

Agricultural Demonstration of Practices and Technologies (ADOPT)

FINAL REPORT

20140445

**DEMONSTRATION OF FORAGE PEAS IN MIXTURE
WITH CEREALS FOR GREENFEED PRODUCTION**

**Funded by: The Saskatchewan Ministry of Agriculture under the
Canada-Saskatchewan Growing Forward bi-lateral agreement**

February 2016

Prepared by: Saskatchewan Forage Council

ADOPT Final Report-Project # 20140445

Project Identification

1. **Project Title:** Demonstration of Forage Peas in Mixture with Cereals for Greenfeed Production
2. **Project Number:** 20140445
3. **Producer Group Sponsoring the Project:** Saskatchewan Forage Council (SFC)
4. **Project Location(s):**
 - **Swift Current, SK- Wheatland Conservation Area (WCA)**
 - **Melfort, SK – Northeast Agriculture Research Foundation (NARF)**
 - **Yorkton, SK – East Central Research Foundation (ECRF)**
 - **Scott, SK – Western Applied Research Corp (WARC)**
5. **Project start and end dates:** April 2015 to December 2015
6. **Project contact person and contact details:**

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Objectives and Rationale

7. Project Objectives

The project was designed to assess and demonstrate the yield and forage value of pea/cereal mixtures in comparison to monocultures of oats, barley and peas across the soil zones in Saskatchewan.

8. Project Rationale

Regional Forage Specialists frequently receive calls from producers on the performance of pea/cereal mixtures when used for greenfeed. Producers also have questions on what seeding rates to use when planting pea/cereal mixtures, and how to stage the crop for harvest. There is some speculation that including peas in a greenfeed mixture can actually improve the forage quality. A potential benefit to

including peas in a mixture is that they can reduce the reliance on commercial fertilizer, and help reduce input costs.

By demonstrating pea/cereal mixtures in side-by-side comparisons with monocultures of barley, oats and peas, producers will be able to see how these mixtures perform in their geographical area. This demonstration will increase the comfort level that producers have with seeding and managing annual forages on their farm and will provide more information on what species to choose when growing annual forages.

Methodology and Results

9. Methodology

Four research farms in varying soil zones were selected as sites for this demonstration project. Sites were located at Swift Current, SK (Wheatland Conservation Group); Melfort, SK (Northeast Agriculture Research Foundation); Yorkton, SK (East Central Research Foundation) and Scott, SK (Western Applied Research Corp). Saskatchewan Agriculture Regional Forage Specialists supervised and assisted at each of the four sites.

Seed was obtained in the spring of 2015 and distributed to the sites. Plots were sown in the spring of 2015 in randomized small plots with four (4) replicates. The annual forages were evaluated using thirteen (13) treatments (seeding rate is 100% of targeted seeding rate unless noted otherwise in brackets):

1. CDC Horizon Forage Pea*
2. CDC Maverick Barley
3. CDC Cowboy Barley (check)
4. CDC Haymaker Oats
5. CDC Baler Oats
6. CDC Haymaker Oats (30% rate) and CDC Horizon Peas (100% rate)
7. CDC Haymaker Oats (50% rate) and CDC Horizon Peas (50% rate)
8. CDC Maverick Barley (30% rate) and CDC Horizon Peas (100% rate)
9. CDC Maverick Barley (50% rate) and CDC Horizon Peas (50% rate)
10. CDC Haymaker Oats (30% rate) and 40-10 Peas (100% rate)
11. CDC Haymaker Oats (50% rate) and 40-10 Peas (50% rate)
12. CDC Maverick Barley (30% rate) and 40-10 Peas (100% rate)
13. CDC Maverick Barley (50% rate) and 40-10 Peas (50% rate)

**Due to lack of availability of CDC Tucker Forage Pea seed, CDC Horizon Forage Pea was substituted for the demonstration.*

Table 1, on the following page, shows the targeted seeding rate for the forages in this demonstration. Actual seeding rates for the sites are located in the results section of the report.

Table 1. Targeted Seeding Rate for ADOPT Pea/Cereal Greenfeed Demo

Annual Forage	Plants/ft ²
Peas	7-8
Oats	25
Barley	25

Pre-seeding burnoff with glyphosate was performed for weed control and Express® SG herbicide was utilized if required to control difficult weeds or Roundup Ready Canola. A low rate of nitrogen-phosphorus fertilizer (30 lbs N and 15 lbs P) was applied across all plots at seeding. Granular inoculant was also applied for the peas.

Data Collection

Plots were harvested based on appropriate stage for greenfeed harvest of each crop:

- Pea plots were cut when the bottom half of the pods are full and thick, while the upper pods were still developing
- Oat plots were cut at mid-late milk stage
- Barley plots were cut at mid-dough stage
- Cereal/Pea mixtures were cut based upon the appropriate stage for the cereal in the mixture

Table 2. ADOPT Pea/Cereal Mixtures for Greenfeed Important Dates in 2015

Site	Seeding Date	Harvest Date				
		Peas	Oats	Barley	Peas/Oats	Peas/Barley
Swift Current	May 27	July 29	Aug 4	July 29	July 29	July 29
Melfort	June 3	Aug 18	Aug 27	Aug 14	Aug 27	Aug 14
Yorkton	May 20	Aug 3-10*	Aug 3-10	Aug 3-10	Aug 3-10	Aug 3-10
Scott	May 19	July 24	July 24	July 24	July 24	July 24

**All plots were ready for harvest on August 3, however the plot harvester broke down twice and this resulted in a range of harvest dates from August 3 to 10th*

Please note: Dates that samples were sent to lab for analysis are listed in individual site descriptions

Establishment data was collected to determine whether targeted seeding rates were achieved. Seedling counts were done for 2 meters of row in total (1 meter for one row, and then 1 meter for another row) per plot. Counts were done at the 1-2 leaf stage, about 3 weeks after seeding.

Yield data was collected and reported on a dry matter basis. A portion of each plot was hand clipped or the entire plot was harvested with a mechanical harvester, pending equipment availability. Combined yield data for the four sites is displayed in Table 6, Appendix B.

Forage nutritional quality was analyzed. Samples were collected from the two replicate plots that best represented each treatment at each site, which resulted in 26 samples per site. These samples were

analyzed at Central Testing Labs by wet chemistry. Forage quality results for selected parameters are listed in Tables 7 to 11, Appendix B.

10. Final Results

Swift Current Site:

Wheatland Conservation Area carried out the Swift Current demonstration which was located at NW 32-15-13 W3. The plots were in the brown soil zone on clay loam soils which had been summer-fallowed in 2014. Seeding was done with a Fabro-built plot drill with atomjet knife openers at nine inch (9") row spacing on May 27, 2015. Fertilizer was side-banded at seeding to provide the equivalent of fifteen (15) pounds of phosphorus and thirty (30) pounds of nitrogen.

Harvest took place on July 29, 2015 for the majority of the treatments and on August 4, 2015 for the baler oats and haymaker oats.

100% seeding rates at the Swift Current site were:

Peas: 133 lbs/ac

Barley: Maverick 155 lbs/ac and Cowboy 149 lbs/ac

Oats: Haymaker 112.2 lbs/ac and Baler 114.8 lbs/ac

Rates were calculated by weighing 1000 kernels of each seed type. Ten percent additional seed was added to compensate for mortality.

Establishment was evaluated three weeks after seeding and the site supervisor noted that seedling emergence was good and all stands appeared healthy at that time.

Samples were collected from the drying ovens and sent away for nutritional analysis on August 13 and 14, 2015. Yield and quality results for the Swift Current site are listed in Tables 7 and 10 in Appendix B.

Melfort Site:

The Melfort Research Farm at SE-31-44-18-W2 was the location of the Melfort demonstration. The site is located in the moist black soil zone on loam/clay-loam soils. The peas, oats and barley were sown into soil that had previously been summer fallowed and one litre per acre of Roundup transorb was used for pre-seeding weed control. Thirty (30) pounds of nitrogen fertilizer was broadcast and worked in prior to seeding and fifteen (15) pounds of phosphorus was seed-placed at seeding.

Seeding took place on June 3, 2015 and establishment was observed on June 18, 2015, with successful establishment observed at all plots. Harvest dates (based on recommended harvest stage) were:

Peas: August 18, 2015

Barley: August 14, 2015

Oats: August 27, 2015

Pea/Barley mixtures: August 14, 2015

Pea/Oat mixtures: August 27, 2015

The site supervisor noted that lodging became a problem for some of the greenfeed mixtures. As the oats and barley lodged, the peas grew up to fill the canopy and the cereals started to decay under the canopy. Lodging was observed and degree of lodging was scored on August 6, 2015 at the Melfort site

as it appears that this may be a problem to successful production of pea/cereal greenfeed mixtures in the moist black soil zone. The results are shown in the table below on a scale of 1-8, where 1 indicates little-to-no lodging and 8 indicates the highest level of lodging. Note that all plots showed some degree of lodging.

Table 3. Pea and Cereal Lodging Scores at Melfort Research Farm Demonstration 2015

Treatment	Average Pea Lodging Score	Average Cereal Lodging Score
CDC Horizon Forage Pea	2.50	-
CDC Maverick Barley	-	6.50
CDC Cowboy Barley	-	5.25
CDC Haymaker Oats	-	4.75
CDC Baler Oats	-	5.50
Haymaker 30% Horizon 100%	4.25	4.50
Haymaker 50% Horizon 50%	4.00	5.50
Maverick 30% Horizon 100%	2.00	5.25
Maverick 50% Horizon 50%	3.50	5.50
Haymaker 30% 40-10 100%	1.50	7.00
Haymaker 50% 40-10 50%	1.50	6.50
Maverick 30% 40-10 100%	2.25	6.25
Maverick 50% 40-10 50%	1.50	7.00

Yield and quality results for the Melfort site are listed in Tables 7 and 8, Appendix B.

Yorkton Site:

The Yorkton demonstration site was at the East Central Research Foundation (ECRF), located at SW 26-25-4 W2 in the black soil zone on clay-loam soil. The plots were sown to annual crops in 2014 and glyphosate and Express herbicide were used for weed control prior to seeding in 2015. Seeding took place on May 20, 2015 using a 10 foot Seedhawk, with fertilizer (30lbs N and 15 lbs P) side-banded.

100% seeding rates at the Yorkton site were:

Peas: 130 lbs/ac

Barley: Maverick 138 lbs/ac and Cowboy 133.5 lbs/ac

Oats: Haymaker 126 lbs/ac and Baler 112 lbs/ac

One June 8, 2015, establishment was assessed and seedlings appeared vigorous and healthy. Plots were intended to have been harvested on August 3, 2015; however due to mechanical breakdowns of the forage harvester, harvest took place over three separate dates. Plots 101-103 and 301-302 took place on August 3; plots 104 to 202 and 303 to 401 were harvested August 4 and plots 203 to 213 and 402 to 413 were harvested on August 10 (see Appendix C for plot diagram). Forage samples for nutritional analysis were all taken on August 10, 2015. Yield and quality results for the Yorkton site are listed in Tables 7 and 11, Appendix B.

Scott Site:

The demonstration plots at the Western Applied Research Corporation (WARC) in Scott, SK were located on south half of 17-39-20 W3rd. The soil type is moist dark-brown loam and the plots were sown to a wheat crop in 2014. Herbicide for pre-seeding control of volunteer wheat and weeds included Roundup and Pardner applied on May 15th, 2015.

Plots were sown May 19, 2015 with an R-tech seeder with 10' row spacing. Fertilizer was applied as monammonium phosphate (11-51-0) and seed placed with peas while urea was applied mid-row to meet project's targeted fertilizer application rates. Peas were put in the seed row and barley/oats were side-banded in the combination treatments.

100% seeding rates at the Scott site were:

Peas: 146 lbs/acre*

Barley: Maverick 170.58 lbs/acre and Cowboy 164.29 lbs/acre

Oats: Haymaker 133.2 lbs/acre and Baler 128.46 lbs/acre

**Pea seeding rate was increased to include a 20% mortality rate*

Emergence of the cereals was observed on May 26, 2015 and pea emergence was observed on May 28, 2015. Emergence counts were completed on June 3, 2015. Harvest for forage quality and biomass took place on July 24, 2015. All crop stages were based on protocols for both peas and cereals. Samples were sent to the lab for forage quality analysis on July 27, 2015. Yield and quality results for the Scott site are listed in Tables 7 and 9, Appendix B.

Average cost per tonne of forage

In order to arrive at a cost per tonne for the 13 treatments, a calculation was made using total seed costs in comparison to average yield for each of the treatments (Table 4). The actual seed costs at time of purchase were: \$20/bushel for forage peas, \$10/bushel for forage oats, and \$15.15 for forage barley. Total seed cost is based on the average seeding rates of all sites used, with a target of 7-8 plants per square foot for the peas and 25 plants per square foot for the cereals.

Table 4. Seed Cost, Yield and Forage Cost for annual forages when averaged over 4 project locations.

Treatment name	Total Seed Cost (\$/ac)	Average Yield (tonnes/ac)	Average Forage Cost (\$/tonne yielded)
CDC Horizon pea	45.33	2.0	23.15
Maverick barley	47.88	2.6	18.11
Cowboy barley (check)	47.88	2.4	20.31
Haymaker oats	35.59	2.6	13.65
Baler oats	35.59	2.9	12.10
Haymaker oats (30) Horizon pea (100)	56.01	3.1	18.32
Haymaker oats (50) Horizon pea (50)	40.46	2.8	14.58
Maverick Barley (30) Horizon pea (100)	59.70	2.6	22.56
Maverick Barley (50) horizon peas (50)	46.61	2.7	16.99
Haymaker oats (30) 40-10 peas (100)	56.01	2.0	27.48
Haymaker oats (50) 40-10 peas (50)	40.46	2.3	17.22
Maverick Barley (30) 40-10 peas (100)	59.70	2.4	25.20
Maverick Barley (50) 40-10 peas (50)	46.61	2.4	19.43
Average of all treatments	47.52	2.5	19.16

This calculation does not account for different seeding rates for different varieties used, as these differences were minimal.

To demonstrate the effect that yield had on the average cost per tonne yielded, the yields and costs for the Melfort (moist black soil zone) and Swift Current (brown soil zone) sites are listed in the table below.

Table 5. Seed Cost per Tonne of Forage Yielded at Swift Current and Melfort Sites

Treatment name	Swift Current Site		Melfort Site	
	Average Yield (tonnes/ac)	Average Cost (\$/tonne yielded)	Average Yield (tonnes/ac)	Average Cost (\$/tonne yielded)
CDC Horizon pea	1.2	36.29	2.3	19.90
Maverick barley	1.6	29.66	5.3	9.10
Cowboy barley (check)	1.4	33.66	5.0	9.51
Haymaker oats	1.7	20.35	4.9	7.33
Baler oats	1.9	18.70	5.2	6.88
Haymaker oats (30) Horizon pea (100)	2.0	28.18	5.4	10.29
Haymaker oats (50) Horizon pea (50)	1.6	25.25	4.8	8.44
Maverick Barley (30) Horizon pea (100)	1.6	36.99	4.6	12.90
Maverick Barley (50) horizon peas (50)	1.7	27.18	4.6	10.19
Haymaker oats (30) 40-10 peas (100)	1.3	42.05	3.1	17.81
Haymaker oats (50) 40-10 peas (50)	1.5	26.75	3.5	11.71
Maverick Barley (30) 40-10 peas (100)	1.7	36.07	3.5	16.95
Maverick Barley (50) 40-10 peas (50)	1.6	29.49	4.1	11.49
Average of all treatments	1.6	30.05	4.3	11.73

This calculation does not account for different seeding rates for different varieties used, as these differences were minimal.

From a nutritional perspective, a producer might consider adding forage peas to a greenfeed mixture in an effort to increase protein in the forage. Total protein harvested per acre was compared for each of the 13 treatments and the results are listed in Table 6, in Appendix B.

11. Conclusions/Recommendations

This demonstration project was carried out to increase the uptake and acceptance of pea/cereal mixtures for greenfeed. Part of the challenge in the past has been a lack of agronomic information available to producers when growing pea/cereal mixtures for greenfeed. This study demonstrated what happens when you use different seeding rate combinations of peas and cereals, and also how to stage a mixture for greenfeed harvest.

From the demonstration, the highest overall yielding mixture was Haymaker oats at 30% of full seeding rate and CDC Horizon pea at 100% of full seeding rate. In contrast the lowest yielding forage treatment was when CDC Horizon was seeded alone without a cereal crop. This demonstration showed that there is a synergistic effect to including a cereal such as oats or barley when growing peas for greenfeed. Oat and barley varieties tended to produce similar yields when seeded alone. Looking at the differences in using a 50/50 (cereal/pea) seeding rate versus a 30/100 (cereal/pea) seeding rate, this did not have a consistent impact upon yield. The Haymaker oat and CDC Horizon pea mixture produced a higher yield on average at the 30/100 rate, while the Maverick barley and Horizon, and the Haymaker oat and 40-10 pea mixtures showed higher yields at the 50/50 rate on average. These results varied by site and it appears that soil zone and growing conditions had more impact on yield than seeding rate had in this demonstration.

Another way to evaluate the treatments is shown in Table 6 looking at total pounds of protein produced per acre, and this is where the full benefit of the pea/cereal mixtures can be shown. The highest protein yield was harvested from the plots containing the pea/cereal mixtures. In particular, the two highest protein yielding treatments were the Haymaker (30) and Horizon pea (100), and Maverick barley (30) and Horizon pea (100) mixtures.

One of the challenges when using peas is the larger seed size associated with them, which results in increased seed cost. This higher seed cost makes pea mixtures a pricier option than straight cereal mixtures when evaluated simply on a cost-per-tonne of feed basis. Adding peas to the mixtures increased the cost per tonne of the greenfeed in all mixtures, except when the peas and cereals were both sown at a 50% seeding rate. Due in part to its smaller seed size Baler oats was the lowest cost option when evaluating greenfeed options on a cost-per-tonne basis. However, from a nutritional perspective there were added benefits of having peas in a mixtures rather than growing a cereal monoculture. In general the peas tended to increase the protein value of the feed. The actual protein increase with peas varied from site to site, with the Melfort site showing the greatest overall protein increase of three-to-six percentage points, while the 100 percent pea treatment (CDC Horizon) had a seven percent increase over a cereal monoculture.

The study also highlighted the cost-of-production differences between Melfort (moist black soil zone) and Swift Current (brown soil zone). When yield was averaged across all the different treatments at each individual site, Melfort (\$11.73) had a significantly lower seed cost/tonne of forage produced than Swift Current (\$30.05) due to the higher yield potential in the moist Black soil zone.

This project pointed out the difference between the two pea varieties. The CDC Horizon pea yielded higher than 40-10 across all the pea/cereal mixtures. This difference in part might be due to the different growth pattern of the 'newer' semi-leafless forage pea types which have a more 'determinate' growth pattern causing them to mature earlier and be more in sync with the cereal maturity stage. The semi-leafless types such as CDC Horizon also tend to be more upright in growth habit, whereas the 40-10 peas is more 'viney' and tended to spread more horizontally.

The results of this demonstration are based on one year of data only and additional years of data would be useful in determining the significance of the variations in yield and quality for these greenfeed mixtures. As lodging was a problem at the northeast site, this issue may also warrant further investigation. This demonstration used the same fertilizer treatment across all plots and it would be valuable for future projects to fine-tune fertilizer application to ensure maximum yield potential.

Extension/Promotion Activities:

The following extension activities were completed to communicate results and raise awareness of this demonstration:

- Signs placed at each of the sites.
 - Plots were toured at the Scott Field Day on July 15, 2015. Although not featured on the general tour, producers interested in forages were personally toured by General Manager Jessica Weber. 119 producers and industry representatives attended the field day.
 - Field day at Yorkton site July 23, 2015, with 75 producers in attendance.
 - An article describing this demonstration project was published in the Saskatchewan Forage Council eNews on November 24, 2015. The eNews is distributed to over 475 contacts and is also posted on the SFC website.
 - Trevor Lennox, SMA Regional Forage Specialist has written an article for the February 2016 edition of AgriView.
 - This article will also be used in the SFC eNews.
 - Information regarding this project has been included on the Saskatchewan Forage Council website (average hits of 2000+ per month). Final results will be posted on the website and featured in the Saskatchewan Hay and Pasture Report in the spring of 2016.
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Supporting Information

12. Acknowledgements

The Ministry's support for the project was acknowledged on signage displayed at each site and in all communication/extension materials.

Industry/co-operator support has also been noted on all project site signage and in all communication/extension materials.

Industry Support: Denis Lueke of One Oak Farms (Humboldt, SK) donated the Baler Oat seed; Scott and Shawn Fraser (Pambrun, SK) donated the Maverick Barley for this demonstration.

In-kind support was provided by Saskatchewan Ministry of Agriculture Regional Forage Specialists to oversee these demonstration sites.

13. Appendices

Appendix A – Site Photos

Appendix B – Charts and Tables

Appendix C – Demonstration Site Plot Plans

14. Abstract

This project was designed to assess and demonstrate the yield and forage value of pea/cereal mixtures in comparison to monocultures of oats, barley and peas across the soil zones in Saskatchewan. The Saskatchewan Forage Council (SFC), in partnership with Saskatchewan Agriculture Regional Forage Specialists, conducted this demonstration at Swift Current, Scott, Melfort and Yorkton, SK in the summer of 2015. Thirteen treatments at each site included pea, barley and oat monocultures as well as pea/barley and pea/oat mixtures at two different seeding rates. This project also demonstrated CDC Horizon, a newer variety of semi-leafless pea as compared to an older variety, 40-10 forage pea.

Plots were sown in the spring of 2015 and yield and forage quality of each treatment was recorded and compared. In this demonstration, the highest overall yielding mixture was Haymaker oats at 30% of full seeding rate and CDC Horizon pea at 100% of full seeding rate. In contrast the lowest yielding forage treatment was CDC Horizon seeded without a cereal crop. When comparing the two pea varieties, the CDC Horizon pea yielded higher than 40-10 across all the pea/cereal mixtures.

Higher seed cost makes pea mixtures a pricier option than straight cereal mixtures when evaluated simply on a cost-per-tonne of feed basis. Compensating somewhat for the higher

cost is the increased protein content of feeds in the mixtures as compared to monocultures. The highest protein yield was harvested from the plots containing the pea/cereal mixtures. In particular, the two highest protein yielding plots were the Haymaker (30% seeding rate) and CDC Horizon pea (100% seeding rate), and Maverick barley (30% seeding rate) and CDC Horizon pea (100% seeding rate) mixtures.

This project successfully demonstrated forage mixtures for greenfeed around Saskatchewan and will provide useful agronomic information for producers interesting in growing these mixtures. Project results were shared with producers at two field days, with over 150 producers in attendance and in articles in the AgriView and SFC eNews publications. Project results will be posted on the SFC website (over 2000+ hits/month on average).

Appendix A – Site Photos

Swift Current Site: Wheatland Conservation Area

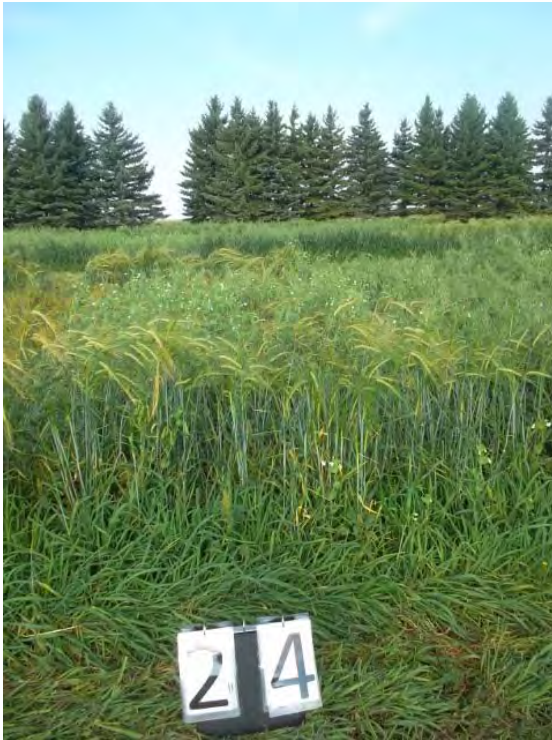


Swift Current Site
August 4, 2015
Maverick Barley at 50% seeding rate
and 40-10 Peas at 50% seeding rate



Swift Current Site
August 4, 2015
Haymaker Oats at 30% seeding rate
And Horizon Peas at 100% seeding rate

Melfort Site: Melfort Research Farm (Northeast Agriculture Research Foundation)

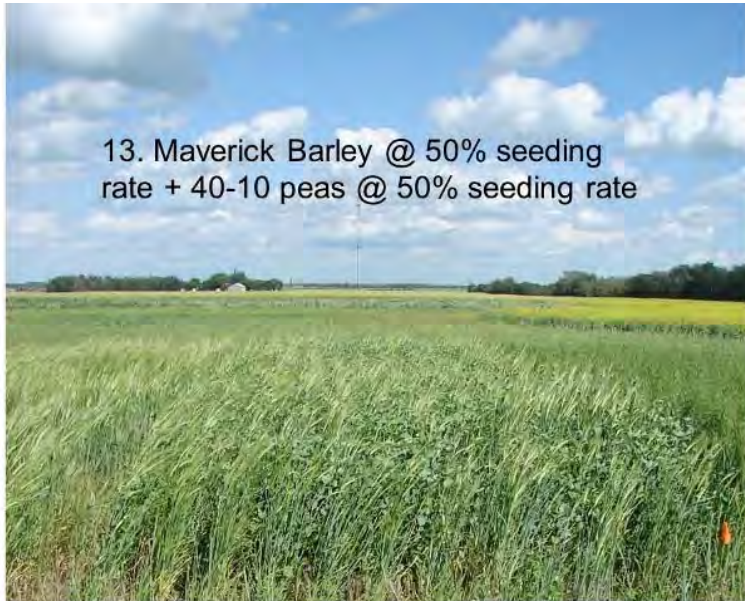


Melfort Site
August 11, 2015
Maverick Barley at 50% seeding rate
and Horizon Peas at 50% seeding rate

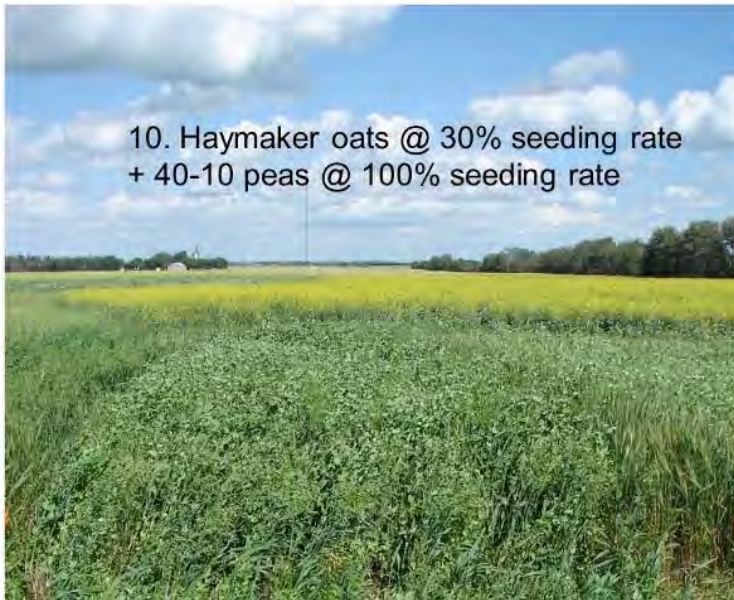


Melfort Site
August 11, 2015
Haymaker Oats at 30% seeding rate
and 40-10 Peas at 100% seeding rate

Yorkton Site: East Central Research Foundation



Yorkton Site
August 10, 2015
Maverick Barley at 50% seeding rate
and 40-10 Peas at 50% seeding rate



Yorkton Site
August 10, 2015
Haymaker Oats at 30% seeding rate
and 40-10 Peas at 100% seeding
rate

Scott Site: Western Applied Research Corporation



Scott Site
July 24, 2015
Maverick Barley at 30% seeding
rate and Horizon Peas at 100%
seeding rate



Scott Site
July 24, 2015
Haymaker Oats at 30% seeding
rate and 40-10 Peas at 100%
seeding rate

Appendix B – Charts and Tables

Table 6: Protein harvested per acre from each forage treatment (averaged across all 4 sites)

Treatment name	Protein Harvested (lbs/ac)
CDC Horizon pea	10,997
Maverick barley	10,214
Cowboy barley (check)	9,572
Haymaker oats	10,273
Baler oats	11,663
Haymaker oats (30) Horizon pea (100)	14,878
Haymaker oats (50) Horizon pea (50)	12,300
Maverick Barley (30) Horizon pea (100)	13,253
Maverick Barley (50) horizon peas (50)	12,380
Haymaker oats (30) 40-10 peas (100)	10,909
Haymaker oats (50) 40-10 peas (50)	11,392
Maverick Barley (30) 40-10 peas (100)	12,761
Maverick Barley (50) 40-10 peas (50)	11,349
Average of all treatments	11,688

Bold lettering indicates highest protein yields

Table 7. Forage yield (kg/ha) at Melfort, Scott, Swift Current, Yorkton in summer 2015

#	Treatment	Average across locations kg/ha	Melfort kg/ha	Scott kg/ha	Swift Current kg/ha	Yorkton kg/ha
1	Baler oats	7,261	12,764	2,463	4,700	9,117
2	Cowboy barley (check)	5,821	12,425	2,489	3,512	4,858
3	Haymaker oats	6,440	11,992	2,516	4,318	6,932
4	Haymaker oats (30) 40-10 peas (100)	5,034	7,767	2,264	3,289	6,815
5	Haymaker oats (30) Horizon pea (100)	7,550	13,440	2,971	4,907	8,883
6	Haymaker oats (50) 40-10 peas (50)	5,799	8,531	2,578	3,735	8,352
7	Haymaker oats (50) Horizon pea (50)	6,853	11,832	3,011	3,957	8,611
8	Horizon pea	4,834	5,625	2,133	3,085	8,494
9	Maverick barley	6,530	12,986	2,983	3,986	6,167
10	Maverick Barley (30) 40-10 peas (100)	5,848	8,697	2,579	4,086	8,031
11	Maverick Barley (30) Horizon pea (100)	6,533	11,428	2,539	3,985	8,179
12	Maverick Barley (50) 40-10 peas (50)	5,924	10,014	2,768	3,902	7,013
13	Maverick Barley (50) horizon peas (50)	6,772	11,298	3,031	4,235	8,525
P-value		0.15	<.0001	0.08	0.10	0.36
CV %		61.61	12.50	13.82	19.50	30.25
Mean		6246	10677	2640	3977	7691
LSD		5504	1909	612	1109	3328

Note: if P-value is lesser than 0.05, the treatments will be considered significantly different.

CV, coefficient of variation; LSD, least significant difference at P =0.05

Data were analyzed for each location, and also for all locations.

Table 8. Forage Quality in Melfort, SK in summer 2015

#	Treatment	Acid Detergent Fibre (% DM*)	Crude Protein (% DM)	Neutral Detergent Fibre (% DM)	Relative Feed Value (DM)*	Total Digestible Nutrients (% AS FED)**
1	Baler oats	35.26	13.64	56.87	102.63	57.17
2	Cowboy barley (check)	28.80	13.04	47.84	121.13	62.09
3	Haymaker oats	36.33	13.84	57.19	103.38	56.32
4	Haymaker oats (30) 40-10 peas (100)	33.68	18.54	42.17	129.88	58.22
5	Haymaker oats (30) Horizon pea (100)	37.80	16.33	53.44	112.00	54.66
6	Haymaker oats (50) 40-10 peas (50)	34.88	17.32	47.62	116.50	57.50
7	Haymaker oats (50) Horizon pea (50)	35.82	14.92	52.33	105.88	56.65
8	Horizon pea	36.59	20.47	44.10	123.75	53.87
9	Maverick barley	31.72	15.40	48.83	128.00	59.27
10	Maverick Barley (30) 40-10 peas (100)	35.97	19.97	45.72	126.00	54.40
11	Maverick Barley (30) Horizon pea (100)	33.19	17.54	47.72	131.25	57.37
12	Maverick Barley (50) 40-10 peas (50)	35.72	16.20	48.22	124.38	55.24
13	Maverick Barley (50) horizon peas (50)	33.36	16.75	48.16	131.13	57.57
P-value		0.007	0.006	<.0001	<.0001	0.010
CV %		4.67	9.52	3.83	10.28	2.75
Mean		34.55	16.46	49.24	119.68	56.95
LSD		3.49	3.38	4.07	12.02	3.38

*DM=Dry Matter Basis

**Melfort feed samples were submitted to lab at 8-10% moisture

Note: if P-value is lesser than 0.05, the treatments will be considered significantly different.

CV, coefficient of variation; LSD, least significant difference at P =0.05

Data were analyzed for each location

Table 9. Forage Quality in Scott, SK in summer 2015

#	Treatment	Acid Detergent Fibre (% DM*)	Crude Protein (% DM)	Neutral Detergent Fibre (% DM)	Relative Feed Value (DM)*	Total Digestible Nutrients (% As Fed)**
1	Baler oats	34.06	10.36	61.82	94.00	35.59
2	Cowboy barley (check)	29.86	9.94	54.19	113.50	38.50
3	Haymaker oats	34.98	9.96	60.97	94.00	35.82
4	Haymaker oats (30) 40-10 peas (100)	30.95	12.90	46.55	130.00	36.45
5	Haymaker oats (30) Horizon pea (100)	33.04	12.16	54.69	107.50	38.10
6	Haymaker oats (50) 40-10 peas (50)	34.12	11.60	55.92	103.50	36.54
7	Haymaker oats (50) Horizon pea (50)	34.69	11.22	58.82	98.00	35.49
8	Horizon pea	34.22	12.69	45.42	127.50	26.28
9	Maverick barley	26.21	9.27	48.83	130.50	40.71
10	Maverick Barley (30) 40-10 peas (100)	31.85	11.66	44.73	134.00	33.38
11	Maverick Barley (30) Horizon pea (100)	31.17	12.17	48.62	124.00	35.04
12	Maverick Barley (50) 40-10 peas (50)	29.50	10.72	47.15	130.00	36.92
13	Maverick Barley (50) horizon peas (50)	28.64	10.91	49.05	126.50	37.92
P-value		0.001	<.0001	<.0001	0.0004	0.035
CV %		4.75	4.46	4.59	6.53	7.94
Mean		31.79	11.20	52.06	116.38	35.90
LSD		3.26	1.08	5.16	16.42	6.16

*DM=Dry Matter Basis

**Scott feed samples were submitted to lab at higher moisture content than the other samples. Peas were submitted at 57% moisture, Barley was submitted at 43% moisture, oats were submitted at 42% moisture, and pea/cereal mixtures had an average moisture content of 41%.

Note: if P-value is lesser than 0.05, the treatments will be considered significantly different.

CV, coefficient of variation; LSD, least significant difference at P =0.05

Data were analyzed for each location

Table 10. Forage Quality in Swift Current, SK in summer 2015

#	Treatment	Acid Detergent Fibre (% DM*)	Crude Protein (% DM)	Neutral Detergent Fibre (% DM)	Relative Feed Value (DM)*	Total Digestible Nutrients (% As Fed)**
1	Baler oats	31.04	15.41	57.33	105.50	59.84
2	Cowboy barley (check)	27.05	15.82	55.15	114.50	62.67
3	Haymaker oats	33.72	14.65	56.90	102.50	56.94
4	Haymaker oats (30) 40-10 peas (100)	32.28	16.72	45.37	131.50	58.94
5	Haymaker oats (30) Horizon pea (100)	29.39	16.37	46.84	132.50	62.54
6	Haymaker oats (50) 40-10 peas (50)	29.72	16.61	50.72	121.50	61.10
7	Haymaker oats (50) Horizon pea (50)	30.89	16.16	50.90	118.50	59.81
8	Horizon pea	36.98	14.69	47.09	119.00	54.84
9	Maverick barley	24.86	12.92	47.19	138.50	66.07
10	Maverick Barley (30) 40-10 peas (100)	27.84	15.62	45.67	137.00	63.49
11	Maverick Barley (30) Horizon pea (100)	22.97	14.13	44.27	149.00	68.51
12	Maverick Barley (50) 40-10 peas (50)	29.07	13.92	52.86	117.00	62.29
13	Maverick Barley (50) horizon peas (50)	22.49	14.62	45.40	147.00	68.47
P-value		0.005	0.352	0.023	0.057	0.012
CV %		9.28	9.67	7.34	10.51	4.78
Mean		29.10	15.20	49.67	125.69	61.96
LSD		5.83	3.18	7.88	28.55	6.39

*DM=Dry Matter Basis

**Swift Current feed samples were submitted to lab at 8-10% moisture

Note: if P-value is lesser than 0.05, the treatments will be considered significantly different.

CV, coefficient of variation; LSD, least significant difference at P =0.05

Data were analyzed for each location

Table 11. Forage Quality in Yorkton, SK in summer 2015

#	Treatment	Acid Detergent Fibre (% DM*)	Crude Protein (% DM)	Neutral Detergent Fibre (% DM)	Relative Feed Value (DM)*	Total Digestible Nutrients (% As Fed)**
1	Baler oats	32.08	6.21	54.05	110.50	56.41
2	Cowboy barley (check)	28.95	6.44	48.78	127.00	60.69
3	Haymaker oats	32.49	6.37	50.29	118.00	56.42
4	Haymaker oats (30) 40-10 peas (100)	37.08	13.71	47.07	120.00	52.57
5	Haymaker oats (30) Horizon pea (100)	37.58	9.58	53.09	104.50	51.75
6	Haymaker oats (50) 40-10 peas (50)	34.66	10.65	47.85	120.50	51.56
7	Haymaker oats (50) Horizon pea (50)	37.60	7.53	56.86	98.50	51.64
8	Horizon pea	39.45	14.52	45.93	121.00	50.49
9	Maverick barley	30.67	6.97	50.41	120.50	58.98
10	Maverick Barley (30) 40-10 peas (100)	39.42	13.06	49.72	109.00	50.43
11	Maverick Barley (30) Horizon pea (100)	34.55	13.98	45.01	129.00	55.35
12	Maverick Barley (50) 40-10 peas (50)	34.82	12.80	43.60	132.50	54.65
13	Maverick Barley (50) horizon peas (50)	32.93	9.73	45.65	129.00	56.98
P-value		0.103	0.007	0.224	0.565	0.144
CV %		9.34	21.62	8.95	12.83	6.38
Mean		34.79	10.12	49.10	118.46	54.45
LSD		7.02	4.72	9.50	32.85	7.50

*DM=Dry Matter Basis

**Yorkton feed samples were submitted to lab at 8-10% moisture

Note: if P-value lesser than 0.05, the treatments will be considered significantly different.

CV, coefficient of variation; LSD, least significant difference at P =0.05

Data were analyzed for each location

Appendix C – Plot Diagrams

Melfort Site Plot Diagram

ADOPT - Forage Pea and Cereal Mix														
Ice Cream Seeder - double														
Plot	TRT 6	TRT 11	TRT 12	TRT 2	TRT 8	TRT 1	TRT 5	TRT 9	TRT 7	TRT 10	TRT 4	TRT 13	TRT 3	Border
	40	41	42	43	44	45	46	47	48	49	50	51	52	
Border	TRT 4	TRT 10	TRT 13	TRT 9	TRT 3	TRT 12	TRT 6	TRT 1	TRT 11	TRT 8	TRT 7	TRT 5	TRT 2	Border
	27	28	29	30	31	32	33	34	35	36	37	38	39	
Border	TRT 5	TRT 7	TRT 11	TRT 13	TRT 3	TRT 8	TRT 10	TRT 4	TRT 12	TRT 2	TRT 9	TRT 6	TRT 1	Border
	14	15	16	17	18	19	20	21	22	23	24	25	26	
Border	TRT 1	TRT 2	TRT 3	TRT 4	TRT 5	TRT 6	TRT 7	TRT 8	TRT 9	TRT 10	TRT 11	TRT 12	TRT 13	Border
	1	2	3	4	5	6	7	8	9	10	11	12	13	
Treatment List														
1. CDC Horizon Forage Pea	6. Haymaker @ 30% seed rate + Horizon @ 100% seed rate	11. Haymaker @ 50% seed rate + 40-10 @ 50% seed rate												
2. Maverick Barley	7. Haymaker @ 50% seed rate + Horizon @ 50% seed rate	12. Maverick @ 30% seed rate + 40-10 @ 100% seed rate												
3. Cowboy Barley	8. Maverick @ 30% seed rate + Horizons @ 100% seed rate	13. Maverick @ 50% seed rate + 40 - 10 @ 50% seed rate												
4. Haymaker Oats	9. Maverick @ 50% seed rate + Horizon @ 50% seed rate													
5. Baler Oats	10. Haymaker @ 30% seed rate + 40-10 @ 100% seed rate													

Swift Current Site Plot Diagram

Seeded plot size= 7' x 30' trimmed back to 18'
 Plot Size= 7' W x 18' L

Rep 1				Rep 2				Rep 3				Rep 4			
Rep	Plot	Trt #	Seed Rate Crop plants / ft ²	Rep	Plot	Trt #	Rate Crop lb/ac	Rep	Plot	Trt #	Rate Crop lb/ac	Rep	Plot	Trt #	Rate Crop lb/ac
1	1	5	Baler Oats 25	2	1	8	Mav. Barley & Horizon peas 7.5 & 8	3	1	10	Hmker Oats & 40-10 peas 7.5 & 8	4	1	12	Mav. Barley & 40-10 peas 7.5 & 8
1	2	13	Mav. Barley & 40-10 peas 12.5 & 4	2	2	2	Maverick Barley 25	3	2	7	Hmker Oats & Horizon peas 12.5 & 4	4	2	3	Cow boy Barley 25
1	3	1	CDC Horizon forage peas 8	2	3	4	Haymaker Oats 25	3	3	13	Mav. Barley & 40-10 peas 12.5 & 4	4	3	5	Baler Oats 25
1	4	12	Mav. Barley & 40-10 peas 7.5 & 8	2	4	11	Hmker Oats & 40-10 peas 12.5 & 4	3	4	3	Cow boy Barley 25	4	4	8	Mav. Barley & Horizon peas 7.5 & 8
1	5	9	Mav. Barley & Horizon peas 12.5 & 4	2	5	10	Hmker Oats & 40-10 peas 7.5 & 8	3	5	9	Mav. Barley & Horizon peas 12.5 & 4	4	5	2	Maverick Barley 25
1	6	8	Mav. Barley & Horizon peas 7.5 & 8	2	6	7	Hmker Oats & Horizon peas 12.5 & 4	3	6	6	Hmker Oats & Horizon peas 7.5 & 8	4	6	1	CDC Horizon forage peas 8
1	7	3	Cow boy Barley 25	2	7	13	Mav. Barley & 40-10 peas 12.5 & 4	3	7	5	Baler Oats 25	4	7	7	Hmker Oats & Horizon peas 12.5 & 4
1	8	6	Hmker Oats & Horizon peas 7.5 & 8	2	8	1	CDC Horizon forage peas 8	3	8	12	Mav. Barley & 40-10 peas 7.5 & 8	4	8	4	Haymaker Oats 25
1	9	4	Haymaker Oats 25	2	9	6	Hmker Oats & Horizon peas 7.5 & 8	3	9	2	Maverick Barley 25	4	9	11	Hmker Oats & 40-10 peas 12.5 & 4
1	10	11	Hmker Oats & 40-10 peas 12.5 & 4	2	10	12	Mav. Barley & 40-10 peas 7.5 & 8	3	10	11	Hmker Oats & 40-10 peas 12.5 & 4	4	10	10	Hmker Oats & 40-10 peas 7.5 & 8
1	11	10	Hmker Oats & 40-10 peas 7.5 & 8	2	11	9	Mav. Barley & Horizon peas 12.5 & 4	3	11	8	Mav. Barley & Horizon peas 7.5 & 8	4	11	13	Mav. Barley & 40-10 peas 12.5 & 4
1	12	7	Hmker Oats & Horizon peas 12.5 & 4	2	12	5	Baler Oats 25	3	12	1	CDC Horizon forage peas 8	4	12	6	Hmker Oats & Horizon peas 7.5 & 8
1	13	2	Maverick Barley 25	2	13	3	Cow boy Barley 25	3	13	4	Haymaker Oats 25	4	13	9	Mav. Barley & Horizon peas 12.5 & 4

Scott Site Plot Diagram

PLOT	401	402	403	404	405	406	407	408	409	410	411	412	413
TRT	13	11	6	9	5	4	10	1	2	3	8	12	7
PLOT	301	302	303	304	305	306	307	308	309	310	311	312	313
TRT	11	4	3	2	7	6	12	13	5	10	1	8	9
PLOT	201	202	203	204	205	206	207	208	209	210	211	212	213
TRT	2	6	1	12	3	10	9	5	13	4	7	11	8
PLOT	101	102	103	104	105	106	107	108	109	110	111	112	113
TRT	1	2	3	4	5	6	7	8	9	10	11	12	13

Yorkton Site Plot Diagram

Trial size		Alley	total			
length	348	348				
width	70	100				
acres	0.559229	0.798898	1.358127			
17. Cereal pea mixture (RCBD)						
Rep 1	Plot	ft		Rep 3	Plot	
	blank space	12			blank space	
	1	101	24		8	301
	2	102	36		12	302
	3	103	48		1	303
	4	104	60		3	304
	5	105	72		11	305
	6	106	84		13	306
	7	107	96		9	307
	8	108	108		6	308
	9	109	120		5	309
	10	110	132		2	310
	11	111	144		7	311
	12	112	156		4	312
	13	113	168		10	313
	blank space	180			blank space	
Rep 2	Plot	ft		Rep 4	Plot	
	10	201	192		3	401
	3	202	204		8	402
	7	203	216		9	403
	2	204	228		2	404
	5	205	240		13	405
	8	206	252		4	406
	1	207	264		7	407
	12	208	276		12	408
	6	209	288		11	409
	4	210	300		5	410
	9	211	312	12	10	411
	13	212	324	24	1	412
	11	213	336	36	6	413
	blank space	348	48		blank space	

Please note, this was a one year demonstration project only. The results, although useful in illustrating the difference in production of pea/cereal mixtures, may only reflect the growing conditions in 2015. Multiple years of testing is needed to verify if the results obtained in this demonstration are consistent over the long-term.