Early, 235-250=Mid, >250=Late; and ^{5/} Disease and insect ranking—Damage observed was None, Low, Moderate, or High. WK=Winterkilled.						

Comparison of Cool Season Cover Crops and Varieties in the North Central Region (Cont.)

Cover Crop	Quick Fall Cover ^{1/}	Fall Stand Quality ^{2/}	Winter Survival ^{3/}	Maturity Date ^{4/}	Disease Ranking ^{5/}	Insect Ranking ^{5/}
DAIKON RADISH						
Big Dog™	Good	Yes	Poor	WK	WK	WK
Concorde	Good	Yes	Poor	WK	WK	WK
Control	Good	Yes	Poor	WK	WK	WK
Defender	Good	Yes	Poor	WK	WK	WK
Driller	Good	Yes	Poor	WK	WK	WK
Eco-Till™	Good	Yes	Poor	WK	WK	WK
Graza	Good/Poor ^a	Yes/No ^b	Poor	WK	WK	WK
Groundhog™	Good	Yes	Poor	WK	WK	WK
Lunch	Good	Yes	Poor	WK	WK	WK
Nitro™	Good	Yes	Poor	WK	WK	WK
Sodbuster	Good	Yes	Poor	WK	WK	WK
Tillage®	Good	Yes	Poor	WK	WK	WK
^a Poor fall cover in KS both years; ^b Unacceptable stand quality in KS both years and MO in in 2016-2017.						
HAIRY VETCH						
CCS Groff	Good/Fair ^a	Yes	Excellent/Good ^d	Mid	None	None
Lana	Good/Fair ^a	Yes/No ^c	Excellent/Good ^e	Mid	None	Low
Purple Bounty	Good/Fair ^b	Yes	Excellent	Mid	None	None
Purple Prosperity	Good/Fair ^a	Yes	Excellent	Mid	None	None
TNT	Good/Fair ^b	Yes	Excellent	Mid	None	None
Villana	Good/Fair ^a	Yes	Excellent/Good ^d	Mid	None	None
^a Good to excellent quick fall cover in MI and MO, fair in KS; ^b Good quick fall cover in MO, fair in KS, MI; ^c Unacceptable stand quality in KS in 2016; ^d Excellent winter survival at all locations, good in MI in 2016-2017; ^e Excellent winter survival at all locations, good in MI and MO in 2016-2017.						
RED CLOVER						
Cinnamon Plus	Good/Poor ^a	Yes/No ^c	Excellent/Poor ^d	Late	None	Low
Cyclone II	Good/Poor ^a	Yes/No ^c	Excellent/Poor ^d	Late	None	Low
Dynamite	Good/Poor ^a	Yes/No ^c	Excellent/Poor ^d	Late	None	Low
Freedom	Good/Poor ^a	Yes/No ^c	Excellent/Poor ^d	Late	None	Low
Kenland	Good/Poor ^a	Yes/No ^c	Excellent/Poor ^d	Late	None	Low
Mammoth	Good/Poor ^a	Yes/No ^c	Excellent/Poor ^d	Late	None	Low
Starfire II	Good/Poor ^a	Yes/No ^c	Excellent/Poor ^d	Late	None	Low
Wildcat	Fair/Poor ^b	Yes/No ^c	Excellent/Poor ^d	Late	None	Low
^a Good quick fall cover in MI, poor in KS both years and fair in MO in 2016-2017; ^b Fair quick fall cover in MI, poor in KS both years and fair in MO in 2016-2017; ^c Acceptable fall stand quality in MI only; ^d Excellent to good winter survival at all locations except poor in KS in 2017-2018.						
^{1/} Quick fall cover—Emergence at 14 days after planting: Excellent >90%, Good 61-90%, Fair 25-60%, Poor <25%; ^{2/} Fall stand quality—Yes is >65% emergence at 28 days after planting; ^{3/} Winter survival—Plant survival rating of Excellent >75%, Good 50-75%, Marginal 25-50%, Poor <25%; ^{4/} Maturity date—Days after planting to 50% bloom: <235=Early, 235-250=Mid, >250=Late; and ^{5/} Disease and insect ranking—Damage observed was None, Low, Moderate, or High. WK=Winterkilled.						

Comparison of Cool Season Cover Crops and Varieties in the North Central Region (Cont.)

Cover Crop	Quick Fall Cover ^{1/}	Fall Stand Quality ^{2/}	Winter Survival ^{3/}	Maturity Date ^{4/}	Disease Ranking ^{5/}	Insect Ranking ^{5/}
WINTER/FIELD PEA						
Arvica 4010	Good	Yes	Poor/Good ^c	Early ^h	Low/Moderate ⁱ	None
Dunn	Good	Yes	Poor/Good ^c	Early ^h	Low/Moderate ⁱ	None
Frost Master	Good/Fair ^a	Yes	Poor/Marginal ^d	Early ^h	Low/Moderate ⁱ	Low
Lynx	Good/Fair ^a	Yes	Good/Marginal ^e	Early ^h	Low/Moderate ⁱ	Low
Maxum	Good	Yes	Marginal/Poor ^f	Early ^h	Low/Moderate ⁱ	None
Survivor 15	Good	Yes	Good/Poor ^g	Early ^h	Low/High ⁱ	Low
Whistler	Good	Yes	Good/Poor ^g	Early ^h	Low/Moderate ⁱ	None
Windham	Good/Fair ^a	Yes/No ^b	Good/Poor ^g	Early ^h	Low/Moderate ⁱ	Low
<p>^aGood to excellent quick fall cover at all locations, fair to poor in KS both years; ^bUnacceptable in KS 2017-2018; ^cGood winter survival in KS in 2016-2017 only; ^dPoor winter survival in KS in 2017-2018 and MI, marginal to poor in MO and KS 2016-2017; ^eGood winter survival in KS 2017-2018 and both years in MO; marginal survival in KS 2016-2017; ^fMarginal survival in KS 2016-2017 only; ^gMarginal to good winter survival in KS 2016-2017 and MO both years; ^hMaturity date is only for KS; ⁱModerate to high disease rankings in KS 2016-2016.</p> <p>^{1/}Quick fall cover—Emergence at 14 days after planting: Excellent >90%, Good 61-90%, Fair 25-60%, Poor <25%; ^{2/}Fall stand quality—Yes is >65% emergence at 28 days after planting; ^{3/}Winter survival—Plant survival rating of Excellent >75%, Good 50-75%, Fair 25-50%, Poor <25%; ^{4/}Maturity date—Days after planting to 50% bloom: <235=Early, 235-250=Mid, >250=Late; and ^{5/}Disease and insect ranking—Damage observed was None, Low, Moderate, or High.</p>						

References

Clark, A., editor. 2012. Managing cover crops profitably, 3rd Edition. Sustainable Agriculture Research and Education. Handbook Series Book 9.

USDA, NRCS. 2019. The PLANTS Database (<http://plants.usda.gov>, 30 September 2019). National Plant Data Team, Greensboro, NC 27401-4901 USA.

For More Information

Analysis of the data used for compiling the tables in this regional report can be found at:

https://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/natpmtnccatsupp.pdf

Final study reports with more details on the performance of the cover crop varieties at each PMC location can be found at:

Manhattan, Kansas

https://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/kspmcsr13637.pdf

East Lansing, Michigan

Coming soon

Elsberry, Missouri

https://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/mopmcsr13641.pdf