CERES TRUST RESEARCH INITIATIVE

ORGANIC CROP CULTIVAR SELECTION FOR GREAT PLAINS STATES IN THE NORTH CENTRAL REGION

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Final Report

Executive Summary

Over 15 vetch and winter pea cover crop treatments, 15 spring pea cultivars, and 19 potato cultivars, were evaluated over a 3-yr period in certified organic fields at research facilities in east central (Carrington) and southwest (Dickinson) North Dakota. Late-summer seeding of in-state, on-farm sources of ‘common’ vetch seed resulted in cover crops that overwintered successfully and produced between 5420 and 8394 lb/acre of dry matter the following summer. Conversely, seedlings of winter pea and vetch cultivars developed outside the region failed to survive the winter. Grain yield of spring-seeded field pea ranged from 8 to 78 bu/acre, depending on cultivar, location, and year. The pea cultivar Spider produced grain yields that were equal or superior to those produced by other pea cultivars in 5 of 6 field experiments ($P < 0.05$), indicating good adaptation of this cultivar to both low- and high-yield, certified organic environments, with one exception. Likewise, the potato cultivar Red Pontiac produced tuber yields that were comparable or greater than those of other cultivars in all but one environment. Results of a pea-weed competition study suggested that cultivars Cooper and CDC Golden may be preferred to three other cultivars in weedy environments, although adverse weather confounded interpretation of the study’s results. Potato cultivar trials in non-replicated strips or rows on certified organic farms failed to identify a cultivar that demonstrated superiority in yield and in certain quality factors (e.g., visual attractiveness to consumer) in all instances. Similarly, the relative rank changed across organic farms where spring-seeded field pea cultivars (DS Admiral, Majorety, CDC Striker) were evaluated. Results of this project demonstrate that cultivar selection must be matched to local conditions on certified organic farms for optimum crop performance. Ranking of pea and potato cultivars for photosynthetically active radiation (PAR) intercepted by the crop canopy reflected the relative rank for yield in some environments. Future evaluations of crop cultivars for adaptation to organic environments should consider measurements of crop canopy interception of PAR as a possible screening tool.

Introduction

The availability of crop cultivars adapted to local conditions is considered essential for successful crop production. Only a limited number of crop cultivar adaptation trials have been conducted under certified organic management in North Dakota. Previous work focused on small-grain crops, notably spring wheat (Carr et al., 2006). More recent screening expanded to include field pea, potato, vegetables, and cover crops at both research facilities and on farms near Carrington and Dickinson (unpublished data). However, inadequate funding limited cultivar evaluations in certified organic environments, until support from The CERES Trust Research Initiative was provided for this project.

Past surveys of organic farmers indicated interest in cultivar comparisons of fall-seeded, annual legume cover crops, potato, and field pea. As a result, winter pea along with vetch cultivars were evaluated for above-ground dry matter (DM) production as cover crop treatments at research facilities at Carrington and Dickinson during 2010-11 and 2011-12 growing seasons. Spring-seeded field pea and potato cultivars were evaluated for seed and tuber yield, respectively, during the 2010, 2011, and 2012 growing seasons. Vegetative (e.g., early season plant vigor) and reproductive (e.g., duration of flowering) data were collected so that relationships between specific growth and yield data could be identified, where any existed.

Cultivar Studies – Research Facilities

Hairy Vetch/Winter Pea Cover Crop Study

Eight winter pea cultivars (Fenn, Frostmaster, Glacier, Granger, Melrose, Specter, Whistler, and Windham), one hairy vetch cultivar (Purple Bounty), two different sources of common hairy vetch seed (MN common and ND Common), and one Hungarian vetch cultivar (Panninic) were evaluated in randomized and replicated, small-plot field experiments at Dickinson and Carrington during the 2010-11 growing season. Those same eight winter pea cultivars were evaluated again during the 2011-12 growing season, along with six vetch treatments, including three in-state, on-farm sources of common hairy vetch seed. The treatments were established in late August to early September during both growing seasons (vetch seeding rate = 9 live seed/ft^2; winter pea seeded rate = 12 live seed/ft^2). Plants were counted before fall freeze and after spring warm up for determination of plant density winter survival percentage.

Extensive winterkill occurred for winter pea treatments in all experiments in certified organic environments (Table 1). There have been reports of winter survival of hardy winter pea cultivars in a few conventional no-till environments in North Dakota (K. McPhee, personal communication), and winter survival $\geq$ 50% occurred for Fenn + Melrose, Glacier, and Spector treatments in a conventional no-till environment included in the project during the 2011-12 growing season. However, poor stands resulted in the conventional no-till environment because of dry seedbed conditions at planting, with average densities prior to fall freeze up < 3 plants/ft^2 across treatments. Yield depression and increased weed competition occurs when pea densities drop below 7 plants/ft^2 in western North Dakota (unpublished data), and spring plant densities for winter pea treatments in the conventional no-till environment were < 2 plants/ft^2. Even fewer pea plants overwintered in certified organic environments, including an organic no-till environment at Carrington during the 2011-12 growing season (data not provided). Results of this project indicate that currently available, winter pea cultivars are not suited as fall-seeded cover crops on certified organic farms in North Dakota.

Sufficient above-ground dry matter (DM) can be produced by hairy vetch when a density of ≥ 2 plants/ft^2 exists in southwestern North Dakota environments (unpublished data). This minimum density was reached or exceeded by all in-state sources of common hairy vetch at both North Dakota locations in spring, 2012, as well as by the Pannonica treatment at Carrington (Table 2). Other vetch treatments failed to produce spring densities ≥ 2 plants/ft^2 at Dickinson in either growing season, whereas densities exceeded 6 plants/ft^2 for all four vetch treatments at Carrington in spring, 2011. Annual grass and broadleaf weed densities were comparable or greater than those of hairy vetch at Dickinson in 2012. However, weeds were unable to compete with hairy vetch plants visually, and weed DM was limited (visual estimate: <100 lb/acre) in vetch plots. In contrast, weeds dominated plots where lentil was spring seeded after the ALSH vetch treatment failed to overwinter (unpublished data).

The inclusion of vetch and winter pea treatments in the same field experiment at Carrington and at Dickinson prevented determination of DM production of vetch cover crop treatments during the 2010-11 growing season. Treatments were arranged differently during the 2011-12 growing season so that DM production of vetch treatments that overwintered successfully could be determined. At Carrington, hairy vetch DM production averaged 5760 lb/acre, while at Dickinson hairy vetch DM production averaged 8059 lb/acre (Table 2). By contrast, lentil DM production averaged 464 lb/acre. The hairy vetch DM yields reported in Table 2 exceed the 5000 lb/acre DM production threshold considered necessary to suppress annual weeds (Carr et al., 2012a).

A PR 2 capacitance probe was used to measure soil moisture content from mid-May through early July, 2012, at Dickinson, in plots established using the Mittleider seed lot of common hairy vetch and Indianhead lentil. Differences in soil water content at six depth increments (4, 8, 12, 16, 24, and 39 inches) were not detected between these two treatments on eight different dates (data not provided). Soil water content in hairy vetch plots indicated very dry conditions persisted at the 4-inch depth (Fig. 1). Soil water use by hairy vetch appeared limited to depths within 12 inches of the soil surface through early July, since little change in water content occurred across the sampling period at greater soil depths.

The percentage of photosynthetically active radiation (PAR) intercepted by the plant canopy was determined on three dates in hairy vetch and lentil plots using an AccuPar LP-80 ceptometer. Significantly greater amounts of PAR were intercepted in hairy vetch plots compared with lentil plots (Fig. 2). Almost 60% of the PAR striking the vetch plant canopy was intercepted and failed to reach the soil surface by 15 May, compared with only 10% in lentil plots. Over 80% of the PAR was intercepted by the hairy vetch canopy one week later, and over 95% on 6 June. The limited amount of PAR reaching the soil surface by early June, coupled with the dry soil conditions at shallow soil depths (Fig. 1) and amounts of DM produced by hairy vetch (Table 2), indicate that hairy vetch has potential as a weed-suppressive cover crop in the conservation-tillage, organic cropping systems discussed by Carr et al. (2012b).

Field Pea Cultivar Adaptation Study

Fifteen field pea cultivars (Agassiz, CDC Golden, CDC Meadow, CDC Striker, Cooper, Cruiser, DS Admiral, Eclipse, Majoret, Medora, Miami, NDP080102, NDP080106, PS07100091, and Spider) were seeded in early April through mid-May at Carrington and Dickinson, ND, in 2010, 2011, and 2012, depending on the location and year. The cultivar treatments were arranged in randomized and replicated, small-plot field experiments in each environment. Seeding was delayed at Dickinson so that volunteering rye (2010) and buckwheat (2011) could be controlled by pre-plant tillage in those two before seeding pea plots. Rye and buckwheat plant densities were reduced by pre-plant tillage, but new plants emerged after tillage was performed, particularly in 2011. In-crop tillage using a rotary hoe reduced populations of green foxtail (*Setaria viridis* (L.) Beauv.) that emerged after field pea was seeded, but surviving foxtail along with late-emerging, volunteering crop plants competed with field pea in 2010 and 2011. In 2012, field pea plots were hand weeded to minimize crop-weed competition. The hand weeding was successful and few weeds occurred (Fig. 3).

Competition for growth resources by weeds was considered minimal at Carrington during all three years, except in 2011 when high winds coupled with heavy rain flattened pea plants, enabling weeds to emerge through the damaged pea canopy. Hail also damaged pea plants that year. Pea grain yield averaged 32 bu/acre across cultivars even with the environmental challenges that occurred (Table 3). By comparison, grain yield averaged 70 bu/acre across field pea cultivars in 2010, and 58 bu/acre in 2012. Grain yield produced by the cultivar Spider was comparable or superior to that produced by other cultivars in any year at Carrington, except in 2012 when more grain was produced by Miami (75 bu/acre) statistically ($P < 0.05$).

Spider produced grain yields that were comparable or greater statistically than those produced by other cultivars at Dickinson in all three years, with Spider grain yield averaging 28 bu/acre in 2010, 14 bu/acre in 2011, and 18 bu/acre in 2012 (Table 3). The relatively low pea yields in 2011 reflect partially the competition for growth resources resulting from volunteering buckwheat and green foxtail plants not killed by tillage. The low relative yields in 2012 reflect the dry conditions that persisted, with annual precipitation totaling less than 11 inches compared to a long-term average of over 16 inches. Precipitation was less than 4 inches, with only three precipitation events ≥ 0.5 inches, during the 1 June through 15 July period (Fig. 4) during late vegetative, flowering, and seed development stages of pea plants. Total precipitation was even less than that amount during that 6-week period in 2011, but greater than average amounts of winter precipitation provided enough stored soil water to support several weeks of crop growth. Greatest amounts of water were received during 2010, when average grain yield across pea treatments exceeded 20 bu/acre.

Dry conditions were encountered at Carrington during the 01 June through 15 July period in 2012 (Fig. 5), though not to the extent as at Dickinson (Fig. 4). Also, soil texture is finer and fields are more gently sloping at Carrington than at Dickinson, so greater amounts of plant-available water can be stored when rain does occur. Average maximum daily temperatures tended to be lower at Carrington (Fig. 6) than Dickinson (Fig. 7) between 01 June and 15 July which, when considered along with precipitation patterns (Figs. 4 and 5) indicate superior growing conditions for field pea at Carrington. This explains partially the differences in performance of pea cultivars at Carrington relative to Dickinson.

Spider was among the highest-yielding cultivars in five of six environments (Table 3), as indicated previously. However, there was no obvious link between grain yield performance and most vegetative or reproductive growth factors for this cultivar. For example, Spider failed to be among the first or last cultivars to flower in each of the six environments included in this project (Table 4). Spider was among the earliest to flower at Carrington and Dickinson in 2010 and 2011, while it was later than one or more of the cultivars at both locations in 2012. Similarly, rank of Spider for flowering period length varied across locations and years (Table 5). Consideration of many other growth characteristics (e.g., seedling vigor) failed to identify an obvious relationship between growth trait and grain yield rank for Spider or other cultivars included in the field experiments (data not provided).

Soil water content was determined in selected pea cultivar plots in both 2011 and 2012 at Dickinson. Differences were not detected between pea cultivar treatments for soil water content at 4, 8, 12, 16, 24, and 39 inch depths on any sampling date (data not provided), so results from plots of only one pea cultivar in 2012 are presented. Soil water content in Cooper cultivar plots indicate that dry soil conditions persisted at a 4-inch soil depth from 15 May through 10 July (Fig. 8). More soil water occurred at 8, 12, and 16 inch depths than the shallower depth, with a gradual decline at the former three depths beginning on 6 June and continuing through 3 July. There was an increase in water content at both 4 and 8 inch depths on 10 July, reflecting the 1.08 inches of rain received during 5 and 6 July (Fig. 4). However, this rain event occurred after flowering had ended for most pea cultivars (data not provided), limiting its impact on reproductive growth. There was little change in soil water content at 24 and 39 inch soil depths throughout the sampling period, indicating limited if any extraction by pea plants at these depths.

The amount of PAR intercepted by the pea canopy for selected cultivars was determined in 2011 and 2012. Weeds in pea plots confounded PAR measurements in 2011 and data are not provided. Hand weeding resulted in little if any weed growth in selected pea plots in 2012 (Fig. 3), so PAR measurements reflected amounts of PAR intercepted by the pea canopy. Significant differences in amounts of PAR intercepted by plant canopies of Cooper and Medora, as well as in plots seeded originally to Miami but, because of poor seedling emergence, later cultivated (Fallow), were not detected on either 23 May or 6 June (Fig. 9). However, by 5 July there was a significant step-wise reduction in the amount of PAR intercepted by plant canopies in Cooper (75%), Medora (64%), and Fallow (4%) plots. The ranking of these three cultivars for PAR interception reflects the ranking for grain yield, with Cooper producing more grain (17 bu/acre) than Medora (12 bu/acre) and, of course, the fallow check (Table 3).

Western North Dakota has the reputation for producing high-quality grain when field crops are grown. Seed weight of pea cultivars included in field experiments at Dickinson averaged 2038 seeds/lb in 2010, 2509 seeds/lb in 2011, and 2273 seeds/lb in 2012 (Table 6). Seed weight of pea cultivars at Carrington averaged 1997 seeds/lb in 2010, 2884 seeds/lb in 2011, and 2041 seeds/lb in 2012. Results of the field experiments indicate that no single cultivar produced the heaviest seed consistently in all environments. For example, Cruiser produced seed that was comparable or heavier statistically than that produced by other cultivars in each year at Dickinson, but in only one of three years at Carrington. Likewise, no single cultivar produced grain with equal or higher protein content in all environments (data not provided).

Potato Cultivar Adaptation Study

Nineteen potato cultivars (Burbank, Butte, Caribe, Dark Red Norland, Defender, Jacqueline Lee, Kennebec, La Ratte, Missaukee, Norkotah, All Blue, Prairie Blush, Red Cloud, Red Norland, Red Pontiac, Russian Banana, Sangre, Yukon Gem, and Yukon Gold) were seeded in wide rows (28 to 32 inches, depending on the location and year) from 9-18 May at Carrington and Dickinson, ND, depending on the location and year. The potato treatments were arranged in randomized and replicated, small-plot field experiments. Limited if any supplemental water was applied to field experiments in 2010 and 2011. Failure to supply any supplemental water resulted in fewer than expected plants at Dickinson during 2011, except in plots of Russian Banana (Table 7). As a result, the field experiment was irrigated twice within 14 days of seeding plots at Dickinson on 9 May in 2012, and this along with rain on 18-19 May resulted in plant numbers matching the targeted density in plots of all cultivars, except Red Cloud and Yukon Gem. No additional supplemental water was applied to the field experiment at Dickinson in 2012. There were no challenges in meeting target plant densities at Carrington in any year.

Tuber yield averaged 136 cwt/acre across cultivar treatments at Carrington in 2010, 195 cwt/acre in 2011, and 183 cwt/acre in 2012 (Table 8). Brown spot infected potatoes in 2010 resulting in premature death of many plants and lowering yield. An unidentified disease affected plants in 2011, although infection was not as severe as was the brown spot infection the previous year. Potatoes were relatively disease free in 2012 although some plants were damaged by Colorado potato beetle.

Potato yield averaged 155 cwt/acre across cultivar treatments at Dickinson in 2010, 116 cwt/acre in 2011, and only 43 cwt/acre in 2012 (Table 8). The relatively low yield in 2012 reflects the dry conditions that persisted throughout the growing season that year. Rainfall totaled only 6.5 inches between 15 May and early September, only 70% of the long-term average. The lack of rainfall is reflected in the low amounts of stored soil water at shallow depths in plots where Kennebec was grown (Fig. 10). Potato roots are most concentrated in the top 12 inches of soil, and volumetric water content were around 15% or even less from mid-May through July at both 4 and 8 inch depths. Little if any water is plant-available at volumetric water contents that are this low. In contrast, volumetric water content was roughly 25% through much of the 15 May through July period at a 12 inch soil depth, suggesting that water could be extracted by potato roots at that depth if they extended that deep. There is an indication that some potato roots were able to extend to a 12-inch depth by mid-June when volumetric water content began to decline. However, dry conditions would develop at this depth as water was extracted, creating water-stress conditions for potato plants and depressing tuber yield.

Relative rank of potato cultivars for tuber yield changed across years at Carrington. Kennebec produced a relatively high tuber yield at Carrington in both 2010 and 2011, but fewer tubers than Burbank, Butte, Caribe, Prairie Blush, and Red Pontiac in 2012 (Table 8). In contrast, Red Pontiac produced tuber yields that were comparable or superior to yields produced by other cultivars in all three years at Dickinson, and in 2010 and 2012 at Carrington. Jacqueline Lee, Kennebec, Missaukee, and Red Cloud produced more tubers than Red Pontiac at Carrington in 2011. The change in rank across the six environments for tuber yield demonstrates the importance of determining cultivar adaptation in certified organic fields under local conditions. Soil water content at 4, 8, 12, 16, 24, and 39 inch depths was compared across selected potato cultivars in both 2011 and 2012 at Dickinson. Differences in soil water content at any depth was not detected between cultivars in 2011 (data not provided). Soil water content did not differ between cultivars at any depth in 2012, with one exception. A greater percentage of soil water occurred at an 8 inch depth in Russian Banana plots than Kennebec plots on 3 July (19% vs. 13%). Differences in water content at this depth were not detected on other sampling dates between these two cultivar treatments (data not provided), suggesting little practical significance in this one-time difference.

The PAR intercepted by developing crop canopies in selected potato cultivar plots was determined in both 2011 and 2012. Greater amounts of PAR were intercepted by the crop canopy in Russian Banana than Kennebec plots on all dates in 2011 (Fig. 11). The PAR intercepted by the potato canopy in Burbank plots was somewhere between plots with the two other treatments. This rank in PAR interception for these three treatments reflects the rank for tuber yield (Table 8); Russian Banana yielded significantly more tubers than Kennebec, with tuber yield by Burbank between that produced by the two other cultivars. A similar relationship in rank between the three cultivars for crop canopy interception (Fig. 12) and tuber yield (Table 8) was not evident in 2012, probably because PAR measurements were made on earlier dates. These data suggest that amounts of PAR intercepted by crop canopies can reflect relative rank of potato cultivars for tuber yield, as long as data are collected at appropriate calendar dates corresponding to particular growth stages. Other vegetative growth data (e.g., plant vigor) failed to indicate a consistent relationship to cultivar rank for yield (data not provided).

Pea-Weed Competition Study

Field experiments were conducted during summer 2011 and 2012 at the Dickinson Research Extension Center (DREC), and at the Carrington Research Extension Center (CREC) in 2012. The objective of this study was to determine the competitive ability of different field pea cultivars against the endemic weed population present in an organically managed cropping system. Five cultivars (Cooper, PS07100091, NDP080106, CDC Golden and NDP080102) were strategically chosen to evaluate field pea competitive ability. CDC Golden was included in the 2012 field experiments only. All cultivars have upright growth habit, lodging resistance and good adaptive abilities, which are important traits for competition against weeds. Cooper is a semi-leafless cultivar with excellent standing ability through interplant support and heavy seed weight (37 g 100 seeds^{-1}). PS07100091 and NDP080106 are sister lines with normal leaves and intermediate seed weight (27 g 100 seeds^{-1}). NDP080102 is normal leaf type cultivar with the light test weight (20 g 100 seeds^{-1}).

Field pea cultivars were planted on 11 May in 2011 and 16 April in 2012 at Dickinson, and on 1 May at Carrington. During 2012 at both locations, the planting rate included 15% overseeding to compensate for low emergence and seedling mortality experienced at Dickinson during 2011. Cultivars were grown in plots arranged in a randomized and replicated experimental design. Crop-free plot (weedy check) were included to assess maximum potential weed emergence and growth. After emergence, three permanent 2.7 ft^2 quadrats were established in each plot for destructive data collection. Leaf area index (LAI), and/or light interception, can be key determinant(s) of plant competitive success. Therefore, canopy light interception/LAI measurements were conducted using an AccuPAR LP-80. LAI/light interception measurements were made at critical pea growth stages (2-3 nodes, 6-8 nodes, and onset of flowering) to quantify pea and weed canopy development. Total canopy LAI was measured, then pea plants were removed from the quadrats and LAI was measured again, allowing for separation of weed vs. pea LAI. After measuring weed-only LAI, weed biomass was destructively harvested. Weed and pea biomass were dried to a constant weight and reported on a DM basis. On the third and final destructive harvest date, number of pea pods and final pea yield were determined from destructive quadrat-level measurements. Weed suppressive ability was calculated to estimate the sensitivity of weed suppressive ability to changing weed pressure at three critical pea growth stages for normal-leaved and semi-leafless cultivars. Whole plot pea yield also was determined via mechanical harvest and yields were adjusted to a per-plant basis using plot level pea stand counts.

Due to unfavorable weather conditions during summer 2011 and 2012, there were differences among pea cultivars in seed germination rate and seedling vigor. Many studies have established that seed size is directly proportional to seedling vigor. Thus, cultivars having larger seed size such as Cooper and Golden had good plant establishment while the other three cultivars did not. Also, the establishment of semi-leafless cultivars (Cooper and CDC Golden) was better than normal leaf cultivars (PS07100091, NDP080102, and NDP080106). Thus, the pea plant density varied substantially among pea cultivars, with Cooper achieving maximum density followed by CDC Golden, NDP080102, NDP080106, and PS0710091.

At the first destructive harvest (2-3 nodes), weed LAI and DM did not differ among pea cultivars or the weedy check at any location, whereas pea LAI and DM differed among pea cultivars. Cooper had the maximum pea LAI and PS0710091 had the least LAI on a quadrat basis, whereas CDC Golden had greater per plant LAI than Cooper. Weed suppressive ability differed among the pea cultivars; Cooper was the most suppressive cultivar against weeds at three node stage. This may be due to greater plant density as compared to other cultivars. Again PS07100091 had least weed suppressive ability.

At the second destructive harvest (6-8 nodes), weed LAI and DM differed among pea cultivars and the weedy check. Weed DM for Cooper and CDC Golden was less than weed DM for the weedy check. NDP080106 had greatest weed DM among the pea cultivars. Pea LAI and pea DM differed among cultivars; CDC Golden had the greatest per plant LAI and PS0710091 had the least LAI.

At the third and final destructive harvest, weed LAI and DM differed among pea cultivars and the weedy check. Weed DM for Cooper and NDP080102 was less than the weedy check. Weed DM and weed LAI for PS07100091 was greatest among the cultivars. Weed suppressive ability did not differ among the cultivars, as all cultivars were equally sensitive towards the increased weed pressure. Per-plant pea LAI and per-plant pea DM did not differ among pea cultivars. There were no differences in per-plant yield (on a quadrat basis) among the cultivars. Cooper and CDC Golden had fewer pods per plant compared to PS07100091 and NDP080106. However, plot level yield differed among cultivars. Cooper had the largest yield of aa60 lb/acre followed by CDC Golden of 1034 lb/acre. PS0710091 had least plot level yield of 268 lb/acre. Two other cultivars NDP080102 and NDP080106 had intermediate plot level yield of 660 and 722 lb/acre, respectively.

Pea cultivars with greater competitive ability should be associated with reduced weed LAI or weed biomass when compared to the weedy check and should have vigorous seedlings and excellent seedling vigor. As seedling mortality occurs in almost all cultivars, a cultivar that has low seedling mortality rate and good emergence will be preferred over other cultivars. In this study, Cooper and CDC Golden had good emergence because of inherent seedling vigor. Thus, these two cultivars could be considered competitive cultivars. Among the other three cultivars, PS07100091 had the lowest emergence rate irrespective of over-seeding. That is probably why PS0710091 had poor initial plant establishment. At the second and third harvests, weed DM in Cooper and CDC Golden (both semi-leafless cultivars) plots was lower than that in the weedy check. PS07100091, a normal leaved cultivar, had greatest weed DM and weed LAI at the third destructive harvest, while the number of pods/plant was greater than that of the other cultivars. However, the greater pod count per plant in PS07100091 did not change the overall yield per plant. A cultivar that could be recommended for the organic producer should germinate and emerge reliably over a wide range of conditions; this will ensure a plant canopy that is competitive against weeds. In this study, Cooper and CDC Golden had reliable germination, uniform emergence, and formed the most competitive pea canopies. In terms of per-plant competitive ability, however, it is very difficult to arrive at any conclusions because of uneven density among the cultivars.

On Farm Trials

On-farm trials of hairy vetch were unsuccessful because of excessive winterkill. However, three on-farm trials involving potato and two involving field pea cultivars were conducted on commercial organic farms. The potato trials included Kennebec, Red Norland, and Yukon Gold cultivars in 2011, and Butte, Defender, and Kennebec in 2012. The field pea trials included Admiral, CDC Striker, and Majoret.

Peas and tubers were not planted in replicated and randomized plots in a scientifically valid experimental design, but rather in observational strips by the farmer-cooperators. Observational data were collected by the farmer-cooperators. Farmer-cooperators were asked to rank the cultivars on their farms based on the qualitative assessments. Their rankings reflected personal preferences; for example, one farmer conducted taste tests on tubers whereas the other farmer limited ranking to agronomic factors.

Results of the on-farm trials failed to identify a superior potato and field pea cultivar across all farms where field comparisons were made. Rather, ranking changed across farms based on field performance as well as criteria used by the farmer-cooperators participating in the project. Score sheets provided by the farmer-cooperators (with names redacted) are provided after the Figures section of this final report.

Publications

None at this time

References

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Expenditures

Expenditures totaled $146,203.67, which is less than the original budget because of less-than-expected expenditures for certain budgeted items. The Grants and Contracts office at North Dakota State University will be returning unspent funds to The Ceres Trust once the necessary paperwork at the university is completed. Questions regarding expenditures or the return of unpaid funds can be directed to Dr. Patrick Carr (Patrick.Carr@ndsu.edu), who will then forward them to the appropriate individual at the university for a timely response. A Statement of Expenditures is provided after the Farmer-Cooperator survey sheets at the end of this report.

Tables and Figures (next page)

Table 1. Winter pea study in two certified fields at Carrington and Dickinson, ND, during one growing season and in two seedbeds at Dickinson during a second growing season.

					Dickinson, 2011-2012					
	2010-2011				Conventional No-till			Certified organic		
Seed	Carrington[1]		Dickinson		Plant stand[2]		Winter	Plant stand[2]		Winter
Source	Fall	Spring	Fall	Spring	Fall	Spring	Survival	Fall	Spring	Survival
	---------- no. ft^2 ----------						- % -	------- ft^2 -------		- % -
Fenn	--	0.8	5.3	0.0	--	--	--	--	--	--
Fenn + Melrose	--	--	--	--	2.4	1.6	67	--	--	--
Frostmaster	--	0.1	6.0	0.0	--	--	--	3.0	0.0	0
Glacier	--	0.0	7.1	0.0	2.0	1.0	50	3.2	0.0	0
Granger	--	0.6	8.2	0.0	1.9	0.7	--	3.3	0.0	--
Melrose	--	0.2	7.5	0.0	--	--	--	--	--	--
Specter	--	0.0	6.9	0.0	2.3	0.3	62	3.0	0.0	0
Whistler	--	0.0	7.4	0.0	2.1	0.1	5	3.7	0.0	0
Windham	--	0.3	8.1	0.0	2.3	0.8	35	3.8	0.0	0
Mean	--	0.25	7.1	--	2.2	0.8	43.6	3.3	0.0	0
C.V.%	--	44.9	16.8	--	37.6	62	--	18.3	--	--
LSD.05	--	4.2	1.6	--	NS	NS	--	NS	--	--

[1]Fall density was > 6 plants/ft^2 for all winter pea cultivars prior to fall freeze-up.

[2]Dry seedbed conditions explain the low plant stands established in the fall.

Table 2. Vetch cover crop study at two locations in North Dakota during the 2011-12 growing season.

	Carrington					Dickinson									
	2010-11		2011-12			2010-11			2011-12						
Seed	Plant stand		Plant stand		Winter	Plant stand		Winter	Plant stand		Winter	Weed density		Dry matter	
Source	Fall[1]	Spring	Fall	Spring	Survival	Fall	Spring	Survival	Fall[2]	Spring	Survival	Grass	Broadleaf	Carrington	Dickinson
	---------- no. ft^2 ----------				- % -	------- ft^2 -------		- % -	------- ft^2 -------		- % -	----- plants ft^{-2} ----		------- lb $acre^{-1}$ -------	
ALSH	--	--	6.3	0.3	4	--	--	--	1.6	0.1	6	--	--	--	--
CREC	--	--	10.3	7.4	72	--	--	--	2.3	4.7	205	3.8	2.1	6180	7529
Lentil[3]	--	--	--	--	--	--	--	--	--	--	--	37	16.1	--	464
Mittleider	--	--	9.1	5.7	62	--	--	--	2.5	3.3	132	3.2	1.9	5680	8394
MN common	--	33	--	--	--	5.4	1.8	33	--	--	--	--	--	--	--
ND Common	--	39	--	--	--	6.1	3.0	49	--	--	--	--	--	--	--
Pannonica[4]	--	6.1	8.7	2.8	32	5.6	0.0	0.0	2.0	1.4	70	--	--	--	--
Podoll	--	--	8.4	5.1	61	--	--	--	2.0	4.0	200	7.8	4.5	5420	8255
Prosperity	--	--	6.0	0.7	12	--	--	--	1.6	0.2	13	--	--	--	--
Purple Bounty	--	6.3	6.0	0.7	12	4.8	0.0	0.0	1.6	0.2	13	--	--	--	--
Mean	--		7.8	3.2	36.3	5.5	1.2	--	1.9	2.0	91.2	13.0	6.2	5760	6161
C.V.%	--	44.9	14.4	12.2	--	16.8	54	--	23.1	42.5	--	12.9	41.7	8.6	18.9
LSD.05	--	4.2	2.1	0.8	--	1.6	NS	--	NS	1.4	--	14.5	4.1	NS	1850

[1]Plant density was reported to be > 4 plants/ft^2 but data were not provided.

[2]Dry seedbed conditions in the fall resulted in low plant densities; seedbeds remained dry in the spring but additional plants emerged because of limited moisture received over the winter and in early spring.

[3]Alsh failed to overwinter and so Indianhead black lentil was spring-seeded into Alsh plots at Dickinson following spring warm up.

[4]Hungarian vetch; the remaining treatments are hairy vetch cultivars or seed lots of common hairy vetch.

Table 3. Grain yield of spring pea cultivars at two locations in North Dakota during three growing seasons.								
	Grain yield							
	Carrington				Dickinson			
Cultivar	2010	2011	2012	3-yr Average	2010	2011	2012	3-yr Average
	---------- bu/acre ----------							
Agassiz	70	--[1]	61	--	24	14	18	19
CDC Golden	78	32	63	58	25	12	17	18
CDC Meadow	71	--[1]	69	--	26	8	17	17
CDC Striker	66	39	67	57	20	10	19	16
Cooper	75	30	63	56	22	--[1]	17	--
Cruiser	68	30	52	50	25	10	18	18
DS Admiral	63	41	54	53	21	13	17	17
Eclipse	76	30	69	58	18	14	14	15
Majoret	71	39	57	56	21	11	16	16
Medora	57	--[1]	30	--	9	--[1]	12	--
Miami	--[1]	--[1]	75	--	--[1]	--[1]	--[1]	--
NDP080102	--[2]	28	62	--	--[2]	--[1]	18	--
NDP080106	--[2]	26	41	--	--[2]	--[1]	13	--
PS07100091	--[2]	18	37	--	--[2]	--[1]	13	--
Spider	76	44	65	61	28	14	18	20
Mean	70	32	58	53	22	12	16	17
C.V.%	7	13.8	10.1	--	10.6	22.6	9.3	--
LSD.05	7	6.6	8.3	--	3.2	3.8	2.1	--

[1]Seed was planted but very poor emergence (< 1 plant/ft^2) resulted so data were not collected.

[2]Seed was unavailable.

Table 4. Days to bloom for field pea cultivars at two locations in North Dakota during three growing seasons.

	Grain yield							
	Carrington				Dickinson			
Cultivar	2010	2011	2012	3-yr Average	2010	2011	2012	3-yr Average
	--- days/bloom ---							
Agassiz	61	57	63	--	46	48	64	53
CDC Golden	60	57	63	60	47	49	64	53
CDC Meadow	59	--	62	--	45	49	64	53
CDC Striker	63	59	62	61	48	49	65	54
Cooper	65	61	70	65	49	54	70	--
Cruiser	59	57	62	59	46	47	63	52
DS Admiral	59	57	62	59	46	49	64	53
Eclipse	61	58	63	60	48	50	65	54
Majoret	59	58	63	60	46	49	64	53
Medora	63	--	66	--	47	50	67	--
Miami	60	--	63	--	48	50	--	--
NDP080102	--	59	64	--	--	--	65	--
NDP080106	--	58	64	--	--	50	66	--
PS07100091	--	58	64	--	--	50	66	--
Spider	60	58	63	60	46	47	65	53
Mean	61	58	63	61	47	49	65	53
C.V.%	15.8	5.1	0.8	--	2.3	0.26	1.4	--
LSD.05	2.4	1.1	0.7	--	1.5	0.2	1.3	--

Table 5. Flowering period length of pea cultivars at two locations in North Dakota during three growing seasons.

	Grain yield							
	Carrington				Dickinson			
Cultivar	2010	2011	2012	3-yr Average	2010	2011	2012	3-yr Average
	days							
Agassiz	18	20	18	--	18	--[1]	21	20
CDC Golden	17	18	15	17	16	--	18	17
CDC Meadow	20	--	16	--	18	--	20	19
CDC Striker	12	11	19	14	15	--	16	16
Cooper	11	14	12	12	14	--	13	--
Cruiser	16	16	17	17	17	--	17	17
DS Admiral	16	14	19	16	17	--	18	17
Eclipse	16	19	16	17	16	--	18	17
Majoret	15	12	14	13	18	--	17	17
Medora	16	--	16	--	16	--	17	--
Miami	--	--	18	--	15	--		--
NDP080102	--	17	16	--	--	--	17	--
NDP080106	--	13	18	--	--	--	17	--
PS07100091	--	12	18	--	--	--	16	--
Spider	20	18	16	18	17	--	18	18
Mean	16	15	16	16	16	--	17	17
C.V.%	1.4	1.4	6.5	--	6.6	--	8.2	--
LSD.05	1.3	1.8	1.5	--	1.5	--	2.0	--

[1]End of flowering was not collected so length of the flowering period could not be determined.

Table 6. Seed weight of field pea cultivars at two locations in North Dakota during three growing seasons.

	Seed weight							
	Carrington				Dickinson			
Cultivar	2010	2011	2012	Average	2010	2011	2012	Average
	------------------------------ seeds/lb ------------------------------							
Agassiz	1913	--	2438	--	1893	2412	2189	2165
CDC Golden	1996	3194	2306	2499	2174	2493	2350	2339
CDC Meadow	2159	--	1995	--	2076	2860	2555	2497
CDC Striker	1867	2715	1916	2166	1958	2339	2151	2149
Cooper	1674	2424	1735	1944	1781	--	1866	--
Cruiser	2274	3285	2021	2527	2254	3139	2428	2607
DS Admiral	1914	2676	1890	2160	1950	2471	2046	2156
Eclipse	1920	2548	1992	2154	1904	2173	2137	2071
Majoret	1823	2751	2419	2331	1956	2349	2274	2193
Medora	2540	--	2211	--	2412	--	2362	--
Miami	--	--	1801	--	2141	--	--	--
NDP080102	--	3283	1832	--	--	--	2562	--
NDP080106	--	3195	2054	--	--	--	2522	--
PS07100091	--	3134	2188	--	--	--	2294	--
Spider	1890	2521	1817	2076	1951	2346	2084	2127
Mean	1997	2884	2041	2307	2038	2509	2273	2256
C.V.%	4.5	4.8	8.2	--	5.4	5.4	5.2	--
LSD.05	131	200	237	--	159	197	135	--

Table 7. Potato plant density in certified organic fields during 2011 and 2012 at Dickinson, North Dakota.							
		Tuber density					
		2011			2012		
Cultivar	Type	13-Jun	17-Jun	11-Jul	11-Jun	18-Jun	22-Jun
		plant/ft^2					
All Blue	specialty	--[1,2]	--	--	0.4	0.4	0.4
Burbank	russet	0.0	0.1	0.3	0.4	0.4	0.4
Butte	russet	0.1	0.2	0.3	0.4	0.4	0.4
Caribe	specialty	0.0	0.2	0.3	0.4	0.4	0.4
Dark Red Norland	red	0.1	0.2	0.2	0.4	0.4	0.4
Defender	white	0.0	0.1	0.3	0.4	0.4	0.4
Jacqueline Lee	yellow	0.0	0.1	0.1	--	--	
Kennebec	white	0.0	0.1	0.2	0.4	0.4	0.4
Missaukee	white	0.0	0.1	0.2	--	--	
Norkotah	russet	--	--	--	0.4	0.4	0.4
Prairie Blush	yellow	0.0	0.2	0.2	0.4	0.4	0.4
Red Cloud	red	--	--	--	0.3	0.3	0.3
Red Norland	red	0.1	0.2	0.3	--	--	--
Red Pontiac	red	0.0	0.1	0.3	0.4	0.4	0.4
Russian Banana	fingerling	0.0	0.1	0.4	0.4	0.4	0.4
Sangre	red	0.0	0.1	0.3	--	--	
Yukon Gem	yellow	0.0	0.1	0.2	0.3	0.3	0.3
Yukon Gold	yellow	0.0	0.1	0.3	0.4	0.4	0.4
Mean		0.0	0.1	0.3	0.4	0.4	0.4
C.V.%		88.8	39.9	25.0	8.2	6.2	6.0
LSD.05		< 0.1	0.1	0.1	< 0.1	< 0.1	< 0.1

[1]Seed was unavailable in this year.

[2]The target density was 0.4 potatoes/ft^2.

Table 8. Tuber yield of potato cultivars at two locations in North Dakota during three growing seasons.

		Tuber yield							
		Carrington				Dickinson			
Cultivar	Type	2010	2011	2012	Average	2010	2011	2012	Average
		---------- cwt acre^{-1} ----------							
Burbank	russet	122	183	216	174	159	124	43	109
Butte	russet	135	173	217	175	150	146	32	109
Caribe	specialty	155	190	248	198	119	112	47	93
Dark Red Norland	red	--	179	198	--	--	81	49	--
Defander	white	--	189	189	--	--	116	47	--
Jacqueline Lee	yellow	--	260	--	--	--	89	--	--
Kennebec	white	175	250	170	198	147	85	49	94
La Ratte	fingerling	65	--	--	--	147	--	--	--
Missaukee	white	--	259	--	--	--	125	--	--
Norkotah	russet	--	--	145	--	--	--	40	--
All Blue	specialty	--	--	131	--	--	--	22	--
Prairie Blush	yellow	--	179	206	--	--	100	58	--
Red Cloud	red	--	274	169	--	--	--	52	--
Red Norland	red	166	175	--	170	164	111	--	137
Red Pontiac	red	161	179	222	187	174	123	46	114
Russian Banana	fingerling	64	104	62	77	150	167	18	112
Sangre	red	156	197	--	177	197	167	--	182
Yukon Gem	yellow	155	126	188	156	148	95	36	93
Yukon Gold	yellow	--	204	196	--	--	105	61	--
Mean		136	195	183	171	155	116	43	116
C.V.%		13.7	15.1	17.0	--	28.8	34.1	25.3	--
LSD.05		27	42	45	--	NS	48	16	--

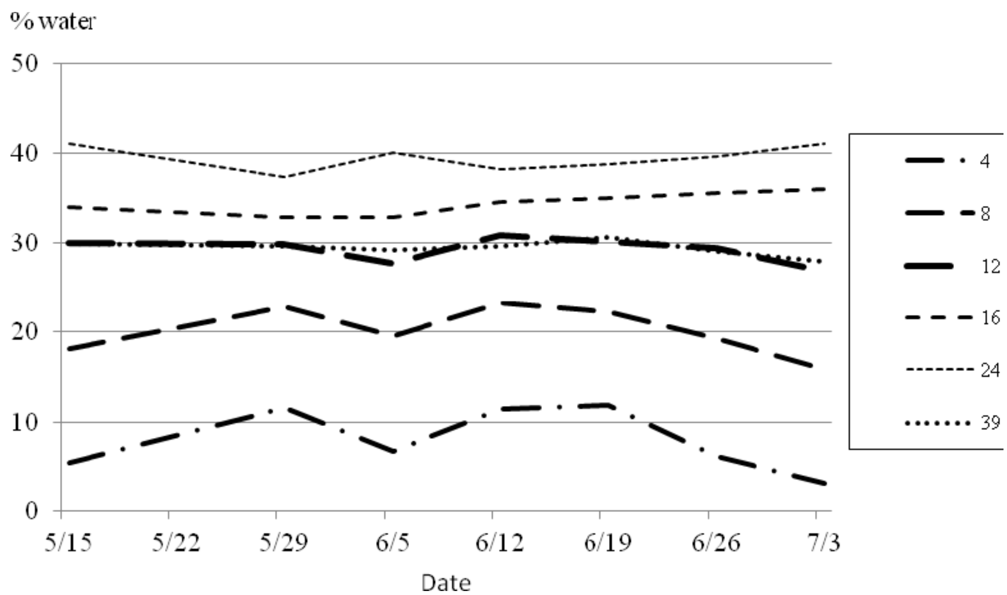

Figure 1. Soil water content at six soil-depth increments in common hairy vetch plots during 2012 at the Dickinson Research Extension Center.

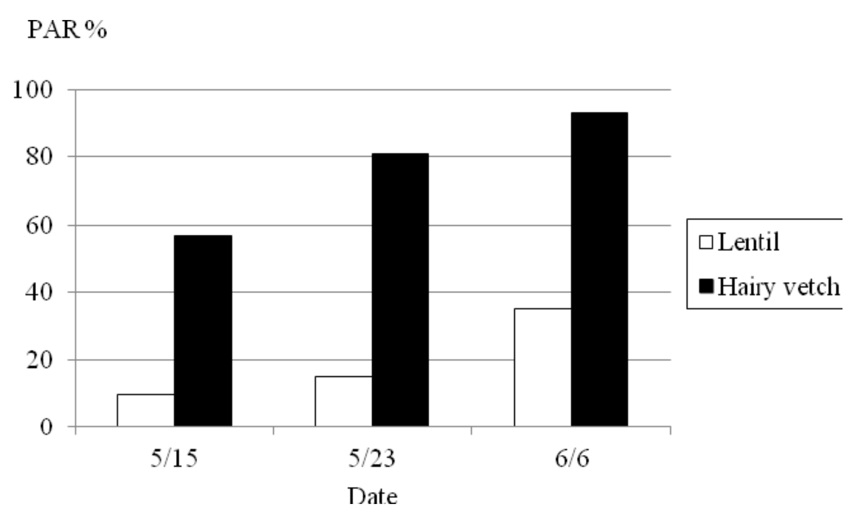

Figure 2. Photosynthetically active radiation (PAR) intercepted by plant canopies of Indianhead black lentil and hairy vetch cover crops during 2012 at the Dickinson Research Extension Center.

Figure 3. Hand weeded pea plots at the Dickinson Research Extension Center in 2012; R-bar poles mark locations of access tubes for measuring soil water content.

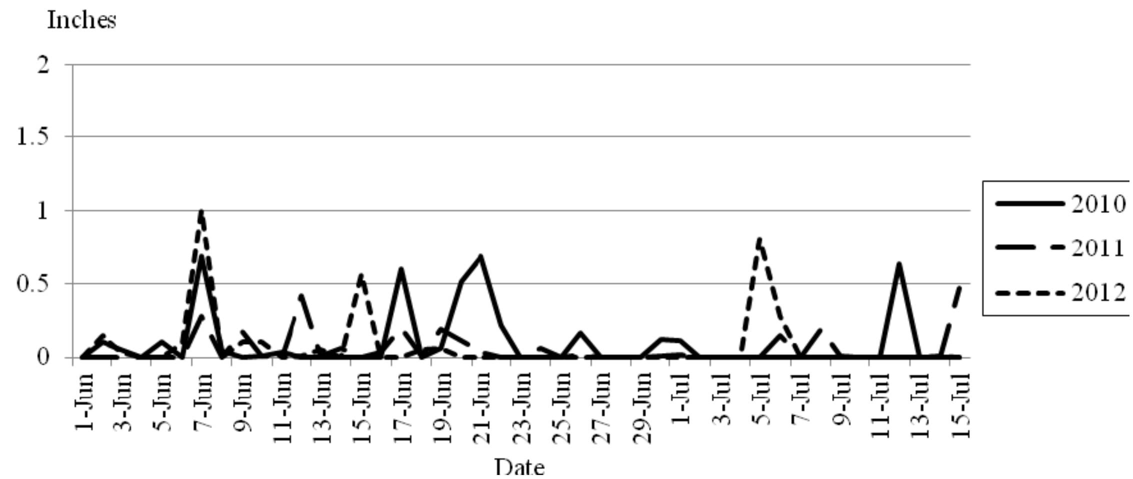

Figure 4. Precipitation received at the Dickinson Research Extension Center over a six-week period.

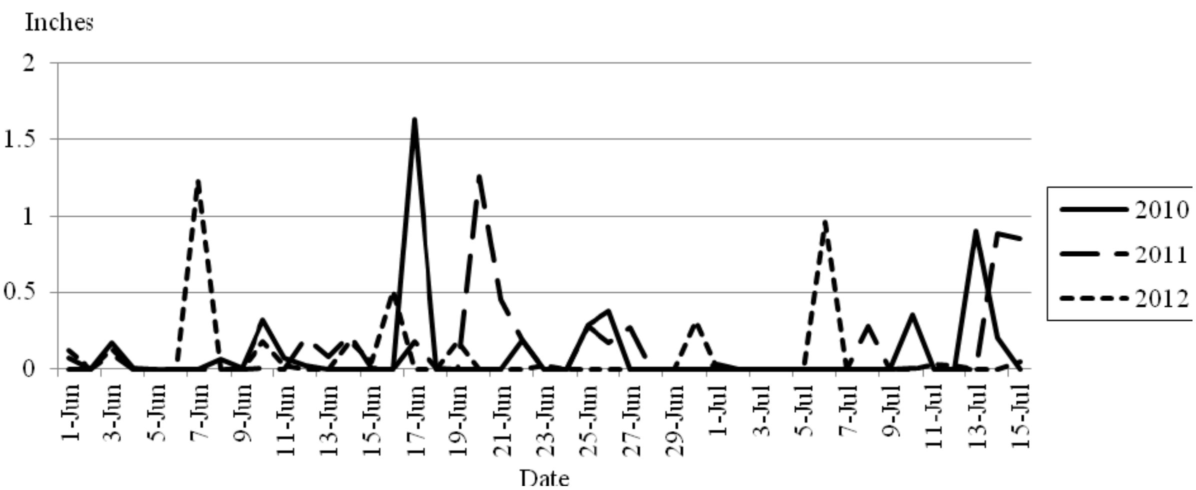

Figure 5. Precipitation received at the Carrington Research Extension Center over a six-week period.

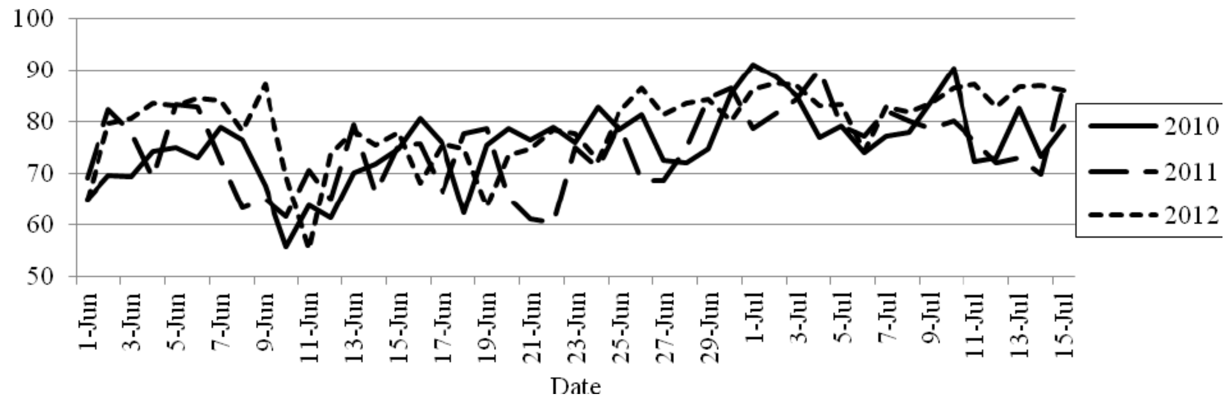

Figure 6. Average maximum temperature (^{o}F) received at the Carrington Research Extension Center over a six-week period.

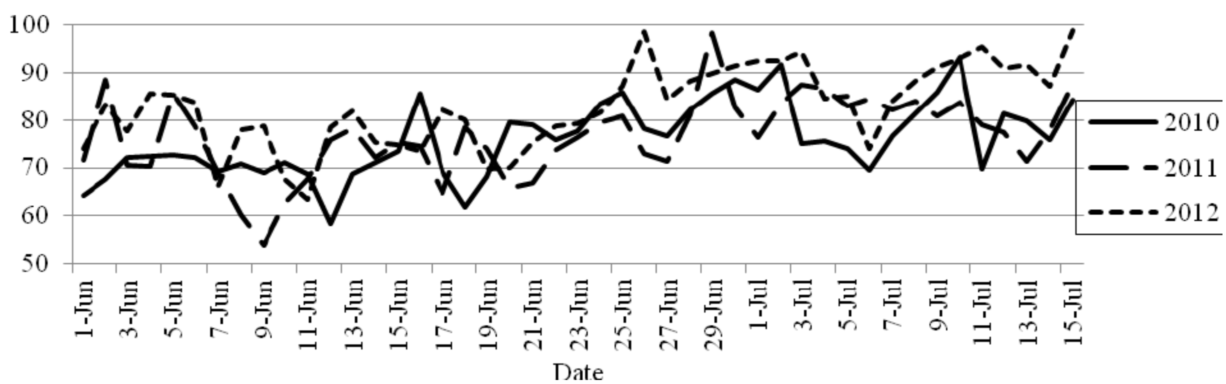

Figure 7. Average maximum temperature (^{o}F) received at the Dickinson Research Extension Center over a six-week period.

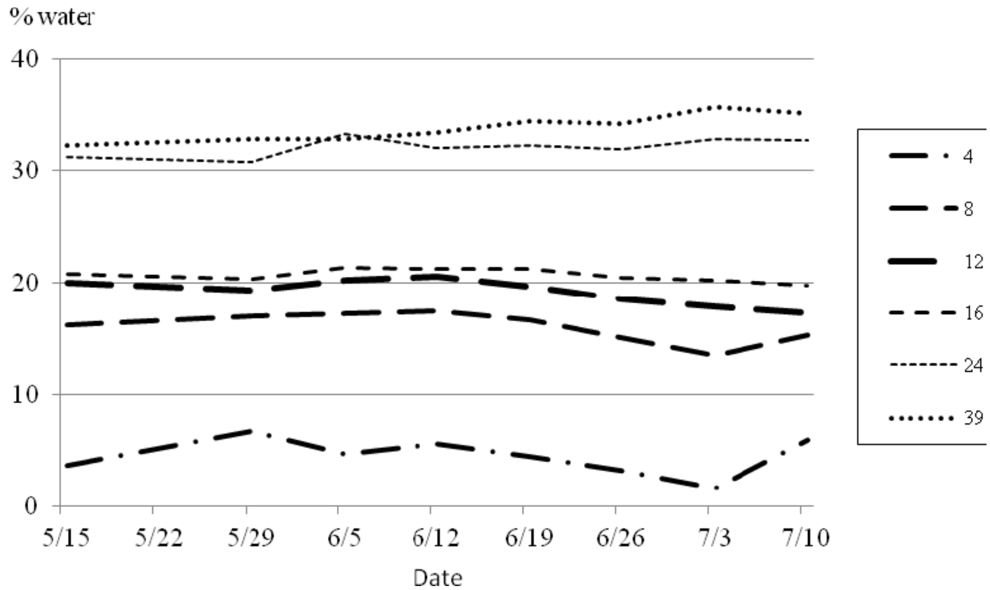

Figure 8. Soil water content at six soil-depth increments in Cooper pea plots during 2012 at the Dickinson Research Extension Center.

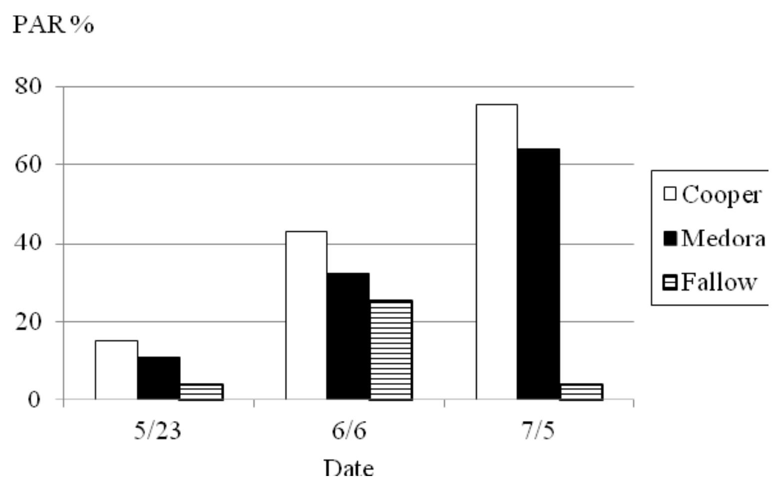

Figure 9. Photosynthetically active radiation (PAR) intercepted by plant canopies of Cooper and Medora peas, and in plots planted originally with Miami but subsequently cultivated because of poor emergence (Fallow) during 2012 at the Dickinson Research Extension Center.

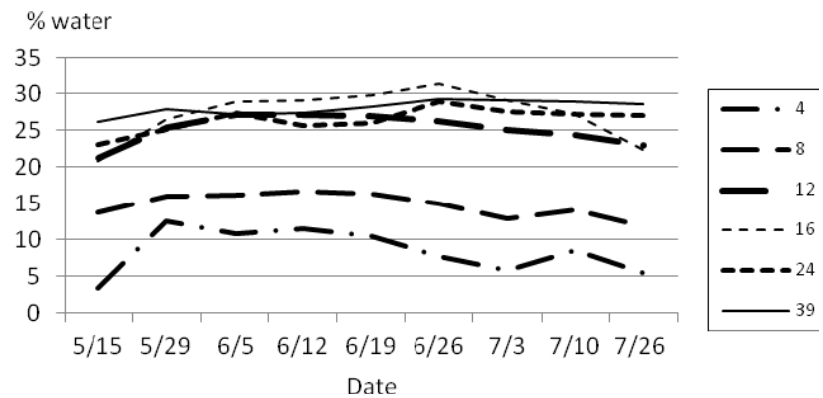

Figure 10. Soil water content at six soil-depth increments in Kennebec potato plots during 2012 at the Dickinson Research Extension Center.

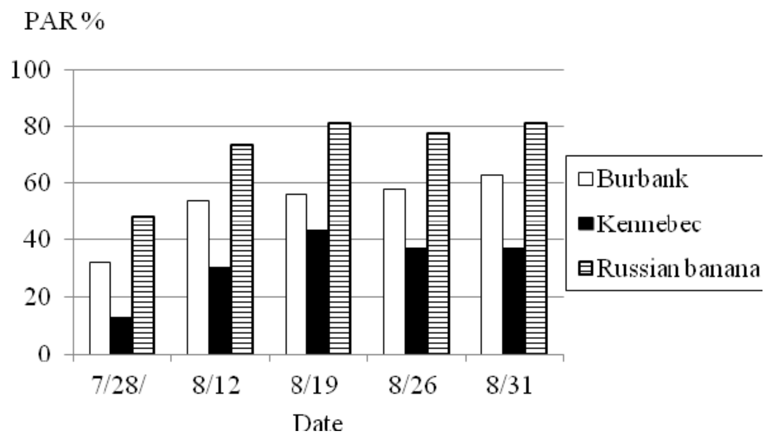

Figure 11. Photosynthetically active radiation (PAR) intercepted by plant canopies of Burbank, Kennebec, and Russian Banana potato plants in plots planted during 2011 at the Dickinson Research Extension Center.

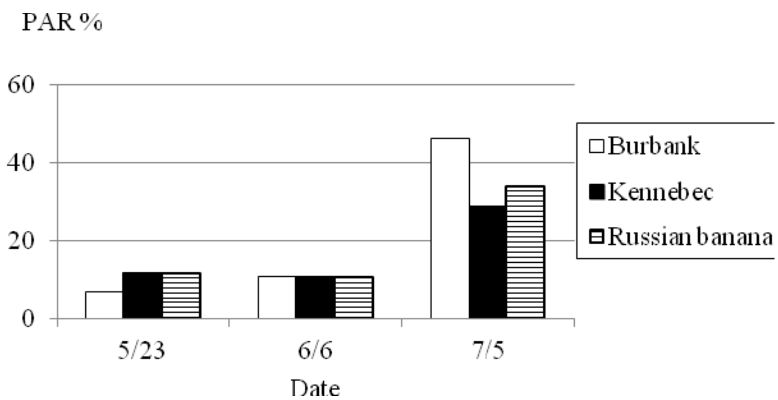

Figure 12. Photosynthetically active radiation (PAR) intercepted by plant canopies of Burbank, Kennebec, and Russian Banana potato plants in plots planted during 2012 at the Dickinson Research Extension Center.

REPORT FORM
CERES GRANT
FARMER PARTICIPANTS
Trial Plots

Please complete and return to the NPSAS office by October 2nd via
mail – PO Box 194, LaMoure ND, 58458
Email – directornpsas@drtel.net
or fax – 701-883-4204.

Name ______

Crops planted on behalf of the CERES Grant: Potatoes 2012

	Variety 1	Variety 2	Variety 3
Name	Kennebec	Defender	Butte
Dated planted	May 2	April 25	April 25
Location and size of strip	82 hills 16" spacing, rows 6' apart on all three rows	84 hills	82 hills
% of germination	100%	100%	100%
Harvest amounts	174 lbs.	164.5 lbs.	141 lbs.
Rate the variety from best overall performance to worst	General comments:	5.30" rain May - August Record warmth much leafhopper damage - early, although plants remained vegetative until killed by frost. No potato bugs seen.	
rating overall quality for marketing	2	1	3

HARVEST DATE Sept. 28.

Comments: (Please list any comments or observations you have on the varieties planted – use back side or additional sheets as needed) Specific comments:

Kennebec: most vigorous vines with least amount of leaf hopper damage. tubers generally poor size, lacking for the most part, the classic Kennebec shape. It is interesting to note that last year, one of the wettest ever, and this year, one of the driest & warmest on record, the Kennebecs had the greatest yield of the three.

Defender: moderate leafhopper damage. These were remarkable in their early, first growth and vigor, although the vines never got as large as Kennebec. Tubers were of medium size, with the fewest misshapen - thus rating #1 for marketability.

Butte: moderate leafhopper damage. Tuber size poor with many misshapen.

Attach or email any photos you may have taken. Email to directornpsas@drtel.net

3-3-12

REPORT FORM

CERES GRANT
FARMER PARTICIPANTS

Name_

Crops planted on behalf of the CERES Grant: Potatoes

rows 6' apart. Plants spaced 16" apart.

	Variety 1	Variety 2	Variety 3
Name	RED NORLAND	YUKON GOLD	KENNEBEC
Dated planted	6-11-11	6-11-11	6-11-11
Location and size of strip 16"x6' spacing	Very uniform, 50' hills of	unreplicated each variety.	plot with 2 rows of each variety.
% of germination	>95%	>95%	>95%
Harvest amounts	68 lbs.	111 LBS	123 LBS.
Rate the variety from best overall performance to worst	#3 Least vigorous Large, knobby tubers with	#2 Witches broom prevalent. Very large tubers - almost	#1 vines large & vigorous tubers large & knobby but good
	many smalls	all with hollow heart	quality overall

Comments: (Please list any comments or observations you have on the varieties planted)

Each variety limited to 50 tubers since we could only obtain 50 seed pieces of Kennebec.

The season was very wet. Ground stayed continuously soggy from planting through July. Planting was more than one month past the usual planting date due to wet ground. Very warm night time temperatures for this area.

Kennebec easily out-performed the others in vigor, production, and wet soil tolerance.

Attach or email any photos you may have taken. Email to directornpsas@drtel.net

REPORT FORM

CERES GRANT
FARMER PARTICIPANTS

Name:

Crops planted on behalf of the CERES Grant: Organic Potato Production

	Variety 1	Variety 2	Variety 3
Name	Red Norland	Yukon Gold	[illegible] Russet
Dated planted	21 June	21 June	21 June
Location and size of strip	100 Feet @ NE¼ of SW¼ Sec 5 140-59	Barnes Co. ND Same	Same
% of germination	≈ 95%	95%	95%
Harvest amounts	300 lbs	22.6	32.4
Rate the variety from best overall performance to worst	Yeild - 2 Consumer - 2	Yeild - 3 Consumer - 1	Yeild - 1 Consumer 3

Comments: (Please list any comments or observations you have on the varieties planted)

See attached narrative.

With the late wet spring and a planting date on the Summer Solstice, aspirations were not high for a high yielding crop. Although all three varieties; Red Norland, Yukon Gold, and Kennebec are rather short season potatoes and may produce good yields from the late, 21 June, planting, the wet planting and subsequent month of extraordinary rainfall did more to damage a good yield than the planting date.

Normal practices for ground preparation, such as deep tilling the previous fall and incorporating an application of one ton per acre of composted pelletized chicken litter were completed in the spring. The planting was done by hand with an in row spacing of ten inches and a between the rows spacing of thirty-eight inches. This plant density and spacing is approximate to a field condition and most applicable to the tillage machinery used on this farm, such as; tractor wheel spacing, cultivator wheel and row spacing, and harrow wheel spacing. The row length for each variety was one hundred feet. This is also a convenient length to determine a per acre yield.

Harvest was done by hand digging each variety separately and weighing the total collected for each variety separately. The total pounds collected from variety one (Red Norland) was thirty pounds. The total collected from variety two (Yukon Gold) was twenty two and six tenths pounds. The total collected from variety three (Kennebec) was thirty two and four tenths pounds. These yields closely approximate per acre yield for other varieties grown on this farm for this year. Furthermore, the ratios between the various varieties approximate each variety's potential yield with a possible exception of variety one's yield compared to variety three's yield. Variety one yielded a little higher than expected relative to variety three.

Tests were done following harvest and a storage period of approximately six weeks. Five non-farmer, non-gardener participants rated each variety from one to ten with one being the least favorable and ten being the most favorable in three categories: appearance, texture, and taste. Approximately two pounds of each variety were cut into wedges, mixed with a little olive oil and salt, and oven roasted on their own separate pans until golden brown. Each participant had three plates labeled for each variety and a single raw sample placed in front of each plate. Participants examined variety one, passing it to their right so that each participant examined each of the five tubers. Similarly the other two varieties were examined. Participants were then asked to rate each variety according to its appearance. Next, a roasted sample of each variety was placed on its corresponding plate in front of each participant. Participants were asked to rate each variety according to texture and taste. Participants were allowed to sample as much as necessary to make a determination. Ratings were compiled and averaged for each quality category. Results are:

Variety	Appearance	Texture	Taste
One (Red Norland)	7.80	7.60	8.20
Two (Yukon Gold)	9.40	9.20	9.80
Three (Kennebec)	7.80	6.60	6.80

REPORT FORM
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FARMER PARTICIPANTS
Trial Plots

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Email – directornpsas@drtel.net
or fax – 701-883-4204.

Name

Crops planted on behalf of the CERES Grant: FIELD PEAS

	Variety 1	Variety 2	Variety 3
Name	CDC STRIKER	MAJOREX	ADMIRAL
Dated planted	5-3-12	5-3-12	5-3-12
Location and size of strip	FIELD 15 141-96-5 16'W X 100'L	FIELD 15 141-96-5 16'W X 100'L	FIELD 15 141-96-5 16'W X 100'L
% of germination	85	90	90
Harvest amounts	18 BU/ACRE	24 BUS/ACRE	17 BU/ACRE
Rate the variety from best overall performance to worst	MID.	BEST	WORST

Comments: (Please list any comments or observations you have on the varieties planted – use back side or additional sheets as needed)

STRIKER - SHORTER PLANTS THAN OTHERS

MAJOREX - VERY GOOD - 4 PEAS TO A POD WHERE OTHERS ONLY HAD 2 - PLANTS WERE TALLER - EASIER TO HARVEST

ADMIRAL - SMALLER PLANTS - LESS PODS - LATER MATURITY BY 2 WEEKS - WOULD NOT RECOMMEND PLANTING.

ALL VARIETY'S SHOWED VERY LITTLE WEED COMPETITION
ALL VARIETIES WERE PLANTED AT A RATE OF 200#/ACRE

Attach or email any photos you may have taken. Email to directornpsas@drtel.net

REPORT FORM

CERES GRANT
FARMER PARTICIPANTS

Name :

Crops planted on behalf of the CERES Grant: Field peas

	Variety 1	Variety 2	Variety 3
Name	CDC Striker	Admiral	Maioret
Dated planted	May 30	May 30	May 30
Location and size of strip	Doyon, ND 8x50 equivalent	Doyon, ND 8x50 equivalent	Doyon, ND 8x50 equivalent
% of germination	92	93	91
Harvest amounts	12.8	12.1lbs	12.5 lbs
Rate the variety from best overall performance to worst	1	3	2

Comments:

The reason I stated the size of the strip as 8x50 equivalent is that we only have a row crop planter. I planted enough rows to equal an 8x50 strip with 6 inch spacing.

All the varieties seemed to perform about the same throughout the summer. Being as they were in rows we were able to till them once before they grew too large. This kept the weed pressure down. They did have some pressure from Green foxtail and Canada thistle as they were maturing, but I don't believe it had much impact on pod fill.

The extra room between rows, I think, wasn't much of an advantage this year. The area between the rows took longer to shade over so most of the extra moisture available was lost to evaporation.

The CDC Striker and the Maioret had a larger stem, but all had about the same standablity.

NORTH DAKOTA STATE UNIVERSITY
Statement of Expenditures

NDSU Award Number:	FAR0016202
Agency Name:	The Ceres Trust
Project Title:	"Organic Crop Variety Selection for Dry Areas in the North Central Region" **Year 3 (January 1 through December 31, 2012)- FINAL**
Principal Investigator(s):	Patrick Carr

Elements of Cost	Cumulative Expenses 01/01/10 to 12/31/12	Total Budget	Available Budget
Salaries & Wages	$55,628.07	$49,172.00	($6,456.07)
Fringe Benefits	$8,377.37	$9,712.00	$1,334.63
Subtotal	$64,005.44	$58,884.00	($5,121.44)
Travel	$12,807.87	$20,165.00	$7,357.13
Communications/Postage	$0.00	$0.00	$0.00
Supplies/Materials	$6,393.84	$7,228.00	$834.16
Rents & Leases	$0.00	$0.00	$0.00
Office/Printing	$0.00	$600.00	$600.00
Repairs	$192.42	$0.00	($192.42)
Fees	$564.79	$0.00	($564.79)
Subawards	$32,798.57	$38,000.00	$5,201.43
Minor Equipment/Durable Supplies	$200.00	$0.00	($200.00)
General (Food,	$0.00	$0.00	$0.00
Subtotal	$52,957.49	$65,993.00	$13,035.51
Major Equipment	$0.00	$0.00	$0.00
Total Direct Costs	$116,962.93	$124,877.00	$7,914.07
Indirect Cost Rate	$29,240.74	$31,219.00	$1,978.26
Total Cost	$146,203.67	$156,096.00	$9,892.33

I CERTIFY THAT ALL EXPENDITURES REPORTED OR PAYMENTS REQUESTED ARE FOR APPROPRIATE PURPOSES AND IN ACCORDANCE WITH THE PROVISIONS OF THE APPLICATION AND AWARD DOCUMENTS.

Approved by: David Munro, Grants Officer   Date: 1/31/13