WADO

Westman Agricultural Diversification Organization

2009 Annual Report

Funded by: Canada Growing Forward Manitoba

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2009 WADO Partners

(Alphabetical Order)

Industry Partners:

Agriculture and Agri-Food Canada
Calendula Oil Ltd.
Canada Manitoba Crop Diversification Centre
Canadian Wheat Board
Manitoba Agriculture Food and Rural Initiatives
Local GO Team Offices
Manitoba Corn Growers Association
Manitoba Crop Variety Evaluation Team
Manitoba Pulse Growers Association
National Sunflower Association
Ontario Hemp Alliance
Parkland Crop Diversification Foundation
Parkland Industrial Hemp Growers
Pollock Farms, Brandon MB
Prairies East Sustainable Agriculture Initiative
Saskatchewan Ministry of Agriculture
Seed Manitoba
Technology Crops International
University of Manitoba
University of Saskatchewan (CDC)
Western Feed Grains Development Cooperative

Farmer Co-operators:

Armstrong Seeds	-- Boissevain
Barkers Agri-Centre	– Melita
Ben Martens	-- Boissevain
Boissevain Select Seeds	– Boissevain
Chalmers Farm	– Carroll
Elliott Bros.	– Reston
Ellis Seeds	– Wawanesa
Greig Farms	– Melita
Kendall Heise	– Crandall
Kevin Beernaert	-- Hartney
Scott & Ryan Tilbury	– Melita
Soutar Farms	– Hamiota
Wayne White	– Melita

Introduction

The Westman Agricultural Diversification Organization Inc. (WADO) manages a number of value-added and diversified research and demonstration projects that are summarized in this report. WADO operates in the Southwest Region of Manitoba and works in conjunction whenever possible with the other diversification centres in Roblin (PCDF), Arborg (PESAI) and the Fed/Prov CMCDC Centres based in Carberry, Portage and Winkler. WADO owes its success to the excellent cooperation and participation we receive from the WADO Board of Directors, cooperating land owners, local producers, industry partners and cooperating research institutes. WADO acts as a facilitator and sponsor/banker for many Ag Extension events held across the province in conjunction with other MAFRI staff and Industry Personnel. This is all part of WADO's goal of helping farmers do better.

WADO receives the majority of its operating funds from the Agricultural Sustainability Initiative (ASI). Smaller amounts of additional funding come from the MCVET committee and other Industry Partners for the contract work that WADO is able to provide to these organizations.

WADO Staff

Scott Day P.Ag. (picture 1st left), the Diversification Specialist with MAFRI is responsible for all activities associated with WADO such as project development, extention, and communications.

Scott Chalmers P.Ag. (picture 2st on left), the Diversification Technician with MAFRI for Southwest Manitoba. Scott typically is responsible for summer staff coordination, plot management, data collection and analysis.

WADO had excellent Summer Staff for 2009, they were an important reason we were able to successfully handle almost 2000 plots throughout the SW region. A full salute goes out to the summer staff: Andrea Bertholet (far right) from Grand Clariere, & Tori Elliott (2nd from right) from Reston.

Honorable mention goes to Alexey Dugin, from Volgograd, Russia, who also assisted WADO in the spring season and enjoyed his stay in Canada. Thanks for all your help Alexey! (picture, right)

Got An Idea?

The Westman Agricultural Diversification Organization continually looks for project ideas, value-added ideas, and producer production concerns. If you have any ideas, please forward them to:

Westman Agricultural Diversification Organization (WADO)
c/o Scott Day MAFRI
Box 519
Melita, MB
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scott.chalmers@gov.mb.ca

WADO Directors

WADO utilizes a board of directors that assists in communications, activities and project development. The directors are from all across southwest Manitoba and they have a direct connection to farming and agriculture. The directors listed below are those that participated with WADO operations for 2009 -2010.

Gary Barker	Melita - Chairman	John Finnie	Kenton
Terry Wilkinson	Melita	Allan McKenzie	Nesbitt
Kelly Vandoorne	Deloraine	Bob McNabb	Minnedosa
Kevin Beernaert	Hartney	Patrick Johnson	Killarney
Kevin Routledge	Hamiota		

There are also 6 MAFRI staff members located in Southwest Manitoba who are part of the 09-10 WADO board: Elmer Kaskiw – Shoal Lake, Lionel Kaskiw – Souris, Murray Frank – Brandon, Kristen Phillips – Virden, as well as Scott Day & Scott Chalmers – Melita

2009 Weather Report and Data – Melita Area

Weather for the Melita Region in the spring of 2009 was rather interesting. It was unusual to experience both a flood warning and a drought risk at the same time. Due to the heavy but late snow melt in the central plains region of North Dakota coupled with sudden warm May temperatures, the Souris River swelled to near 1999 flood levels peaking on May 4 in Melita. Thousands of acres of farm land were flooded at that time however much of that was eventually seeded. Seeding

conditions were preferable with ample soil moisture coupled with light rains in May. June, July, & August experienced lower than normal rainfalls, but coupled with cooler than normal average monthly temperatures. By the start of September crops like corn, sunflower and soybean were not mature and were still highly susceptible to fall frost. However, September proved to be an exceptional month and was much warmer than normal. The first fall frost was much later than normal. Most, if not all, crops were able to mature in time before the first fall frost on Oct 6 reaching -1.4°C then Oct 8 at -3.3°C. Since May 15 until the first fall frost, the Melita region received approximately 2452 CHU (Corn Heat Units) or 94% of normal values for the entire growing season. However, on Sept 1, Melita had only received 85% of the normal CHU values.

Season Summary May 1 - September 1, 2009			
	Actual	Normal[1]	% of Normal
Number of Days	124		
Growing Degree Days	1206	1436	84
Corn Heat Units	2001	2338	86
Total Precipitation	173	303	57

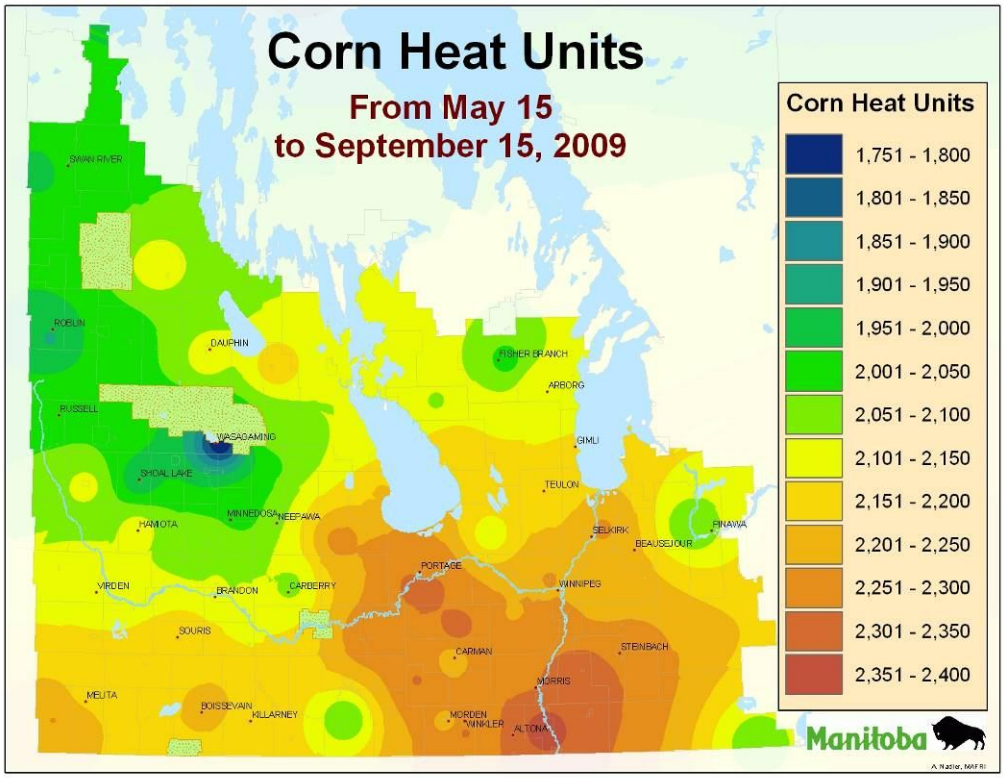
2009 Season Report by Month							
Month	May	June	July	Aug	Sept	Oct	Total
Precip (mm)	15	49	65	44	54	38	265
Norm. Precip[1]	55	77	68	52	47	32	330
Temp Ave°C	10	15	17	17	17	4	
Norm Temp[1]	12	17	19	19	13	5	
CHU	307	467	603	599	574	44	2594
GDD	157	290	368	376	358	26	1576

[1]Normals are based on 30-yr averages
Source: Manitoba Ag-Weather Program, MAFRI

To Calculate Growing degree days (GDD), first determine the mean temperature for the day. This is usually done by taking the maximum and minimum temperatures for the day, adding them together and dividing by 2. The base temperature (0C for cereals, 5C for both alfalfa and canola) is then subtracted from the mean temperature to give a daily GDD. If the daily GDD calculates to a negative number it is made equal to zero. Each daily GDD is then added up (accumulated) over the growing season.

Corn or Crop heat units (CHU) are based on a similar principle to growing degree days. CHUs are calculated on a daily basis, using the maximum and minimum temperatures; however, the equation that is used is quite different. The CHU model uses separate calculations for maximum and minimum temperatures. The maximum or daytime relationship uses 10°C as the base temperature and 30°C as the ceiling, because warm-season crops do not develop at all when daytime temperatures fall below 10°C, and develop fastest at about 30°C. The minimum or nighttime relationship uses 4.4°C as the base temperature and does not

specify an optimum temperature, because nighttime minimum temperatures very seldom exceed 25°C in Canada. The nighttime relationship is considered a linear relationship, while the daytime relationship is considered non-linear because crop development peaks at 30°C and begins to decline at higher temperatures. CHU's is a more accurate crop prediction tool for crops like corn and beans that require heat for proper growth.



WADO Tours and Special Events

Ag Days was the largest event WADO was involved in for 2009. WADO attended the show with the rest of Manitoba's Diversification Centres featuring a booth showcasing new farming opportunities and possibilities in Innovation Corner. Ag Days attracted 36,500 people in 2009.

Picture: Ag Days, Manitoba Diversification Centres Booth

Other tradeshows WADO participated in were: the Farm Focus Event in Boissevain, Crop Meetings in: Reston, Forrest, Binscarth & Neepawa, and Deloraine's & Bottineau's Ag Shows.

WADO also presented and exhibited at the MANDAK Zero-till Workshop and Eastern Prairies Organic Tradeshow, both held in Brandon.

WADO offered several spring and summer tours during the growing season of 2009. Spring winter cereal schools were held at Crandall (picture above), and Boissevain at the MCVET fall cereal plots. Summer tours included the major on site tour in Melita (picture right) on July 21nd, a tour in Hamiota on August 12th, and a tour in Wawanesa on August 13th. All plots at each site were showcased with a wide range of content on old and new crops, varieties, and agronomy. Presentations were made by several industry partners at these tours as well.

WADO also organized the Melita Corn & Sunflower Tour (picture left) in cooperation with the National Sunflower Association and the Manitoba Corn Growers Association on Oct.19th.

Understanding Plot Statistics

There are two types of plots at WADO. The first type is replicated research plots and the other is demonstration plots. Demonstration plots are not used to determine statistical differences between data, such as varieties; they are typically used only for show and tell and observation.

Replicated plots are scientific experiments in which various treatments (ex. varieties, rates, seed treatments, etc.) are subject to a replicated assessment to determine if there are differences or similarities between them. Many designs of replicated trials include randomized complete block designs (most common), split plot design, split-split plot design and lattice designs. Since these types of trials are replicated, statistical differences can be derived from the data using statistical analysis tools.

The analysis of variance (ANOVA) is the most common of these calculations. From those calculations, we can determine several important numbers such as coefficient of variation (CV), least significant difference (LSD) and R-squared. CV indicates how well we performed the trial in the field which is a value of trial variation; variability of the treatment average as a whole of the trial. Typically CV's greater than 15% are an indication of poor data in which a trial is usually rejected from further use. LSD is a measure of allowable significant differences between any two treatments.

If “means” (averages) do not fall within this minimal difference, they are considered not significantly different from each other. R-squared is a value of how “sound” the data really is. It is determined by a value that approaches the value of 1, which represents perfect data in a straight line. In most plot research, R-squared varies between 0.80 and 0.99 indicating good data. Ex: Consider two treatments; 1 and 2. The first treatment has a mean yield of 24 bu/ac. The second treatment has a yield of 39 bu/ac. The LSD was found to be 8 bu/ac. The difference between the treatments is 15. Since the difference was greater than the LSD value 8, these treatments are significantly different from each other. In other words, you can expect the second treatment (variety or fertilizer amount, etc.) to consistently produce yields higher than treatment one in field conditions.

Data in all replicated trials at WADO has been analyzed by statistical software from either Agrobase version 16.2.1 software, or Analyze-it version 2.03 software. Coefficient of variation and least significant difference at the 0.05 level of significance was used to determine trial variation and mean differences respectively. At this level of significance, there is less than 5% chance that this data is a fluke when considered significant. For differences among treatments to be significant, the p-value must be less than 0.05. A p-value of 0.001 would be considered highly significant.

MCVET Variety Evaluation Trials

The Westman Agricultural Diversification Organization is one of many certified sponsored sites that are part of the Manitoba Crop Variety Evaluation Team (MCVET)/ MCVET facilitates variety evaluations of many different crop types.

The purpose of the MCVET variety evaluation trials is to grow both old and new varieties side by side in a replicated manner in order to compare and contrast various variety characteristics such as yield, maturity, protein content, disease tolerance, and many others. From each MCVET site across the province, yearly data is created, combined, and summarized in the ‘Seed Manitoba 2010” guide. Hard copies can be found at most MAFRI and Ag Industry Offices. A digital version is available online at www.seedmb.ca

Winter Cereals

Site Information

Boissevain
Cooperator: Wes Froese — Location: SW 27-3-20 W1
Previous Crop: Canola — Soil Texture: clay loam

Crandall
Cooperator: Kendall Heise — Location: NE/SE 35-13-25 W1
Previous Crop: Canola — Soil Texture: clay loam

Reston
Cooperator: Elliott Bros. — Location: NW 8-7-27 W1
Previous Crop: Oats — Soil Texture: clay loam

Soil Tests:

Depth	0-6"				6-24"		
Nutrient	N	P	K	S	N	S	
Site	lbs/ac	olsen ppm	ppm	lbs/ac	lbs/ac	lbs/ac	pH
Boissevain	20	16	413	40	42	84	7.8
Crandall	19	12	354	20	33	54	6.7
Reston	22	7	268	120+	27	360+	7.6

Objectives

1. To evaluate yield and demonstrate different varieties of winter wheat and fall rye for milling and food processing for local farmers.

2. Expand the current industry for value-added processing opportunities.

3. Grow winter cereal trials in several locations across Southwest Manitoba to assess site yield potentials.

Methods

This trial consisted of 9 varieties of winter wheat and 4 varieties (plus a fill treatment) of fall rye in plots that were 1.44 m wide by 9 m long. Varieties were organized in a randomized complete block design. Variety plots were replicated three times. Plots were direct seeded September 25 at a depth of ¾". Total fertilizer applied was 50 lbs. nitrogen, and 30 lbs phosphorus in the form of granular 11-52-0 and liquid 28-0-0 as well as granular 46-0-0 (50 lbs N as spring broadcast, April 14). Plots were maintained for weeds with a broadleaf and grassy herbicide product at recommended timing and rates. Plots were harvested at full maturity in mid August. Grain yield was recorded by the HarvestMaster GrainGauge for total plot weight, moisture and test weight.

Results (by site)

Fall Rye

There were significant yield differences at Boissevain and Reston Sites. Co-efficient of variation among all sites was very low, indicating that the accuracy and precision quality of the data was very good. At all sites AC Hazlet was the top performing variety, ranging from 104% to 109% that of the check Prima, but not significantly different in all sites. Lowest yielding was AC Rifle in most sites, which was significantly lower than AC Hazlet at all sites.

Sites

Reston

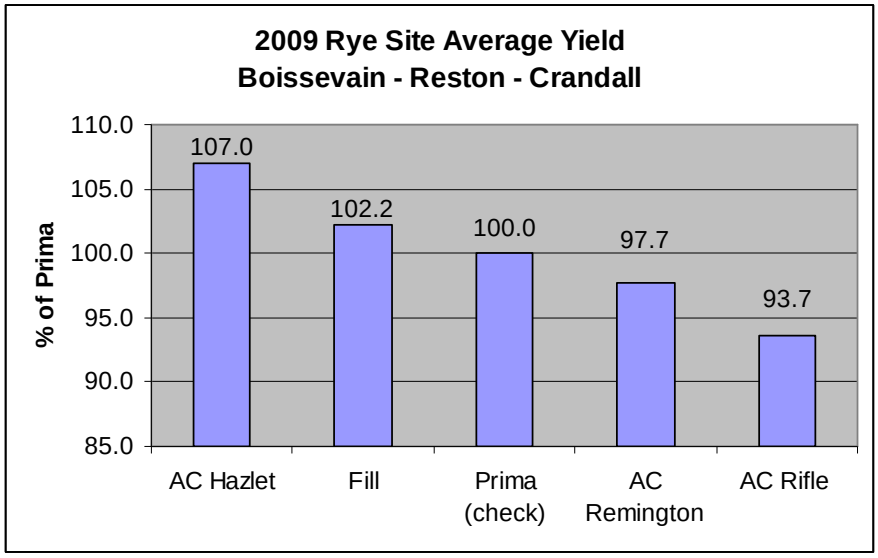
	Yield		
Variety	kg/ha	bu/ac	% of Check
AC Hazlet	6069.08	97	104.0
Prima (check)	5852.3	93	100.0
Fill	5737.23	91	98.0
AC Remington	5723.01	91	98.0
AC Rifle	5441.15	86	93.0
CV%	6.8		
LSD (p<0.05)		NS	
Prob. Entry	0.45		
GRAND MEAN	5764.6	91.7	98.6
R-square	0.49		

Boissevain

	Yield		
Variety	kgha	bu/ac	% of Check
AC Hazlet	5624.5	89	109.0
Fill	5364.9	85	104.1
AC Remington	5234.4	83	101.0
Prima (check)	5162.0	82	100.0
AC Rifle	4753.5	75	92.0
CV%	5.4		
LSD (p<0.05)	527.3	8.4	10
Prob. Entry	0.048		
GRAND MEAN	5227.9	83.1	101.4
R-square	0.69		

Crandall	Yield		
Variety	kgha	bu/ac	% of Check
AC Hazlet	7060.6	112	108.0
Fill	6842.5	109	104.6
Prima (check)	6520.8	104	100.0
AC Rifle	6251.9	100	96.0
AC Remington	6136.5	98	94.0
CV%	3.9		
LSD (p<0.05)	481.8	7.7	10
Prob. Entry	0.01		
GRAND MEAN	6562.4	104.4	100.4
R-square	0.91		

To better understand the overall trend, yields were combined and averaged as a 2009 site yield across all three sites. Generally, as noted earlier, AC Rifle was significantly lower yielding than the other varieties that tended not to differentiate themselves. These results are consistent in ranking of variety performance with 18 years of supportive site data from across the province found in the Manitoba Seed Guide.



Winter Wheat

Yield means were significant at all three sites. Co-efficient of variation among all sites was very low indicating that the accuracy and precision quality of the data was very good. In Boissevain, Accipiter was highest yielding, but not significantly different from CDC Falcon. CDC Falcon ranked the highest in protein content among all wheats. In Reston, Peregrine was the highest yielding wheat, but not significantly different from CDC Falcon, and despite the low site protein values, CDC Falcon still had the highest protein content. In Crandall, Peregrine, followed

by DH99W181*45, Accipiter, CDC Buteo, and CDC Ptarmigan were highest yielding and were significantly different from the lowest yielding variety, CDC Falcon. Crandall did not have a protein analysis.

Site

Boissevain

	Yield			
Variety	kg/ha	bu/ac	% of Check	Protein
Accipiter	5639.8	84.0	110.8	11.4
CDC Ptarmigan	5538.4	82.5	108.8	11.2
Peregrine	5488.9	81.8	107.8	12.0
CDC Raptor	5460.7	81.3	107.2	12.1
CDC Falcon (CHECK)	5091.9	75.8	100.0	12.7
McClintock	5069.3	75.5	99.6	12.5
AC Radiant	4965.5	74.0	97.5	12.3
DH99W18I*45	4817.8	71.8	94.6	12.4
CDC Buteo	4785.0	71.3	94.0	11.8
CV%		5.5		
LSD (p<0.05)	496.6	7.4	9.8	
Prob. Entry		0.01		
GRAND MEAN	5206.4	77.5	102.2	
R-squared		0.74		

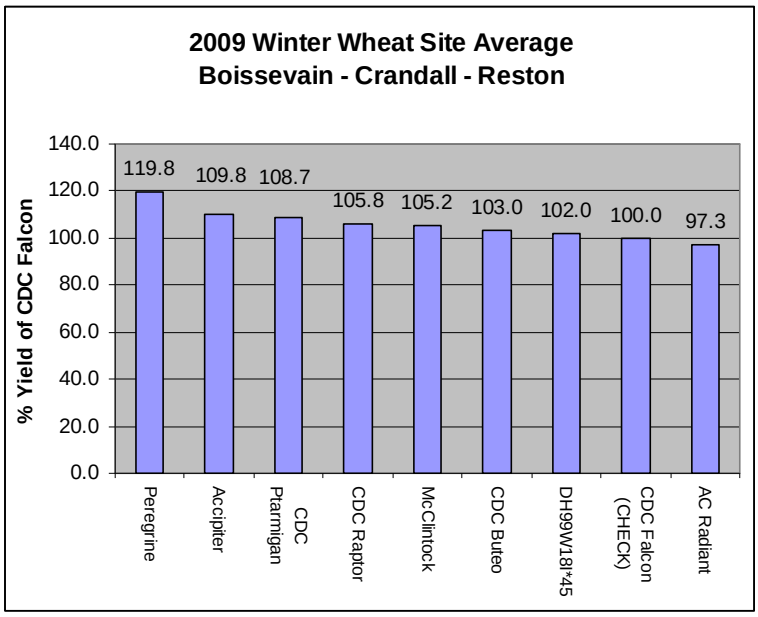
Reston

	Yield			
Variety	kg/ha	bu/ac	% of Check	Protein
Peregrine	7382.3	110.0	122.4	7.9
CDC Raptor	6596.6	98.3	109.3	7.9
McClintock	6529.7	97.3	108.2	8.8
CDC Ptarmigan	6504.9	96.9	107.8	7.6
Accipiter	6112.4	91.0	101.3	8.8
CDC Buteo	6108.8	91.0	101.2	9.1
CDC Falcon (CHECK)	6033.6	89.9	100.0	9.6
AC Radiant	5646.5	84.1	93.6	8.9
DH99W18I*45	5338.0	79.5	88.5	9.3
CV%		13.3		
LSD (p<0.05)	1443.0	21.5	28.3	
Prob. Entry		0.22		
GRAND MEAN	6250.3	93.1	122.8	
R-squared		0.52		

Crandall

	Yield			
Variety	kg/ha	bu/ac	% of Check	Protein
Peregrine	5993.6	89.3	129.4	N/A
DH99W18I*45	5699.0	84.9	123.0	
Accipiter	5441.2	81.0	117.5	
CDC Buteo	5271.5	78.5	113.8	
CDC Ptarmigan	5077.1	75.6	109.6	
McClintock	4988.1	74.3	107.7	
CDC Raptor	4673.3	69.6	100.9	
AC Radiant	4663.4	69.5	100.7	
CDC Falcon (CHECK)	4631.9	69.0	100.0	
CV%		5.3		
LSD (p<0.05)	485.9	7.2	9.5	
Prob. Entry		0.0003		
GRAND MEAN	5159.9	76.9	101.3	
R-squared		0.95		

CDC Peregrine, Accipiter, and CDC Ptarmigan are all typically high yielding wheats with low protein bred to support the feedstock needs of the ethanol industry. They are soft white winter wheats in the Canada Western General Purpose class. DH99W181*45 is a variety being tested or proposed for registration.



Spring Wheat

Cooperators

Westman Agricultural Diversification Organization
Seed Manitoba

Site Information

Cooperator: Wayne White Location: NE 36-3-27
Previous Crop: Spring Wheat Soil Texture: Loamy

Soil Test

Depth	N lbs/ac	P ppm (olsen)	K ppm	S lbs/ac	pH
0-6"	10	19	302	14	7.8
6-24"	21			36	
0-24"	31			50	

Objective

To evaluate and demonstrate different varieties of Canada Western Red Spring, Canada Prairie Spring Red, Canada Western Extra Strong, and Canada Western Hard White wheats to support the high quality food demand, feed wheat, ethanol and other industries for yield potential and protein content. This variety data is used to support the province wide data set published in Manitoba's Seed Guide for 2010.

Methods

The trial consisted of 18 varieties in plots that were 1.44 m wide x 8.5 m long. Varieties were organized in a 3x6 alpha lattice design. Varieties were replicated three times. Plots were direct seeded May 14 at a depth of 5/8". Fertilizer was applied at 80 lbs/ac nitrogen in the form of liquid 28-0-0, and 30 lbs/ac phosphorous in the form of granular 11-52-0. Plots were maintained weed free using herbicides Everest and 2,4-D Ester 500 at rates of 17.4g/ac and 0.45 L/ac, respectively, applied July 15 and were desiccated with glyphosate at a rate of 1 L/ac on September 1. Plots were harvested at full maturity on September 4. Protein samples were analyzed from composite samples of each variety.

Results

There were highly significant differences among varieties and overall yields were exceptional. The two varieties Sadash and AC Andrew were significantly higher yielding than all other varieties. These varieties belong to the Canada Western Soft White class of wheats and are typically high yielding with low protein and high starch levels.

In contrast the lowest yielding varieties were Glencross VB, WR859CL, CDN Bison, Fieldstar VB, Kane, AC Barrie, 5603HR, and CDC Abound. Among

them AC Barrie sustained one of the highest protein levels in the trial at 14%. However, the variety 5602 HR yielded significantly more than AC Barrie yet had the same protein content as AC Barrie.

	Mean Yield			
Variety	kg/ha	bu/ac	% of Check	% Protein
Sadash	5749.2	89	128.7	10.1
AC Andrew	5638.0	87	126.2	10.2
Minnedosa	5261.0	81	117.7	11.6
5702PR	5095.5	79	114.0	10.9
Unity VB	5023.9	78	112.4	12.9
5602HR	5016.6	77	112.3	14.0
Stettler	4972.0	77	111.3	13.3
Waskada	4891.1	76	109.5	13.4
Glenn	4876.6	75	109.1	13.8
Goodeve VB	4872.5	75	109.0	13.7
Glencross VB	4852.1	75	108.6	13.2
WR859CL	4786.7	74	107.1	13.4
CDN Bison	4661.8	72	104.3	12.8
Fieldstar VB	4655.2	72	104.2	13.8
Kane	4637.5	72	103.8	13.9
AC Barrie	4468.1	69	100.0	14.0
5603HR	4437.9	69	99.3	13.5
CDC Abound	4376.9	68	98.0	13.3
CV%		5.88		
LSD (p<0.05)	492.5	7	11.0	
Prob. Entry		0.0006		
GRAND MEAN	4904.0	73	109.8	
R-squared		0.93		

Important Comments

CDC Bison and 5603HR are currently registered wheats, but availability is limited until 2011. The varieties CDC Sadash and Minnedosa are currently distributed by SeCan but a seed availability date is yet to be known.

Varieties noted as ‘VB’ are the first midge tolerant varieties now available. They contain the Sm1 gene for tolerance. To minimize resistance build-up, these varieties are seeded with a separate ‘refuge’ variety susceptible to midge. VB varieties are not completely midge tolerant and can still suffer damage during high infestations.

Syngenta’s WR859Cl is a non-genetically modified Clearfield tolerant wheat that has a ‘good’ resistance rating against Fusarium head blight. It will be available to growers in limited quantities in 2010 exclusively through James Richardson International (Western Producer Jan 7,2010 issue).

In December 2009, SeCan announced via their website that AC Unity VB has recently been added to the select variety list for Warburton’s Foods IP program.

Oats

Cooperators

Westman Agricultural Diversification Organization
Seed Manitoba

Site Information:

Cooperator: Wayne White Location: NE 36-3-27
Previous Crop: Spring Wheat Soil Texture: Loamy

Soil Test

Depth	N lbs/ac	P ppm (olsen)	K ppm	S lbs/ac	pH
0-6"	12	12	319	12	8.0
6-24"	30			42	
0-24"	42			54	

Background

To evaluate and demonstrate varieties of oats for yield and protein for milling, food processing and expand the current industry for value-added processing opportunities.

Methods

This trial consisted of 7 varieties of hulled oats in plots that were 1.44 m wide by 8.5 m long. Varieties were organized in a randomized complete block design and replicated three times. Plots were direct seeded May 21 at a depth of 5/8". Fertilizer was applied at 70 lbs/ac nitrogen in the form of liquid 28-0-0, and 30 lbs/ac phosphorous in the form of granular 11-52-0. Plots were maintained weed free using herbicides Buctril M at rates of 0.4 L/ac applied July 18 and Stampede and 2,4-D ester 500 applied July 18. Plots were desiccated with an application of Credit on August 18 at a rate of 1 L/ac. Plots were harvested at full maturity August September 15. Protein samples were analyzed from composite samples of each variety.

Results

Yields were exceptional in Melita. There were significant yield differences among varieties. Yield ranged from a minimum of 152 bu/ac to 196 bu/ac. The top yielding varieties were Summit and Triactor, however their protein contents as well as CDC Minstrel were relatively lower than most other varieties. This protein trend is similar to the overall provincial data.

	Mean Yield			
Variety	kg/ha	bu/ac	% of check	% Protein
Summit	7440	195.5	116	13.4
Triactor	7396	194.3	115	12.5
CDC ProFi	6687	175.7	104	14.4
Leggett	6436	169.1	100	14.2
CDC Minstrel	6347	166.8	99	12.8
Stainless	5949	156.3	92	14.4
Souris	5773	151.7	90	14.0
CV%		5.6		
LSD (p<0.05)	656	17.2	10.2	
Prob. Entry		0.006		
GRAND MEAN	6575	172.8	102.2	
R-Square		0.88		

Comments

Seed availability for the variety 'Summit' will be available in 2012 and is distributed by FP Genetics.

The variety Stainless exhibits a light grey hull which is a by-product of breeding; however, its real significance is the 'very good' resistance rating against oat stem rust compared to its ancestors AC Assiniboia, and HiFi.

All varieties registered in Manitoba are acceptable for milling; however, the racehorse industry prefers to use white-hulled varieties

Barley

Cooperators
Westman Agricultural Diversification Organization
Seed Manitoba

Site Information
Cooperator: Wayne White Location: NE 36-3-27
Previous Crop: Spring Wheat Soil Texture: Loamy

Soil Test

Depth	N lbs/ac	P ppm (olsen)	K ppm	S lbs/ac	pH
0-6"	10	19	302	14	7.8
6-24"	21			36	
0-24"	31			50	

Background

To evaluate varieties of barley for feed and malting processing and expand the current industry for value-added processing opportunities.

Methods

This trial consisted of 17 varieties in plots that were 1.44 m wide x 8.5 m long. Varieties were organized in a randomized complete block design. Variety plots were replicated three times. Plots were direct seeded May 14 at a depth of 5/8". Fertilizer was applied at 70 lbs/ac nitrogen in the form of liquid 28-0-0, and 30 lbs/ac phosphorous in the form of granular 11-52-0. Plots were maintained weed free using herbicides Puma Super and Buctril M at rates of 0.265 L/ac and 0.4 L/ac, respectively, applied July 15. Plots were desiccated with glyphosate at a rate of 1 L/ac on August 21. Plots were harvested at full maturity August 26.

Results

Mean yields were exceptional in Melita. There were significant differences among variety yields. Varieties in the following table are listed from highest yielding to lowest. Generally feed types (F) were higher yielding than malting/feed (MF) and Hulless types, however protein values remained similar.

		Mean Yield			
Market	Variety	kg/ha	bu/ac	% of Check	% Protein
MF	CDC Mayfair	7183.6	133	115.9	11.9
F	Champion	7026.1	130	113.4	11.0
F	CDC Austenson	6984.3	130	112.7	11.8
MF	CDC Reserve	6556.3	122	105.8	11.3
F	Chigwell	6300.9	117	101.7	11.2
F	Desperado	6282.3	117	101.4	11.6
F	CDC Mindon	6253.3	116	100.9	12.0
MF	AC Metcalfe	6196.0	115	100.0	12.0
MF	CDC Clyde	6186.2	115	99.8	11.5
MF	TR05910	6142.6	114	99.1	12.2
MF	CDC Meredith	6128.9	114	98.9	11.8
MF	CDC Kamsack	6086.2	113	98.2	12.2
MF	Merit 57	6084.7	113	98.2	12.0
MF	Bentley	5991.1	111	96.7	11.8
MF	Norman	5648.2	105	91.2	12.2
Hulless	CDC Lophy-I	5353.7	99	86.4	12.3
Hulless	CDC Carter	5275.9	98	85.2	11.7
	CV%		9.29		
	LSD (p<0.05)	960.6	18	15.5	
	Prob. Entry		0.02		
	GRAND MEAN	6216.5	115	100	
	R-squared		0.71		

Comments

Seed availability for varieties Merit 57 and Norman, will be in 2012. For varieties CDC Austenson, CDC Carter, and CDC Lophy-I, those date are unavailable at this time.

Durum

Cooperators

Westman Agricultural Diversification Organization
Seed Manitoba

Site Information

Cooperator: Wayne White Location: NE 36-3-27
Previous Crop: Spring Wheat Soil Texture: Loamy

Soil Test

Depth	N lbs/ac	P ppm (olsen)	K ppm	S lbs/ac	pH
0-6"	14	14	348	16	8.0
6-24"	36			42	
0-24"	50			58	

Background and Objectives

Durum wheat was in the spotlight for a little of 2007 and most of 2008, so there was a revival of the MCVET Durum wheat trials and they were brought back into the spotlight. However like all good things, high prices have ended for the 2009 harvest. Producer interest was re-established in the crop and a demand was created to have performance trials. Three new varieties that had been developed in Swift Current (AAFC) and Saskatoon (CDC) needed to be tested in Manitoba. From Swift Current were varieties Brigade and Eurostar and from the Crop Development Centre was CDC Verona.

Manitoba Durum production has been minimal as of late due to its higher susceptibility to Fusarium head blight (FHB) and leaf diseases linked to southern Manitoba's unique climate. FHB not only affects final yield potential by shriveling kernels, it also produces deoxynivalenol (DON) toxins. Durum is also easily downgraded because of other fungal diseases so this has limited its acreage in Manitoba as well.

Methods

This trial consisted of 5 varieties in plots that were 1.44 m wide x 8.5 m long. Varieties were organized in a randomized complete block design. Variety plots were replicated three times. Plots were direct seeded May 20 at a depth of 5/8". Fertilizer was applied at 70 lbs/ac nitrogen in the form of liquid 28-0-0 and 30 lbs/ac phosphorous in the form of granular 11-52-0. Plots were maintained weed free using herbicides Everest and 2,4-D Ester 600 (Attain B) were used at rates of 17 g/ac and 0.4 L/ac, respectively, applied July 158. Plots were harvested at full maturity September 15. A composite sample of each variety was analyzed for protein content.

Results

There were no significant yield differences among varieties. Site elevation was slightly variable and likely contributed to the elevated coefficient of variation and R-squared values.

	Mean Yield			
Variety	kg/ha	bu/ac	% of Check	% Protein
Eurostar	4470.4	66.6	106	13.2
Brigade	4429.4	66.0	105	12.7
DT787	4382.7	65.3	104	13.1
Strongfield	4231.5	63.0	100	14.0
CDC Verona	4170.1	62.1	99	13.5
CV%		11.67		
LSD (p<0.05)	NS	NS	NS	
Prob. Entry		0.93		
GRAND MEAN	4336.8	64.4	102	
R-squared		0.42		

Discussion

Durum is highly susceptible to FHB and if grown in Manitoba, strict production management practices should be exercised. These measures may include crop rotation cycles and field stubble selection, timely use of fungicides, seed treatments, and attention to weather patterns, humidity and temperature. Varieties used in this trial and others found in the Manitoba Seed Guide are rated as poor or very poorly resistant to FHB, therefore, these management practices are a must to follow. However, it goes without saying that these practices must also make economic sense.

Annual Forage Trials

Cooperators

Manitoba Forage Council
Seed Manitoba
Westman Agricultural Diversification Organization

Site Information

Cooperator: Wayne White Location: NE 36-3-27
Previous Crop: Spring Wheat Soil Texture: Loamy

Soil Test:

Depth	N lbs/ac	P ppm (olsen)	K ppm	S lbs/ac	pH
0-6"	11	10	419	14	8
6-24"	27			36	
0-24"	38			50	

Background

Annual forages provide a short term solution with maximum production potential for livestock without having to establish perennial forages more suited for long term feedstocks or that may be in short supply.

There are many annual crops and options available to producers provided they make their plans early in the growing season. When planting annuals early in the spring, producers can take advantage of spring moisture, cooler conditions, less evaporation and larger selection of crops which can be used.

Manitoba operates the Forage Cultivar Evaluation Program. This program has several testing sites including Arborg, Rosebank, Roblin, Hamiota, Minnedosa, Boissevain and Melita. The objective of the evaluation program is to provide information to Manitoba producers and industry partners in the performance of annual and perennial forage cultivars under regional Manitoba conditions. The program measures dry matter yields in annuals under a one-cut three production years system combined with feed tests for feed value quality. These results are available in this report (Melita) and in the Manitoba Seed Guide.

Crops types tested in Melita include barley, oats, triticale, foxtail and proso millet.

Methods

This trial consisted of 25 entries in plots that were 1.44 m wide x 8.5 m long. Each crop type was organized in a randomized complete block design. Variety plots were replicated four times. Plots were direct seeded May 21 (Barley and Oats) & 22nd (Triticale and Millets) at a depth of 5/8". Fertilizer was applied at 70 lbs/ac nitrogen in the form of liquid 28-0-0, and 30 lbs/ac phosphorous in the form of granular 11-52-0. Plots were maintained weed free using herbicides Puma Super (barley only) and Buctril M at rates of 0.265 L/ac and 0.4 L/ac, respectively, applied July 15. Triticale was kept weed free with an application of Achieve at a rate of 0.2 L/ac on July 18. Plots were harvested at early dough stage with a Swift Current plot forage harvester. Wet weights were taken at the plot sites, samples were dried to determine moisture content in order to determine total dry matter from original harvest weights. Samples varieties were combined into composite form and used to determine forage quality. Forage quality values reported are the Melita site composite values.

Results

There were significant differences in final dry matter yield in barley, oat, triticale, and foxtail millet plots (Table 1). There were no significant differences in foxtail millet plots.

Table 1. Mean Dry Matter (DM) yields for each crop type and their respective varieties. In Oats and Triticale trials also had a single AC Ranger barley check treatment to compare back to other barley varieties. * Feed Quality parameters based on a dry matter basis.

Crop	Variety	Mean DM Yield (lbs/ac)	RFV	Feed Quality Parameters* (%)					
				ADF	NDF	TDN	CP	Ca	P
Barley	CDC Cowboy	9615.2	99	35.7	57.7	60.3	8.7	0.34	0.22
	Binscarth	9450.6	98	35.9	57.6	60.2	7.8	0.26	0.16
	AC Ranger (Check)	9021.3	91	36.5	61.5	59.9	8.1	0.33	0.19
	Champion	8795.3	85	40.2	62.9	58.1	6.7	0.23	0.14
	Vivar	8790.2	112	33.9	52.1	61.2	7.3	0.35	0.19
	Xena	8533.2	83	39.8	65.2	58.3	6.7	0.25	0.16
	CDC Mindon	8440.6	93	36.0	60.8	60.2	6.7	0.26	0.17
	Stockford	8036.0	109	32.3	54.6	62.0	6.8	0.37	0.20
	CV%	8.1							
	Grand Mean	8835.3							
	LSD (p<0.05)	1179.2							
Oat	AC Jordon	6676.8	94	36.6	59.9	59.9	9.4	0.22	0.19
	Triple Crown	6341.0	83	41.7	62.9	57.4	5.8	0.30	0.14
	AC Ranger (Barley)	6337.2	78	44.3	64.7	56.0	5.5	0.33	0.10
	Pinnacle	6120.6	90	40.1	59.5	58.2	6.5	0.27	0.17
	Triactor	6105.4	96	36.6	58.6	59.9	7.7	0.24	0.18
	AC Assiniboia	5492.9	95	36.7	59.2	59.8	7.9	0.22	0.18
	AC Mustang	5488.9	83	41.8	63.4	57.3	5.2	0.27	0.17
	CV%	9.7							
	Grand Mean	6080.4							
	LSD (p<0.05)	982.0							
Triticale	AC Ranger (Barley)	9195.2	87	39.4	62.2	58.5	6.2	0.40	0.12
	TR-196	8820.7	98	38.6	56.1	58.9	7.1	0.21	0.17
	Bunker	8728.3	93	40.1	57.5	58.2	6.6	0.17	0.14
	Tyndal	7895.1	98	37.7	56.3	59.3	8.3	0.16	0.15
	CV%	7.4							
	Grand Mean	8659.8							
	LSD (p<0.05)	1152.4							
Foxtail Millet	Black Millet	6962.5	72	44.8	69.4	55.8	6.2	0.33	0.11
	Golden German	6689.1	87	36.6	64.4	59.9	9.7	0.38	0.22
	Siberian Red	6152.9	80	40.9	66.2	57.8	6.5	0.33	0.15
	CV%	10.8							
	Grand Mean	6601.5							
	LSD (p<0.05)	1385.6							
Proso Millet	Red Proso Cerise	8890.9	79	41.2	67.2	57.6	4.8	0.30	0.12
	Green Proso Crown	8697.6	91	33.5	64.4	61.4	6.9	0.25	0.17
	Yellow Proso AC Prairie Gold	7153.3	94	32.8	62.5	61.8	7.0	0.24	0.18
	CV%	11.9							
	Grand Mean	8247.2							
	LSD (p<0.05)	NS							

Acronyms: RFV – Relative Feed Value, ADF – Acid Detergent Fiber
NDF – Neutral Detergent Fiber, TDN – Total Digestible Nutrients,
CP – Crude Protein, Ca - Calcium, P – Phosphorous

Western Manitoba Soybean Adaptation Trial

Cooperators

Manitoba Pulse Growers Association
Seed Manitoba
Westman Agricultural Diversification Organization

Site Information

Melita:

Cooperator: Wayne White — Location: NE 36-3-27
Previous Crop: Spring Wheat — Soil Texture: Loamy

Soil Test

Depth	N lbs/ac	P ppm (olsen)	K ppm	S lbs/ac	pH
0-6"	12	14	429	18	8.2
6-24"	21			36	
0-24"	33			54	

Wawanesa:

Cooperator: Ellis Seeds — Location: NW 35-7-17
Previous Crop: Summer fallow — Soil Texture: Loamy Sand

Soil Test

Depth	N lbs/ac	P ppm (olsen)	K ppm	S lbs/ac	pH
0-6"	36	16	323	18	6.8
6-24"	156			54	
0-24"	192			72	

Background

Soybean production in parts of Manitoba and across the prairies has been limited to accumulated heat units and moisture needed to produce a good crop. Most soybean production is limited to areas near Morden and Winkler where heat units and moisture are abundant enough to finish a crop.

Recent research from Manitoba Agriculture, Food and Rural Initiatives has found that soybeans grown in areas where moisture becomes the limiting factor of production, the soybean plant shuts down growth and forces itself into early maturity, finishing bean development but lowering overall production potential (unpublished data).

The season of 2009 saw the first expansion of the soybean insurable acres into the more western part of the province. For more information about the areas of the province able to insure soybeans please visit the MASC website at: http://www.masc.mb.ca/

Objective

To evaluate and demonstrate varieties in the Southwest region of Manitoba.

Methods

Trials consisted of 12 varieties of glyphosate tolerant varieties arranged in a randomized complete block design. Varieties were replicated three times. Agronomic parameters for establishment and growing season are summarized in the table below. Seed was inoculated with Rhizobia just prior to planting.

	Seeding	Plot Size	Depth	Fertilizer Application	Herbicides	Harvest
Site	date	m^2				date
Melita	22-May	12.96	1"	30 lbs/ac P (11-52-0)	Treflan, Credit	13-Oct
Wawanesa	27-May	12.96	1"	none applied	Treflan, Credit	20-Oct

Data collected included height, and test weight. Plots were harvested with a Hege plot combine at full maturity and yield was determined with the combine yield monitor system (Harvest Master Classic GrainGauge).

Results

There were significant yield differences among varieties at each site. The Wawanesa site yielded over 1200 kg/ha more than Melita. In Wawanesa overall yields were favored likely to increased temperatures during emergence (from fallow) as well as being in a well treed area.

			Melita			Wawanesa		
			Yield					
Variety	Company Heat Unit	2009 DTM	kg/ha	bu/ac	% of Check	kg/ha	bu/ac	% of Check
Montcalm	2450	2	2638	39	94	3710	55	82
Apollo RR	2450	0	2648	40	94	3888	58	86
IsisRR	2400	2	2829	42	101	3963	59	88
24-52 R	2500	7	3106	46	111	2866	43	63
25-04 R	2450	6	2628	39	94	3601	53	80
RR Russell	2550	3	2713	41	97	4025	60	89
RR Rosco	2450	0	2806	42	100	4516	67	100
90A06	2450	8	2796	42	100	4114	61	91
LS 0036	2425	3	3210	48	114	4805	71	106
LS 0028	2375	4	3252	49	116	4696	70	104
NSC Warren RR	2350	-1	2698	40	96	4604	68	102
NSC Gimli RR	2450	0	2768	41	99	4155	62	92
CV%		RR Rosco	7.7			13.4		
LSD (p<0.05)		127 days	372	6	13	925	13.7	20.5
GRAND MEAN		to Maturity	2841	43	101	4079	60.5	90.3
Prob. Entry			0.01			0.01		
R-squared			0.83			0.63		

Comments

The Wawanesa site suffered cattle getting into the plot late in season and this may have contributed to slightly higher variation within the trial. Also, significant lodging occurred prior to harvest there.

Picture: Soybeans showcased at Wawanesa Tour, August 13. Notice the height of the soybeans. Varieties were reaching over a meter tall at maturity.

Peas

Cooperators
Manitoba Pulse Growers Association
Seed Manitoba
Westman Agricultural Diversification Organization

Site Information
Cooperator: Wayne White Location: NE 36-3-27
Previous Crop: Spring Wheat Soil Texture: Loamy

Soil Test

Depth	N lbs/ac	P ppm (olsen)	K ppm	S lbs/ac	pH
0-6"	10	16	291	14	8
6-24"	30			42	
0-24"	40			56	

Objective

To assess varieties of peas including green, yellow, maple, silage types for yield potential in the Southwest region of Manitoba.

Methods

The trial consisted of 26 varieties in plots that were 1.44 m wide x 8.5 m long. Varieties were organized in a randomized complete block design and replicated three times. A pre-seed burn-off was applied day of seeding with glyphosate and a pre-emergent herbicide Rival. Plots were direct seeded in wheat stubble at a depth of 1” on May 14th. Seed was inoculated with Rhizobia and phosphate was applied at 30 lbs/ac from 11-52-0. Plots were maintained weed-free with Select and Odyssey applied at a rate of 120 mL/ac and 17 g/ac, applied June 25 and

July 15th, respectively. Plots were desiccated August 18 with Reglone at a rate of 0.9 L/ac. Plots were harvested August 31.

Data collected included plant emergence, leaf disease rating, height, lodging and days to maturity. Plots were harvested for grain yield with a Hege plot combine. Test weight, sample moisture, and total plot weight were collected.

Results

There were significant differences among pea varieties (Table). The top yielding variety was CDC Meadow, yielding almost 68 bu/ac, but it was not significantly different from six other varieties yielding just short of CDC Meadow. Overall the average yield for the trial was 56.8 bu/ac slightly below the check yield of Cutlass at 61 bu/ac. Coefficient of variation was 6.75% indicating good data.

Table: Varieties of peas are grouped by market type (yellow, green, maple, silage) then by descending yield for that type. Lodging rating is specific to the Melita site plots. Lodging is defined by 1= upright, and 9 = flat to ground. DTM = days to maturity.

		Mean Yield			Height	Lodge	DTM
Market	Variety	kg/ha	lbs/ac	% of Check	cm	(1-9)	days
Yellow	CDC Meadow	4577	4077	111	98	1.0	95
	CDC 1749-8	4457	3970	108	97	1.0	95
	Agassiz	4353	3877	106	102	3.3	97
	CDC 1897-3	4274	3806	104	91	2.3	97
	CDC Treasure	4260	3794	104	93	2.0	94
*	APCM 97107	4238	3775	103	103	4.3	95
*	IN4188	4197	3739	102	104	3.3	97
	Cutlass	4112	3663	100	83	1.0	97
	CDC Golden	4106	3657	100	92	5.7	96
	CDC 1897-14	4020	3580	98	89	1.0	95
	Polstead	4008	3570	97	77	1.0	99
	Thunderbird	3894	3468	95	89	1.0	97
	Sorento	3814	3397	93	93	2.0	99
	CDC Bronco	3780	3366	92	82	3.7	97
	CDC Prosper	3754	3343	91	90	2.7	97
	DS-Admiral	3593	3201	87	94	1.7	94
	Eclipse	3425	3051	83	94	1.0	99
Green	CDC 1932-201	4424	3940	108	93	3.0	96
	CDC Striker	3989	3553	97	92	1.3	94
	CDC Patrick	3842	3422	93	95	4.7	98
	CDC 1812-5	3232	2879	79	96	4.0	100
	Cooper	3041	2709	74	93	1.7	100
Silage	CDC Leroy	3863	3440	94	87	5.0	97
	40-10	2493	2221	61	92	7.3	101
Maple	JSC43001	3610	3216	88	107	1.7	96
	JS 03206-11	2110	1879	51	95	7.3	101
CV%			6.75		5.7	62.9	1.6
LSD (p<0.05)		424	378	10	9	2.9	3
GRAND MEAN		3826	3407	93	93	2.8	97
R-squared			0.77		0.70	0.64	0.75

*Varieties being tested or proposed for registrations

Lentils

Cooperators

Westman Agricultural Diversification Organization
Seed Manitoba
Manitoba Pulse Growers Association

Site Information

Cooperator: Wayne White Location: NE 36-3-27
Previous Crop: Spring Wheat Soil Texture: Loamy

Soil Test

Depth	N lbs/ac	P ppm (olsen)	K ppm	S lbs/ac	pH
0-6"	12	11	271	14	7.9
6-24"	39			42	
0-24"	51			56	

Background

Lentils are a cool season crop with a restricted root system that is only somewhat resistant to high temperatures and drought. They cannot withstand flooding, water-logging, or soils with high salinity. Lentils work well in rotation with cereals such as spring and durum wheat. They have the ability to fix nitrogen from the air which can then be used by other crops in following years. Lentils are vulnerable to ascochyta blight as well as anthracnose. To reduce the risk of these blights, lentils should be seeded in the same field only once every four years. (AAFC)

Lentil production has been limited in Manitoba due to several factors, such as disease incidence, limited processing companies, and the limited need to grow such a specialty crop in regions better suited for other crop production such as wheat, barley, and canola. The pulse industry in Manitoba has adopted peas, edible beans, and soybeans as pulses rather than the lentil more suited for cooler, drier brown and light brown soil zones of Saskatchewan.

Despite all these factors, large yields in certain areas are not impossible. As seen in this trial in 2009, yields were reaching near 58 bu/ac. Yields like this could be very competitive and profitable compared to a market dominated by Saskatchewan farms typically reaching 30 bu/ac on average. With new varieties and weed control options becoming available, producers in Manitoba may be able to capitalize on some serious returns.

Methods

The trial consisted of 36 varieties in plots that were 1.44 m wide x 8.5 m long. Varieties were organized in a 6 x 6 completely balanced lattice design and replicated three times. Plots were seeded directly into wheat stubble at a depth

of 1" on May 12th. Seed was inoculated with Rhizobia and phosphate was applied at 30 lbs/ac from 11-52-0. Plots were maintained weed-free with Select applied at a rate of 120 mL/ac applied July 18th. They were desiccated August 30 with Reglone at a rate of 0.9 L/ac and were harvested September 3rd.

Data collected included plant emergence, height, lodging, and days to maturity. Plots were harvested for grain yield with a Hege plot combine. Test weight, sample moisture, and total plot weight were collected.

Results

There were significant differences among lentil varieties at Melita. Coefficient of variation was low indicating a good data set. Yields of each market class are summarized below and are sorted in descending order of yield potential of each class. Greatest yields among all varieties were small red types of 2271-5, CDC Maxim, 2268-7, a large red 3232-11, and a small green CDC Milestone (check). All other varieties were lower yielding than these.

		Mean Yield		
Market Class	Variety	kg/ha	lbs/ac	% of check
Extra Small Red	CDC Rosetown	4328	3855	98.8
	CDC Rosebud	4177	3720	95.4
	CDC Robin	4146	3693	94.7
	CDC Imperial	3920	3491	89.5
	1897T-30a	3874	3451	88.5
	CDC Improve	3533	3147	80.7
	CDC Impala	3336	2971	76.2
Small Red	2271-5	4782	4259	109.2
	CDC Maxim	4461	3973	101.9
	2268-7	4404	3923	100.6
	CDC Redcoat	4217	3756	96.3
	2321-6	4108	3659	93.8
	1894T-1	4095	3647	93.5
	CDC Redberry	4083	3637	93.2
	CDC Impact	3600	3206	82.2
Medium Red	CDC Imax CL	4060	3616	92.7
	2262-14	3887	3462	88.8
Large Red	3232-11	4417	3934	100.9
	2275-15	4203	3744	96.0
Small Green	CDC Milestone	4379	3900	100.0
	CDC Imvincible CL	3822	3404	87.3
Medium Green	IBC-193	4042	3600	92.3
	CDC Impress	4019	3580	91.8
	CDC Imaigreen CL	2786	2481	63.6
Large Green	CDC Plato	3665	3264	83.7
	CDC Greenland	3460	3082	79.0
	CDC Impower CL	2904	2587	66.3
Green Cotyledon	3056-12	2777	2473	63.4
French Green	CDC Peridot	4078	3632	93.1
Spanish Brown	3216-7	4221	3760	96.4
	3591-3	4185	3728	95.6
	3020-6	4041	3599	92.3
	Pardina	3927	3498	89.7
Small Yellow	Eston	4142	3689	94.6
Medium Yellow	Richlea	3966	3532	90.6
Large Yellow	Laird	3071	2735	70.1
	CV%		6.75	
	LSD (p<0.05)	433.15	386	9.9
	GRAND MEAN	3919.88	3491	89.5
	R-squared		0.89	

Discussion

Lentils are not a crop typically grown in Manitoba due to the high precipitation region that our agriculture sector lies within. Normally, the plot would be infected with Ascochyta and Anthracnose, fungi that typically infests lentils where rain is abundant. Typically lentils are grown in regions such as the Brown and Dark Brown soil zones of Saskatchewan. The 2009 growing season was optimal for lentil production in Melita as precipitation and temperatures were below normal favoring diseases free plot development.

Beans

Cooperators

Westman Agricultural Diversification Organization
Seed Manitoba
Manitoba Pulse Growers Association

Site Information

Cooperator: Wayne White Location: NE 36-3-27
Previous Crop: Spring Wheat Soil Texture: Loamy

Soil Test

Depth	N lbs/ac	P ppm (olsen)	K ppm	S lbs/ac	pH
0-6"	12	14	429	18	8.2
6-24"	21			36	
0-24"	33			54	

Background

Dry bean production in Southwest Manitoba is limited to the amount of frost free days, moisture, and accumulated heat unites over the growing season. Typically dry beans require 90 to 110 days to reach full maturity. Given a late seeding date (normally seeded in late May), this requires a season finish by late August. The growing season of the dry bean also requires a 24°C optimum temperature and a cool flowering period under 30°C to prevent bloom blasting. If any of these factors are lacking or are in abundance, the dry bean production will suffer. With careful production practices many varieties and types of dry bean can be produced in many southern areas of the province including the Southwest regions. The 2009 growing season would be considered average or below average year for dry bean production due to the lack of accumulated heat units.

Objective

To evaluate and demonstrate varieties of dry beans including Pinto, Black, and Navy types for yield in the Southwest region of Manitoba.

Methods

Trials consisted of 16 varieties of narrow row dry beans in plots that were 1.44 m wide by 8.5 m long. Varieties were organized in randomized complete block design replicated three times. Plots were direct seeded May 29 at a depth of 1". No nodulator was used in this trial. Fertilizer applied was 60 lbs N, and 30 lbs P in the form of granular 11-52-0 and liquid 28-0-0. Plots were maintained for weeds with Basagran Forte herbicide sprayed at a rate of 0.91 L/ac, applied July 12 with 20 gal/ac water volume. Centurion herbicide was applied June 25 at a rate of 150 mL/ac to control grassy weeds. Plots were desiccated with glyphosate (1 La/c) on September 22 and were harvested September 28 with the Hege plot combine.

Results

There were significant differences in final yield and days to maturity (DTM) among varieties. The highest yielding variety BK05-009 is in the black bean marketing class and yielded 1604 lbs/ac. There were no significant differences in height among varieties.

		Yield		Height	DTM
Market Class	Variety	kg/ha	lbs/ac	cm	days
Black	BK05-009	3259.1	1604.0	45	108.0
	*CDC Jet	2837.3	1396.4	48	108.7
	1681a-6	2693.1	1325.4	47	109.3
Navy	H96204	2784.3	1370.4	38	107.0
	OAC 05-1	2776.8	1366.6	42	111.0
	OAC Lightning	2564.4	1262.1	53	110.0
	*Envoy	2498.0	1229.4	47	108.7
	Skyline	2293.6	1128.8	40	110.7
Pinto	Winchester	2949.3	1451.6	48	106.7
	*CDC Pintium	2840.4	1398.0	45	106.0
	AC Ole	2679.7	1318.9	47	109.0
	Island	2672.1	1315.1	53	108.7
	CDC WM-1	2561.7	1260.8	42	105.7
	CDC WM-2	2532.4	1246.4	42	107.0
	1702-17	2438.3	1200.1	53	109.0
	Winmor	2256.8	1110.7	57	107.3
	CV%	7.21		14.4	1.0
	LSD (p<0.05)	320.6	157.8	NS	1.7
	GRAND MEAN	2664.8	1311.5	47	108.0
	R-squared	0.74		0.53	0.82

Comments

'CDC Pintium', a variety that matures quickly and was developed for cooler climates, performed very well, which is not a surprise given the abnormally cool conditions of the 2009 season. In a "normal" year, other varieties may have performed better.

Sunflowers

Cooperators

Westman Agricultural Diversification Organization
Seed Manitoba
National Sunflower Association of Canada

Site Information

Cooperator: Scott Tilbury
Previous Crop: Spring Wheat
Location: SW 29-3-27 (2.5 miles NE of Elva)
Soil Texture: Fine Sandy Loam

Depth	N lbs/ac	P ppm (olsen)	K ppm	S lbs/ac	pH
0-6"	11	15	317	20	7.5
6-24"	36			360	
0-24"	47			380	

Background and Objectives

As part of WADO's support for special crops, WADO partnered up with the National Sunflower Association as there was a need to represent and test varieties in Western Manitoba. A site southwest of Melita was set up to determine various aspects of confectionary and oil type sunflowers such as test weight, oil content, screen seed size distribution, and final yield.

Methods

Test design:	Randomized complete block design for each type
Treatments:	7 confectionary and 9 oil types
Replications:	Three
Plot size:	1.524 m x 9 m
Row Spacing:	29.5" x 4 rows/plot
Plant Spacing:	Seeded heavy rate then thinned out stand at 8" (oilseed) and 10" (confectionary)
Seeding date:	June 1, 2009
Fertilizer applied:	Sideband: 80 lbs/ac N. from 28-0-0 and 30 lbs/ac P. from 11-52-0
Herbicide applied:	Treflan, Glyphosate, Select, recommended rates
Insecticide:	Ripcord applied at 25 mL/ac July 7 for grasshoppers
Harvest date:	October, 2008
Product handling:	Each plot was harvested with only the two middle rows of the four being used. Plot samples were weighed and moisture was determined
Data Collected:	Height, disease rating, lodging, maturity (R9), Oil content, seed size, screen seed size distribution, test weight, final yield

Results

There were significant yield, bushel weight, height, and days to maturity differences in both oil and confectionary sunflower varieties in Melita. Coefficient of variation was low, indicating a good data set.

Oilseed

		2009 Yield: lbs/ac					
Name	**2009 Average Yield**	**Carman**	**Melita**	**Minto**	**Morden**	**Oak Bluff**	**Rathwell**
IS 2930 NS/DM	2341	2110	3260	2493	1832	969	3379
803 DMR NS	2293	1776	3231	2904	1591	897	3356
IS 7120 HO/DM	2471	1817	3188	2804	1990	1121	3908
63M80	2696	2349	3089	2972	2395	1131	4241
8N358CLDM	2389	1713	2836	2894	2153	1347	3389
IS 3480CL	2486	1808	2827	2705	2366	1501	3708
Defender Plus	2423	1678	2785	2912	2546	1092	3523
3080 DMR NS	2369	1683	2446	3067	2223	862	3933
Viper	1789	1658	1849	1658	1199	1298	3257
Grand Mean	2362	1844	2835	2712	2033	1135	3633
CV%		9.2	10.3	10.8	13.3	14.7	12.5
LSD (lbs/acre)		292	506	505	471	287	-
Sign Diff		Yes	Yes	Yes	Yes	Yes	No

	Bushel Wt	Height	Days to Maturity	Oil Content
Variety	lbs/bu	cm	days to R9	%
IS 2930 NS/DM	31.1	175	120	48
803 DMR NS	30.2	160	118	49
IS 7120 HO/DM	29.8	140	120	44
63M80	31.2	163	124	50
8N358CLDM	29.6	172	125	47
IS 3480CL	28.1	168	124	46
Defender Plus	30.0	137	121	44
3080 DMR NS	29.6	139	122	50
Viper	26.5	131	131	46
CV%	4.8	7.7	0.9	-
LSD (p<0.05)	2.4	20	2	-
GRAND MEAN	29.5	154	123	47.2
R-squared	0.62	0.80	0.95	-

Confectionary

		2009 Yield: lbs/ac					
Name	**2009 Average Yield**	**Carman**	**Melita**	**Minto**	**Morden**	**Oak Bluff**	**Rathwell**
Panther DMR	2425	1665	3705	2047	1977	1504	3820
8C451	2171	1522	2930	2378	1808	1506	2885
RH1121	2008	1709	2797	1867	1751	1227	2697
RH3126RT	2088	1414*	2719	2320	2330	781	2964
6946	2308	1838	2638	2761	2376	1341	2894
Jaguar	2088	1749	2455	2107	1850	2236	2290
Grand Mean	2181	1650	2874	2246	2015	1432	2925
CV%		10.8	10.0	9.4	8.0	9.0	9.4
LSD (lbs/acre)		-	504	367	285	234	487
Sign Diff		-	Yes	Yes	Yes	Yes	Yes

*10% head clipper damage in all 3 replicates

	Bushel Wt	Height	Days to Maturity
Variety	lbs/bu	cm	days to R9
Panther DMR	19	169	117
8C451	19	153	123
RH1121	19	166	127
RH3126RT	19	170	125
6946	22	153	116
FILLER	18	143	123
Jaguar	19	150	121
CV%	4.4	5.8	1.2
LSD (p<0.05)	2	16	3
GRAND MEAN	19.5	158	122
R-squared	0.77	0.69	0.92

Seed size was larger in Melita compared to the provincial average. In Melita, the majority (~79%) of seed cleaned in the 22/64 screen size compared to the province average with a grand mean of 42%.

	Provincial			**Melita**		
Name	**18/64**	**20/64**	**22/64**	**18/64**	**20/64**	**22/64**
6946	30	30	22	12	26	58
8C451	18	23	49	4	13	79
Jaguar	16	27	48	1	4	91
Panther DMR	22	26	38	3	8	83
RH1121	11	17	60	2	4	90
RH3126RT*	23	29	35	3	21	71
Grand Mean	20	25	42	4	13	79

Discussion

Yields in the region were average to above average for sunflower production due to ideal late season weather conditions. The months of August and September received above normal precipitation amounts and likely contributed to inflated yields during the seed filling and maturity stages.

Sunflower rust caused by the fungus *Puccinia helianthi* was quite prominent in the region in 2008 & 2009 seasons. Currently in Manitoba, there was no minor use fungicide registration for use against sunflower rust. The variety trial at Melita did have some sunflower rust infection. Data was taken near maturity regarding the severity of infection. Producers in years to come may have to deal with integrated management strategies for future infestations. Even though this disease is typically an issue south of the Canadian border, recent changes have been speculated as possible proponents of sunflower rust in the Canadian prairies, such as tight rotations of sunflowers, prevalence of new rust races combined with lack of cultivar resistance, mild winters due to climate change, infestation of wild sunflower in fields creating an alternative host, and/or history of adjacent fields previously grown as sunflowers with past infections. For further information, please contact the National Sunflower Association of Canada www.canadasunflower.com or Manitoba Agriculture Food and Rural Initiatives (www.gov.mb.ca/agriculture).

Corn

Cooperators

Westman Agricultural Diversification Organization
Seed Manitoba
Manitoba Corn Growers Association

Site Information

Cooperator: Brian Greig Location: NE 4-4-26 W1
Previous Crop: Grazed Corn Soil Texture: Sandy Loam, stony

Soil Test

Depth	N lbs/ac	P ppm (olsen)	K ppm	S lbs/ac	pH
0-6"	15	14	229	12	7.5
6-24"	39			36	
0-24"	54			48	

Background

Grain corn is still an uninsured crop for the southwest and possesses some high risk investment with a gamble on the weather conditions. In 2009, this risk was high, however, some producers managed to produce a grain crop while many others still have a crop in the field during the winter months. Later planting were more unfortunate and have had issues with dry down, mold, and poor forage quality.

Planting date, corn heat unit rating, and new performing hybrids can offer some sort of resilience to grain corn production risks.

This was the first year WADO has joined forced with the Manitoba Corn Growers Association to produce a grain corn variety trial for the southwest region of Manitoba.

Objective

To assess various hybrid corn varieties for grain production entering into the feed, food, and ethanol markets.

Methods

Trial consisted of 16 varieties grown in a randomized complete block design replicated three times. Plot size was 3 m wide by 9 m long. Four rows were planted at 29.5” spacing and seeded at a heavy rate at 1” depth. Plots were fertilized with 80 lbs/ac N (28-0-0) and 30 lbs/ac P (11-52-0). Plants were thinned at the three leaf stage to accommodate 8” between plants. Plots were kept weed free with the use of glyphosate applied as a 0.75 L/ac split application applied

June 25 and July 12. Plots were harvested for yield November 10. Samples were bagged and weighed, moisture and bushel weight recorded.

Results

There were significant differences in yield, sample moisture, and bushel weight among varieties. Three varieties (A4170 RR, A4176 BT RR, LR 9875 RR) had to be disregarded in the final analysis due to lodging and animal damage initially caused by insect pressure presumed to be the European corn borer. Coefficient of variation was low and acceptable, indicating a good data set.

Final yields ranged from 79 bu/ac to 103 bu/ac with a site average of 90 bu/ac. Generally, moisture values increased with later maturity which is likely related to late season mold growth.

Variety	CHU	Traits[1]	Distributor	% Moisture at Harvest	Yield (bu/ac)	Bushel WT (lbs/bu)
39B94	2250	HX1,RR	Pioneer Hi-Bred	32.8	102.8	45.6
P7213R	2050	RR	Pioneer Hi-Bred	29.6	100.6	47.1
39D95	2175	RR	Pioneer Hi-Bred	30.5	98.3	43.3
DKC 27-33	2200	BT, RR	Monstanto	36.9	95.8	48.3
HL R208	2225	RR	Hyland Seeds	33.0	95.7	45.6
P7535R	2100	RR	Pioneer Hi-Bred	35.1	93.8	43.9
DKC 26-79	2150	BT, RR	Monstanto	39.9	93.0	44.8
NO5C-GT	2200	GT	Syngenta Seeds	33.3	89.5	49.3
LR 9975 RR	2150	RR	Quarry Grain	41.4	82.7	43.2
LR 9875 RR	2150	RR	Quarry Grain	36.5	82.3	45.0
39B61	2100	RR	Pioneer Hi-Bred	35.4	80.8	44.2
LR 9074 RB	2125	YG, RR	Quarry Grain	39.4	80.5	43.7
Baxxos RR	2250	RR	Hyland Seeds	40.6	78.8	46.3
			CV%	9.4	8.6	3.7
			LSD (<0.05)	5.7	13.2	2.8
			Prob. Entry	0.004	0.006	0.003
			GRAND MEAN	36	90	45
			R-Square	0.69	0.73	0.68

Traits – BT, HX1, CB, YGCB – resistant to European Corn Borer; RR, RR2 – Roundup herbicide tolerant; GT – glyphosate herbicide tolerant; LL – Liberty herbicide tolerant; RW – resistant to rootworm, VT3 - resistant to European corn borer, Roundup herbicide tolerant and resistant to rootworm.

Final yields were adjusted to 15% moisture in table, however moisture values are included as insight into harvest conditions applicable to those varieties.

Discussion

There were significant mold infections observed in the Melita grain corn trials. Generally, those varieties that did not dry down or mature early were infected.

Cool, wet weather for most of October, as well as frost and upright ear position, favored mold development. It should be stressed that feeding moldy corn to livestock may be a risk to their health. For further information on feeds and feeding consideration please visit the MAFRI website and check out the following link: http://www.gov.mb.ca/agriculture/livestock/beef/baa05s00.html. If corn containing mycotoxins is delivered to an ethanol plant for ethanol production, these mycotoxins are not destroyed or inactivated during the fermentation process and will be present in DDGS produced from this corn source. In fact, the concentration of mycotoxins in DDGS will be 2 to 3 times higher than the initial concentration in the grain. This is because the removal of starch during the fermentation process concentrates all of the unfermentable residual portions of the grain that remain after fermentation. Many "new generation" ethanol plants monitor incoming corn for mycotoxins and reject loads that are contaminated to prevent mycotoxins in DDGS (Shurson et al.).

For more information about corn production, market development, research and education please visit the Manitoba Corn Growers Website at: http://www.manitobacorn.ca and the Manitoba Agriculture Food and Rural Initiatives website at: www.gov.mb.ca/agriculture

Reference:

Shurson, J., M. Spiehs, M. Whitney, and J. Knott. 2004. Nutritional and value added benefits of feeding maize DDGS and other dry-mill co-products to swine. Presented at the Eastern Nutrition Conf. Pre-conf. Symposium, Ottawa, Canada. May 11, 2004

Hulless Oat Variety Evaluation Trial

Co-operators:
AAFC Ottawa – Dr. Vern Burrows (retired)
Wedge Farms Nutrition – Arborg Mb.

Background

Hulless oats are an oat variety type well suited for animal feed or human food. Hulless oats are not actually hulless; their hull is held loosely to the seed and is removed during combining or through further processing. Traditional hulless oat varieties have as much as 30% hull retention after harvest and have a fine coating of hair (trichomes) on the groat that makes the oats very itchy to handle and prevents them from flowing freely in the bin.

Dr Vern Burrows, Research Scientist with Agriculture and Agri-Food Canada in Ottawa, has been developing hulless oat lines that overcome these problems. He has developed VAO (value-added oat) lines that have only a trace of retained hulls in bin-run grain, as well as "bald" varieties that shed the trichomes along with the hulls at harvest. Dr Burrows has also been working with Semican International, Inc., a company based in Quebec that has developed "Equavena" hulless oats as a high quality diet for race horses.

Scott Sigvaldason of Wedge Farms is an Arborg-area producer who is processing hulless oats for human consumption markets worldwide under the trade name *Cavena Nuda* or "Rice of the Prairies". Scott has been very successful in promoting the *Cavena Nuda* product into many of the health food markets due to its gluten free content. He has appeared on CBC's *Dragon's Den* program and has gained a lot of attention from food processors and larger food companies interested in selling their products. The oat variety Gehl has been acquired by Wedge Farms as the proprietary variety for marketing options at this time.

Objective

To evaluate the agronomics and yield of unregistered and registered hulless oat variety lines grown in Manitoba conditions.

Methods

Site #1 Information – North Interlake
Location: Arborg, Manitoba Seeded: June 3, 2009
Cooperator: PESAI Harvested: September 25, 2009
Land-Base: S.S. Johnson Seeds Plot Size: 8.2 m^2

Site #2 Information – South Interlake
Location: Warren, Manitoba Seeded: May 21, 2009
Cooperator: PESAI Harvested: September 15, 2009
Land-Base: Craig Riddell Plot Size: 8.2 m^2

Site #3 Information – Eastman
Location: Beausejour, Manitoba Seeded: June 15, 2009
Cooperator: PESAI Harvested: October 19, 2009
Land-Base: Viterra Agri-Center Plot Size: 8.2 m^2

Site #4 Information – South West
Location: Melita, Manitoba (River Site) Seeded: May 21, 2009
Cooperator: WADO Harvested: September 15, 2009
Land-Base: Wayne White Plots Size: 14 m^2

Site #5 Information – Parkland
Location: Roblin, Manitoba Seeded: May 21, 2009
Cooperator: PCDF Harvested: September 16, 2009
Land-Base: PCDF Plot Size: 5 m^2

The trial consisted of multiple hulless lines replicated 3 times in plots arranged in a randomized complete block design (RCBD) in five locations across Manitoba. Refer to site information above for plots sizes, seeding and harvesting dates. The target seeding rate was 220 plants/m^2. Trials were fertilized (Table 1) according to soil test results and herbicides were applied as needed. The site at Beausejour was harvested, but due to hail damage and other factors beyond the researcher's control, the data could not be used in this report. There were a total of 18 varieties, however due to seed availability at planting, not all sites received all 18 varieties, or the same combination of varieties. The hulless oat variety Navan was included as a check in all the trials.

Table 1: Fertilizer Applications to 2009 Manitoba Hulless Oat Trials by Location.

Location	***Actual lb N/ac***	***N Application***	***Actual lb N/ac***	***P Application***
Arborg	90	granular, broadcast and incorporated	27	granular at seeding
Warren	90	NH_3 incorporated	27	granular at seeding
Beausejour	50	granular, broadcast and incorporated	27	granular at seeding
Melita	70	liquid at seeding	30	granular at seeding
Roblin	20	granular at seeding	30	granular at seeding

Results

Least significant differences (LSD) for Arborg, Warren, Melita and Roblin, are 338.27, 352.51, 318.48 and 926.91 kg/ha, respectively (Table 2). (If differences in yield between varieties within a site are greater than or equal to the LSD, those variety yields are significantly different from each other.)

The coefficients of variation (CV) at all sites were acceptable, at 6.39%, 6.55%, 6.86%, and 10.38% for Arborg, Warren Melita, and Roblin, respectively. (CV is a

relative measure of variation within a trial, with lower numbers indicating less variability across reps.) The Roblin site had the highest grand mean yield (5323 kg/ha), followed by Warren (3179 kg/ha), Melita (2774 kg/ha) and Arborg (2509 kg/ha).

Table 2: Mean yields (kg/ha) and percent of check of hulless oat varieties planted across Manitoba in 2009. Not all varieties were planted at all sites. AC Navan was the check variety. Varieties are arranged by mean rank, with bolded values indicating the highest yielding varieties at individual sites.

Variety	***Arborg***		***Warren***		***Melita***		***Roblin***		***Variety Means Across Sites***	
	kg/ha	**%**	**kg/ha**	**%**	**kg/ha**	**%**	**kg/ha**	**%**	**kg/ha**	**%**
VAO-52	**3116**	**109**					6076	96	**4596**	**102**
VAO-50	2719	95			**3381**	**105**			3050	100
AC Navan	*2869*	*100*	*3362*	*100*	*3213*	*100*	***6341***	***100***	*3946*	*100*
VAO-49	2424	84	**3707**	**110**	3186	99	5780	91	3774	96
AC Gehl	2981	104	3492	104	2792	87	5674	89	3735	96
VAO-58	2961	103			2802	87			2882	95
VAO-46	2626	92	3118	93	3200	100	5067	80	3503	91
VAO-48	2519	88	3289	98	2802	87	5002	79	3403	88
VAO-60	2288	80	3366	100	2660	83	5316	84	3408	87
VAO-44	2427	85	3217	96	2818	88	4780	75	3311	86
VAO-1	2717	95	2997	89	2983	93	4123	65	3205	85
VAO-51	2826	99	2731	81	2323	72			2627	84
VAO-45	2059	72	3133	93	2923	91	4612	73	3182	82
VAO-10	1968	69	3355	100	2252	70	5557	88	3283	82
VAO-57	2227	78					5332	84	3780	81
VAO-53	2290	80							2290	80
VAO-54	2537	88			1964	61			2251	75
VAO-22	1617	56	2383	71	2316	72	5387	85	2926	71
CV %	6.39		6.55		6.86		10.38			
LSD (p<0.05)	338.27		352.51		318.48		926.91			
grand mean	2509.28		3179.25		2774.31		5323.14			

Hulless oat varieties can be expected to yield 20-25% less than hulled varieties, since the weight of the hulls are removed from hulless oats at harvest. In Arborg, the highest yielding variety, VAO-52, yielded 109% of the check, while in Warren, VAO-49 yielded 110% of the check, in Roblin, AC Navan (the check) yielded the greatest with VAO-52 at 96% of the check, and in Melita, VA0-50 yielded 105% of the check.

The variety yield rankings differed between sites, but overall, the top three yielding hulless oat varieties were VAO-52 (102%), VAO-50 (100%) and AC Navan (check).

Table 3: Mean lodging ratings for hulless oat varieties grown in Warren and Roblin in 2009. Lodging ratings on a 1-5 scale, where 1=0 % and 5=100% lodging.

Variety	***Warren***	***Roblin***	***Average***
VAO-1	1	1	1
AC Gehl	1	2	1.5
AC Navan	*1*	*2*	*1.5*
VAO-51	1	2	1.5
VAO-22	1	3	2
VAO-46	1	3	2
VAO-48	1	3	2
VAO-52		2	2
VAO-57		2	2
VAO-10	1	4	2.5
VAO-44	2	4	3
VAO-49	3	4	3.5
VAO-60	2	5	3.5
VAO-45	3	5	4
VAO-50			n/a
VAO-53			n/a
VAO-54			n/a
VAO-58			n/a
CV %	36.05	30.23	
LSD	0.97	1.52	
grand mean	1.58	3.00	

Visual lodging ratings were taken at harvest on a scale of 1-5 (1=0% and 5=100% lodging) (Table 3). Ratings were not available for Melita or Arborg. Ratings were taken in Roblin and Warren; however, there were high C.V.'s at both sites which can be expected with subjective ratings. Overall, VAO-1 showed better lodging than the check at both sites and VAO-51 and AC Gehl were equal to the check.

As indicated above, hulless oat varieties generally yield less than hulled varieties–partly due to the weight of the hull. However, since there are fewer hulls to add bulk to the grain volume, hulless oats test weights are often 20-25% greater on average than that of the hulled oats. On average, the check, AC Navan, had the lowest test weight, while VAO-22 and VAO-53 were the greatest. With regards to sites, test weights decreased in the order of Warren > Arborg > Melita > Roblin (Table 4).

Days to maturity ratings were only taken at the Melita location, where results of all varieties were similar, ranging from 95-99 days with a mean of 96.7 days for the varieties tested.

Table 4: Mean test weights (g/0.5L) of hulless oat varieties grown in four locations across Manitoba in 2009.

Variety	*Arborg*	*Warren*	*Melita*	*Roblin*	*Average*
VAO-22	324	347	328	294	323
VAO-53	322				322
VAO-54	322		305		314
VAO-51	331	334	290	289	311
VAO-50	310		311		311
VAO-1	318	323	302	288	308
VAO-44	313	332	302	277	306
VAO-46	311	338	294	280	306
VAO-49	315	326	308	268	304
AC Gehl	318	322	302	274	304
VAO-10	311	332	309	259	303
VAO-45	309	327	294	275	301
VAO-58	314		283		299
VAO-52	322			274	298
VAO-60	305	329	295	263	298
VAO-57	309			268	289
VAO-48	293	306	268	257	281
AC Navan	281	297	238	237	263
CV %	1.40	0.97	4.05	3.91	
LSD (p<0.05)	7.27	5.35	19.99	17.84	
grand mean	312.76	326.08	295.13	271.74	

Important Considerations & Recommendations

A new, evolving market for hulless oats is quickly developing. As with regular oat varieties, prospective hulless oats growers should clarify the management and marketing issues prior to seeding these varieties. Many producers grow hulless oats under contract for very specific markets with different marketing risks associated. Be sure to check specific production issues with your contractor.
Since the hull does not protect the inner seed of hulless oats, the seed can be more prone to damage during handling and harvest. Thus, threshing cylinder speeds and concaves should be adjusted to prevent damage. Seeding rates should also be increased to account for potentially lower germination, and seed treatment is recommended. The higher oil content at the surface of the seed makes the seed more attractive to storage insects, and to prevent rancidity during storage, hulless oats need to be stored at a drier moisture content than hulled varieties (<12% moisture). Moisture tables for hulless oat varieties have been developed by the Canadian Grain Commission, which may make the storage of this product somewhat easier for producers. The link to the table has been listed below from the Canadian Grain Commission website.
http://www.grainscanada.gc.ca/guides-guides/moisture-teneur/table-tableau/ho-agn-1.pdf

Conclusions

As more varieties of hulless oats become available, growers will be able to choose varieties with more favourable qualities for their targeted markets, as well as those which are more suited to their agronomic conditions. Future testing will continue as markets develop and alternative uses present themselves. The WADO staff have eaten the Cavena Nuda "Naked Oat" product both uncooked and also prepared in soups and other side dishes. Our conclusion is that this is an excellent product and we hope/expect the commercialization of this crop will be a great success.

Ethanol Wheat Screening Trial

Cooperators:

- Westman Agricultural Diversification Organization – Scott Day, Scott Chalmers (Melita, MB)
- Saskatchewan Ministry of Agriculture – Shannon Chant, Sherrilyn Phelps
- University of Saskatchewan - Dr. Curtis Pozniak – Saskatoon, SK
- Prairies East Sustainable Agriculture Initiative - Paula Halabicki, Roger Burak and Jamie Lindal – Arborg, MB
- Parkland Crop Diversification Foundation - Jeff Kostuik and Keith Watson – Roblin, MB
- Canada Manitoba Crop Diversification Centre (CMCDC)- Craig Linde, Claude Durand – Carberry, MB
- CMCDC - Curtis Cavers – Portage, MB
- Syngenta Seeds Canada Inc - Dr. Francis Kirigwi – Morden, MB.

Introduction

Due to federal and provincial mandates for ethanol blended gasoline, there is now a demand for grain-based ethanol produced in Western Canada. While interest in Ethanol has waned as of late, there are new technologies being used in how ethanol is produced and how it is used. Such as wet ethanol, that will significantly improve the efficiency of using ethanol compared to many other fuels. Given this current and increasing demand, the ethanol industry is continuing to seek high yielding ethanol wheat varieties with high test weights, low protein levels, and elevated seed starch content. These are the key characteristics needed in ethanol feedstocks, outside of the traditional corn growing regions across the Prairies. Most prairie farmers are producing wheat that is more suited for human consumption with greater emphasis on high protein content and specific kernel visual distinctions, but with less regard for starch content. With so much focus on human consumption qualities, little information is available on head-to-head comparisons of current wheat varieties and their traits more suited for the ethanol industry.

The objective of this trial was to demonstrate what wheat varieties and high starch cereal crops are currently best suited as a feed stock for ethanol production in a given region of the Prairies. This trial attempts to survey the yield and adaptability performance of specific varieties throughout the Province of

Manitoba and across the Prairies. This trial included varieties of wheat such as Soft White (CWSWS), Canada Prairie Spring (CPSR & W), and the new class of wheat called Canada Western General Purpose (CWGP). This is in comparison to the traditionally grown high protein spring wheats of Canada Western Red Spring (CWRS) and Canada Western Hard White (CWHW). Triticale was also included as there is increasing interest in using this crop as alternative ethanol feedstock due to its high yielding potential, its unique enzyme content for starch conversion, and its bountiful straw production. Hulless Barley and Hulless Oats have been included in this trial in previous years and while they have good ethanol potential as well – they have been dropped in order to focus on the most likely contenders at this time.

Methods

Identical ethanol screening trials were conducted at many sites across the Prairie Provinces. This report is concerned with those in the Province of Manitoba. Six sites were present in Manitoba and included the following sites near the towns of Melita, Arborg, Roblin, Carberry, Portage, and Rosebank. Sites were managed by their respective managers and affiliations listed above.

Table 1: Cereal Varieties and their corresponding description, along with the seed supplier.

Variety	Seed Type	Supplier
AC Ultima	Triticale	Farm Pure Seeds
Pronghorn	Triticale	Progressive Seeds Ltd.
Tyndal	Triticale	SeCan
AC ANDREW	Soft Wht Spring	SeCan
BHISHAJ	Soft Wht Spring	Crooymans
AC Sadash	Soft Wht Spring	SeCan
5700PR	CPS	Viterra
AC CRYSTAL	CPS	SeCan
SUPERB	CWRS	SeCan
Hoffman	CWGP	Hyland Seeds

Plots were arranged in a randomized complete block design. Each treatment was replicated three times. Soil fertility recommendations were estimated from current soil tests in order to optimize yield potential. Each site sampled fertility levels prior to seeding to determine residual soil fertility levels (Table 2).

Table 2: Residual soil fertility levels for two depths of the soil profile according to the specific site.

Site/Depth	0-6"				6-24"	
Nutrient (lbs/ac)	N	P	K	S	N	S
Melita	14	28	696	16	36	42
Roblin	50	70	180	20	77	14
Carberry	10	13	351	28	12	12
Portage	50	10	281	46	180	264
Rosebank				n/a		

Plots were seeded, fertilized and custom maintained for each site (Table 3). Fungicides were not used at all Manitoba sites. Target seed rate was 300 plants/m^2 for all treatments.

Table 3: Seeding date, fertility regimes, Herbicide use and harvest dates according to each site.

	Seeding	Plot Size	Fertilizer (lbs/ac)		Herbicides		Harvest
Location	*Date*	m^2	*N*	*P*	*Product**	*Application Date*	*Date*
Roblin	19-May	5.00	46	30	Frontline & Axial	15-Jun	16-Sep
Melita	20-May	12.96	70	30	Everest, 2,4-D ester500	15-Jul	17-Sep
Carberry	20-May	7.20	120	50	Refine G	-	25-Sep
Portage	24-May	9.00	19	60	Frontline & Simplicity	-	24-Sep
Rosebank	28-May	3.50	4	19	Prestige, Axial, Achieve, Attain	June 22, July 8	06-Oct

*Herbicides applied at recommended rates

Precipitation values were derived from the Manitoba-Ag Weather Program and are summarized by site (Table 4). Rosebank accumulated the most precipitation while Roblin accumulated the least between May 1 and Sept 30.

Table 4: Total monthly precipitation values between May 1 and September 30 for Rosebank, Roblin, Melita, Hamiota, Carberry, and Portage. Asterisk indicates that a nearby station was used in that location.

	Month Precipitation (mm)					
Site	May	June	July	August	September	Total
Rosebank*	69	127	68	53	18	335
Roblin	12	13	91	83	16	215
Melita**	15	41	106	40	69	271
Hamiota	30	44	70	118	32	294
Carberry	68	35	77	56	22	257
Portage	65	82	76	43	19	285

* data taken from Carman weather station

** data taken from Pierson weather station

For all sites prior to harvest, each plot was sampled for height (cm), leaf disease, and maturity (days after seeding). Plots were harvested, entire dry straw weights were taken from each plot and final grain yields. Grain moisture, thousand kernel weight, test weight, were collected and recorded. An analysis of variance was performed on individual site yield data. Coefficient of variation (CV%) and least significant difference (LSD) at a significance level of 5% was calculated. Individual grain samples have been sent to Dr. Curtis Pozniak at the University of Saskatchewan. Straw samples have been sent to Dr, Brian Beres of AAFC in Swift Current for analysis of various constituents such as lignin, cellulose and hemicellulose. Extractives and specific sugars from the different constituents will be looked at as part of conversion for energy or other products. This work will be done through an Agricultural Bioproducts Innovation Program project coordinated by Dr. Gruber and Dr. Laberge of AAFC. When cellulosic (straw based) ethanol

becomes more possible we will already have the data from this trial to choose the cereal varieties best suited for that form of energy production.

Results

Grain, straw and total biomass yields were significantly different among varieties at all sites, except at Portage straw yields were not. Coefficient of variation was acceptably low among all sites indicating a good data set, except in Carberry for their straw yields. Grand Mean for grain, straw, and total biomass varied among each site considerably. Rosebank had the greatest grand mean on average for grain, straw and total biomass, a result of their excellent growing season in '09.

Grain

Variety performance was generally similar among all sites according to provincial average with only a few deviations (Table 5). Hoffman, the high yielding general purpose wheat, and the triticale varieties: Pronghorn, AC Ultima were highest yielding and generally held this rank for all sites. In Melita these were slightly deviated as varieties AC Andrew and Bhishaj were comparatively higher yielding than AC Ultima and Tyndall. In Rosebank exceptional yields in 5700PR and Superb wheats were observed relative to provincial trends of these varieties.

Table 5: Mean grain yields across Manitoba including Melita, Roblin, Melita, Carberry, Portage and Rosebank. All grain yield "means" were combined into a provincial average and sorted from highest to lowest yielding variety compared to Superb, the variety check.

		Grain Yield (kg/ha)					
Variety	Description	Roblin	Melita	Carberry	Portage	Rosebank	Provincial Average
Hoffman	CWGP	7587	5942.7	6438.4	5485.2	8267.9	6744.2
Pronghorn	Triticale	7653	6081.7	6086.6	6001.4	7235.8	6611.7
AC Ultima	Triticale	6813	5346.6	6638.9	5822.7	7876.7	6499.6
AC Andrew	Soft White Spring	6187	6150.6	5067.1	4955.1	6645.7	5801.1
Tyndal	Triticale	6907	5326.3	4657.4	4731.0	7009.3	5726.2
Bhishaj	Soft White Spring	5687	6237.8	4546.3	4893.5	7213.0	5715.5
AC Crystal	CPS	6180	5717.4	5336.6	3744.4	6676.8	5531.0
AC Sadash	Soft White Spring	5873	5517.9	5191.7	4618.5	5924.5	5425.1
Superb	CWRS	4913	4865.9	5202.3	4976.4	6569.2	5305.4
5700PR	CPS	5453	5239.3	4663.0	3611.1	7139.4	5221.1
CV%		4.38	7.1	6.9	3.5	10.4	
LSD (p<0.05)		474.8	683.3	640.8	296.0	1255.7	
GRAND MEAN		6325	5643	5382.8	4883.9	7055.8	

Table 5A: Mean grain yields in bushels per acre among all locations. Keep in mind that there are 36.744 bushels in a tonne of wheat but there are 42.396 bushels in a tonne of Triticale.

		Grain Yield (bu/ac)					
Variety	Description	Roblin	Melita	Carberry	Portage	Rosebank	Provincial Average
Pronghorn	Triticale	131.1	104.2	104.3	102.8	123.9	113.2
AC Ultima	Triticale	116.7	91.6	113.7	99.7	134.9	111.3
Hoffman	CWGP	112.6	88.2	95.6	81.4	122.7	100.1
Tyndal	Triticale	118.3	91.2	79.8	81.0	120.1	98.1
AC Andrew	Soft White Spring	91.8	91.3	75.2	73.6	98.7	86.1
Bhishaj	Soft White Spring	84.4	92.6	67.5	72.6	107.1	84.8
AC Crystal	CPS	91.7	84.9	79.2	55.6	99.1	82.1
AC Sadash	Soft White Spring	87.2	81.9	77.1	68.6	87.9	80.5
Superb	CWRS	72.9	72.2	77.2	73.9	97.5	78.8
5700PR	CPS	80.9	77.8	69.2	53.6	106.0	77.5
CV%		4.38	7.1	6.9	3.5	10.4	
LSD (p<0.05)		7.0	10.1	9.5	4.4	18.6	
GRAND MEAN		93.9	83.8	79.9	72.5	104.7	

Straw

Provincial average straw yields were essentially similar in rank as provincial grain yields (Table 6). AC Ultima, Pronghorn, Sadash, and Hoffman were generally the highest yielding straw varieties as well. AC Crystal, Superb and 5700PR were generally low yielding and likely due to their short to medium stature.

Table 6: Mean straw across Manitoba including Melita, Roblin, Melita, Carberry, Portage and Rosebank. All straw yields means were combined into a provincial average and sorted from highest to lowest yielding variety compared to Superb, the variety check.

		Straw Yield (kg/ha)				
Variety	Description	Melita	Carberry	Portage	Rosebank	Provincial Average
Pronghorn	Triticale	5830.9	3898.1	6235.4	6855.8	5705.1
AC Ultima	Triticale	4776.2	4175.9	6402.1	7323.5	5669.4
AC Sadash	Soft White Spring	4583.5	4203.7	6040.5	6549.3	5344.3
Hoffman	CWGP	5096.6	3898.1	4952.0	7385.1	5332.9
Tyndal	Triticale	5433.7	3481.5	5617.1	6226.2	5189.6
AC Andrew	Soft White Spring	4687.0	3523.1	6478.9	5941.5	5157.7
Bhishaj	Soft White Spring	4307.3	3287.0	6269.1	6113.8	4994.3
Superb	CWRS	4179.4	3092.6	5231.1	5472.3	4493.9
AC Crystal	CPS	3719.7	2601.9	6237.9	5219.3	4444.7
5700PR	CPS	3589.4	2356.5	4961.3	6378.3	4321.4
CV%		8.4	18.8	13.5	10.1	
LSD (p<0.05)		665.5	1112.8	ns	1104.6	
GRAND MEAN		4620.4	3451.9	5842.5	6346.5	

Biomass

Straw and grain yields were combined by plot then analyzed by site for variance in means. Site variety "means" were created to form an overall total biomass provincial average (Table 7). Coefficient of variation was low and acceptable at each site.

Table 7: Mean dry matter biomass yields and respective CV%, LSD, and grand site means among locations across Manitoba including Melita, Roblin, Arborg, Rosebank and Carberry. All dry matter biomass yields means were combined into a provincial average and sorted from highest to lowest yielding variety compared to AC Barrie, the variety check.

		Total Biomass Yield (kg/ha)				
Variety	Description	Melita	Carberry	Portage	Rosebank	Provincial Average
AC Ultima	Triticale	10122.8	10814.8	12224.8	15200.2	12090.6
Pronghorn	Triticale	11912.6	9984.7	12236.8	14091.6	12056.4
Hoffman	CWGP	11039.3	10336.6	10437.1	15653.0	11866.5
AC Andrew	Soft White Spring	10837.7	8590.3	11434.0	12587.1	10862.3
Bhishaj	Soft White Spring	10545.1	7833.3	11162.6	13326.8	10717.0
AC Sadash	Soft White Spring	10101.4	9395.4	10659.0	12473.8	10657.4
Tyndal	Triticale	10760.0	8138.9	10348.1	13235.5	10620.6
Superb	CWRS	9045.3	8294.9	10207.5	12041.5	9897.3
AC Crystal	CPS	9437.1	7938.4	9982.4	11896.1	9813.5
5700PR	CPS	8828.7	7019.4	8572.4	13517.6	9484.5
CV%		7.1	10.0	7.3	8.2	
LSD (p<0.05)		1241.8	1509.2	1344.8	1881.1	
GRAND MEAN		10263.0	8834.7	10726.5	13402.3	

Biomass yields were similar to grain and straw provincial ranking. AC Ultima, Hoffman and Pronghorn were generally the highest biomass producing varieties with a few exceptions depending on the site. Portage reported relatively high yields with AC Andrew and Bhishaj and lower yields with Hoffman. In Melita Pronghorn produced biomass exceptionally well compared to all varieties.

Discussion

Rosebank accumulated the greatest grain, straw, and total biomass among all sites likely due to heavy timely rains that occurred on June 8 (22.8mm), June 26 (59.2mm), and July 11 (33.4).

The current ethanol industry is reliant on seed based carbon from starch, however, a very major component of the ethanol industry in the future may be dealing with straw (cellulosic, lignin) based carbon. Despite the fact that straw production from any given crop or variety can be extremely variable, finding a valuable use for that crop residue gives more value to the crop as a whole. In places like Arborg where wet weather induced Fusarium reduced final grain yields, straw yields were much higher. These higher straw yields could be used

to buffer the grain losses to supply feedstock for ethanol production. In contrast, in areas like Melita, where it was much drier, grain yields were optimized with less than half of the plant's resources being devoted to straw production, therefore, boosting supply to the grain ethanol industry. In a province like Manitoba, where a great deal of variability occurs each year, an ethanol industry that can utilize both straw and grain will have a much more stable source of feed stock.

It is important to keep in mind that we are waiting on a more complete evaluation of all of these varieties in relation to their ethanol feed stock potential. These addition tests will establish starch content and quality and other traits that relate to their ethanol producing ability. For instance, AC Andrew might have a slightly higher grain yield per acre than Bhishaj, but Bhishaj usually has higher starch content and therefore could still produce more "ethanol per acre" despite a slightly lower yield. These additional tests are being completed at the U of S and when finished will include the quality test results from both the 2008 & 2007 & 2009 ethanol screening trials.

Western Feed Grains Development Cooperative Variety Trial

Cooperators:

Westman Agricultural Diversification Organization – Melita MB
Prairies East Sustainable Agriculture Initiative – Arborg MB
Parkland Crop Diversification Foundation – Roblin, MB
Ag-Quest Inc. – Minto MB - Carol Evenson, Dana Rourke

Introduction (partially taken from the WFGDC website: http://www.wfgd.ca)

The formation of this cooperative was initiated as an alternative approach to filling a void that existed in feed wheat varieties. For over forty years there have been attempts by both public and private groups to develop and license a feed wheat variety which, until recently, were unsuccessful. These failed attempts were largely due to the traditional approach taken by breeders that has stringent KVD requirements for variety licensing. Some of the cultivars developed by the cooperative will be exempt from licensing and KVD requirements, as seed will be supplied to members only. Grain will be sold only to members and will be used exclusively for livestock feed or ethanol production within a closed loop. Other cultivars developed by the Cooperative have been submitted for registration under the new Canada Western General Purpose wheat class.

Wheat as a feed grain has historically been supplied by default. Poor weather conditions and disease determine the availability of supply. By developing feed wheat cultivars, livestock producers will have a continuous, predictable supply of grain without compromising high value grain for feed. New high yielding cultivars

with low FHB and low protein will increase feed value and farm gate revenues, lower feed costs, and reduce the reliance on imported feed grains, both provincially and internationally.

Development of these new cultivars will also create a better feedstock for the production of ethanol. This value-added opportunity will help satisfy the Provincial and Federal Government's objectives to increase the supply of ethanol-blended gasoline in Canada.

This newly formed WFGDC cooperative is currently offering memberships (through their website) to both grain producers and end users of the grain. Membership fees collected will finance the research necessary for such development. Feed wheat cultivar releases are anticipated in approximately five to seven years from the time the first crosses are made, and some varieties developed by the Co-op are very close to public release at this time.

Since some of the feed wheat varieties will not be registered, it is imperative that all members enter contracts which state clearly that any grain produced will not enter the export market, they will only sell to recognized members of the Co-op, and the grain will only be used for livestock feed and ethanol production.

Feed grain development is not limited only to feed wheat, as many feed grain varieties could be developed in the future through this cooperative.

In 2009, yield trials featuring the best lines currently being developed by the Co-op were evaluated against some of the current standards. Field Plot trials were conducted in Melita, Roblin, Hamiota, and Arborg. In addition to straight yield per acre they were also tested for higher than normal starch content. Some of the WFGDC varieties are being bred to fulfill this specific need for higher starch in addition to higher yields.

Methods

A variety trial was located at four sites in Manitoba: Melita, Roblin, Hamiota, and Arborg. Plots were arranged in a randomized complete block design replicated three times. The Melita site was slightly different than other sites in that the trial replications were split in half so that one side would be sprayed with fungicide and the other not. Hamiota, Arborg and Roblin did not have fungicide applications. Melita site was planted into a loamy soil on Souris River bottom located on NE 36-3-27 W1, while the Hamiota site was planted on a Newdale Clay loam soil at SW 6-15-24 W1. Soils in Arborg and Roblin are clay and loamy textures, respectively. Seeding dates, seeding fertility, weed control, and harvest dates varied among sites (Table 1).

Table 1: Seeding date, fertility regime, weed control and harvest information for Arborg, Hamiota, Roblin, and Melita (river) sites.

Site	Seed Date	Fertility Regime	Weed Control*	Application Date	Harvest Date
Melita	21-May	70 lbs/ac N & 30 lbs/ac P	Everest, 2-4D ester500	15-Jul	16-Sep
Hamiota	27-May	80 lbs/ac N & 30 lbs/ac P	Attain A+B, Puma, Axial	20-Jul	29-Sep
Roblin	14-May	40 lbs/ac N & 30 lbs/ac P	Frontline, Axial	June 15 & 25	24-Sep
Arborg	03-Jun	90 lbs/ac N & 27 lbs/ac P	-	-	-

*Applied at recommended rates

Soil tests were taken prior to seeding at each site (Table 2). Considerable nitrate values were available at the Hamiota and Roblin sites compared to the Melita and Arborg sites.

Table 2: Soil nutrient profiles of Melita, Hamiota, Roblin and Arborg sites at 0-6" and 6-24" depths.

Site/Depth	0-6"				6-24"	
Nutrient	N	P	K	S	N	S
	lbs/ac	ppm	ppm	lbs/ac	lbs/ac	lbs/ac
Melita	13	13	358	14	36	54
Hamiota	37	7	220	18	60	54
Roblin	50	70	180	20	77	14
Arborg	17	11	442	-	22	-

In Melita, Tilt 250E, a propiconazaole formulation, was used as the fungicide to control leaf diseases at recommended rates. The fungicide was split into two applications. The first application was on July 2nd, and the second was on July 12th at the booting and flag leaf emergence stages, respectively.

Data collected included height, leaf disease severity, test weight and final yield. Disease ratings were taken in Melita before application of the fungicide. Final yields were adjusted for 14.5% moisture content. In Melita, disease was rated as one rating per plot based on the McFadden Scale (AAFC, McLaren, Brandon, MB). All site data was analyzed with a two-way analysis of variance (Analyze-it version 2.03 statistical software, Microsoft) to test data means for significance according to each location. A paired t-test was also performed to compare variety response yield means to fungicide application versus without fungicide application.

Results

There were significant yield differences at both harvestable sites at the 0.05 level of significance according to the analysis of variance (Table 3). Coefficient of variation was low at all sites indicating a good data set. Grand mean for each site was 5396 kg/ha in Roblin, 4855 kg/ha in Melita (without fungicide), and 4611

kg/ha in Hamiota. There was no yield data developed at the Arborg site because of extensive flooding in that region once again in 2009.

Table 3: Shows the mean yields of the Hamiota, Roblin, and Melita wheat yields. Melita compares sprayed versus unsprayed yield means and its corresponding mean spray advantage as a percentage of yields. Both sites' means do not include the sprayed Melita values for yield, only unsprayed.

	Average Yield*	Hamiota	Roblin	Melita (kg/ha)		
Variety	kg/ha	kg/ha	kg/ha	Sprayed	Unsprayed	% Spray Adv.
WFT 503	5795.2	5579.7	6326.7	5723.2	5479.1	4.5
WFT 504	5633.0	5066.8	6260.0	5630.0	5572.2	1.0
WFT 510	5410.9	5411.6	6000.0	5387.9	4821.1	11.8
WFT 516	5392.0	5374.3	5433.3	5997.5	5368.4	11.7
AC Andrew	5355.5	4732.9	5673.3	6525.7	5660.1	15.3
WFT 514	5206.3	4837.9	5420.0	5922.9	5361.2	10.5
5702PR	5151.2	4999.3	5480.0	5558.9	4974.3	11.8
WFT 507	5138.4	5349.7	4906.7	5065.2	5158.9	-1.8
WFT 409	4998.3	4520.2	5326.7	5510.2	5148.0	7.0
WFT 517	4937.6	4706.6	5373.3	5369.6	4733.0	13.4
WFT 508	4763.4	4064.5	5846.7	4354.7	4379.0	-0.6
Unity	4759.7	4287.8	5240.0	5319.5	4751.3	12.0
WFT 502	4703.2	4426.5	4980.0	4893.3	4703.1	4.0
WFT 501	4530.5	4293.4	5093.3	4402.3	4204.7	4.7
WFT 411	4288.0	3689.8	4680.0	4996.0	4494.1	11.2
WFT 506	4094.9	3256.4	4920.0	3874.4	4108.4	-5.7
WFT 509	4064.1	3794.7	4780.0	3661.8	3617.6	1.2
	CV%	9.0	8.7	8.7	8.0	Sign. Adv.
	LSD (p<0.05)	688.0	777.4	749.2	647.2	p<0.003
	Grand Mean	4611.3	5396.5	5187.8	4855.0	6.9

*Average Yield between Hamiota and Melita (unsprayed)

Yields were not taken at the Arborg site due to overland flooding.

In Hamiota, yields were significantly different among varieties and generally followed the provincial average in rank. Varieties including WFT 503, WTF 516, WTF 504, WTF 507, WFT 510, and 5702PR were the highest yielding varieties.

In Roblin, yields were significantly different among varieties and generally followed the provincial average in rank. Varieties WFT 503, WFT 504, WFT 510, AC Andrew, and WFT 508 were the highest yielding varieties.

In Melita, plot replications were split in half with one side being sprayed with fungicide and the other not. Fungicide application significantly increased yield overall by 6.9% on average according to grand means ($p < 0.003$). The majority of varieties responded positively to a fungicide application ranging from 1.0% to 15.3% yield response whereas only three varieties responded negatively to

fungicide application ranging from -5.7% to -0.6%. CV% for the trial was low for plots applied with fungicide as well as those without an application indicating a good data set. The most positive response to fungicide was AC Andrew, improving 865.6 kg/ha compared to unsprayed plots. This is not necessarily a positive attribute in a variety. Some of the WFT varieties such as WFT 504 and, to a lesser extent, 503 had much greater yield stability, in that the fungicide had little impact in increasing the already respectable yield. These "stable" varieties could be an option for keeping costs down by reducing fungicide use. In WADO's trials at Melita, WFT 516, AC Andrew, and WFT 514 were the highest yielding varieties after the fungicide application. Without spraying, WFT 516, WFT 514, and AC Andrew are still the highest yielding varieties, but other varieties such as WFT 503, WFT 504, WFT 501, and WFT 409 are also among the top yielders. Lowest yielding varieties were WFT 509, WFT 506, and WFT 501 (both sprayed and unsprayed). In 2009 across the three locations, 503, then 504, then 510 and 516 were the highest yielding of all the varieties.

2009 was a good year for low disease pressure. So, based on this year's results, it would be difficult to justify the extra application costs of a fungicide given the relatively small 6.9% yield advantage across all these varieties given the basic price of $4 to $5/bushel for this type of wheat. However for varieties which respond strongly to fungicides, applications could be worth while in a year like 2009, but especially in a year that would favor high disease pressures.

Representative samples of each plot were bagged and sent to AgQuest for further analysis of protein and *Fusarium* infection levels. For further information on data such as disease, height and test weight values, please contact WADO or the WFGDC / AgQuest.

Picture: WFGDC Evaluation Trial at Melita in 2009 (notice mowed area in centre for fungicide comparison on the front half of each plot)

Ancient Grains Resurrected

With the onset of organic agriculture, food quality awareness, and health trends in society, the need for an ancient wheat demonstration in Manitoba became appropriate. A collection of ancient and/or forgotten grains was compiled from several sources and grown in various locations across the province including Arborg, Roblin, Melita, Carberry and Portage. These grains (mostly wheats) served as a demonstration backdrop during field tours as well as assessing their growth and form. Some are grown even today in parts of Manitoba as well as across the world. Markets and development for these wheats include organic products, wheat allergy food products, and breeding stock for future wheat lines.

DWARF INDIAN WHEAT

(*T. sphaerococcum*) – Dwarf Indian (AABBDD, 2n = 6x = 42) is a hexaploid land race of wheat known from the Indian subcontinent. Short and very upright, the heads are rather short and look like bottle brushes. The kernels are plump and almost round. It has several favorable characters including short and strong culms, hemispherical grains with a shallow crease (that may increase the yield of white flour), higher protein content compared to bread wheat (*T. aestivum*), and resistance to drought, and yellow rust caused by *Puccinia striiformis*. However, an unfavorable characteristic of *T. sphaerococcum* is its lower yield compared to bread wheat. Being a land race, the sphaerococcum wheat is poorly studied. According to recent evidence, it is possible that the origin of *T. sphaerococcum* was the result of a mutation in *T. aestivum*.

CLUB WHEAT

(*T. aestivum* subsp. *compactum*) – One of the more modern species of wheat, probably developed around 8,000 years ago as a result of a cross between *T. dicoccum* and *Aegilops squarrosa*. Club was widely grown for food before common bread wheat dominated wheat growing. The heads and beards are short, the yield is good, and it threshes easily, producing plump blonde kernels; it is considered as a soft white wheat. Club wheat is a hexaploid (AABBDD) with 2n=42 chromosomes, belonging to the same species as common bread wheat. The heads of this subspecies are more compact, but the difference can be attributed to changes in just two genes controlling spikelet density. Most of the commercial production of Club wheat occurs in the Pacific Northwest of the US (360,000 tonnes/yr), with limited production in Australia.

POLISH WHEAT

(T. *polonicum*) – this tetraploid (AABB) species has large bearded seed heads. The seeds are long and about twice the size of ordinary wheat and can be cooked. It is usually ground into flour and used as a cereal, which is high in gluten. The large seeds are suitable for making macaroni but not for bread. The grain falls readily from the ears, but it is of no value for milling. A rather primitive wheat, it probably arose through cultivation about 10,000 years ago following a cross between *T. aethiopicum* (the first primitive wheat) and *Aegilops sp*. It is

sometimes cultivated for its edible seed, especially in N. Africa and the Mediterranean, and it can be grown very successfully under garden conditions. There are some named varieties. 'Kamut' has very large kernels: 2 - 3 times the size of modern wheats. The seed contains significantly higher levels of protein and slightly higher levels of lipids and minerals. Polish wheat is reportedly less allergenic, though this has not been substantiated by controlled studies. The seed is said to have a superior flavor.

VAVILOV WHEAT
(*T. vavilovii*) – a hexaploid (AABBDD) species named after the great Russian plant scientist and collector, this old wheat has a very irregular seed head and is somewhat difficult to thresh. The straw has many uses: as a biomass for fuel etc, for thatching, as mulch in the garden etc. A fiber obtained from the stems is used for making paper. The stems are harvested in late summer after the seed has been harvested; they are cut into usable pieces and soaked in clear water for 24 hours. They are then cooked for 2 hours in lye or soda ash and beaten in a ball mill for 1½ hours. The fibers make a green-tan paper. The starch from the seed is used for laundering, sizing textiles etc. It can also be converted to alcohol for use as a fuel. It succeeds in most well-drained soils in a sunny position. Vavilov is one of the more modern species of wheat, probably developed in cultivation around 8,000 years ago, following a cross between *T. dicoccum* and *Aegilops squarrosa*. This cross contributed an extra protein gene to the seed, making much stronger flour for baking as bread. This species is still occasionally cultivated for its edible seed in Armenia.

RIVET WHEAT
(*T. turgidum*) – An old wheat species with large blonde grains that are used in the production of pasta, it is similar to Vavilovii except that the heads are bearded. An easily grown plant, it succeeds in most well-drained soils in a sunny position. One of the more primitive forms of wheat, it was probably developed in cultivation from *T. dicoccoides* about 10,000 years ago. It is still occasionally cultivated for its edible seed, there are some named varieties. It is not very high yielding. A tetraploid (AABB) species, it is grown mainly in Britain.

KAMUT
(*T. turgidum*) – a relative to modern durum, it is referred to as the “Sweet Wheat,” its origin in the fertile crescent of Mesopotamia (Iraq and Syria) and parts of Egypt. A rather large hard amber wheat with a humpbacked kernel, it has rather low quality and yield but high nutritional value. Kamut contains more energy, minerals and antioxidants that other wheats. The high versatility of KAMUT® brand khorasan wheat makes it ideal for many uses: flour, bread, pasta, hot and cold breakfast cereals, pizza, cookies, crackers, cakes, snacks, pancakes, syrup, green foods and a delicious drink. Although it has hypo-allergenic and hypoglycemic properties, it also has a very low glycemic index which is great for diabetics, hypoglycemics, dieters, and athletes who look for foods that don’t stimulate insulin and fat storage. Research on patients with celiac disease

(gluten intolerance) has not been completed and Kamut is not recommended for consumption with this illness. The seed was obtained from PHS Organics Inc. in Radville, Saskatchewan. For more info visit: www.kamut.com

BLACK EINKORN

(*T. monococcum*) – is a diploid (AA) and most likely the earliest domesticated wheat, Einkorn has flat black heads that are not very long and resemble the heads of crested wheat grass. Einkorn matures later than common spring wheats. Suited for arid marginal land, it is now a relict in modern day, most commonly used to make bulgur (parboiled, dried, de-branned) or as animal feed, in mountainous areas of France, Morocco, the former Yugoslavia, Turkey and other countries. Einkorn is a diploid hulled wheat, with tough glumes ('husks') that tightly enclose the grains. The cultivated form is similar to the wild, except that the ear stays intact when ripe and the seeds are larger. Einkorn wheat was one of the earliest cultivated forms of wheat, alongside emmer wheat (*T. dicoccon*). Grains of wild einkorn have been found in Epi-Paleolithic sites of the Fertile Crescent. It was first domesticated approximately 9000 BP (9000 BP ≈ 7050 BCE), in the Pre-Pottery Neolithic A or B periods. In contrast with more modern forms of wheat, there is evidence that the gliadin protein of einkorn may not be as toxic to sufferers of celiac disease. It has yet to be recommended in any gluten-free diet.

SPELT

(*T. aestivum* subsp.*spelta*) – This hexaploid (AABBDD) wheat has long (up to 6") slim heads which break easily. Plants and heads bend over when ripe. It requires moderate amounts of nitrogen compared to common spring wheat (25-50% less) making it suitable for organic systems. Although most Spelts are fall seeded, this is a spring seeded variety. 'CDC Nexon' is the first registered spring Spelt wheat cultivar in North America, and in the OECD sphere. Small amounts of seed were made available directly from the CDC, starting in 2003. People with wheat allergies commonly report that spelt is easier to digest than other wheats, but for people with gluten allergies, this wheat offers no substitute. Winter Spelts offer a harvest advantage of 8 to 10 days earlier than common winter wheat varieties, providing potential to seed relay or catch crops for longer season growth late in the year. Common Spelt is susceptible to rusts, *Fusarium*, powdery mildew and loose smut, but during cool moist spring, Spelt can stave off soil born diseases because of its thick hull. The seed in the plot was obtained from Pollock Farms, near Brandon, MB.

Dwarf Indian Wheat

Vavilov Wheat

Club Wheat

Polish Wheat

Black Einkorn Wheat

Rivet Wheat

Spelt

Kamut wheat

Teff

TEFF

(*Eragrostis tef* (Zucc.) Trotter) – Teff is a warm season annual grass that resembles a similar morphology as a Proso Millet. Teff is grown primarily as a cereal crop in Ethiopia and is believed to have been developed from 4000 BC to 1000AD. The grain is ground into flour, fermented and made into enjera, a sour-dough type flat bread. Nutritionally teff consists mainly of bran and germ, and contains no gluten - a source of many food allergies. Teff is rich in calcium, phosphorous, iron, copper, aluminum, barium and thiamin, and is a good source of protein, amino acids (especially lysine), carbohydrates and fibre.Teff is eaten as porridge or used as an ingredient of home-brewed alcoholic drinks. Teff is also grown for livestock forage. In Ethiopia teff straw from threshed grains are considered to be excellent forage, superior to straws from other cereal species. Teff straw is also utilized to reinforce mud or plasters used in the construction of buildings. Teff is virtually unknown in North America and the cultivation that does exist is done by private entrepreneurs in the U.S.

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Predicting Drop Development with Accumulated Thermal and Meteorological Relationships

Cooperators:
Canadian Wheat Board – Mike Grenier
University of Manitoba - Dr. Paul Bullock

Locations:
AAFC – Swift Current, Regina, Melfort (Saskatchewan)
University of Saskatchewan – Crop Development Centre
Westman Agricultural Diversification Organization – Melita (River Site), Wawanesa, Hamiota, MB
University of Manitoba – Carman, MB

Background

As part of the weather network initiative and launch of weatherfarm.ca, the CWB has undertaken a number of projects in support of application development for weather based decision support systems. The CWB is coordinating the growth stage work and in collaboration with Dr. Paul Bullock from University of Manitoba will be conducting the final data analysis. Cooperators are anticipating at least two years of field work before the start of any information release.

The CWB, through its weather network is looking at opportunity to provide daily growth stage predictions in real time based on meteorological parameters or thermal time. Various growing degree day and photothermal models are being evaluated. To help guide model development, in field plant development staging is required to evaluate model predictions.

The broad spectrum of locations provides good coverage of brown, dark brown and black soil zones as well as good range of day length with the varying location latitudes and meteorological conditions.

Objectives

- To validate phenological development models for use in predicting growth stage development through CWB weather network project.
- To observe phenological growth stage under field grown conditions in order to compare predicted versus observed data over the growing season.

Field setup

Trial design to include at least 8 varieties by two replicates in a randomized block design. Plot size to be determined by local site co-operator and based on standard layout given available equipment.

Varieties:

CWRS:	Early:	AC Splendor and Intrepid
	Medium	AC Barrie (neutral) and Kane
	Late	Superb and BW874
Barley:	Malting	AC Metcalfe
	Feed	Conlon

Phenological Development Measurements

At each location, phenological observations were recorded weekly from seeding using the Haun scale (Haun 1973) followed by the Zadok scale during the vegetative, reproductive (anthesis) and final maturity phases of crop development. A total of 10 plants per plot were designated for observation at Melita, Hamiota, and Wawanesa. Data was collected and sent to the Canadian Wheat Board for computation and analysis.

Data is to be correlated with climatic parameters to help forecast various agronomic considerations in terms of crops stage and real time crop scouting issues.

What does this mean for Producers?

This data will help farmers by improving pest risk forecast in terms of synchronizing risk with the crop development stage. For example synchronizing pest development risk with host crop stage such as anthesis stage for Fusarium Head Blight. Earlier growth stage information will be useful for farmers in planning their crop scouting and assessing where crop development is relative to potential pest risks.

Significance to CWB

From the CWB perspective, having improved crop growth staging information will be incorporated into internal crop yield and quality forecasts. This will allow better assessment of any heat or moisture stress impacts during critical periods for yield determination as well as end use quality functionality.

Reference:

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Alternative Use Barley Demonstration

Site Information
Location: Melita, MB
Cooperator: Dr. Mario Therrien – Agriculture and Agri-Food Canada

Background
Provided by Dr. Mario Therrien

Not all areas in Manitoba are suited to growing high quality and malt barley. This demonstration has a total of 15 barley varieties grown to demonstrate to producers new non-malting barley varieties. The varieties showcased in this demonstration give producers options to utilize barley on their farms.

Objective

A demonstration of the newest barley varieties from AAFC including 2 and 6 row hulless, forage, malt and grazing varieties.

Methods

Treatments: 15 varieties (Table 1)
Replication: 1
Plot size: 1.44 m x 8.5 m
Test design: Simple plot demonstration – not replicated
Seeding date: May 21, 2009
Fertilizer applied: 70 lbs. actual N (28-0-0) and 30 lbs. actual P (11-52-0)
Pesticide applied: Puma and Attain AB June 19
Harvest date: September 2, 2009
Product handling: Some data recorded with harvest errors – demonstration only

Table 1. Barley Varieties and Description

Alston	New six-row feed cultivar from Viterra
Champion	New two-row feed cultivar from Viterra
AC Ranger	Established six-row forage barley from AAFC Brandon - most widely grown
Desperado	Newest six-row forage cultivar from AAFC Brandon
CDC Cowboy	New two-row forage cultivar from the Crop Dev. Centre in Saskatoon
Binscarth	New specialized forage-grazing barley cultivar from AAFC Brandon
FB015	Unique extended grazing barley from AAFC Brandon in coop testing
Millhouse	Canada's first milling food barley
HB 122	Second-year entry in coop trials as two-row hulless food
HB 123	First-year entry in coop trials as two-row hulless food
HB 124	First-year entry i n coop trials as two-row hulless food
CDC McGwire	Established two-row hulless feed cultivar - for use in poultry, mainly
HB 125	First-year HB Coop six-row hulless feed entry - for swine feed
Enduro	New two-row 'waxy' hulless food barley from Viterra
CDC Lophy-I	Specialized low phytate two-row hulless feed barley from CDC

Results

This was a demonstration where no data was taken. It is intended for general observation and visual comparison.

Important Considerations and Recommendations

This demonstration has barley varieties from every major class of barley intended for multiple uses and markets. Direct one-on-one comparisons may, therefore, not be valid.

Conclusions

Demonstration of multiple types of barley can inform the producer of multiple uses and marketing options for barley and the general suitability for local production.

Relay Cropping Effects of Black Medic, Red Clover, & Hairy Vetch on Spring Triticale Silage & Grain Production

Investigators
Scott Chalmers P. Ag. & Scott Day P. Ag.
Westman Agricultural Diversification Organization (WADO), Melita MB

Background

Relay Cropping (a specific type of cover cropping) is the practice of seeding a separate crop into/with a main crop in order to maximize the resources of the entire growing season. Generally the goal is to take advantage of any extra growing season that may occur after the main harvest. With our short cropping season in Manitoba relay crops are sometimes "harvested" as forage or grazing in late fall, but there are opportunities where a second "crop" could be produced as well. However, Relay Crops most often are used to provide ground cover and fix nitrogen in the fall after the main crop is harvested. As such they are often not harvested and are left to grow until winter shuts them down. Relay crops can offer benefits to conventional cropping systems such as adding soil N, improved light, moisture and nutrient efficiency, reducing soil erosion, improving soil quality, boosting yield, and suppressing weeds. However, Relay Crops can also act like a "weed" themselves and very careful planning and suitable conditions need to be present for the technique to be effective.

Black medic (*Medicago lupulina* L.) is an annual, winter annual, biennial, or short lived perennial legume able regenerate itself from seed every year.

It has a tap root, and spreads low to the ground, but it does not root from nodes on the stems. Research conducted by the University of Manitoba has show black medic to produce up to 38 kg/ha soil N when cropped with flax (Naguleswaran & Entz, 2007). Black Medic is not generally integrated intentionally into most farms and is considered a noxious weed in many jurisdictions. Black Medic can be a significant problem in forage seed production, with other pulse crops, and can be difficult to clean out of flax.

Red clover (*Trifolium pratense* L.) is a short lived perennial legume generally grown for fodder and its inherent ability to fix nitrogen during the growing season (similar to black medic). It is typically under-seeded within a cereal crop and later used for late season grazing. It seems to do well in higher rainfall situations.

Hairy vetch (*Vicia villosa* Roth) is grown as an annual or winter annual and able to produce prolific stands with 3-10 spindly vines up to 6 ft long. Its popularity has increased recently as a cover/relay crop and in organic systems as both a quality forage and significant N-fixer. (Undersander et al. 1990)

Purpose: To evaluate the performance of spring triticale in both grain and silage systems when seeded with the relay cover crops: black medic, red clover, or hairy vetch. Then to evaluate the late season re-growth of the legumes in these systems.

Methods

The trial, located at Melita Manitoba, consisted of three seeding combinations with spring triticale and one check replicated three times in a randomized complete block design (RCBD). Treatments were as follows:

1. Triticale (Check) - variety 'Banjo' (100 lbs/ac)
2. Triticale + Black Medic cv. 'George' (10 lbs/ac)
3. Triticale + Red Clover cv. 'Altaswede' (10 lbs/ac)
4. Triticale + Hairy Vetch (35 lbs/ac)

Six rows per plot were direct seeded May 20th into wheat stubble at a depth of 1" using Seedhawk™ dual knife openers with 9.5" spacing. Soil test was taken prior to seeding (Table 1). Fertilizer was side banded using 28-0-0 (liquid) and 11-52-0 (granular) for a final rate of 50 lbs/ac N and 30 lbs/ac P.

Table 1: Soil nutrient profile of site prior to seeding at Melita, MB.

Depth	N lbs/ac	P ppm (olsen)	K ppm	S lbs/ac	pH
0-6"	14	14	348	16	8.0
6-24"	36			42	
0-24"	50			58	

Weeds were controlled with Achieve (400g/L tralkoxydim) at a rate of 0.2 L/ac (+ Turbocharge adjuvant) at tiller stage. Plots were split in half by length in order to do a silage harvest at the soft dough stage, followed by a grain harvest at maturity. Plot was harvested for silage with a flail mower and grain was harvested with a Hege plot combine. Hairy vetch plots had to be desiccated with glyphosate (Credit 1 L/ac) in order to dry down properly for a grain harvest.

Data was analyzed with a two-way ANOVA and coefficient of variation (CV%) was calculated. If ANOVA was significant and unprotected least significant difference (LSD) was calculated at the 0.05 level of significance. Data collected included dry silage biomass, a composite feed test sample, and total grain yield.

Results

There were no significant differences among treatments with the dry matter silage harvest, but there were significant differences in the grain harvest (Figure 1). Acceptable coefficients of variation indicate a solid data set (Silage 10.9% & Grain 13.5%). The addition of legumes into the system appears to boost silage dry matter, though this trend is not statistically significant. Hairy vetch continued to grow very well past the silage harvest date in the grain plots. This indicates that if we had taken a second silage harvest at a later date the Hairy Vetch combination would have produced even more superior yields (picture # 3). However, no further measurements were taken after the initial silage harvest of all the plots (there were no more plots left to harvest)

Feed test analysis was performed on all treatments and summarized in Table 2. Relevant differences were observed with higher crude protein, calcium, potassium and Acid Detergent Fiber in hairy vetch plots, but the Hairy Vetch had lower values for Relative Feed Value. Generally, the triticale check plots were of lower quality than those including legumes.

Grain yields resulted in significantly lower values (LSD = 18.1 bu/ac) in plots seeded to Hairy Vetch compared to all other treatments (graph 1), this was expected with the significant biomass production of the Hairy Vetch. Black medic and red clover treatments were not significantly different to the check, indicating their potential for suitability in grain production without affecting final grain yield.

Figure 1: Silage dry matter and final grain yield in triticale (T) plots under seeded to hairy vetch (HV), black medic (BM), or red clover (RC). Asterisk* indicates a significant difference at the 0.05 level of significance.

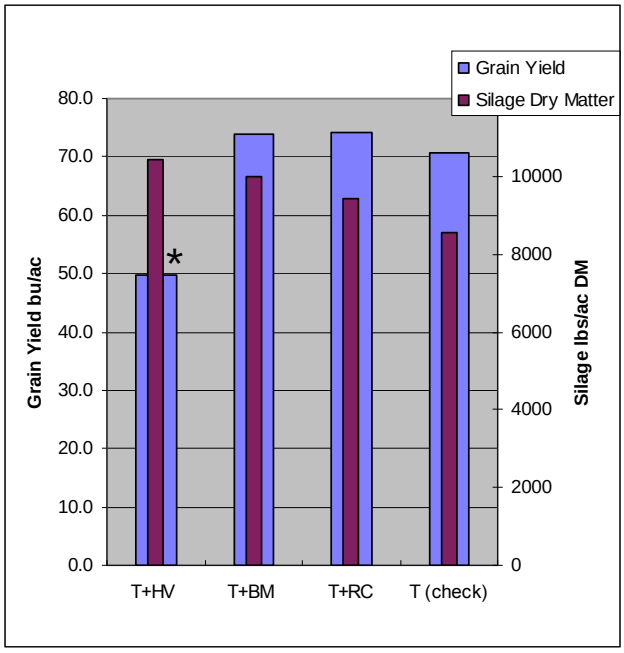

Table 2: Composite feed quality parameters in Triticale (T) plots under seeded to Hairy Vetch (HV), Black Medic (BM), or Red Clover (RC).

	Dry Matter Analysis											
	CP	Ca	P	Mg	K	Na	ADF	NDF	NFCarb	TDN	NetE Gain	RFV
Treatment	%	%	%	%	%	%	%	%	%	%	Mcal/kg	
T+HV	9.09	0.40	0.21	0.12	2.04	0.08	40.57	60.89	19.22	57.90	0.67	88
T+BM	7.95	0.26	0.25	0.10	1.20	0.08	36.28	57.29	23.95	60.04	0.73	98
T+RC	8.14	0.18	0.24	0.11	1.13	0.11	35.97	57.14	23.92	60.20	0.74	99
T (check)	7.70	0.18	0.14	0.16	1.09	0.03	37.40	56.91	24.59	59.48	0.72	98

Visual assessments of legume regrowth were monitored after both the silage and grain harvest. After the silage harvest on August 10th, none of the legumes were able to recover and grow. It is expected that the impact of entire plant removal right to ground level at this point was detrimental to post-silage growth, even despite that black medic and red clover's growth habit are basal. After grain harvest on Sept 27th the black medic continued to grow in the stubble and was able to produce seed (Picture 1 – taken Sept. 30th). Red clover failed to produce any appreciable growth after grain harvest. Hairy vetch would have continued to grow well into late fall, however it had to be desiccated prior to harvest for the triticale grain yield assessment.

Picture 1: Black Medic continuing to grow well after the harvest of triticale grain, a self seeding legume and N fixer.

Picture 2: Taken Aug 21st showing the significant biomass growth in triticale plots with hairy vetch (left orange box) compared to those without hairy vetch (right blue box). This is eleven days after silage harvest (silage harvested from the front half of each plot)

Discussion

Relay cropping legumes such as black medic and hairy vetch appear to have the potential to boost silage yields with Triticale. The competitive nature of triticale along with its other characteristics such as drought tolerance and its lower need for inputs makes it a desirable crop to be used in combination with a relay crop. The real benefit from Relay cropped legumes is the additional nitrogen they fix in the fall. This experiment was not capable of evaluating this benefit. However, we plan to revisit this site in 2010 to evaluate this expected N bonus. This experiment did show that you could relay crop some legumes without significant detriment to the cereal crop in the year of establishment.

Red clover appears to have little economic effect on silage yield, feed quality, grain yield and potential as late season forage for grazing, especially when you consider the high price of its seed. However, its N contribution could be significant and is yet to be determined.

Black medic may boost silage yield and increase crude protein, Ca, P, and K without compromising relative feed values (RFV) or energy content (TDN). In addition, the producer would have the option to harvest the cereal as grain without affecting final yield. Yet still have an N-fixing legume for late fall grazing or simply providing extra N for subsequent crops. However, like was mentioned at the beginning Black Medic should be used with significant caution.

Hairy vetch may also boost silage yield and improve some feed quality characteristics but may reduce TDN and RFV. Final silage yield and feed quality characteristics may have changed if left to grow longer but that may have compromised triticale feed quality. Adjustment of seeding date of hairy vetch to a fall dormant date may assist in proper timing for maximum silage potential and quality. Delaying the seeding of the hairy vetch in relation to the cereal crop may offer improved grain production and still provide the benefits of late season grazing.

Hairy vetch significantly reduced final grain yield. The amount of material put through the harvester was not practical, and grain moisture levels were slightly higher on average (~1%) than other treatments. There was some hairy vetch seed production in the triticale grain sample but it was likely uneconomical to separate and market, we also don't know if this seed had reached full maturity. Hairy vetch seed production systems are likely more suited to winter cereal production and the fall seeding of hairy vetch.

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Intercropping Peas and Canola

Investigators:
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Westman Agricultural Diversification Organization (WADO)

Background

Intercropping is the agricultural practice of cultivating two different crops in the same place at the same time (Andrews & Kassam 1976). Benefits of intercropping can lead to greater than expected yields compared to the sole crop. Reasons for additional yield may be the result of greater efficiency in the use of nutrients, light and water (Szumigalski & Van Acker 2008). Intercropping may improve pest control and provide structural support advantages when compared to each being grown as a sole crop. Intercropping is not a new concept and has been used by farmers for several generations. However, recent improvements in

farm machinery and individual variety characteristics have once again tweaked producer's interests in intercropping.

Often, intercropping is not only measured by total yield of products, but as a total economical value (total $/acre) by combining each crop value, or by Land Equivalent Ratio (LER). The LER is a measure of how much land would be required to achieve intercrop yields with crops grown separately as pure stands. When the LER is greater than 1.0, over-yielding is occurring and the intercrop is more productive than the component crops grown as sole crops. When the LER is less than 1.0, no over-yielding is occurring and the sole crops are more productive than the intercrop. For example; a LER rating of 1.20 from an intercrop of pea-canola means it would take 20% more land to equal that final yield if each crop was planted as separate components.

The purpose of this trial was to examine the effect of seeding rate combinations of pea-canola intercropping in regards to total yield, separate crop yield components, Land Equivalent Ratio (LER), and final stand characteristics compared to that of the sole crop characteristics.

Methods

Plots were direct seeded with a dual knife system on May 14, 2009 at Melita, MB. Seeding depth was 1" into a loam type soil that was previously spring wheat. Six rows per plot were spaced at 9.5". Fertilizer was placed in a side band at a rate of 50 lbs/ac N and 30 lbs/ac P. All pea treatments were inoculated with proper granular based *Rhizobium leguminosarum* bv. *Viciae*. Residual soil fertility was relatively low (Table 1). Treatments were arranged in a Randomized Complete Block Design (RCBD) and replicated three times.

Seeding rate treatments were as follows:

1. Canola Full rate (6 lbs/ac) - variety 71-30 CL
2. Peas Full (120 lbs/ac) - variety CDC Striker
3. Canola 2/3 + Peas Full
4. Canola 1/2 + Peas Full
5. Canola Full + Peas Full
6. Canola 2/3 + Peas 1/2
7. Canola 1/2 + Peas 1/2
8. Canola Full + Peas 1/2
9. Canola 2/3 + Peas 2/3
10. Canola 1/2 + Peas 2/3
11. Canola Full + Peas 2/3

Table1: Soil fertility of site prior to seeding.

Depth	N lbs/ac	P ppm (olsen)	K ppm	S lbs/ac	pH
0-6"	12	14	429	18	8.2
6-24"	21			36	
0-24"	33			54	

Weeds were controlled using Odyssey™ (35% imazamox + 35% imazethapyr) at a rate of 17g/ac+adjuvant merge applied July 15. Plots were desiccated with Reglone™ (0.91 L/ac) prior to harvest and left standing. Emergence counts were taken June 12 on a single 1 m row. Plots were harvested with a Hege plot combine set at a cylinder speed of 910 rpm, with about 1" cylinder-concave gap. Wind was adjusted for canola. Plot samples were separated using a fanning-mill, then they were weighed and moisture determined. Weights were re-calculated to a constant moisture of 10%.

Harvest values were converted to partial and total LER using the following equation:

Total LER = Ia/Sa + Ib/Sb = Partial LER Peas + Partial LER Canola

Where total LER is the total Land Equivalent ratio, I is the intercrop yield, S is the sole crop yield, and a and b refer to the crop components.

All data (Total Yield, LER's and Emergence) was analyzed with a two-way analysis of variance (ANOVA) and coefficient of variation and Fisher's unprotected Least Significant Difference (LSD) at the 0.05 level of significance was calculated if the ANOVA was significant.

Results

There were significant differences in total yield, both crop's partial LER, total LER, and final stand germination (canola only). (Table 2).

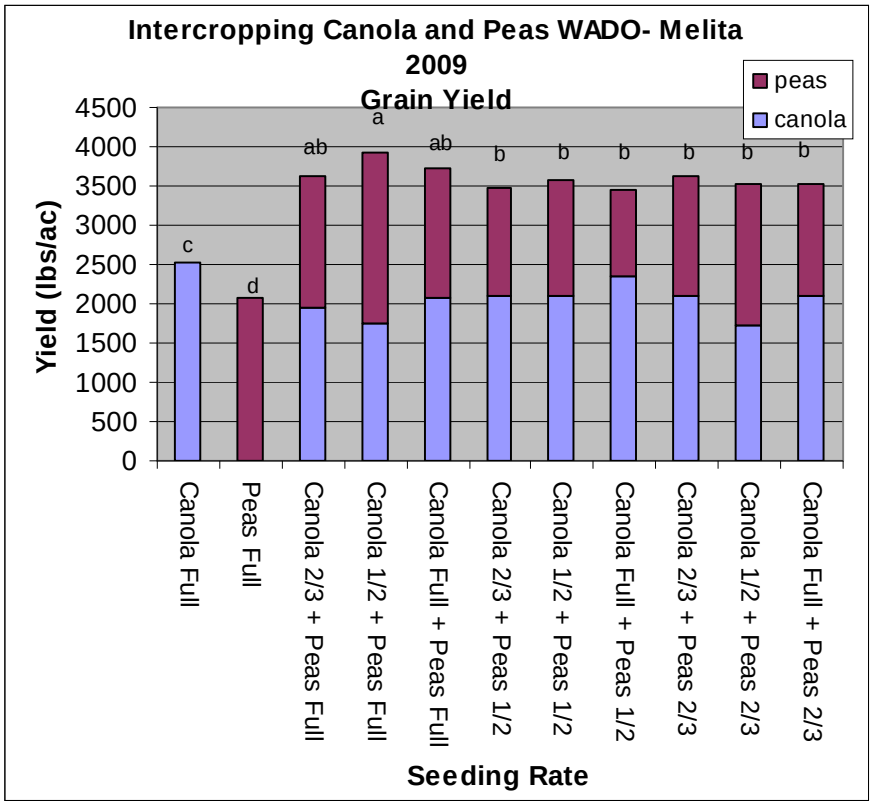
Total grain yield was significantly higher ($p<0.001$) for all intercropped treatments compared to their sole crop derivatives (Graph 1). Treatments 4,5,and 3 (in order of highest to lowest) were the highest yielding treatments. Treatments 5 and 3 were statistically similar to all other intercrop treatments.

Table 2: Final Yield, LER, and stand germination values for each intercrop combination and sole crop treatments.

		Mean Yield (lbs/ac)			Land Equivalent Ratio			Germination* (%)	
Trt No.	Seeding Rate Combination	Canola	Pea	Total	Canola	Pea	Total	Pea	Canola
1	Canola Full	2519.0	-	2519.0	1.00	-	1.00	-	100
2	Peas Full	-	2068.9	2068.9	-	1.00	1.00	100.0	-
3	Canola 2/3 + Peas Full	1956.8	1668.3	3625.1	0.78	0.83	1.61	106.7	45.9
4	Canola 1/2 + Peas Full	1743.5	2174.2	3917.7	0.69	1.08	1.77	66.7	34.5
5	Canola Full + Peas Full	2081.1	1635.9	3717.0	0.83	0.82	1.65	73.3	36.8
6	Canola 2/3 + Peas 1/2	2095.8	1373.7	3469.5	0.83	0.67	1.50	56.7	44.3
7	Canola 1/2 + Peas 1/2	2102.5	1474.1	3576.7	0.83	0.74	1.58	60.0	48.3
8	Canola Full + Peas 1/2	2351.2	1091.8	3443.0	0.93	0.55	1.48	63.3	29.9
9	Canola 2/3 + Peas 2/3	2093.9	1526.4	3620.3	0.83	0.75	1.58	62.1	44.3
10	Canola 1/2 + Peas 2/3	1723.9	1794.6	3518.5	0.69	0.90	1.59	68.0	29.3
11	Canola Full + Peas 2/3	2109.8	1421.5	3531.3	0.84	0.70	1.54	56.2	44.8
	CV%			6.3	9.39	10.08	6.80	35.0	38.0
	LSD (p<0.05)			358.2	0.13	0.14	0.17	ns	30.2
	R-squared			0.94	0.78	0.89	0.91	0.44	0.67
	Grand Mean	2077.7	1622.9	3364.3	0.83	0.80	1.48	71.3	45.8

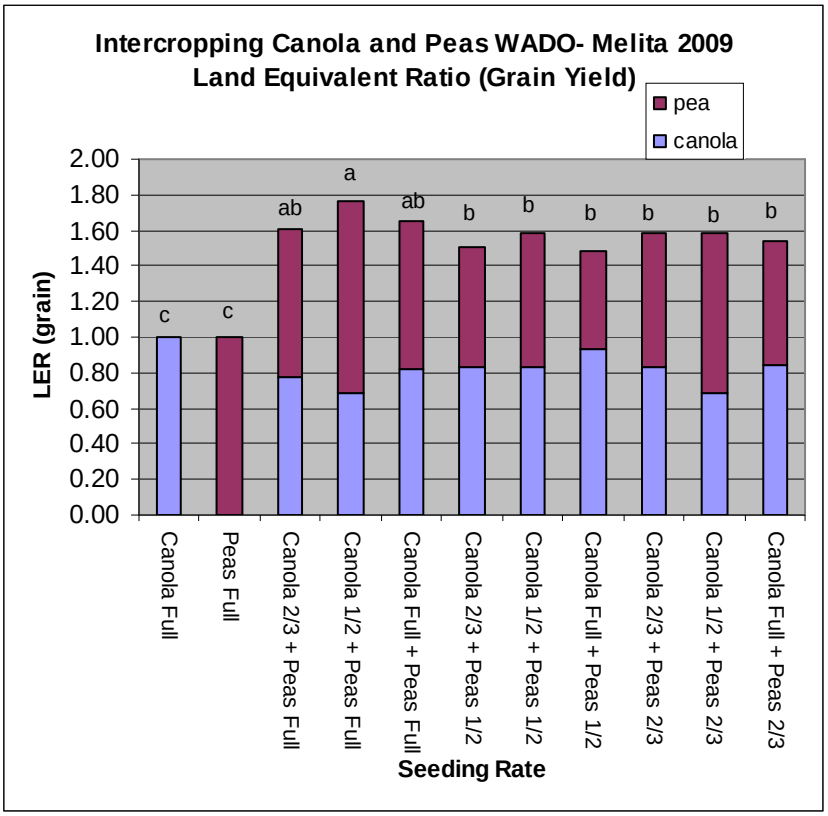
* Germination based on sole crop emergence values and not actual seed quality

Graph 1 (Right): All crop grain components in intercrops were lower yielding than their sole crop derivatives indicating some sort of competitive effects between each crop co-existing together. Treatment No. would be ascending left to right.



Total LER generally followed the same conclusions as total yield. Treatment 4 (1/2 rate canola, full rate peas) with a total LER of 1.77 was similar to treatments 5 and 3, but superior to all other intercrop combinations.

Graph 2 (Right): Total LER composed of each partial LER component for all treatments. Treatment No. would be ascending left to right.



Despite a low coefficient of variation value in both total yield and LER components, error still may have been caused by wildlife browsing during the bolting and early flower stages of crop development. Scare-crows and moth balls were used as deterrents and appeared to be successful.

Interestingly, the plant counts show that canola emergence was possibly inhibited when intercropped with peas. Although there was considerable variation in the data it appears that significant reductions in the canola stand occurred in all intercrop combinations (Table 2, far right). We do not know if this reduction in the canola stand occurred during germination or emergence, or both. The reductions in pea germination were determined to be statistically insignificant. The Coefficient of Variation (CV) in the plant counts was very high in both crops (35% & 38%) and this casts doubt on our observations; regardless, something unique was occurring. This large variability may have been caused from a single count per plot or spatial bias within the plot during counts. Multiple

counts per plot may have helped improve this error. However, there may have just been considerable plant stand variation between the plots, as well.

Discussion

According to this evidence, significant yield increases are achievable by intercropping canola and peas compared to their sole crop derivatives. Despite stand reductions in canola when intercropped with any pea combination, total yield accumulations with both crops were more than sole crop values. Their component grain yields were less when intercropped compared to sole crop yields but when they were combined the intercrop yields were always superior.

Total LER maintained similar results to that of total grain yield. The combination that resulted in maximum production, whether in total grain yield or LER, was when peas were seeded at their full rate and canola at 1/2, 2/3 or the full rate. Canola maintained a rather large partial LER despite the high population of pea plants in those intercrop plots.
We observed that the emergence of canola was negatively affected by pea intercropping. However, the very high CV's in the plant counts detracts from the certainty of this observation. Possibly there was an unforeseen variable in the seeding operation or maybe there were allelopathic pea exudates of root or seed chemicals inhibiting the growth of canola, or some sort of root or seedling disease issue. Similar topics have been discussed by Marles et al. (2008) when weathered pea extracts are used to suppress canola germination in both the lab and greenhouse setting. A similar bioassay would assist in answering this question.

Harvest samples indicated that peas were higher moisture content compared to canola (14.5% moisture vs. 9.8%, respectively). On-farm adoption would need to stress grain separation prior to storage.

Future research considerations should be focused on the effects of pod shatter in this system, possible allelopathic relationships, nutrient, water and light dynamics and economic gain. Further site years of work are needed to confirm these results.

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Development centre, University of Saskatchewan, 51 Campus Drive, Saskatoon, SK, S7N 5A8, Canada.

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Intercropping Peas & Oats for Grain & Silage Production

Investigators:

Scott Chalmers, P. Ag. & Scott Day, P. Ag
Westman Agricultural Diversification Organization (WADO)

Background

Intercropping is an agricultural practice of cultivating two different crops in the same place at the same time (Andrews & Kassam, 1976). Benefits to intercropping can lead to greater yield and quality compared to the sole crop. However, carefully planning and suitable conditions need to occur for each crop to be complimentary (creating a higher overall yield), rather than antagonistic (lowering yields). Reasons for additional yield with intercropping may be the result of greater efficiency in the use of nutrients, light, and water (Szumigalski & Van Acker, 2008). Feed Quality parameters such as crude protein (CP), neutral detergent fiber (NDF) generally improve compared to sole crop parameters (Strydhorsta et al. 2008). Harvest timing can be delayed with oat/pea intercrop silage as the peas will maintain a higher moisture value than oats. This intercrop helps lengthen the optimum time period for silage harvesting. Intercropping is not a new concept and has been used by farmers for several generations. However, recent improvements in farm machinery and individual variety characteristics have once again tweaked producer's interests in intercropping.

Often, intercropping is not only measured by total yield of products, but as a total economical value (total $/acre) by combining each crop value, or by Land Equivalent Ratio (LER). The LER is a measure of how much land would be required to achieve intercrop yields with crops grown as pure stands. When the LER is greater than 1.0, over-yielding is occurring and the intercrop is more productive than the component crops grown as sole crops. When the LER is less than 1.0, no over-yielding is occurring and the sole crops are more productive than the intercrop. For example of an intercrop LER of pea-oat yield was 1.20, it would take 20% more land to equal that final yield as separate components.

The purpose of this trial was to examine the effect of several seeding rate combinations of pea-oat intercropping on total silage yield, forage feed quality characteristics, and final grain yield.

Methods

Six rows per plot were direct seeded May 12th into wheat stubble at a depth of 1" using Seedhawk™ dual knife openers with 9.5" spacing. Soil test was taken prior to seeding. Fertilizer was side band at a rate of 40 lbs/ac N and 30 lbs/ac P. All pea treatments were inoculated with proper granular based *Rhizobium leguminosarum* bv. *Viciae*. Residual soil fertility was relatively low (Table 1). Treatments were arranged in a Randomized Complete Block Design (RCBD) and replicated three times. Through a calculation error the "full rate" for oats was about 33 % more than normal and the full rate for Peas was about 33 % less than normal Seeding rates were as follows:

1. Oats full rate (120 lbs/ac) - variety 'Furlong'
2. Peas full (120 lbs/ac) - variety 'CDC Striker'
3. Oat 1/2 rate+ Pea 1/2 rate
4. Oat 2/3 rate + Pea 2/3 rate
5. Oat full rate + Pea full rate

Table 1: Soil fertility of site prior to seeding.

Depth	N lbs/ac	P ppm (olsen)	K ppm	S lbs/ac	pH
0-6"	12	14	429	18	8.2
6-24"	21			36	
0-24"	33			54	

Weeds, although were not a major concern, were controlled with some minor hand weeding. Plots were split into halves by length, one half for silage harvest and the other half for grain harvest.

Plots were harvested for silage using a plot flail mower at the soft dough stage of the oats on August 5th. Total dry matter was calculated by determining total plot wet weight and subtracting moisture percentages from subsamples taken at harvest and dried. Dried subsamples were combined into composite samples from all three replicates and set to Central Testing Labs (Winnipeg, MB) to determine feed quality characteristics.

Plots were harvested August 26 for grain with a Hege plot combine set at a cylinder speed of 910 rpm, with about 1" cylinder-concave gap. Wind was adjusted for oats. Plot samples were separated using a fan-mill, and separated crop components were weighed. Data collected included crop emergence, leaf disease, dry matter silage yield, feed quality characteristics, and final grain yield.

Crop components were converted to partial and total LER using the following equation:

Total LER = Ia/Sa + Ib/Sb = Partial LER Peas + Partial LER Oats

Where total LER is the total Land Equivalent ratio, I is the intercrop yield, S is the sole crop yield, and a and b refer to the crop components. All data (Total Yield, total LER) was analyzed with a two-way analysis of variance (ANOVA). Coefficient of variation and Fisher's unprotected Least Significant Difference (LSD) at the 0.05 level of significance was calculated.

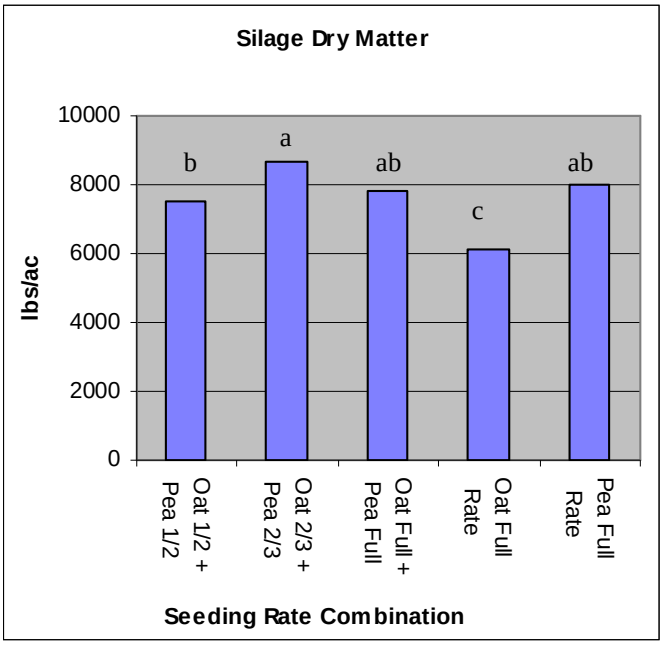
There were significant differences in silage yield ($p<0.0085$) among treatments but not total grain yield and total LER (Table 2).

Table 2: Crop component grain yield, total grain yield, total LER values, and silage dry matter (DM) for each intercrop combination and sole crop treatments.

	Grain (lbs/ac)				Silage DM
Seeding Rate	Peas	Oats	Total	Grain TLER	lbs/ac
Oat 1/2 + Pea 1/2	923.9	4995.4	5919.3	1.3	7495.5
Oat 2/3 + Pea 2/3	508.7	3742.6	4251.3	1.0	8637.8
Oat Full + Pea Full	805.1	4665.0	5470.1	1.2	7793.6
Oat Full Rate	-	4897.6	4897.6	1.0	6138.2
Pea Full Rate	3695.4	-	3695.4	1.0	7994.2
		CV%	30.0	20.4	7.7
		LSD ($p<0.05$)	ns	ns	1108.0
		R-squared	0.37	0.45	0.96
		Grand Mean	4846.8	1.1	7611.9

Coefficient of variation (CV%) was low for silage DM indicating a solid data set. All intercrop silage treatments with pea significantly yielded more DM than the sole oat crop. Seed combination oat 2/3 + pea 2/3 maximized the most silage DM but was not significantly different from using full rates of intercrops or simply peas (Figure 1). The CV on the grain yields from this trial were too high to consider a good data set.

Figure 1: Silage dry matter yields of various oat and pea intercrop combinations compared to sole crops of oat and pea.



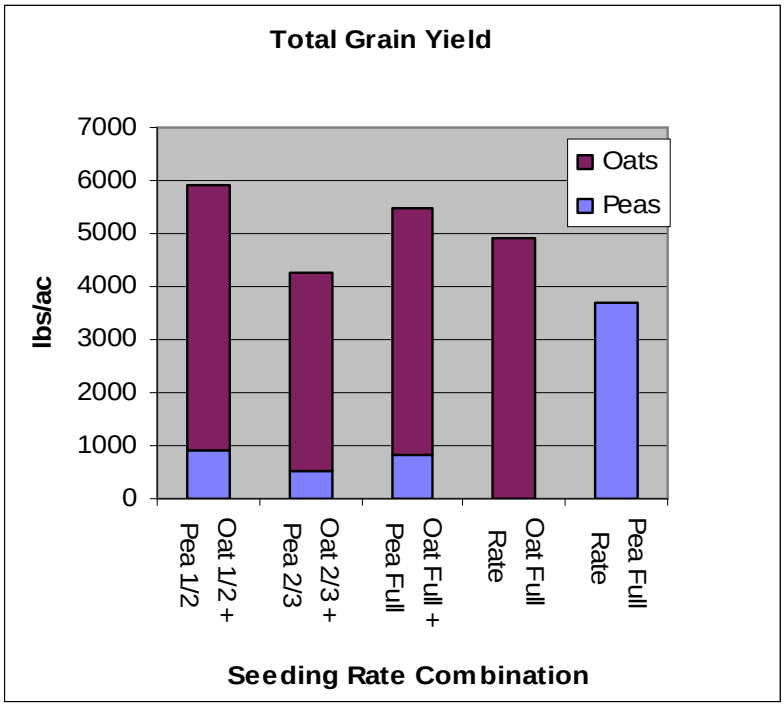
Forage quality characteristics generally improved for oats when intercropped with peas (Table 3). Multiple parameters such as Crude protein, Ca, Mg, K, NaCl, and RFV improved when oats were intercropped with peas.

Table 3: Feed Quality parameters of various oat and pea intercrop combinations compared to sole crops of oat and pea.

Seed Rate Treatment	CP %	Ca %	P %	Mg %	K %	Na %	NaCl %	ADF %	NDF %	NonFiber Carb %	TDN %	NEG Mcal/kg	RFV
Oat 1/2 + Pea 1/2	9.37	0.47	0.21	0.22	1.97	0.28	0.70	41.16	58.57	21.26	57.6	0.66	90
Oat 2/3 + Pea 2/3	7.78	0.37	0.19	0.21	1.93	0.08	0.21	35.76	56.09	25.33	60.3	0.74	101
Oat Full + Pea Full	8.66	0.51	0.16	0.23	2.26	0.20	0.08	38.76	59.10	21.44	58.8	0.70	92
Oat Full Rate	6.34	0.22	0.18	0.16	1.94	0.18	0.07	39.97	59.88	22.98	58.2	0.68	90
Pea Full Rate	11.62	1.00	0.18	0.28	1.41	0.05	0.12	39.39	50.01	27.58	58.5	0.69	108

There were no significant difference in total grain yield (graph 2) and total LER. However, the variation (CV) was too high (30%) to have confidence in this data. Despite this we did observe that the competitive nature of oats greatly suppressed the yield potential of pea in intercropped treatments (Figure 2). Further skewing the results was the higher than normal Oat seeding rate and lower than normal rate for Peas in the trial. By reducing the population of oats significantly (ex. 25% rate), it is likely that there would have been a more even intercrop ratio within the grain component and a larger difference in the feed quality.

Figure 2: Total grain yield from combined partial yield values of intercropped pea-oat seeding rate combinations compared to sole crop grain yield.



Discussion

Intercropping oats and peas proved to boost overall silage dry matter yield and their respective feed quality characteristics compared to sole crop oats. Oats proved to be highly competitive and dominated the final grain sample when intercropped with peas. A more in-depth combination of seeding rates with fewer oats in the mixture may encourage a greater potential of peas in the system, and therefore a higher overall yield.

Picture: This intercrop stand is dominated by oats despite the full rate of peas.

Grain harvesting issues may arise from threshing limits on harvest equipment when peas and oats are intercropped. Peas require a larger threshing gap between the concave and the threshing drum and a lower threshing drum speed compared to oats. Producers will have to

take extra care with peas to insure that splitting is not an issue. Like was observed with our Pea/Canola intercrop the separation of the two crops prior to storage would be very important.

Within the raw data, peas contributed 5 to 10% more moisture in the silage sample compared to the sole oat plots (results not shown). This may allow for a longer optimum period for silage harvest to occur with this pea/oat intercrop mixture.

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Intercropping Hairy Vetch and Winter Wheat

Investigators: Westman Agricultural Diversification Organization - Scott Day, Scott Chalmers

Background

Intercropping is the agricultural practice of cultivating two different crops in the same place at the same time (Andrews & Kassam 1976). Benefits of intercropping can lead to greater than expected yields compared to the sole crop. Reasons for additional yield may be the result of greater efficiency in the use of nutrients, light and water (Szumigalski & Van Acker 2008). Intercropping may improve pest control and provide structural support advantages when compared to each being grown as a sole crop. It is not a new concept and has been used by farmers for several generations. However, recent improvements in farm machinery and individual variety characteristics have once again tweaked producer's interests in intercropping.

Hairy Vetch (*Vicia villosa*) is considered a winter annual and also noted as a biennial or perennial. The plant is a fine stemmed, viney legume that is adapted to most soil types and very competitive. The Hairy Vetch under our winter wheat

plots grew about 100 cm, whereas Hairy Vetch on its own lodges and tangles profusely with a height of 30 cm, similar to a good crop of Laird Lentils. It apparently can contribute 60-120 lbs/ac nitrogen back to the soil from nitrogen fixation (source www.hort.purdue.edu/). However, expectations of N fixing from Hairy Vetch in our northern and shorter growing season would be less than that amount. Our observations with Hairy Vetch indicate the plant has good late season frost tolerance, but a poor potential for winter survivability. Pod maturity is uneven, prone to shatter, and occurs late in the fall.

Several reasons have lead up to the need for a study of Hairy Vetch in a winter cereal system such as winter wheat. These reasons include the following:

1. A possible seed production industry for Hairy Vetch: this high value seed is typically imported into Manitoba. The price for Hairy Vetch has been around $2.50 USD per pound (Whelter Seed, Iowa USA). Its popularity has been driven by its substantial quick growth and ability to fix a considerable amount of nitrogen over a wide range of conditions in a relatively short time. In 2007, WADO conducted a small plot experiment along side the winter wheat variety trial located near Hartney. This plot was intended to compare fall and spring seeded legumes intercropped with winter wheat. In those plots, results indicated that Hairy Vetch not only successfully grew with winter wheat (without affecting final yield) but was also able to produce some Hairy Vetch seed in both fall and spring seeded plots. More Hairy Vetch seed was obtained in the fall seeded plots where approximately 100 lbs/ac was harvested in some treatments. It is speculated that the fall seeded Hairy Vetch was able to take advantage of a very early start in the spring which assisted in seed production. Results from the plots in Hartney in 2008 indicate that Hairy Vetch seed may be successfully produced in a winter wheat system and may add value to a traditional winter wheat monocrop without affecting the cereal crop's yield. What was not known is the optimal seeding rate for both Hairy Vetch and winter wheat to maximize both crops seed production without affecting the yield of the main crop, winter wheat. This was the main focus of this trial.

2. Intercropping legumes has indicated a beneficial production value: due to some interactive use of water, nutrient or light usually leading to equal or greater production overall. The use of legumes also helps fix N in the soil and reduce the need for commercial fertilizer in following crops. This leads to more sustainable farming systems with greater production output and fewer artificial inputs. These parameters were not focused on in this trial. Further work will be needed to evaluate these benefits in a winter cereal production system.

The purpose of this trial was to examine the effects of seeding rate between winter wheat and Hairy Vetch to understand yield interactions of both crops when grown together compared to when they are grown separately.

Methods

The trial was located at Reston, MB on NW 8-7-27 W1. Plots 1.44 m wide by 9 m long were direct seeded into oat stubble on September 25, 2008. Sixteen treatments were arranged in a randomized complete block design replicated three times. Seeding rate combinations (treatments), which were derived as modifications to the previous WADO demo plot at Hartney in 2007, were as follows: The seed for both crops was put in the same envelope for each treatment, which was then seeded down the seed knife along with the fertilizer applied down the fertilizer knife of WADO's SeedHawk style plot seeder.

Treatments:

1. 100% Winter Wheat – 'CDC Buteo' (WW seeded at 75 lbs/ac, or 250 seeds/m2 @ 95% germ)
2. 100% Hairy Vetch (HV seeded at 35 lbs/ac, or 146 seeds/m2 @ 85% germ)
3. 75% Winter Wheat
4. 125% Winter Wheat
5. WW 75% + HV 50%
6. WW 75% + HV 75%
7. WW 75% + HV 100%
8. WW 75% + HV 125%
9. WW 100% + HV 50%
10. WW 100% + HV 75%
11. WW 100% + HV 100%
12. WW 100% + HV 125%

Continued from previous:

13. WW 125% + HV 50%
14. WW 125% + HV 75%
15. WW 125% + HV 100%

Hairy Vetch seed was *not* inoculated. Plots were seeded at a depth of 0.75 inches and sideband with 50 lbs/ac N and 30 lbs/ac P with liquid 28-0-0 and granular 11-52-0. Plots were maintained weed free using Basagran Forte (BASF Canada), sprayed May 27 at a rate of 0.91 L/ac with a backpack sprayer, and were later sprayed June 8th with Achieve + adjuvant at a rate of 0.2 L/ac to control grassy weeds. They were desiccated August 9 at maturity with Reglone (Syngenta) at a rate of 0.91 L/ac. Plots were harvested August 21 with a Hege plot combine and grain samples were separated into their crop components using a 4' spiral separator (AAFC, Brandon, MB) that separates the more round Hairy Vetch seed from the more oblong winter wheat seed by centripetal force.

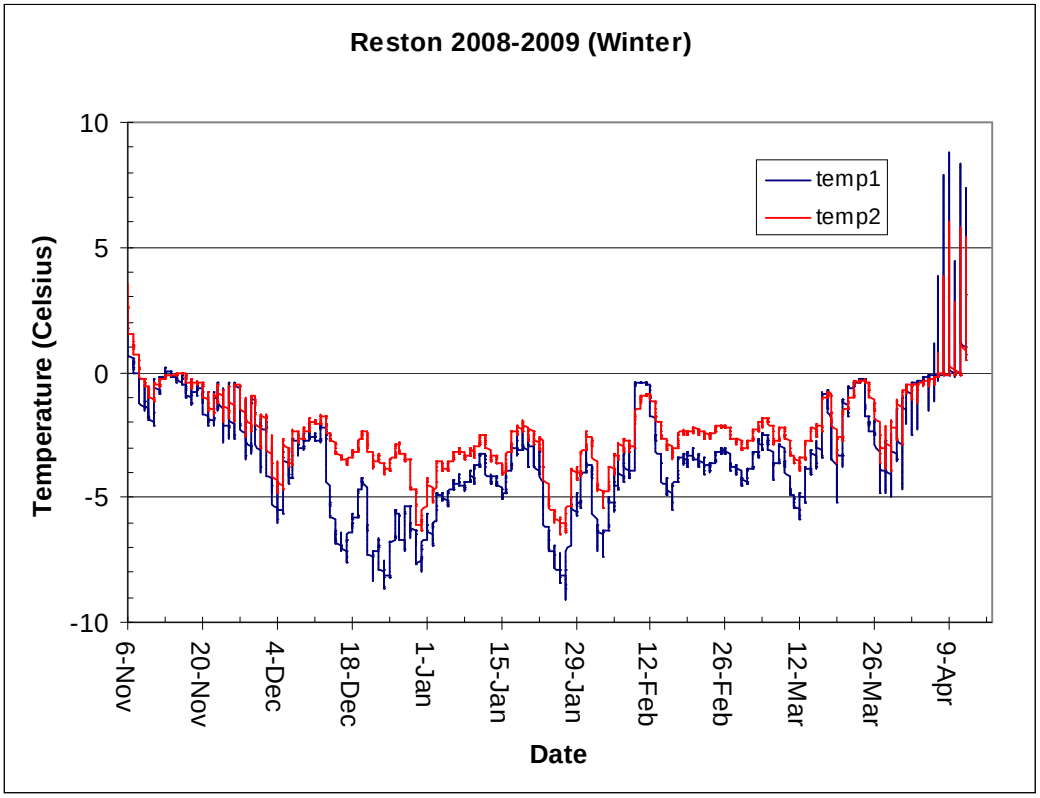
Data collected included plant counts June 9 on winter wheat and Hairy Vetch (treatments 2, 11) to assess winter survivability in Hairy Vetch and any interactions. A t-test was used to determine if differences existed in sole crop HV compared to intercropped HV winter survival. A temperature probe was also placed in the trial to determine hourly temperature values during winter months. Total plot grain weight and their sole crop component percentages by weight were determined. Both grain yield components were analyzed with a two-way analysis of variance separately. Coefficient of variation was calculated and least

significant difference was determined at the 0.05 level of significance if ANOVA was significant.

Results

Emergence counts for winter wheat indicate that approximately 75% of the seed germinated and survived the winter. Hairy Vetch emergence counts indicate approximately 17% plant survival rate (~26 plants/m^2) after winter. The t-test between treatment 2 and 11 indicate that there was no survival rate advantage for Hairy Vetch to being intercropped with winter wheat. This is a major concern given the current price of Hairy Vetch seed to establish a fall seeded crop. It is assumed that winter soil temperatures and snow cover had the greatest effect on Hairy Vetch survival. The first major snow fall occurred on December 4, 2008 and until this point, subsoil temperatures in Figure 1 (2.5 cm below the surface) were reaching a minimum of -5.7°C and minimum air temperatures were reaching -16°C. In late December and late January when temperatures were close to -8.8*C at that 2.5 cm depth. These temperatures may also pose some harm to Hairy Vetch winter survival and may have contributed to low survival values.

Figure 1: Subsoil Temperatures of the Reston site from November 2008 to April 2009. Two sensors (temp1 & temp 2) taking hourly readings at approximately 1" below the soil surface.



Grain yields indicate a significant difference in yield among the Hairy Vetch component but not among the winter wheat component between treatments (Table 1). In layman's terms, the Hairy Vetch did not have a negative effect on the winter wheat yield, but there was variation consistent with variable seeding rates of Hairy Vetch. Oddly, Hairy Vetch grain production was statistically similar as a sole crop to that of a 100% & 125% seeding rate of winter wheat.

Table 1: Final component yields of all sole and intercrop seeding rate combinations at Reston, MB.

Treatment	Seeding Rate	WW	HV
		lbs/ac	
1	100% Winter Wheat	1623.9	0.0
2	100% Hairy Vetch	0.0	130.4
3	75% Winter Wheat	1499.4	0.0
4	125% Winter Wheat	1491.9	0.0
5	WW 75% + HV 50%	1235.7	16.6
6	WW 75% + HV 75%	1314.9	9.6
7	WW 75% + HV 100%	1460.1	31.8
8	WW 75% + HV 125%	1327.8	29.7
9	WW 100% + HV 50%	1471.1	19.3
10	WW 100% + HV 75%	1409.2	27.1
11	WW 100% + HV 100%	1287.9	49.0
12	WW 100% + HV 125%	1379.1	45.8
13	WW 125% + HV 50%	1406.9	24.2
14	WW 125% + HV 75%	1439.9	55.7
15	WW 125% + HV 100%	1310.6	86.6
16	WW 125% + HV 125%	1124.6	135.5
	CV	11.3	81.6
	LSD ($p<0.05$)	ns	69.9

What became apparent is that, as winter wheat seeding rate increased, Hairy Vetch yielded exceptionally more given that same seeding rate. For example, when comparing treatments 8 and 16, both have similar Hairy Vetch seeding rates, but in treatment 16, Hairy Vetch produced significantly more seed. This interaction between the seeding rate of winter wheat and Hairy Vetch is presumed to be related to a stress-survival mechanism of the Hairy Vetch. The more the winter wheat is present, the more apt the Hairy Vetch is to be stressed and therefore more likely to set seed. This trend can be observed in graphs 1, 2, and 3.

In Figure 2, winter wheat is grouped into the 75% seeding rate range with Hairy Vetch being variable. Hairy Vetch increased its yield marginally with increased Hairy Vetch seeding rates. Trend line slope of this graph is 7.46. From Figure 3 to 4, winter wheat seeding rate groups change from 100% to 125% and the slope of the Hairy Vetch yields increases from 12.12 to 33.3, respectively. Therefore,

the greater the winter wheat seeding rate and the greater the Hairy Vetch seeding rate, corresponds with a greater final Hairy Vetch seeding yield.

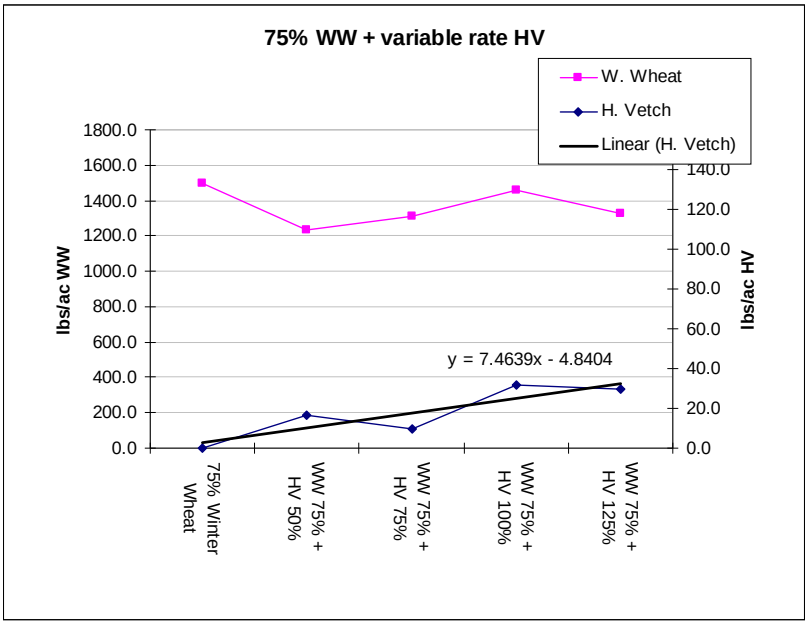


Figure 2: Component intercrop yields of winter wheat and Hairy Vetch seed when winter wheat is fixed at a 75% seeding rate with corresponding variable seeding rates of Hairy Vetch.

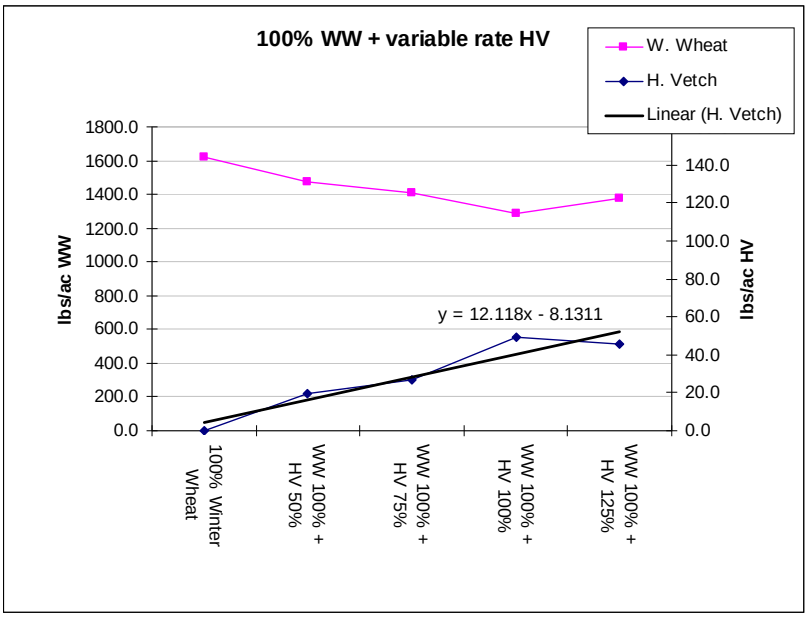


Figure 3: Component intercrop yields of winter wheat and Hairy Vetch seed when winter wheat is fixed at a 100% seeding rate with corresponding variable seeding rates of Hairy Vetch.

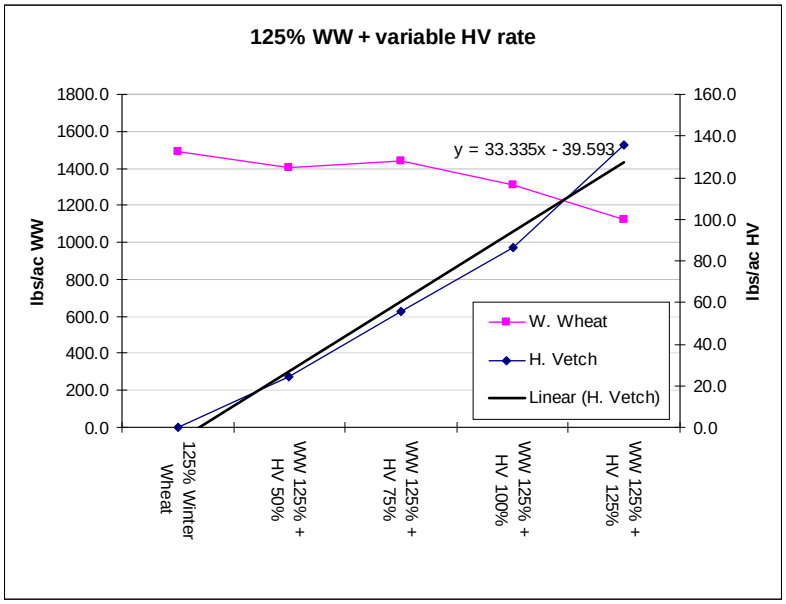


Figure 4: Component intercrop yields of winter wheat and Hairy Vetch seed when winter wheat is fixed at a 125% seeding rate with corresponding variable seeding rates of Hairy Vetch.

Coefficient of variation was low (11.3%) for the winter wheat component indicating a good data set, however for Hairy Vetch, CV was 81.6% well above the acceptable range (<15%). This source of high variation indicates a poor data set and results should be used with caution. Sources of variation may include winter survival differences in plant density, shatter differences among treatments, or variation produced during the crop component separation process. However, the main reason for this high variation in the Hairy Vetch data is probably because the volume of Hairy Vetch seed production per treatment was so small, in some cases only a few grams per treatment. Therefore, most differences would show a great difference on a percentage basis.

Discussion

Economically, if treatment 16 (125% WW + 125% HV) was applied to cash returns on a monocrop farming system, the producer would incur costs of 25% more wheat seed, the cost of the 125% Hairy Vetch seed (~$2.50/#), a swathing pass, and a seed cleaning cost. In terms of cash flow, the producer would have an additional marketable high value Hairy Vetch seed crop of 160 lbs/ac worth approximately $2.00 per pound.

By observation some shattering within the trial did occur between August 7 (physiological maturity) and the final harvest date (August 21), however the use of desiccant may have assisted this. The use of pod sealants may aid in the reduction of shatter in Hairy Vetch seed, but to our knowledge, research is yet to be done. A product in Ontario called SPODNAM is registered in the forage

industry for crops like alfalfa, lentils and vetches (distributed by ENGAGE Agro Corporation) which may help this issue.

Fall dormant seeding of Hairy Vetch would have likely improved winter survival but would have had a later seed set date, likely more suited for spring wheat or triticale production. Sole demo plots of dormant seeded Hairy Vetch in Melita indicate substantial seed ripening August 29 compared to the plots in Reston maturing August 7 and likely shattered before harvest. Dormant seeding is also very inconvenient (seeding in late November or December).

Inoculating Hairy Vetch could also produce more encouraging results. It is likely that native Rhizobium and applied fertilizers were supplying the N needs for this trial.

Intercropping Hairy Vetch with winter wheat did not affect wheat yield. Increasing both cereal and legume populations resulted in greater seed production in Hairy Vetch but not in winter wheat. There appears to be a survival mechanism related to plant density in wheat to that of the seed set of Hairy Vetch. It is not understood what (light, water, nutrients) is controlling this behavior in the Hairy Vetch.

Swathing instead of desiccation would be encouraged, since Reglone™ is not registered for winter wheat desiccation. Use of glyphosate would endanger the germination of Hairy Vetch seed use for a following season. However given the extra green material to dry down it would likely require extra time to fully dry the windrow. This extra time poses a danger of weathering and a reduced grade of the wheat.

Cleaning Hairy Vetch from winter wheat could only be done with a spiral cleaner or possibly an optical cleaner. Conventional screen equipment would be near impossible to separate these crop components. Moderate success was achieved with two spiral cleanings of each crop component, this, however, was never 100%.

Markets for Hairy Vetch seed are attractive given the increased popularity of organic production as well as multi-species forage production. In consideration of current seed costs for Hairy Vetch, on farm production of this seed would be possible with this (or a similar) system. Having seed production in Manitoba would likely reduce the seed cost to the Manitoba farmer and help build a more sustainable, more productive grain and livestock industry. Importing and shipping seed from deep in the U.S. is rather impractical and expensive. While we harvested what appears to be mature Hairy Vetch seed, we do not know at this time what percentage of germination that seed will express.

In previous years, WADO has conducted feed tests on Hairy Vetch from their various demo sites in SW Manitoba. These tests have shown that Hairy Vetch

has very good feed potential and the important nutrient levels are very similar to good quality alfalfa. However, actual feeding trials with livestock and Hairy Vetch were not conducted. In considering these feed tests it would be expected that the feed quality and livestock suitability of the straw from a winter wheat/Hairy Vetch intercrop would be highly desirable for cattle producers.

Photo taken April 22: Notice Hairy Vetch emerging within winter wheat rows near Reston.

Photo taken June 29: Notice most of the winter wheat heads are above Hairy Vetch canopy.

Close up of the Hairy Vetch flowers

Photo taken August 21st: both winter wheat and Hairy Vetch are ripe.

References:

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Szumigalski, A., Van Acker, R. C., 2008. Land Equivalent Ratios, Light Interception, and Water Use in Annual Intercrops in the Presence or Absence of In-Crop Herbicides. Agronomy Journal. Vol. 100, Issue 4, pg. 1145-1154

Effect Application Rate and Timing of Glyphosate use for Alfalfa Suppression in Canola Production

Background

Utilizing the benefit of nitrogen fixation in terminated alfalfa can help offset the costs incurred by producers for expensive man-made nitrogen based fertilizers. After an alfalfa termination, most producers are aware of the lower need for synthetic N-based fertilizers for the proceeding annual crop. As much as 50 lbs/ac of nitrogen can be credited to the soil annually (Peel M.D., 1998). Two years of establishment would contribute enough nitrogen to sustain a robust annual crop of any sort. Other benefits include improved water infiltration and reduced erosion risk.

Problems most common to a termination of alfalfa is the lack of effective alfalfa control, extensive moisture loss, and greater risk of water and wind erosion, especially in tilled stands. Often, producers who are unsuccessful with herbicides resort to multiple tillages compounding these effects. After harvest, succeeding alfalfa plants are not fully terminated and producers continue controlling stands. This is costly from a time and fuel standpoint, but it also wastes precious moisture and increases nutrient losses. It may be more economical to *suppress* or *tolerate* residual alfalfa stands in a dry-land annual cropping system rather than using multiple tillage and herbicide passes. Currently conventional practices of alfalfa termination include tillage and/or herbicides (Mohr et al. 1999, Entz et al. Ext Bulletin). Research has focused on these two practices as a side-by-side comparison. No research has been done on suppression of alfalfa in an annual crop rotation.

The timing of alfalfa termination has been found to be critical in the synchronized release of nitrogen for subsequent annual crops. Mohr et al. (1999) found that herbicides used to terminate alfalfa stands delayed short term nitrogen release compared to intensive tillage termination. Herbicides seem to synchronize the release of mineralized available long term nitrogen for the subsequent annual spring wheat crop and did not compromise yield compared to intensive tillage. Additionally, delaying herbicide application to late spring further delayed nitrogen mineralization of residues compared to herbicide treatments after the second cut of alfalfa. Other research by Mayerle G. (SSCA) has shown improved control during fall application of herbicides compared to those during the spring. One L/ac glyphosate alone had shown 30% control compared to 90% control when used in the fall of that year. Other research by Button R. (1994) has indicated that alfalfa has the capability to re-grow as short as one month after 1 L/ac glyphosate has been applied with substantial recovery after two months. Research also suggests that acceptable control was provided for 1.5 months when Roundup was used at 1 L/ac. It is possible that split applications of glyphosate may provide enough competitive control over alfalfa to allow the annual crop to succeed to harvest.

Alfalfa suppression has yet to be researched in an annual crop system. Some work with herbicides has been done to suppress or "set back" alfalfa for improved bloom timing for leaf cutting bee pollination in alfalfa seed production (Ransom et al. 2001. Malheur Experiment Station, Oregon State University). Other hands-on work done by Ernie Luchsinger, a producer near Rosthern, SK has shown that superior yields of oats (100 bu/ac) can be attained when seeding into spring stands of alfalfa previously treated with 1 L/ac Roundup. He suggests that 100% of the alfalfa will recover if let be. An in-crop treatment with Curtail M is enough to allow the oats to gain a competitive ability. However, Ernie prefers to terminate stands rather than letting them recover.

It is hypothesized that suppression of alfalfa, compared to conventional practices, could result in the following benefits: soil moisture content for annual crop rotations, more economically sound production of annual crops, reduced need for reseeding of alfalfa stands in rotation, improved soil carbon sequestration, long term benefits of nitrogen fixation, additional fall forage production for grazing, and overall lowered costs of fuel and herbicides.

On the other hand, hypothesized negative aspects associated with suppression of alfalfa in annual crop production compared to conventional practices may include reduced soil moisture content, poor recovery of alfalfa after annual crop production, poor yields of annual crops, negative nutrient impacts on annual crop caused by competitive aspects of alfalfa, weed infestations from reduced plant stands during alfalfa recovery periods, and soil moisture deprivation.

Research from this trial may provide additional insight into what rate will effectively suppress and/or terminate alfalfa for successful annual crop production, help understand the recovery response of alfalfa after different timings and rates of glyphosate applications, provide a fair comparison of conventional and alternative alfalfa mananagement strategies, assess soil moisture differences among each management system, and help assess soil nutrient margins affected by the various management strategies.

Site Information

- Location
    - The experiment was started in the fall of 2008 and will conclude in 2010 at a single location about two miles northeast of Carroll MB on SE 17-8-19W1. The soil name and texture is classified as a Woodfield clay loam and is well drained.
- History
    - For decades, this location has been farmed using conventional tillage practices combined with summer fallow every three years. There have been no zero tillage practices in the past. Liberty (Glufosinate) tolerant canola was produced on this quarter in 2004, followed by a wheat crop in 2005, and finally a barley cover crop and alfalfa in 2006.
- Alfalfa Establishment
    - Alfalfa was established under a crop of ‘Lacey’ barley (100 lbs/ac) in 2006. Alfalfa was seeded at a rate of 10 lbs/ac to the variety

'Algonquin', a variegated tap root variety. Fertilizer was applied at 50 lbs/ac N, and 30 lbs/ac P. Alfalfa was inoculated with proper Rhizobia prior to planting. The following production year (2007), the stand yielded a single cut of 5600 lbs/ac of dry hay. In 2008, the stand yielded 4900 lbs/ac from a single cut. The area was left to grow the rest of the summer until fall herbicide treatments commenced.

- Weather Conditions
    - First fall frost was September 27, 2008 at -2.1°C at the Brandon Airport (-1.4°C Souris), and likely contributed to glyphosate translocation within the plant. In 2009, May and June received below normal precipitation (normal is 52.7 mm, 74.4 mm, respectively), and likely accounted for the drought symptoms exhibited by canola plants during these months (Table 1).

Table 1: Monthly weather conditions from Brandon Airport (Environment Canada) of maximum temperature, minimum temperature, average temperature, and total precipitation for 2008 and 2009 seasons. Additional weather data was obtained from Virden to supplement the data retrieved from Brandon.

	Temperature			
Month	Max Temp	Min Temp	Average Temp	Total Precip
2008	**°C**	**°C**	**°C**	**mm**
Jan	-10.9	-17.1	-23.3	4.2
Feb	-10.7	-16.9	-23.1	8
Mar	-1.9	-7.6	-13.2	36
Apr	10.4	3.1	-4.3	4.2
May	16.4	8.7	0.9	59.8
Jun	21.3	15	8.6	133.6
Jul	23.7	17.5	11.3	131.8
Aug	25.7	18.4	11.1	42
Sep	18.7	11.9	5	27.4
Oct	12.1	5.6	-1	55.4
Nov	0.6	-4.4	-9.3	9.8
Dec*	-14.6	-23.23	18.9	55.4
			total	567.6
2009				
Jan*	-11.5	-23.8	-17.7	32.7
Feb	-10.2	-15.6	-21	33.2
Mar	-4.4	-10.1	-15.7	46.4
Apr	7.9	2.9	-2	32.8
May	16.2	8.4	0.6	24.4
Jun	22.2	15	7.8	41.8
Jul	22.9	16.3	9.7	85.6
Aug	22.9	16.3	9.7	89.4
Sep	24.6	16.8	9	57
Oct	6.4	2.7	-1.1	52.6
Nov	6.9	-7.2	-0.15	trace
Dec	-12.7	-21.2	-16.92	22.2
			total	518.1

* data supplimented by Virden water tower

Methods

A total of sixteen treatments were arranged in a randomized complete block design replicated three times. Treatments (Table 2) were comprised of fall and spring glyphosate (Roundup Transorb HC 540 g/L) and tillage (JD rotovator) treatments on standing alfalfa with an initial height of 30 cm.

Table 2: List of herbicide and tillage treatments to be used in this trial with various fall, spring applications, and in-crop glyphosate applications and their respective dates of application on alfalfa.

		Actual Date	
Treatment No.	Description	2008	2009
1	Check Biomass Forage sample 2009/2010		
2	Check Roto-till Fall (Time of initial glyphosate)	14-Sep	
3	Check Roto-till Spring (Time of Preseed Burnoff App glyphos)		03-Jun
4	0.5 L/ac Glyphosate Fall	14-Sep	
5	1.0 L/ac Glyphosate Fall	14-Sep	
6	1.5 L/ac Glyphosate Fall	14-Sep	
7	2.0 L/ac Glyphosate Fall	14-Sep	
8	0.5 L/ac Glyphosate Pre-seed only		30-May
9	1.0 L/ac Glyphosate Pre-seed only		30-May
10	1.5 L/ac Glyphosate Pre-seed only		30-May
11	2.0 L/ac Glyphosate Pre-seed only		30-May
12	0.5 L/ac Glyphosate Fall + 0.5 L/ac Glyphosate Pre-seed only	14-Sep	30-May
13	0.75 L/ac Glyphosate Fall + 1.0 L/ac Glyphosate Pre-seed only	14-Sep	30-May
14	1.0 L/ac Glyphosate Fall + 1.0 L/ac Glyphosate Pre-seed only	14-Sep	30-May
15	1.5 L/ac Glyphosate Fall + 1.0 L/ac Glyphosate Pre-seed only	14-Sep	30-May
16	0.5 L/ac Glyphosate Fall + 0.5 L/ac Glyphosate Incrop	14-Sep	29-Jun
17	0.75 L/ac Glyphosate Fall + 1.0 L/ac Glyphosate Incrop	14-Sep	29-Jun
18	1.0 L/ac Glyphosate Fall + 0.5 L/ac Glyphosate Incrop	14-Sep	29-Jun
19	1.5 L/ac Glyphosate Fall + 1.0 L/ac Glyphosate Incrop	14-Sep	29-Jun

Pictures: (Left) Seeding of plots, (right) mid bloom plots after all treatment applications were finished approximately one month prior to photo, taken July 22. Variable flower dates are apparent.

On May 30 a soil test was taken from rep 1 on treatments 1, 2 and 7 to compare extreme soil nutrient differences among the untreated alfalfa stand, fall tillage, and high rate fall glyphosate application, respectively.

Plots were seeded to 45H24 RR at a rate of 6 lbs/ac on June 3, 2009 into plots 1.44 m wide by 9 m long comprised of six rows at 9.5" spacing. Seed was placed at a 1" depth using Seedhawk™ dual knife openers. Fertilizer was sideband at a rate of 40 lbs/ac N (liquid UAN 28-0-0) and 30 lbs/ac P (granular 11-52-0) during seeding. Weed control consisted of an application of Centurion on June 13 at a rate of 0.2 L/ac on treatments 2, 4, 5, 6 and 7 to control wild oats. Otherwise, weeds were controlled with their respective glyphosate applications. A hand weeding was needed on June 29 for larger broadleaf weeds (buckwheat, flixweed, mustard) commonly found in treatments 4, 5, 6, and 7. Competition ratings were taken on June 29 and July 22 between alfalfa and canola in each plot on a scale from 1-10, where 10 is considered thriving without competitive pressure from the other crop. Only the July 22 rating for competition will be used in this report. Notes were made on weed control and drought issues. Harvest commenced September 25 after plots naturally ripened standing. Plots were harvested with a Hege plot combine.

Yield and competition data was analyzed with a two-way analysis of variance (ANOVA). Coefficient of variation was determined as well as least significant difference if ANOVA was significant.

Results

Soil Tests

Soil tests taken in late May comparing nutrient differences among the untreated alfalfa stand, fall tillage, and high rate fall glyphosate application indicated a wide range of nitrate values, especially in the 6-24" depths (Table 3). These values give insight into the maximum nutrient contribution that is likely available to the canola crop. Nitrate (N) values for untreated alfalfa are unsurprisingly low with a total of 59 lbs/ac available N, whereas, fall tillage or a fall application of glyphosate resulted in much higher total nitrate values of 147 lbs/ac and 129 lbs/ac, respectively. The nitrate values suggest that fall tillage results in the highest immediate release of crop available nitrogen.

Table 3: Spring soil analysis of untreated alfalfa, fall tillage, and fall full rate glyphosate application on alfalfa and their respective nutrient variations.

Treatment	Description	Nutrient	N	P	K	S	
		Depth	lbs/ac	olsen ppm	ppm	lbs/ac	pH
1	Untreated Alfalfa	0-6"	23	19	347	16	6.9
		6-24"	36			36	
		0-24"	59			52	
2	Fall Tillage	0-6"	48	28	353	18	6.4
		6-24"	99			48	
		0-24"	147			66	
7	Fall 2 L/ac Glyphosate Application	0-6"	48	23	307	24	6.8
		6-24"	81			60	
		0-24"	129			84	

During soil testing of treatments 1, 2, and 7, visual assessments on soil moistures were extremely variable among each treatment. In order of magnitude of greatest soil moisture to least, they are ordered: the fall glyphosate application, then the fall tillage application, followed by the untreated alfalfa check. These assessments became more apparent later in the season based on the growth of the succeeding canola crop. Generally spring tillage or herbicide application exhibited greater signs of moisture stress in the canola crop than fall applications.

Competition Ratings and Grain Yield

Competition ratings were highly significant for both observation dates and generally follow what was to be expected (Table 4). Three distinct trends were occurring. The first trend is that fall application of glyphosate was significantly more effective in the suppression or control of alfalfa than spring applications. Lower competition values for alfalfa were observed in fall applied treatments (4-7) than spring applied treatments (8-11), later translating into greater fall applied treatment canola yields for this reason. Similar trends were apparent for fall tillage treatment (2) compared to the spring tillage treatment (3).

Table 4: The relationship of alfalfa and canola competition observations to canola yield with glyphosate or tillage applications in alfalfa.

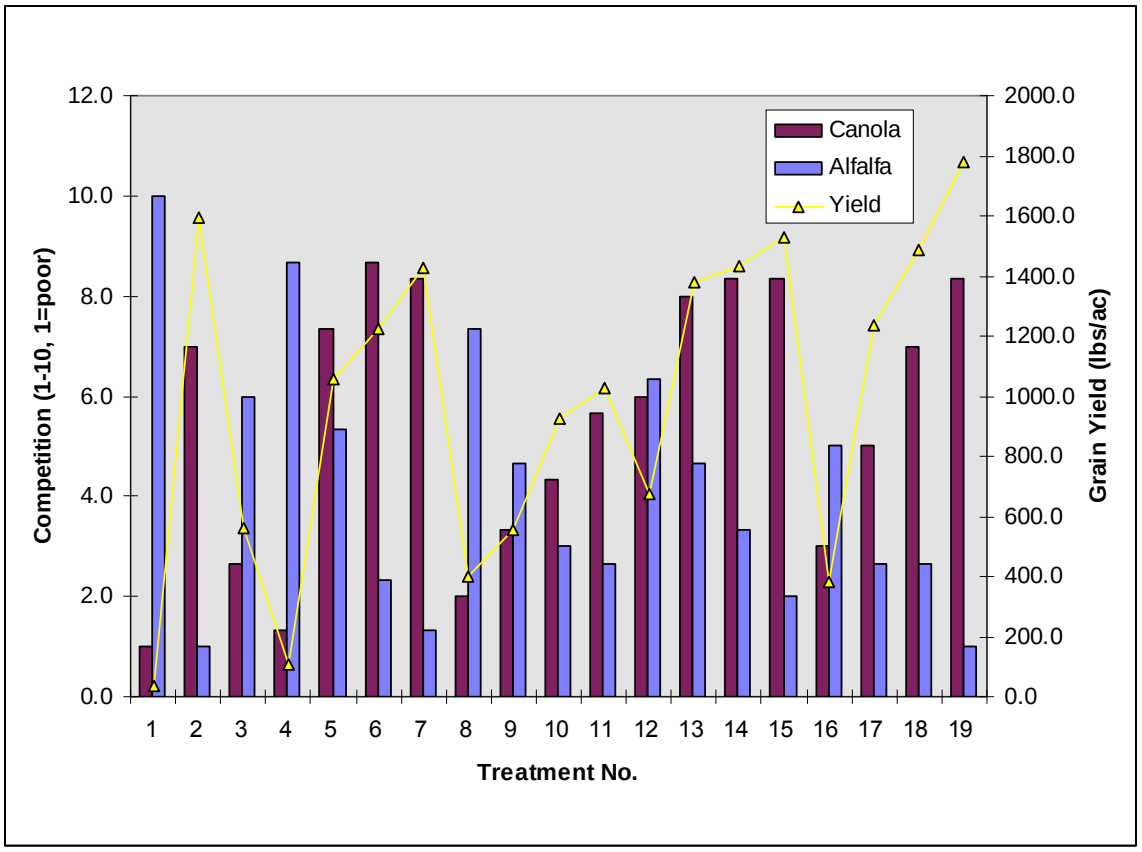
		Competition June 29		Competition July 22		Mean Grain
Treatment	**Description**	Alfalfa	Canola	Alfalfa	Canola	**Yield**
1	Untreated Alfalfa (Check)	9.3	1.0	10.0	1.0	34.4
2	Check Roto-till Fall	1.0	6.0	1.0	7.0	1592.7
3	Check Roto-till Spring	3.0	6.0	6.0	2.7	559.2
4	0.5 L/ac Glyphosate Fall	6.7	3.7	8.7	1.3	105.4
5	1.0 L/ac Glyphosate Fall	4.3	7.0	5.3	7.3	1054.2
6	1.5 L/ac Glyphosate Fall	3.3	7.7	2.3	8.7	1226.0
7	2.0 L/ac Glyphosate Fall	3.0	8.3	1.3	8.3	1427.4
8	0.5 L/ac Glyphosate Pre-seed only	5.3	4.0	7.3	2.0	401.0
9	1.0 L/ac Glyphosate Pre-seed only	5.3	3.0	4.7	3.3	556.9
10	1.5 L/ac Glyphosate Pre-seed only	4.3	5.3	3.0	4.3	923.5
11	2.0 L/ac Glyphosate Pre-seed only	4.0	5.0	2.7	5.7	1026.7
12	0.5 L/ac Glyphosate Fall + 0.5 L/ac Glyphosate Pre-seed only	5.3	5.0	6.3	6.0	673.8
13	0.75 L/ac Glyphosate Fall + 1.0 L/ac Glyphosate Pre-seed only	4.3	8.3	4.7	8.0	1377.3
14	1.0 L/ac Glyphosate Fall + 1.0 L/ac Glyphosate Pre-seed only	2.7	9.0	3.3	8.3	1432.3
15	1.5 L/ac Glyphosate Fall + 1.0 L/ac Glyphosate Pre-seed only	2.3	8.0	2.0	8.3	1528.5
16	0.5 L/ac Glyphosate Fall + 0.5 L/ac Glyphosate Incrop	6.3	2.7	5.0	3.0	382.7
17	0.75 L/ac Glyphosate Fall + 1.0 L/ac Glyphosate Incrop	4.7	5.3	2.7	5.0	1235.2
18	1.0 L/ac Glyphosate Fall + 0.5 L/ac Glyphosate Incrop	3.7	6.7	2.7	7.0	1489.5
19	1.5 L/ac Glyphosate Fall + 1.0 L/ac Glyphosate Incrop	5.0	6.0	1.0	8.3	1778.3
	CV%	35.6	33.0	25.3	17.5	24.1
	LSD (p<0.05)	2.6	3.1	1.8	1.6	395.6

The second trend is that the addition of a pre-seed or in-crop application of glyphosate to fall applications (12-15 & 16-19, respectively) generally did not improve final grain yield to similar fall treatment rates (4-7). However, spring applications of glyphosate did improve weed control issues that were apparent after a fall application. In-crop applications were not better than similar pre-seed application treatments when comparing final grain yield, but seem to suppress alfalfa slightly more than pre-seed applications. This may indicate that there may be no need for a pre-seed application after a fall application, and that a fall application is enough to establish a high yielding crop.

The third trend, which is to be expected, is that increasing rates of glyphosate resulted in greater alfalfa suppression or control translating into greater yields. This trend is observed in treatments 4-7, 8-11, 12-15, and 16-19.

Final canola yield was directly related to the final canola competition rating (Figure 1). Likewise, the lower the competition of alfalfa (or the greater the control of alfalfa) was inversely related to greater canola yield.

Figure1: Final competition ratings between alfalfa (blue bars) and canola (red bars) and their relationship to final yield (yellow line).



Conclusions

- Sole fall applications produced yields similar to those fall applications with a pre-seed or incrop application, suggesting that fall applications are more deterministic of final crop yield than spring applications, implying spring applications are ineffective and likely cosmetic. Sole fall applications are at risk of severe weed competition and likely would require a spring application of some sort for proper weed control measures.
- Fall applications of glyphosate or tillage likely improve soil moisture and nutrient mineralization from alfalfa residues compared to spring treatments.
- Competitive observations suggest that fall or spring glyphosate applications equal to or less than 1 L/ac rate will recover the following year, as well as spring tillage treatments.
- Fall grazing opportunities may be possible following suppression of alfalfa for canola production, providing additional late season grazing in mix farm operations that may have not existed in conventional canola systems.
- It may be possible to achieve conventional yields of canola production, yet have additional grazing potential late season or next year considering the grain yield and midseason competition rating results of treatments 13 and 18.
- Alfalfa re-growth and weed ratings will be taken during the hay season of 2010 to assess forage production post-hoc.

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The Canadian National Hemp Grain Variety Characterization Project

Investigator: Ontario Hemp Alliance - Tavistock - Gordon Scheifele

Site Information

2007

15 test sites across Canada from Alberta to Quebec.
Varieties evaluated were: Anka, Jutta, Yvonne, Heidrun, Alyssa, Crag, USO 14, USO 31, Finola & ESTA-1

2008

18 test sites across Canada from British Columbia to Quebec.
Varieties evaluated were: Anka, Jutta, Yvonne, Heidrun, Alyssa, CFX-1, CRS-1 & Finola

2009

17 test sites across Canada from British Columbia to Quebec.
Varieties evaluated were: Anka, Jutta, Yvonne, Heidrun, Alyssa, CFX-1, CRS-1 & Finola
Data not available at time of printing

Background

A National hemp grain variety Characterization trial was set up in 2007 and has continued in 2008 and 2009. The trial is coordinated by the Ontario Hemp Alliance (Gordon Scheifele, Tavistock), Ontario with funding from Canadian Adaptation Council and Industry. A total of up to 19 sites were hosted in locations in Alberta, Saskatchewan, Manitoba, Ontario, & Quebec.

Table 1. Individual Locations and GPS points

2007-08 Locations	CANADIAN BREEDING SITES:
Arborg, Manitoba: 50°54'23.35"N	Dauphin, Manitoba: 51° 8'58.75"N
Carberry, Manitoba: 49°52'16.42"N	Ottawa, Ontario: 45°25'24.58"N
Dauphin, Manitoba: 51° 8'58.75"N	Saskatoon, Sask.: 52° 7'45.36"N
Joliette, Quebec: 46° 1'23.44"N	Stirling, Ontario: 44°17'46.08"N
Lethbridge, Alberta: 49°41'30.21"N	Tavistock, Ontario: 43°19'15.25"N
Melfort, Saskatchewan: 52° 51'39.11"N	Vegreville, Alberta: 53°30'0.16"N
Melita, Manitoba: 49°16'16.65"N	
New Liskeard, Ontario: 47° 30'30.89"N	
Redvers, Saskatchewan: 49° 34'37.09"N	
Scott, Saskatchewan: 52° 21'48.63"N	
St, Hyacinthe, Quebec: 45° 37'36.58"N	
Swift Current, Saskatchewan: 50° 17'6.70"N	
Tavistock, Ontario: 43°19'15.25"N	
Thunder Bay, Ontario: 48° 24'24.54"N	
Vegreville, Alberta: 53°30'0.16"N	
Winchester, Ontario: 45° 5'34.68"N	

Varieties were evaluated in 2007 & 2008 for agronomic characteristics, fatty and amino acid profiles, % THC levels, % Oil & Protein & Seed size. Data collection, THC & grain collection was completed by research co-operators on site. Trials were set up as small plot randomized complete block trials. Data for 2009 is not available at time of printing.

Objective

To characterize and evaluate newly developed and already registered commercial hemp grain varieties.

Methods

Trials are managed with best management practices by the cooperators to maximize the yields for their locations.

Lab Analysis
THC samples were all analyzed at Metheral Laboratories in 2007 and at SGS Lakefield Research Laboratories in 2008.

Fatty acid analysis was done by Loyalist College Laboratories, Bellville, Ontario using CO_2 extraction methods and qualitative fame GC-MS analysis of seed samples

Amino acid, protein and fat analysis was conducted at University of Guelph Research Laboratories. Preparation of all THC and grain samples for lab analysis were done by Gordon Scheifele in Tavistock, Ontario.

Results

The following results are for 2008 trials done across Canada. The 2009 results will be available at a later date. For 2009 Manitoba results, refer to “Industrial Hemp Fibre (or Grain) Trials – Manitoba” section in this report.

Table 2. Grain Yields in kg/ha

2008 NATIONAL HEMP GRAIN VARIETY CHARACTERIZATION SUMMARY FOR GRAIN YIELD																
	1	2	3	4	6	8	10	12	13	15	16	18	19	All Sites		
VARIETY	INGERSOLL	TAVISTOCK	GADSHILL	ARTHUR	NEW LISK	WINCH	ST. HYAC	MEILITA	CARBERY	MELFORT	SCOTT	WWAR	Vegerville	MEAN	Variety	Stdev
Late	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha		
ANKA	950	1275	875	1120	1973	1478	635	1272	1558	1043	998	547	1173	1146	ANKA	383
JUTTA	1100	1410	925	1250	1268	1044	806	1667	1745	1267	1098	466	1652	1208	JUTTA	364
YVONNE	1075	1320	890	1210	1769	1480	984	1137	1459	795	730	552	1252	1127	YVONNE	340
HEIDRUN	980	1340	905	1125	1537	1486	1422	1100	1216	590	639	510	2504	1181	HEIDRUN	522
ALYSSA	1025	1250	850	1150	1280	1309	825	1302	1421	778	736	479	771	1014	ALYSSA	292
MEAN	1026	1319	889	1171	1565	1359	934	1296	1480	895	840	511	1470	1135	MEAN	313
CV	10	11	9	12	17	14	16	10	12	12	12	14	13			
LSD	185	215	175	215	537	250	185	212	268	240	196	155	247			
Stdev	63	62	29	57	308	169	299	225	194	124		39	657			
Early																
CFX-1	625	750	620	650	1391	492	581	1528	1897	837	1204	211	896	899	CFX-1	475
CRS-1	910	1100	780	925	1507	602	1249	1758	2039	924	1165	562	1128	1127	CRS-1	432
FINOLA	520	675	520	580	877	246	150		1170	819	1397	365	568	657	FINOLA	363
MEAN	685	842	640	718	1258	169	660	1643	1702	860	1255	379	864			
CV	11	8	10	12	32	13	13	11	14	12	11	14	13			
LSD	180	171	168	155	614	160	190	225	342	159	210	145	184			
Stdev	202	227	131	183	335.13	446.7	553.74	546.85	466.18	66.88		175.95				

Table 3. Laboratory Analysis

2007 - 2008 Canadian Hemp Grain Variety Characterization										
VARIETY	SEX	MATURITY	THC %	GRAIN PERF	HEIGHT-	FATTY	AMINO	% OIL	% PROTEIN	SEED SIZE
		Relative	mean and Sd	Index	METERS	ACID %	ACID	Mean & Sd	Mean & Sd	g/100 k
		*N of 48 lat **S of 48 lat	*07 **08 *** 08 & 09	2007 -15 sites* 2008-18 sites**	As index 2008 *early trial	GLA mean/Sd 2007 *	Mean/Sd Mg/g & Sd	2007* 2008	2007* 2008	mean & Sd 2007*
					**late tral	2008	2007*			2008
					*** 07		2008			
FINOLA	Dioecious	very early*	0.14/0.09***	0.56**	0.82*	5.1/1.25	188.38/21.67	27.9/2.79	20.9/1.55	14.1/2.15
CRAG	Dioecious	FS*	*0.06-0.02	0.98*	1.0***	4.74/1.52*	196.85/10.97*	29.1*	20.5*	16*
USO 14	monoecious	FS*	*0.06-0.02	0.64*	0.9***	4.10/0.77*	186.36/13.05*	26.6*	19.5*	15*
USO 31	monoecious	FS*	*0.06-0.02	0.96*	0.9***	3.22/0.87*	189.58/13.81*	26.7*	19.6*	15*
CFX-1	dioecious	MS*	0.09/0.05**	0.83**	1.05*	4.4/1.03	179.88/14.73	27.9/3.99	20.6/1.67	17.7/1.36
CRS-1	dioecious	FS*	0.10/0.09**	1.09**	1.14*	3.5/0.8	169.25/13.03	27.4/3.33	19.1/1.30	18.1/1.91
ALYSSA	monoecious	Medium	0.12/0.08***	0.92**	0.90**	3.5/1.8	161.49/16.93	26.4/3.36	18.5/1.13	17.9/1.23
ANKA	monoecious	FS**	0.08/0.05***	1.12**	0.99**	3.4/1.05	155.12/18.12	25.49/3.0	18.5/1.13	18.5/0.98
JUTTA	monoecious	FS **	0.09/0.05***	1.16**	0.96**	3.4/1.32	161.52/15.61	26.6/2.87	18.7/0.85	18.5/1.44
YVONNE	monoecious	FS**	0.11/0.6***	1.13**	1.18**	3.3/0.69	164.35/14.36	26.2/3.33	18.75/1.05	17.9/0.89
HEIDRUN	dioecious	FS**	0.17/0.09***	1.2	0.97**	3.1/1.05	162.36/9.58	26.0/3.27	18.8/1.33	18.9/2.03
ESTA-1	dioecious	Medium**	*0.09-0.04	1.09*	1.14***	3.51/1.15*	200.8/14.89*	28.2*	21.2*	15*
mean		FS: full season	*0.09/0.02	999kg/ha**	0.83m*:1.85m**	*3.71/0.68	167.6/10.58	27.0/2.05	19.2/0.93	15g *
		MS: mid season	**0.12/0.04	641kg-ha*	1.45m***	3.62/0.54				17.7g-1.03
			***0.113/0.37							

ALYSSA: monoecious, earlier and shorter than Anka, average grain yield. Adapted for Western Canada for grain & fibre. Also below average seed size. Has good fibre potential in prairies. Owned and sold by Parkland Hemp Growers.

ANKA: monoecious, strong grain variety with large seed and high grain yield potential. Adapted for grain in Ontario and Quebec with high fibre yield potential in the Prairie Provinces and Ont/Quebec. Has average + fatty acid profile and high oil yield. Excellent nutty flavour. Has average + height and responds to fertility. Owned and sold by Ontario hemp Alliance.

CFX-1: dioecious, early grain variety. About same height as Crag and slightly earlier. Similar sized seed as Crag. Adapted for early growing regions like N of 48th latitude. Good GLA level . Owned and sold by Hemp Genetics International.

CRS-1: dioecious, early grain variety, slightly later & taller than CFX-1 and considerably higher yielding. Grain yield is competitive with Anka but considerably earlier & shorter. Has potential as early variety in Ontario & Quebec. Similar seed size as Anka. Owned and sold by Hemp Genetics International.

FINOLA: dioecious, very, very early adapted for N of 48th Lat. About 50% grain yield and shorter in height than CRS-1 and 78% seed size. Grain is high in GLA and FA and protein profile. Owned and sold by Hemp Oil Canada.

HEIDRUN: dioecious, very high yielding grain variety with large seed, same height as Anka with similar FA& AA profile and oil & protein quality. Has potential for fibre in prairies, Ontario & Quebec. Adapted for Ontario & Quebec for grain. Owned and sold by Ontario Hemp Alliance.

JUTTA: monoecious, strong, very uniform grain variety higher yielding than Anka with same seed size and similar AA & FA profile and high oil yield. Slightly shorter in height than Anka. Adapted to Ontario & Quebec for grain. Owned and sold by Ontario Hemp Alliance.

YVONNE: monoecious, as high grain performing variety as Anka with same seed size, about 20% taller than Anka with fibre potential in Prairies and Ont/Quebec. Excellent FA & AA profiles. Grain adaptation for Ontario & Quebec. Owned and sold by Ontario Hemp Alliance

Important Considerations and Recommendations

This is a project coordinated by Ontario Hemp Alliance (Gordon Scheifele) with cooperating Industry partners. This national data will give the hemp industry a good evaluation of the varieties available over a wide period of years and climates.

This is 2008 data. 2009 data was not available at time of printing.

Sponsors:

"Funding for this project was provided in part by Agriculture and Agri-Food Canada through the Agricultural Adaptation Council."

Canada

Agricultural Adaptation Council

Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

"Further Funding and acknowledgement for this project was provided in part by"

CANADIAN HEMP TRADE ALLIANCE
ALLIANCE COMMERCIALE CANADIENNE DU CHANVRE

Ontario Hemp Alliance

Garry Meiery Farms, SK

Parkland Hemp Growers, MN

Alberta Res. Counsel, AB

Midnight Acres, ON

Agro Central, Joliette, QC

In-kind contributions made by all test site cooperation.

Industrial Hemp Grain Trials – Manitoba

Cooperators:

- Parkland Crop Diversification Foundation – Keith Watson and Jeff Kostuik - Roblin, MB
- Westman Agricultural Diversification Organization – Scott Day, Scott Chalmers – Melita,
- Manitoba Crop Variety Evaluation Team

Site Information

Location: Dauphin, Melita (Barker Site)
Cooperator: MCVET

Background

Amino acids are the building blocks of protein, and hemp seed contains the complete spectrum, including the eight essential ones. As well hemp seeds contain a healthy oil content, rich in polyunsaturated fats as well as Essential Fatty Acids (EFAs), notably Omega 3 and Omega 6. EFAs are not made by the human body and must be acquired through the diet. Their presence helps regulate such common conditions as: cardiac function, insulin balance, mood stability, skin and joint health.

The seed can be eaten in many forms. The seed is crushed to produce hemp oil; the seed cake leftover from the crush is processed into flour. Sometimes the whole seed is enjoyed toasted, and for other uses, processors remove the seed shell to create hulled seed that can be an added ingredient in many recipes.
These basic forms are used to make a number of healthy food products including: bread, pasta, chips, dips, cheese substitutes, salad dressings, spreads, ice cream and lactose-free milk. (Canadian Hemp Trade Alliance, 2009)

The Industrial hemp grain trials located in Manitoba were in Dauphin, Melita, and Arborg. These trials were also included in the National "characterization" trial that was coordinated by Gordon Scheifele, Tavistock, Ontario. A total of 16 sites were chosen in Alberta, Saskatchewan, Manitoba, Ontario, and Quebec. This is the second year of these trials.

Objective

To evaluate early and late maturing industrial hemp varieties in terms of grain yield and quality.

Table 1. Trial Information for Dauphin and Melita

Site:	**Dauphin**	**Melita**
Treatments:	10 varieties (Table 1)	10 varieties (Table 1)
Replication:	4	4
Plot size:	1m x 5m	1.44m X 11.44m
Test design:	Randomized complete block design	Randomized complete block design
Seeding date:	June 2, 2009	May 27, 2009
Fertilizer applied:	106 lbs. actual N (46-0-0) and 30 lbs. actual P (11-52-0)	80 N, 30 P lbs/ac
Harvest date:	September 11, Late varieties Sept. 25	August 25, 2009
Product handling:	Each plot individually bagged and recorded	Each plot individually bagged and recorded

The Dauphin trial was direct seeded into wheat stubble with 30 lbs. actual P and 106 lbs. actual N banded prior to seeding. All plots were harvested with a small plot combine. Each treatment was individually bagged and weight recorded.

Table 2. Industrial Hemp Varieties

Early Maturing Varieties	Late Maturing Varieties
CRS-1	Yvonne
CFX-1	Alyssa
Delores	Anka
PK 403-2	Heidrun
USO 14	Jutta

Table 3. Spring Soil Test Results

	Estimated Available Nutrients	Fertilizer Applied (actual lbs)	Estimated Available Nutrients	Fertilizer Applied (actual lbs)
	Dauphin	Dauphin	Melita	Melita
N*	86 lbs/acre	80 lbs/acre	62 lbs/acre	80 lbs/acre
P	8 ppm (medium)	30 lbs/acre	12 lbs/acre	30 lbs/acre
K	187 ppm (high)		146 lbs/acre	
S*	244 lbs/acre		44 lbs/acre	
pH		8.1	7.7	

* Nitrate – N *Sulphate - S

Results

Due to excessive moisture conditions in the Interlake in 2010, the trial in Arborg was not included in this year's data.

Table 4. Dauphin and Melita Hemp Grain Yields in Kg/ha*

Early Maturing Varieties	Dauphin	Melita
PK 403-2	2667	N/A
CFX-1	2174	1813
CRS-1	2061	2139
Delores	1753	1620
USO 14	1590	590
CV%	8.24	8.85
LSD	260	218
Grand Mean	2049	1541

* 2009/10 Seed Manitoba

Table 5. Dauphin and Melita Hemp Grain Yields in Kg/ha*

Late Maturing Varieties	Dauphin	Melita
Jutta	2712	1747
Anka	2488	1578
Alyssa	2398	1556
Yvonne	1998	1388
Heidrun	1951	1379
CV%	9.42	7.48
LSD	335	176
Grand Mean	2309	1530

* 2009/10 Seed Manitoba

Chart 1. Dauphin Grain Yields in lbs/acre

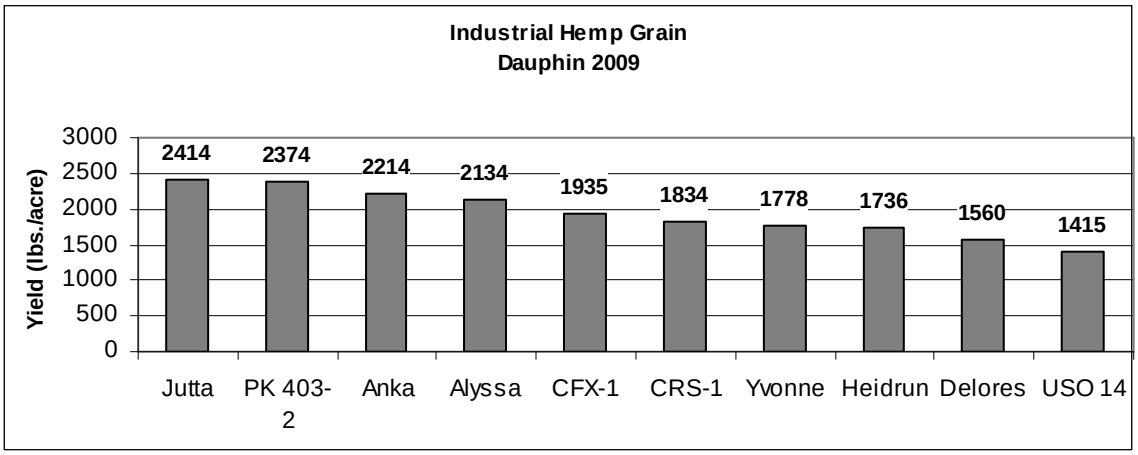
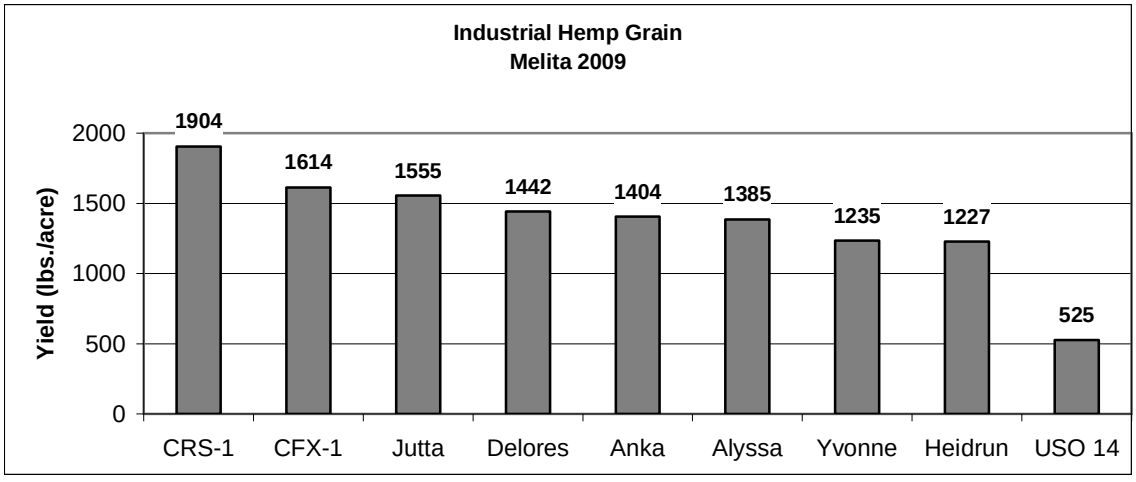


Chart 2. Melita Grain Yields in lbs/acre



Varieties are tested over a number of years and are entered into the MCVET database for inclusion in the 2010 Seed Manitoba guide. Always use caution when using a single site year of data. Environmental conditions vary so

performance will be variable. The more site years, the more dependable the data.

Table 6. Long Term Data*

Variety	Yield % of Check	Site Years Tested	2009 Average Yield	Site Years Tested	2009 Yield: % of Alyssa	
					Dauphin	Melita
Alyssa	100		100	2	100	100
Anka	103	4	102	2	104	100
CFX-1	111	4	101	2	91	115
Crag	89	3	-		-	-
CRS-1	119	4	105	2	86	132
Finola	64	10	-		-	-
USO 14	75	13	55	2	66	40
Varieties that are being tested or proposed for registration						
Delores	109	13	86	2	73	105
Heidrun	85	4	84	2	81	89
Jutta	117	4	111	2	113	109
PK 403-2	111	1	111	1	111	-
Yvonne	90	4	86	2	83	90
CHECK CHARACTERISTICS				Alyssa (lb/acre)	2398	1696
Alyssa	1319 lb/acre	13 site years		CV %	8.7	9.2
				LSD %	13	16
*Source: http://www.seedmb.ca/				Sign Diff	Yes	Yes

Important Considerations and Recommendations

The Industrial hemp industry as a whole is growing by about 20% per year. Approximately 4875 acres (MASC seeded acreage reports) were grown in 2009 in Manitoba.

There are now a number of Canadian varieties that are showing significantly higher grain yields than the varieties that were originally introduced at the beginning of hemp industry in Canada.

Farmers should use long-term, multi-site data to select the best, yield-stable varieties. The more site years, especially if they are over more than one season, the more dependable the data will be.

Industrial hemp is a crop that requires a license for possession and production from Health Canada. All varieties must have every field tested for THC each year by the grower unless the variety is specifically exempt by Health Canada. Growers need to check the exemption list.

Conclusions

New hemp varieties adapted to Canadian growing conditions are now available and show promise of improved grain yields.

Reference

Canadian Hemp Trade Alliance, Products, Hemp Seed Food Facts, available at http://www.hemptrade.ca/products.php?cat=food&lang=en; Internet; accessed 11 January 2010.

Industrial Hemp Fibre Trials – Manitoba

Cooperators

- Parkland Crop Diversification Foundation – Keith Watson and Jeff Kostuik - Roblin, MB
- Westman Agricultural Diversification Organization – Scott Day, Scott Chalmers – Melita, MB
- Canada Manitoba Crop Diversification Centre – Craig Linde – Carberry, MB
- Manitoba Crop Variety Evaluation Team

Site Information

Location: Dauphin, Carberry, Melita (Barker Site)
Cooperator: MCVET

Background

Traditionally around the world hemp has been grown for fibre. Canada is really the first country that has created a hemp economy around the grain and grain processing.

Hemp plants are composed of the hemp bast fibre which is the long strong fibres around the outside of the plant. Bast fibres comprise about 30 – 35% of the total plant make up. Hurd is the short fibre that is found in the middle of the plant.

To date Canada has a very small fibre processing industry with a small plant in Manitoba and Ontario. There are 3 or 4 initiatives across Canada that are looking at the feasibility and financing of hemp decorticating plants but at time of publishing none have been announced or started building.

This project is to evaluate hemp varieties that may produce high biomass and a high fibre yield.

This project is also a part of a national “Characterization” trial with locations in other provinces. A report of other locations is not available at this time and will be reported on later.

Objective
To evaluate industrial hemp varieties in terms of fibre yield.

Methods

Table 1. Trial Information

Site	Dauphin	Melita	Carberry
Treatments	10 varieties (Table 1)	10 varieties (Table 1)	10 varieties (Table 1)
Replication	4	4	4
Plot size	1m x 5m	1.44m x 11.44m	1.2m x 7m
Test design	Randomized complete block design	Randomized complete block design	Randomized complete block design
Seeding date	June 2, 2009	May 27, 2009	May 24, 2009
Fertilizer applied	106 lbs. actual N (46-0-0) and 30 lbs. actual P (11-52-0)	80 N, 30 P lbs/ac	
Harvest date	September 11, Late varieties Sept. 25	August 25, 2009	September 2, 2009
Product handling	Each plot individually bagged and recorded	Each plot individually bagged and recorded	Each plot individually bagged and recorded

The Dauphin trial was direct seeded into wheat stubble with 30 lbs. actual P and 106 lbs. actual N banded prior to seeding. A $1m^2$ sample from each plot was harvested and bound individually. Each sample was then dried, stripped of leaves and small branches, weighed and recorded.

Table 2. Industrial Hemp Varieties

Petera	Alyssa	Selicia (Dauphin only)
Carmen	Anka	

Table 3. Soil Test Results (Carberry- not available)

	Estimated Available Nutrients	Fertilizer Applied (actual lbs)	Estimated Available Nutrients	Fertilizer Applied (actual lbs)
	Dauphin	**Dauphin**	**Melita**	**Melita**
N*	86 lbs/acre	80 lbs/acre	62 lbs/acre	80 lbs/acre
P	8 ppm (medium)	30 lbs/acre	12 lbs/acre	30 lbs/acre
K	187 ppm (high)		146 lbs/acre	
S*	244 lbs/acre		44 lbs/acre	
pH	8.1		7.7	

** Nitrate – N* **Sulphate - S*

Results

Plant Population

To achieve optimum fibre yields, a high plant population is desired. Target seeding rates in the plots were 300 plants per square metre. To achieve that target, the plots were seeded at a rate of 30 pounds per acre. Typical emergence rates for the plots are expressed in the table below.

At this population the maximum yield potential was expressed. Also it is important to maintain a high population to ensure there are smaller stem diameters. The fibre processing industry does not want stalks that are much over one cm in diameter.

Table 4. Plant Population – Dauphin site only

Variety	Plants/m^2
Carmen	213
Petera	195
Selicia	194
Anka	151
Alyssa	111

Height

Height of the hemp crop is one measure that contributes greatly to the fibre yield of hemp. There are some variety and location differences when the crop is harvested for fibre.

Table 5. Average Plant Height (cm) at Fibre Harvest

Variety	Dauphin (19-Aug)	Carberry (02-Sep)	Melita (18-Aug)
Petera	225	187	245
Carmen	200	205	245
Alyssa	185	162	240
Anka	195	175	239
Selicia	195	-	-

Chart 1. Average Height of Fiber Hemp varieties at Dauphin, Carberry, and Melita and the respective measurement date.

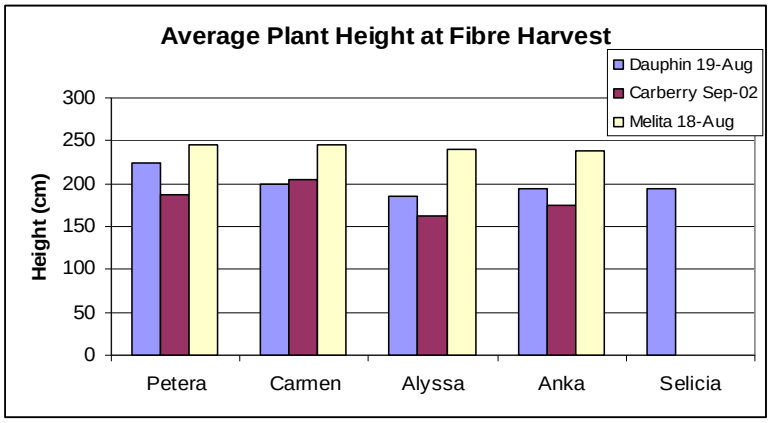


Table 6. Stalk Yield 2009 - tonnes per acre*

Variety	Dauphin	Melita	Carberry
Alyssa	4.522	3.218	4.379
Anka	5.362	3.763	5.641
Carmen	4.899	3.690	6.599
Petera	7.983	4.203	6.623
Selisia	4.846	-	-
CV %	10.47	7.73	17.9
LSD (tonnes)	2.200	1.136	1.042

* Stalks only - All short stems and leaves removed

Multi Year data for Manitoba is summarized as a percentage in Table 7 below.

Table 7. Manitoba Industrial Hemp Fibre Summary **

Industrial Hemp Fibre Summary				% of Alyssa		
Variety	**Yield % of Check**	**Site Years Tested**	**2009 Yield**	Dauphin	Melita	Carberry
Alyssa	100	14	Alyssa	100	100	100
Anka	114	5	Anka	119	117	129
Carmen	115	5	Carmen	108	115	151
Petera	137	7	Petera	177	131	151
USO 14	91	12	USO 14	-	-	
Check Characteristics			Alyssa (t/a	4.5	3.2	4.4
Alyssa	4.5	14	CV %	10.5	7.7	17.9
	t/acre	site years	LSD %	20	14	14
**Source: http://www.seedmb.ca/			Sign Diff	Yes	Yes	Yes

Important Considerations and Recommendations

The yields summarized above represent the yield of stalks only. The small stems and leaves are stripped off.

There are **no allowances** made for machine and harvesting losses that would be experienced in commercial production.

Industrial hemp has a potential for producing a high biomass and fibre yield per acre. Good fibre yields require a higher seeding rate than for grain to ensure a good plant population to ensure maximum yield and smaller stalks.

The optimum time for fibre only harvest is after pollen set and at the early formation of seed, but prior to any viable seed being formed. At this stage, the fibre content of the plant is mature. Depending on the variety and the year, this will take place between the middle to the end of August. This should give a good window of favorable weather to cut, dry down, ret and bale the crop before winter.

Conclusions

Hemp can produce a relatively high biomass and fibre yield in Manitoba.

This research gives a trend for the crop with limited data available. More research is needed to identify hemp fibre quality characteristics to capture the crops full potential. The processing industry when developed will dictate the quality requirements needed.

Industrial Hemp Trial – Dormant Seeded vs. Spring Seeded

Site Information

Location:	Roblin and Melita (Barker Site)	
Cooperator:	Parkland Industrial Hemp Growers	Dauphin, Manitoba
	Scott Day & Scott Chalmers	MAFRI/WADO – Melita

Background

It has been noted that certain varieties of hemp will volunteer from shelling that occurs from the previous harvest. The plants are some of the first plants to begin growth in the spring and can withstand early frost and cool soil conditions.

Previous seeding demonstration trials have shown that some of the varieties in the Parkland Industrial Hemp Growers Coop (PIHG) will grow early in the spring and survive spring frosts if seeded in the late fall.

This project is to evaluate the potential of late fall seeding hemp varieties and to evaluate their survival and potential yield production. If a successful management plan can work into the hemp production cycle, it would help farmers spread out their workload and potentially increase both fibre and grain yields.

There are, obviously, weather related risks involved, but if guidelines can be established that show potential yield increases of fibre and or grain from fall seeding, there may be justification for farmers to utilize this in their production cycle. The worst-case scenario would be having to reseed in the spring every so often. This spring reseed threshold, along with other agronomy factors needs to be studied.

Objective

To evaluate the potential of fall seeded industrial hemp vs. spring seeded in terms of fibre and grain yield.

Methods

Table 6. Trial Information for Roblin and Melita

Treatments:	6 (3 varieties, seeded both in fall and spring)	
Replication:	3	
Test design:	Randomized complete block design	
Product handling:	Fibre – 1m^2 sample from each plot bound, dried, stripped of leaves and small branches, weighed and recorded; Grain – 4m^2 yield of each plot individually bagged and recorded	
	Roblin	Melita
Plot size:	1m^2 for fibre; 4m^2 for grain	1.95 m^2 for fibre, 12.96 m^2 for grain
Seeding date:	Fall seeded – October 30, 2008; spring seeded – May 28, 2009	Fall seeded – November 19, 2008; spring seeded – May 22, 2009
Fertilizer applied:	126 lbs. actual N (46-0-0) and 30 lbs. actual P (11-52-0)	80 lbs. actual N (46-0-0) and 30 lbs. actual P (11-52-0)
Harvest date:	Fibre – August 28, 2009; Grain – September 16, 2009	Fibre – August 26, 2009; Grain – August 29, 2009

Plots were seeded to a desired density of 300 plants/m2. The trial in Roblin was direct seeded into canola stubble. Melita was direct seeded into wheat stubble. Plant density was determined June 9th in Melita, and June 15 in Roblin. Heights were taken August 18th in Melita and August 28th in Roblin. Fibre harvest was

done with a Mitsubishi crop binder and grain harvest with a small plot combine. Each fibre treatment was individually bound, dried, stripped of leaves and weight recorded. Each grain treatment was individually bagged and recorded.

The fall seeded hemp was seeded late in the fall when soil temperatures had cooled down but just before freeze up. In the past few years this has been the last week of October or the 1st week of November. The hemp needs to be seeded late enough so it does not germinate in the fall. The seed was seeded shallow at about ½ inch depth. In this trial the same seeding rates and seed lots were used for the fall and spring seeded plots.

Industrial Hemp Varieties

Petera Alyssa Delores

Table 2. Soil Test Results – Roblin and Melita

	Estimated Available Nutrients	**Fertilizer Applied (actual lbs)**	**Estimated Available Nutrients**	**Fertilizer Applied (actual lbs)**
	Roblin	**Roblin**	**Melita**	**Melita**
N*	124 lbs/acre	80 lbs/acre	62 lbs/acre	80 lbs/acre
P	70 lbs/acre	30 lbs/acre	12 lbs/acre	30 lbs/acre
K	358 lbs/acre		146 lbs/acre	
S*	34 lbs/acre		44 lbs/acre	
pH		7.0	7.7	

** Nitrate – N* **Sulphate - S*

Results

When dormant seeding a crop, weather is expected to play a major role in the success or failure of this type of seeding. The fall seeding must occur when the soil temperatures are low and daytime temperatures will not be high enough to encourage germination.

A Hobo temperature data logger was buried in the soil at the 2 inch level the day after seeding at Roblin. A graph of the temperatures at the Roblin site is in the chart below. The soil temperature was in the range of -5 to -10 most of the months from mid-December to the first week of March. The fall seeded hemp emerged in the spring in Roblin on April 29th and on April 18 in Melita. The Roblin spring seeded hemp was seeded on May 28 and emerged on June 8. Melita Spring seeded hemp was seeded on May 22 and emerged on May 27. On the date when the spring seeded hemp emerged, the fall seeded hemp was on average 4 inches tall in Roblin and 5 inches tall in Melita.

Figure 1.

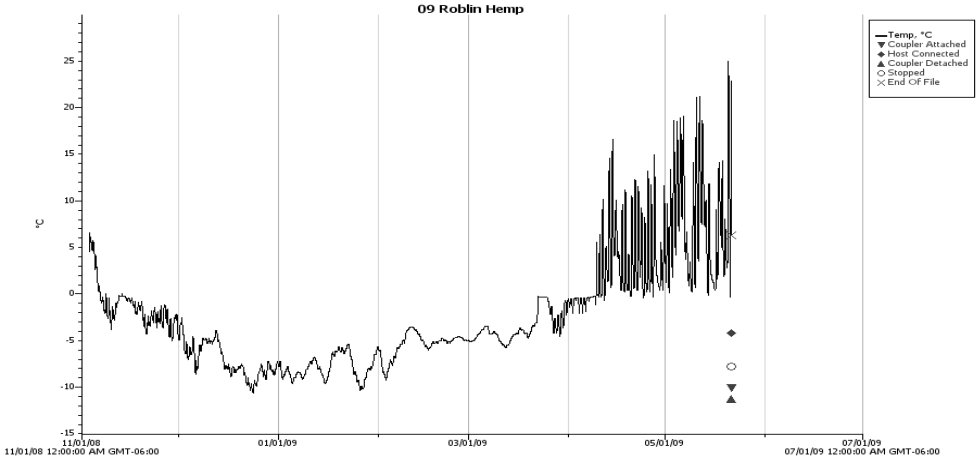


Table 3 indicates the extremes that the fall seeded hemp experienced in the spring at Roblin. The plants emerged and withstood the most extreme overnight temperature on May 16 of -8.8 degrees C at Roblin. The last spring frost at Roblin was -2.8 degrees on May 23 and -.01 degrees in Melita on May 22.

Table 3: Roblin Weather April 5 to May 30, 2009

	Roblin	Date	Melita	Date
Number of Days below 0	30		23	
Lowest Minimum Temp	-8.8° C	May 16 2009	-4.9° C	April 9 2009
Last Spring Frost	-2.8° C	May 23 2009	-0.01° C	May 22 2009
Maximum Temp	25.5° C	May 27 2009	26.4° C	May 27 2009

Table 4 summarizes the temperature ranges experienced for daytime highs and night lows and the percentage of days in that range at each site. The fall seeded hemp emerged in Roblin on April 29

Table 4: Weather Summary April 5 to May 30, 2009

	Roblin				Melita			
	Daytime Highs (days)	% Days	Over night lows (days)	% Days	Daytime Highs (days)	% Days	Over night lows (days)	% Days
Number of days < -5 degrees			6	10.91%				
Number of days 0 to -5 degrees			24	43.64%			23	41.82%
Number of days 0 - 5 degrees	6	10.91%	18	32.73%	1	1.82%	20	36.36%

Number of days 5 - 10 degrees	19	34.55%	7	12.73%	11	20.00%	12	21.82%
Number of days 10 - 15 degrees	10	18.18%			15	27.27%		
Number of days 15 - 20 degrees	12	21.82%			16	29.09%		
Number of days above 20 degrees	8	14.55%			12	21.82%		

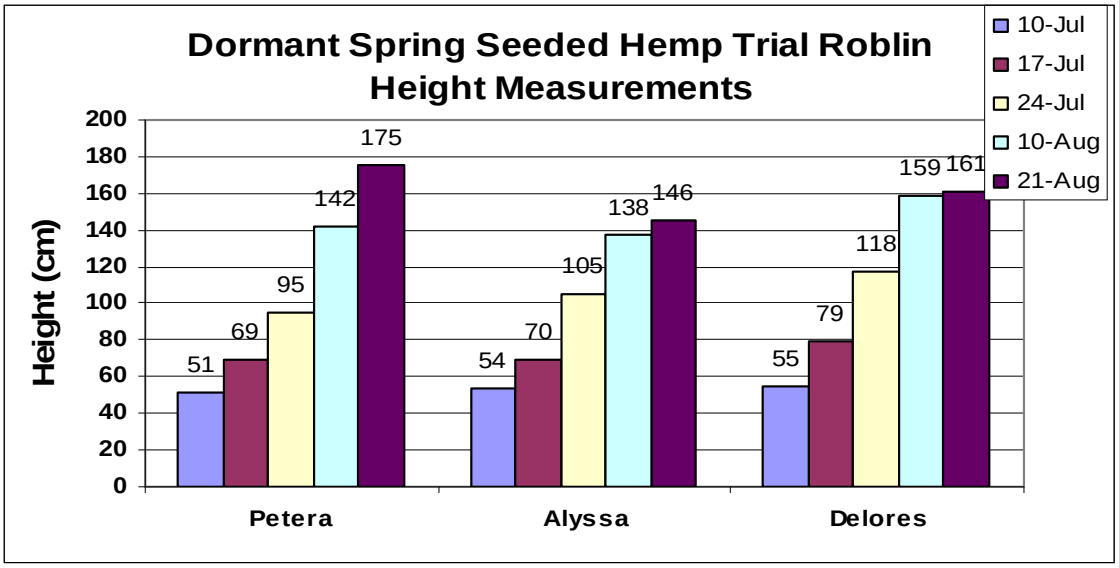
Plant population comparison from fall to spring is a measure of how tolerant the plants and varieties are to the spring freezing conditions. Table 5 shows a drop in the number of plants that survived in the fall compared to the spring. There is some difference in varieties on their ability to survive the winter and spring conditions. This is limited information but does indicate that further study is needed so seeding rates can possibly be adjusted to give the populations in the spring that are needed for adequate yields. Plant populations appear to drop 12 to 49% between fall and spring dependant on the variety.

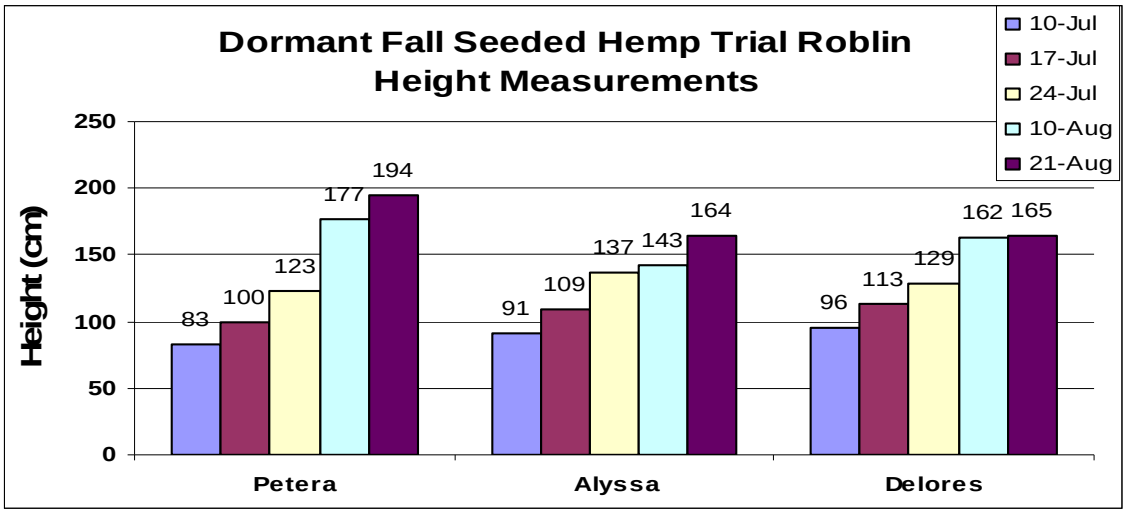
Table 5. Plant populations – Average Roblin and Melita

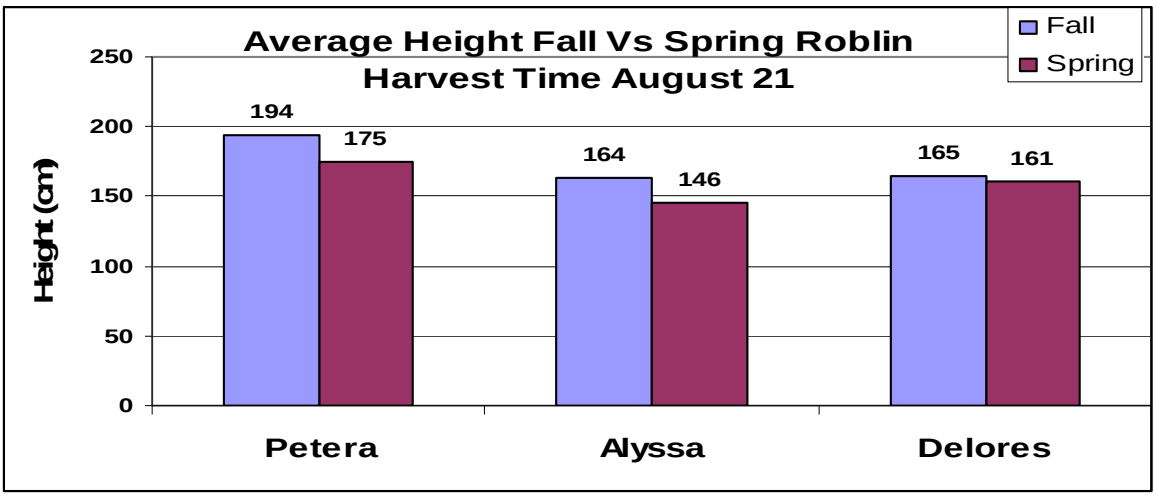
	Avg. Plants/m^2 Fall	**Avg. Plants/m^2 Spring**	**% Fall vs. Spring**
Petera	188	364	51.6%
Alyssa	211	289	72.8%
Delores	84	94	88.9%

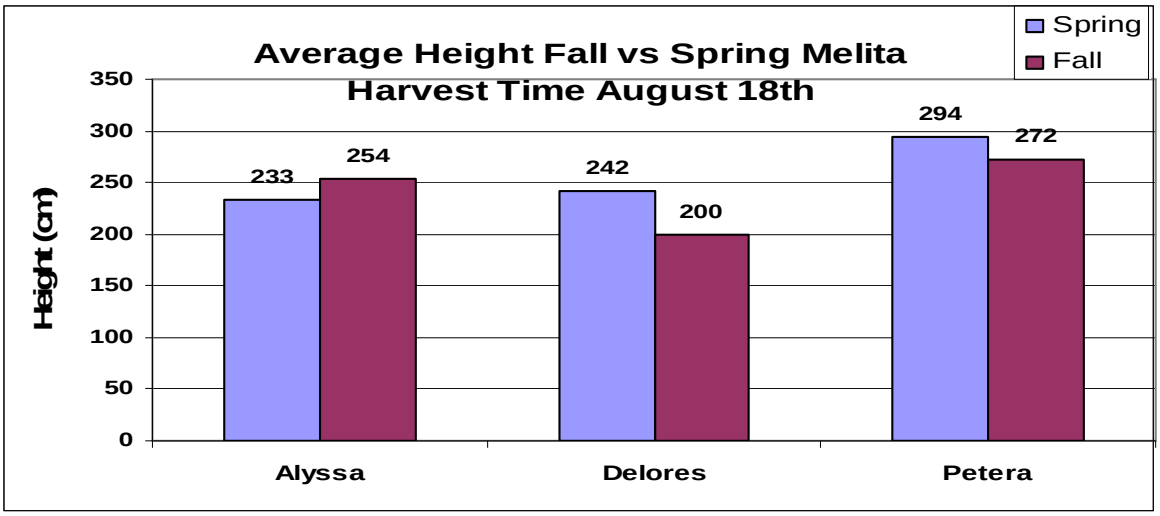
Growth Curve and Heights

It was observed that the fall seeded hemp varieties all started to grow two to three weeks before the spring seeded plots were seeded.




Dormant Fall Seeded Hemp Trial Roblin
Height Measurements
10-Jul
17-Jul
24-Jul
10-Aug
21-Aug
Height (cm)
250
200
150
100
50
0
83
100
123
177
194
91
109
137
143
164
96
113
129
162
165
Petera
Alyssa
Delores


Average Height Fall Vs Spring Roblin
Harvest Time August 21
Fall
Spring
Height (cm)
250
200
150
100
50
0
194
175
164
146
165
161
Petera
Alyssa
Delores


Average Height Fall vs Spring Melita
Harvest Time August 18th
Spring
Fall
Height (cm)
350
300
250
200
150
100
50
0
233
254
242
200
294
272
Alyssa
Delores
Petera

The fall seeded varieties Petera and Alyssa were approximately 10% higher at harvest time in Roblin. In Melita the fall seeded variety Alyssa was 8% taller. The fall seeded varieties Delores and Petera were17 and 7% shorter than the spring seeded hemp.

Yield

Grain and fibre yields were taken from the plots in Roblin and Melita. The yields were too variable and will not be reported.

The general trend observed indicated that there is a significant yield increase possible of both grain and fibre by seeding in the fall.

Important Considerations and Recommendations

Hemp must be seeded very late in the fall so it does not germinate before freeze up. Hemp seems to like warmer soils than a lot of crops so this may be an advantage to make this practice feasible.

Further research is needed to evaluate and quantify possible yield advantage or disadvantages, variety differences, field selection and other agronomic factors.

It is anticipated that there will be years when there is a total crop failure with no spring germination. The frequency of these events needs to be documented so a farmer can assess the risk versus potential yield benefit from fall seeding hemp vs. the chance of having to reseed the crop in the spring.

Conclusions

With limited data to date it does appear that some varieties of hemp may be suited to dormant seeding very late in the fall before freeze up. Further study is required to determine the risk and evaluate the percentage of years that the practice may be successful.

Plant Density of Fall Dormant and Spring Seeded Crops: Canola, Cow Cockle, Niger, Camelina, Hairy Vetch, and Calendula

Background

Benefits of fall seeded crops can potentially offer higher net returns in many ways. These many include improved early season moisture utilization, relaxed spring seeding workloads, heat stress avoidance, fungal and insect pressure avoidance, day length benefits, improved weed competition, greater yield potential, and an earlier harvest relating to earlier marketing opportunities.

Unfortunately, some crops are not suited for fall dormant seeding and should be spring seeded. Reasons for poor early season seeding may be premature germination followed by the plant's inability to deal with frost or cool soil temperatures, seedling desiccation, depth of seed in soil, variety variations, and general adaptability.

Objectives

To assess the plant emergence differences in fall dormant and spring seeded plantings of various crops including Canola, Cow Cockle, Calendula, Niger, Camelina, and Hairy Vetch

Methods

Plots of canola, Cow Cockle, Calendula, Niger, Camelina and Hairy Vetch were used in this experiment. A fall dormant and spring seeded plot of each crop were seeded side by side. The fall dormant plots were seeded on November 19, 2008 and spring seeding commenced on May 22nd. Plots were seeded at a ½" depth using Seedhawk dual knife openers. Fertilizer was sideband at a rate of 60 lbs/ac N (28-0-0) and 30 lbs/ac P (11-52-0). Emergence was taken from two separate 1 meter row lengths per fall or spring plot. Additional notes were taken for each crop during the season depending on important observations specific to the crop. Mean emergence density and their standard deviations were determined.

Seeding rates were as follows:

Crop	Seeding Rate (lbs/ac)
Canola	5
Cow Cockle	5
Calendula	10.6
Niger	7
Camelina	5
Hairy Vetch	35

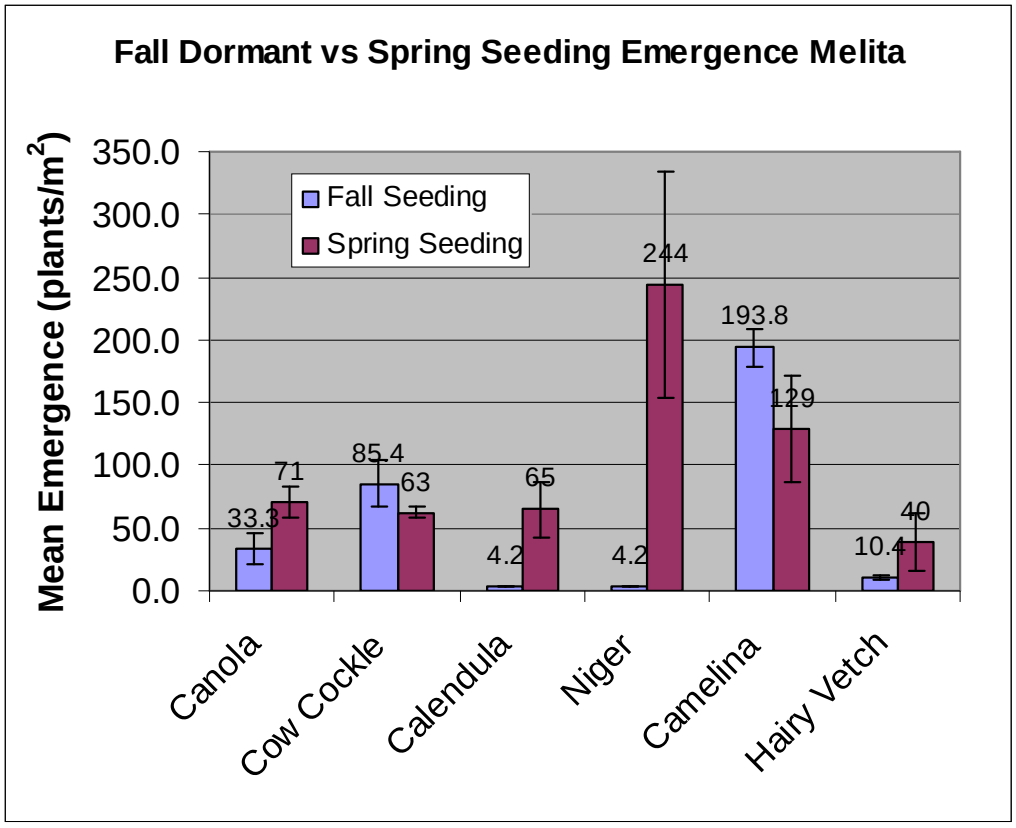
Results and Discussion

Canola:
There was nearly twice the emergence potential in spring seeded canola compared to fall dormant seeded canola. Despite having an insecticide seed treatment, the fall seeded canola still failed to flee beetles in early May. Fall seeded canola also appeared to be a poor weed competitor compared to the vigor of spring seeded canola.

Cow Cockle:
There was a slight improvement of fall dormant seeded Cow Cockle seedling density compared to spring seeded plants but these results are likely insignificant..

Calendula:
Calendula did not fair well as a fall dormant seeded crop and should be strictly seeded as a mid-spring crop. However, fellow horticulturists suggest that some Calendula has been found to overwinter in some gardens.

Niger:
This crop does not respond well to fall dormant seeding and should be spring seeded.



Camelina:
As expected from other unpublished work done by WADO, the prospect of fall dormant seeded camelina has proved to be an effective production practice for camelina. A multi-year replicated trial would prove if there was a significant difference between timings. Emergence of fall seeded camelina was April 18th and several days after for spring seeding. Fall seeded camelina (picture left) had a great competitive advantage over weeds compared to spring seeded plots (picture right). No herbicides used during the duration of this experiment.

Camelina was left to mature and was harvested August 18th. Fall seeded plots matured much earlier and out yielded the spring seeded plot. Final yield for fall dormant and spring seeded plots was 1683.1 lbs/ac and 1058 lbs/ac, respectively.

Hairy Vetch:
Spring seeded hairy vetch appeared to be superior to fall dormant seeded Hairy Vetch, however, greater variation in spring seeded emergence counts may indicate there is no significant difference. Seed production in fall seeded hairy vetch was earlier and relatively abundant compared to the spring seeded plots that tend to be more vegetative and low yielding in seed (observation August 29). There was no formal seed harvest taken.

Developing yield loss relationships and economic thresholds for kochia and biennial wormwood in sunflowers in Manitoba

Researchers:
Derek Lewis, Graduate Student, Department of Plant Science, University of Manitoba

Dr. Rob Gulden, Assistant Professor, Department of Plant Science, University of Manitoba

Funding body:
National Sunflower Association of Canada

Background

Previous research has shown that sunflower is a crop that has a high susceptibility to yield losses caused by weed interference. Kochia and biennial wormwood are two weeds that producers often have difficulty controlling in sunflower crops. Sunflower producers use combinations of herbicides and in-crop tillage to control weeds after crop emergence, however, there is movement towards zero-tillage production systems in many areas, and with the removal of tillage, herbicides remain the only option for weed control in sunflowers under zero-tillage. There has been no local research to date examining the potential yield losses in sunflowers caused by weed interference under zero-tillage production systems. The goal of this research is to determine yield and quality losses caused by kochia and biennial wormwood in sunflowers and provide the information necessary to calculate economic thresholds for control of these weeds in sunflowers in Manitoba. The 2009 experiments were located in Melita, Winnipeg and Carman.

Preliminary Results for Melita

Kochia

Measurements in sunflower in response to interference with kochia included plant height, number of leaves, stem diameter, time of flowering, head diameter at harvest, and yield. In 2009, kochia that emerged at the same time as the crop and after the 4 leaf sunflower stage did not affect any of the growth parameters measured except yield. Kochia that emerged with the crop caused yield losses as great as 30% at a density of about 44 kochia plants per square meter. Kochia seedling recruitment was lower than anticipated, with target seeding populations of 200 plants per square meter resulting in only 44 plants per square meter in the field at this location. Adequate seed has been secured for 2010 to increase seeding rates accordingly.

Biennial wormwood

The biennial wormwood seed collected in spring 2009 for this experiment germinated under greenhouse conditions. However, under field conditions where germination conditions are not ideal, seedling recruitment was poor. As a result, the density series of biennial wormwood seedlings was incomplete in 2009, but did include the natural population and a weed-free control. A sunflower yield loss of approximately 8% was observed at a density of 150 biennial wormwood plants per square meter.

The kochia and biennial wormwood experiments will be repeated in 2010 in Melita, Carman and Winnipeg.

For more information about this research contact:
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Rob Gulden: phone 204-474-6080, email gulden@cc.umanitoba.ca

NSAC Herbicide Trial 2009 – Sulfentrazone to Control Kochia

Background

The need for improved weed control in sunflower production for Manitoba is great. Currently there are few products registered for broadleaf weed control in sunflower. Moreover, the expansion of herbicide resistant weeds has limited the effectiveness of registered herbicides and limits overall yield potential in sunflower. In 2009 products available for broadleaf weed control in sunflower were Edge Granular (ethalfluralin), Eptam 8E (EPTC), Muster Toss-N-Go (ethametsulfuron-methyl), and Solo (imaxamox). Edge and Solo offer good to suppressive control to Kochia (*K. scoparia*), and Solo may offer suppression if kochia is not a Group 2 resistant biotype. Multiple herbicide types have to be applied in order to cover a greater spectrum of weeds. This creates shrinking margins. To make matters worse, there are no herbicides available to offer control of Sow Thistle, Canada Thistle, Cocklebur, Dandelion, Round-leaf Mallow and Night-flowering Catchfly; all serious weed concerns typical in areas for sunflower production.

Sulfentrazone more commonly known in Saskatchewan as Authority® is a selective soil applied herbicide for the control of Wild Buckwheat, Kochia, Lamb's Quarters, and Redroot Pigweed in chickpeas. It comes from the Group 14 family of herbicides and can offer control to Group 2 resistant biotypes. Sulfentrazone has already been used in North Dakota for almost a decade in sunflowers ranging from various emergency registrations to product names. Manitoba has yet to have any sort of registration for sulfentrazone on sunflowers.

Manitoba Agriculture Food and Rural Initiatives together with WADO conducted a pair of efficacy trials in Melita and Carman, Manitoba. Several unregistered herbicides were used to establish weed control and crop tolerance ratings in

sunflower. This work may help support an emergency use approval for products such as sulfentrazone in Manitoba.

Objectives

- To measure the efficacy and crop safety of available sunflower crop herbicides in the United States, which are not currently registered in Canada.

- To provide field trial support for new herbicides that will provide new modes of action for weed control, especially group 2 resistant kochia and lower rate herbicides compared to those currently available.

Methods

Treatments will be tested as a random complete block design. Rival EC incorporated herbicide will be used as the standard herbicide. Sulfentrazone and test product ABC will be applied prior to seeding or within 3 days from time of seeding. Application will be timed so that potential of precipitation is high within 3 days after application.

Weed efficacy ratings and sunflower crop tolerance will be taken at the intervals of 7-14, 21-35, 42-56, 72 days after planting (DAP). Height and stage of sunflower development will be collected to assess the crop tolerance to the specific application rates.

Table 1: Herbicide Treatments Used in the Trial

Entry	Treatments	Rival	Sulfentrazone	Carfentrazone	ABC
		mL/ac	mL/ac	mL/ac	g ai/ha
1	Untreated Check	0	0	0	0
2	RIVAL EC	890	0	0	0
3	Sulfentrazone @ 1X rate	0	118	0	0
4	Sulfentrazone @ 1.5X rate	0	177	0	0
5	Sulfentrazone @ 2X rate	0	237	0	0
6	Carfentrazone-ethyl @ 1X rate	0	0	14.8	0
7	Carfentrazone-ethyl @ 2X rate	0	0	29.6	0
8	ABC @ 1X rate	0	0	0	-
9	ABC @ 2X rate	0	0	0	-
10	ABC @ 3X rate	0	0	0	-
11	Sulfentrazone @ 1X + Carfentrazone @ 1X	0	118	14.8	0
12	Sulfentrazone @ 1X + Carfentrazone @ 2X	0	118	29.6	0
13	Sulfentrazone @ 2X + Carfentrazone @ 1X	0	237	14.8	0
14	Sulfentrazone @ 2X + Carfentrazone @ 2X	0	237	29.6	0
15	Sulfentrazone @ 1X + ABC @ 1X	0	118	0	-
16	Sulfentrazone @ 1X + ABC @ 2X	0	118	0	-
17	Sulfentrazone @ 1X + ABC @ 3X	0	118	0	-
18	Sulfentrazone @ 1.5X + ABC @ 1X	0	177	0	-
19	Sulfentrazone @ 1.5X + ABC @ 2X	0	177	0	-
20	Sulfentrazone @ 1.5X + ABC @ 3X	0	177	0	-
21	Sulfentrazone @ 2X + ABC @ 1X	0	237	0	-
22	Sulfentrazone @ 2X + ABC @ 2X	0	237	0	-
23	Sulfentrazone @ 2X + ABC@ 3X	0	237	0	-

Each plot was 4 rows wide, measuring 8.0 meters length with 0.75 m (~30 inch) row spacing, pathways between ranges were 2.0 m wide. Total trial area including guards on either end of the replicates will be approximately 0.75 acres. All plots were seeded at a standard 180,000 seeds/acre with the confection-type variety 6946.

Seeding occurred at Melita, MB on June 1st located at SW 29-3-27 on a fine sandy loam soil. A preseed burnoff of glyphosate (1 L/ac) was used prior to seeding. Plots were seeded into spring wheat stubble. Herbicide treatments were applied June 3 with a four nozzle CO_2 powered pesticide sprayer.

Seeding occurred at Carman, MB at the University of Manitoba farm location on May 21st. Herbicide applications were applied on May 23rd. On May 25th, 20 mm of rain was recorded by Environment Canada from the weather station at the University of Manitoba farm weather station approximately half a mile east of the trial site.

The Carman trial was re-seeded on June 11th due to poor plant populations from mechanical problems with row planter. Emergence of the second planting of sunflowers was very good.

Carman Weather:

Month	Mean Temperature	GDD (base 0°C)	Precipitation
May 23 – 31	11.5°C	62.7	24.4 mm
June	15.4°C	189.3	127.0 mm
July	16.8°C	184.5	62.4 mm
August	17.1°C	184.1	52.6 mm
TOTAL	**16.0 C**	**620.6**	**266.4 mm**

Melita Weather: (Pierson weather stn)

Month	Mean Temperature	GDD (base 0°C)	Precipitation
June 1 - 31	16.5°C	319.3	41
July	17.3°C	380.2	105
August	17.5°C	386.9	40
TOTAL	**16.8°C**	**1086.4**	**186 mm**

Results

Results from Carman and Melita are reported in Table 2. Weed pressure from kochia was minimal at the Melita site and will not be discussed. Only Carman observations are discussed in this report.

Table 2: Various herbicide treatments and rates in sunflower including Rival, carfentrazone, sulfentrazone, and product ABC. Crop tolerance and percent weed control for kochia and red root pigweed are recorded at 20, 34, 46, and 60 days after planting (DAP). Data is Melita and Carman sites combined. RPgwd = Redroot Pigweed

	20 DAP			34 DAP			46 DAP			60 DAP	
Treatment	**Crop Tolerance**	**Kochia**	**RPgwd**	**Crop Tolerance**	**Kochia**	**RPgwd**	**Height (inch)**	**Kochia**	**RPgwd**	**Crop Stage (R stage)**	**Height (inch)**
Untreated Check	0	0	0	0	0	0	28	0	0	2.9	45.4
RIVAL EC	0	12.5	0	0	0	0	28.5	0	0	2.9	51.3
Sulfentrazone @ 1X rate	0	78.8	0	0	75	0	33.5	65	0	3.4	56.3
Sulfentrazone @ 1.5X rate	0	84.5	0	0	83.3	0	30.8	77.5	0	3.8	60.5
Sulfentrazone @ 2X rate	0	87.8	6.7	0	85.8	0	34.5	89.5	0	4	60.9
Carfentrazone-ethyl @ 1X rate	0	0	0	0	0	0	22.3	0	0	2.4	50.8
Carfentrazone-ethyl @ 2X rate	0	0	0	0	0	0	29.8	0	0	3.1	51.1
ABC @ 1X rate	0	42.5	35	0	35	32.5	31.3	20	35	3.3	53.3
ABC @ 2X rate	0	68.8	78.3	0	55	71.3	32.3	40	62.5	3.5	59.1
ABC @ 3X rate	0	75	98	0	58.8	98	31.8	40	90.8	3.8	58.8
Sulfentrazone @ 1X + Carfentrazone @ 1X	0	82.5	0	0	75	0	33.8	65	0	3.8	61.6
Sulfentrazone @ 1X + Carfentrazone @ 2X	0	78.8	0	0	72.5	0	33.8	67.5	0	3.6	57.4
Sulfentrazone @ 2X + Carfentrazone @ 1X	0	92.8	0	0	89.5	0	33.5	81.3	20	3.8	63
Sulfentrazone @ 2X + Carfentrazone @ 2X	0	93.3	5	0	92	0	33	87.5	0	4	61.6
Sulfentrazone @ 1X + ABC @ 1X	0	85	70	0	77.5	65	36.5	70	52.5	3.8	62.1
Sulfentrazone @ 1X + ABC @ 2X	0	88.8	89	0	81.3	87	37	75	77.5	4	64.5
Sulfentrazone @ 1X + ABC @ 3X	0	91.3	68.7	0	82.5	78.7	36.5	75	79.3	4	62.6
Sulfentrazone @ 1.5X + ABC @ 1X	0	85	73.3	0	85	73.3	35.8	77.5	65	3.8	59.6
Sulfentrazone @ 1.5X + ABC @ 2X	0	87.5	93.5	0	85	87	35.8	73.8	69.5	3.9	61.1
Sulfentrazone @ 1.5X + ABC @ 3X	0	92	98	0	82.5	98	35	72.5	92	4	62
Sulfentrazone @ 2X + ABC @ 1X	0	92	57.5	0	88.8	65	36	83.8	52.5	4	62.9
Sulfentrazone @ 2X + ABC @ 2X	0	91.5	96	0	89.5	94	36.3	86.3	88.3	4	62.5
Sulfentrazone @ 2X + ABC@ 3X	0	97.3	98	0	95.3	93.3	36.5	93.8	88.3	4	60.3

Crop Tolerance:
At 20 days and 34 days after planting (DAP) there looked to be no difference in the treatments in regards to crop tolerance. Emergence, development all appeared equal. As the season progressed and weed species developed and began to compete with the sunflowers for moisture, nutrients, differences in height began to appear. At the 46 DAP rating the treatments were there was reduced weed control, sunflower plants were shorter in height and beginning to show symptoms of nitrogen deficiency chlorosis. Again at the 60 DAP rating, in the treatments where there was greater weed competition, sunflower plants were showing more stunting, chlorosis as well as developmental delays. Tolerance to the herbicide product and higher rate applications did not seem to be a concern. More developmental delays and detrimental symptoms to the sunflowers occurred in the treatments where weeds were not controlled adequately.

Kochia Control:
Treatments that included sulfentrazone had better control throughout the length of the trial. As time progressed there was reduction in kochia control, especially at the 1X rate. The addition of ABC to sulfentrazone did provide better control of kochia compared to the same rate of sulfentrazone throughout the trial period in most treatment additions. The best control at the 60 DAP rating was sulfentrazone at the 2X rate and ABC at the 3X rate. Carfentrazone-ethyl in addition to sulfentrazone in most treatments provided similar kochia control.

ABC alone provided control to suppression of kochia, with the higher application rate of 3X providing the best control. Carfentrazone-ethyl alone did not appear to provide any control of kochia at any rating timing. Rival EC provided some kochia control at the 20 DAP rating, but did not appear to provide any control in future ratings.

Redroot Pigweed Control:
Treatments that included ABC had better control on redroot pigweed throughout the length of the trial. The addition of sulfentrazone to ABC did boost redroot pigweed control at the 1X and 2X ABC rates, but ABC at the 3X rate alone usually provided the best control. Carfentrazone-ethyl tank-mixes with ABC provided similar kochia control.

Sulfentrazone and carfentrazone-ethyl alone provided minimal to no control of redroot pigweed. Rival EC provided no control of redroot pigweed

Conclusions:

The use of sulfentrazone for control of kochia in sunflowers does provide control for the majority of the growing season. Rate applied needs to be carefully considered based on the soil type (Table 3), as lower rates on the clay loam soil

at Carman, MB did not have as prolonged or acceptable control levels. The addition of other products that are currently being promoted in the United States such as carfentrazone-ethyl or KIH 485 can help boost the kochia control, but the small increase in control may not be economical. As stand alone products carfentrazone-ethyl and ABC do not provide adequate control of kochia which is reflected in the control rating at 46 DAP and the reduced height and crop staging at 60 DAP.

ABC did provide superior redroot pigweed control compared to all the other herbicide treatments. ABC may be beneficial as a complimentary herbicide to increase the spectrum of weed species control in sunflower when applied with another product.

The most interesting part of this trial besides the level of weed control on species was the impact that weed control had on the development of the sunflowers. Kochia was the dominant weed in the trial and if it was not adequately controlled, the sunflowers suffered with delayed development, height and symptoms of nutrient deficiency, specifically nitrogen chlorosis. No yields were taken from the trial, but it would be expected in the treatments that had poor kochia control would also have a large reduction in yield.

In the future the impact of weed population, weed control and timing would be useful to understand the economic impact of weeds such as kochia on sunflower profitability.

Table 3: Spartan (Sulfentrazone) Rate Table as published by US manufacturer FMC

Spartan 4F Use Rate Table (Sunflowers) Fall, Early Spring Preplant, Preemergence, and Preplant Incorporated Applications			
Broadcast Rate	**Fluid Ounces Spartan 4F per acre**		
Soil Texture			
% Organic Matter	**Coarse** (Sand, Loamy sand, Sandy loam)	**Medium** (Sandy clay loam, Sandy Clay, Loam, Silt loam, Silt**)**	**Fine** (Silty clay loam, Silty clay, Clay loam, Clay**)**
<1.5	3.0 - 3.75	3.0 – 4.5	3.75 – 5.25
1.5-3.0	3.0 – 4.5	3.75 – 6.0	4.5 – 6.75
>3	3.75 – 6.0	4.5 – 6.75	6.0 – 8.0
Use higher rates for soils of pH less than 7.0 and lower rates for pH greater than 7.0 within the rate range.			

Mycorrhizae: Does it make a Difference with Cadmium uptake in Flax under various fertility regimes?

Cooperators:
Shape Foods Ltd – Brandon, MB
Dr. Marcia Monreal - Agriculture and Agri-Food Canada – Brandon, MB
Dr. Cynthia Grant - Agriculture and Agri-Food Canada – Brandon, MB
Westman Agricultural Diversification Organization – Melita, MB
Premier Tech – Quebec

Background

As promised in the 2008 annual report, WADO is now able to better address the question: "do mycorrhizae inoculated on flax seed make a difference in the uptake of Cadmium under different fertility regimes?"

The importance of this question has to do with the benefits and drawbacks of flax in our everyday health. With the expansion of the health food industry creating a safe food for consumption is important and an important marketing feature. Cadmium content in processed flax products or any food is a concern. Cadmium accumulates in kidneys, where it damages filtering mechanisms. This causes the excretion of essential proteins and sugars from the body and further kidney damage. It takes a very long time before cadmium that has accumulated in kidneys is excreted from a human body. Other health effects that can be caused by cadmium are diarrhea, stomach pains and severe vomiting, bone fracture, reproductive failure and possibly even infertility, damage to the central nervous system, damage to the immune system, psychological disorders and, possibly DNA damage or cancer development. Production of flax is limited to very specific regions in North America. In southwest Manitoba, conditions for flax production are often optimal. Cadmium concentrations in our Manitoba soils range from 0.1 ppm in the extreme southwest (Melita region) to 0.6 ppm in the central regions near Carmen, Manitoba (Klassen R.A. et al. 2007). The higher levels can pose a risk of increased uptake by crops like Flax and Sunflowers. Finding an effective barrier to cadmium uptake in flax would be beneficial.

Flax frequently does not strongly respond to fertilizers like other crops can. Flax seedlings are also very sensitive to seed placed fertilizer. Phosphorous is a nutrient that is difficult to get a response from in flax and is occasionally skipped in the production of flax. Use of monoammonium phosphate fertilizers have been found to contain variable concentrations of cadmium. Not only Cadmium from the phosphate fertilizer is released into the plant but phosphate fertilizers with even low cadmium levels seem to assist in increase Cadmium uptake in plant (Grant C.A. et al. 2007). This has caused some concern to the consumer food industry. Uptake of cadmium in plants is fairy mobile (compared to other heavy metals) and is well documented (Rivera-Becerril F., *et al*. 2002).

Mycorrihzae may offer an additional barrier to the uptake of cadmium in flax plant tissues. The buffering effect of mycorrhizae has been documented. Mycorrhizae are the symbiotic relationship between a filamentous fungus and the roots of a higher plant level. By providing a larger surface area for mineral uptake mycorrhizae may provide a longer nutrient transport system or dilution effect to the plant and therefore accumulate Cd further from the plant root zone with the filamentous fungi acting as a sponge preventing uptake of heavy metals such as Cd.

In 2008, an experiment was set up to try to visualize this barrier with the use of an agriculturally available mycorrhizae product called Myke Pro (Premier Tech Biotechnologies, Quebec).

Methods

This trial consisted of six treatments with variable amounts of fertility ranging from a zero rate, half fate and full rate fertility package. Mycorrhizae inoculant called Myke Pro™ containing the fungal species *Glomus intraradices* was supplied by Premier Tech (Quebec). The inoculant was acquired at a local farm that had purchased the product, under the full knowledge of the company rep. Plots were seeded May 14. Just prior to seeding, inoculant was applied to the corresponding fertility treatments at a rate of 5 lbs/ac to the flax seed variety 'Lightning' (untreated with fungicide). Flax was seeded at a rate of 40 lbs/ac. Flax was maintained weed free with the use of Buctril M and Axial herbicide application at the recommended tank mix rate as an incrop application. Prior to seeding Cleanstart herbicide was used to burnoff the seeding area used at a recommended rate. Fertility treatments either had seed that was or was not inoculated with mycorrhizae. The following treatments summarize this concept:

Treatments (lbs/ac actual)

1. 0 N + 0 P (untreated check)
2. 25 N + 12.5P
3. 50 N + 25 P
4. 0 N + 0 P + Myke Pro
5. 25 N + 12.5P + Myke Pro
6. 50 N + 12.5P + Myke Pro

Spring Soil Test (2008)

	N	P	K	S	Salts	pH
Depth	lbs/ac	ppm (olsen)	ppm	lbs/ac	mmho/cm	
0-6"	18	12	239	34	0.13	7.7
6-24"	36			84	0.14	7.7
0-24"	54	12	239	118	0.27	7.7

Comparison of Treatments:

Treatments 1 and 4, 2 and 5, 3 and 6 act as comparisons to test for mycorrhizal responses while the increase in fertility regime from 1 to 3 or 4 to 6 will show fertility responses to fertilizer without inoculation. Cadmium uptake in both root and shoots is expected to be less in treatments 4, 5, and 6 compared to 1, 2, and 3. A slight increase in cadmium tissue concentration may be observed in 3 compared to all other treatments due to the intrinsic Cadmium content in the mono-ammonium phosphate fertilizer.

Cadmium Samples:

After harvest, root and seed samples were taken from plots for Cadmium content analysis. Roots and their stalks were dug up after harvest, washed of dirt, and let to dry. Roots were clipped with tree pruners away from the stalk at the ground line of the stalks. Stalks were discarded. Enough samples were needed to produce at least 5 grams of dry root matter. Roots were ground by a Thomas-Wiley Intermediate Mill with a #20 sieve (0.85 mm). Seed samples were cleaned and packaged as is, with more than 5 g per sample needed for analysis.

Root and seed samples were each sent to Agriculture and Agri-Food Canada at the Brandon Research Centre. There they were analyzed for total Cadmium content in each plot treatment. Samples are subjected to a nitric/perchloric acid then a Graphite Furnace Atomic Absorption Spectroscopy with Zeeman background correction for analysis. This analysis analyzed the elements Cd, Cs, Cu, Fe, K, Mg, Mn, P, S, and Zn in both the roots and shoots. Element concentration values were subject to a two-way ANOVA. If interactions were suspect, further analysis included this function between mycorrhizae use and fertility levels.

Results

Grain

There were significant differences between treatments and their concentrations of copper (Cu), potassium (K), Manganese (Mn), and zinc (Zn) [Table 1], however further analysis revealed no interaction between fertility and inoculation affecting uptake of these nutrients. Only fertility was responsible for these significant fluctuations. No combination of fertility or mycorrhizal use was able to change Cd uptake. The use of mycorrhizae did not assist or hinder the uptake of all nutrients analyzed in the seed sample.

Table 1: Element concentrations in flax seed samples under various fertility levels and mycorrhizae (Myke) inoculation. N = nitrogen, P = phosphorous

Fertility (lbs/ac)	Cd_ppb	Ca_ppm	Cu_ppm	Fe_ppm	K_ppm	Mg_ppm	Mn_ppm	P_ppm	S_ppm	Zn_ppm
0 N 0P	162.9	2450.1	6.25	49.7	7882.4	3664.7	35.85	6692.4	1956.0	36.9
25N 12.5P	157.2	2323.4	4.96	45.6	7143.5	3542.2	34.65	6352.2	1872.9	33.5
50N 25 P	144.6	2357.4	4.52	46.8	7101.2	3604.7	34.95	6422.4	1907.5	31.5
0 N + Myke	166.2	2438.4	6.42	49.2	7713.5	3605.9	35.10	6626.3	1933.2	38.0
25N 12.5P + Myke	153.2	2235.4	5.28	46.6	6998.1	3458.0	34.37	6271.5	1843.7	34.5
50N + 25P + Myke	153.1	2358.5	4.37	51.0	7312.0	3653.4	36.03	6454.0	1941.3	33.8
CV%	7.4	3.4	8.9	6.5	3.3	2.1	1.68	2.9	3.0	5.9
LSD (p<0.05)	ns	ns	0.86	ns	439.5	ns	1.07	ns	ns	3.7
Grand Mean	156.2	2360.5	5.3	48.1	7358.5	3588.2	35.2	6469.8	1909.1	34.7

Roots

In the root system, statistical differences were found between treatments and their concentrations of K, P and Zn [Table 2], however further analysis revealed interaction between fertility and mycorrhizae in concentrations of S, and Zn, only.

Table 2: Element concentrations in flax roots samples under various fertility levels and mycorrhizae (Myke) inoculation. N = nitrogen, P = phosphorous

Fertility (lbs/ac)	Cd_ppb	Ca_ppm	Cu_ppm	Fe_ppm	K_ppm	Mg_ppm	Mn_ppm	P_ppm	S_ppm	Zn_ppm
0 N 0P	328.4	4425.0	7.3	1968.1	9684.1	1760.4	109.7	1634.5	1046.5	16.26
25N 12.5P	284.7	4249.3	7.5	1427.7	9196.0	1720.9	105.9	1248.8	526.4	14.41
50N 25 P	253.6	3968.4	7.7	1074.6	9045.9	1738.5	99.1	1087.9	518.9	11.45
0 N + Myke	286.9	4115.2	7.5	1325.2	8831.6	1589.5	94.3	1292.6	658.2	14.53
25N 12.5P + Myke	220.3	4048.7	6.7	1242.7	8888.8	1800.9	96.0	1172.2	683.0	12.97
50N + 25P + Myke	284.6	4075.7	7.1	1395.9	7982.4	1725.8	105.1	1319.7	792.6	14.21
CV%	14.8	7.0	27.1	38.9	5.5	8.1	19.0	10.7	28.5	10.17
LSD (p<0.05)	ns	ns	ns	ns	899.4	ns	ns	252.4	ns	2.58
Grand Mean	276.4	4147.1	7.3	1405.7	8938.1	1722.7	101.7	1292.6	704.3	13.97

Neither fertility nor mycorrhizae was solely responsible for concentration differences of S, but both together initiated the differences as some sort of interaction (Figure 1). Due to the high coefficient of variation resulting from the analysis of sulfur in the roots, caution must be used in making any sort of conclusion with these treatments.

Zinc uptake was significantly affected by the interaction of fertility and mycorrhizae use, with fertility playing a significant part. Overall, Zn uptake was increased in roots when fertility was high and mycorrhizae was present compared to when fertility was low and mycorrhizae was not present (Figure 2).

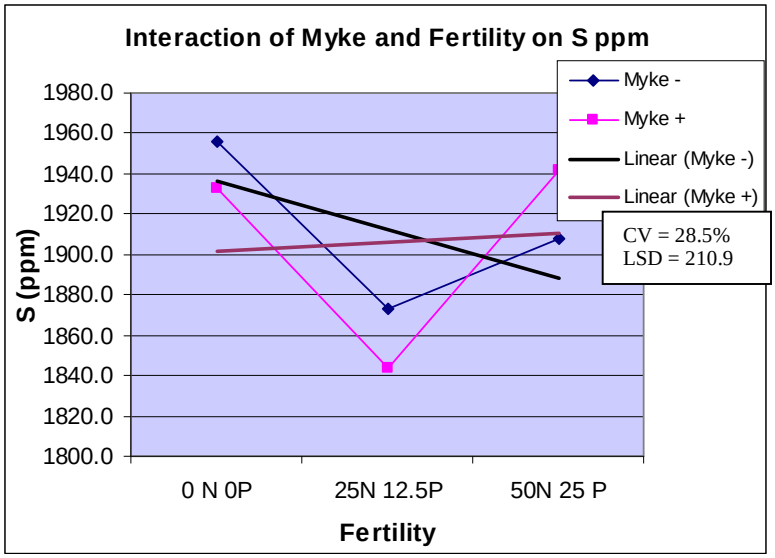

Figure 1: Interaction of fertility level and sulfur concentrations in flax roots.

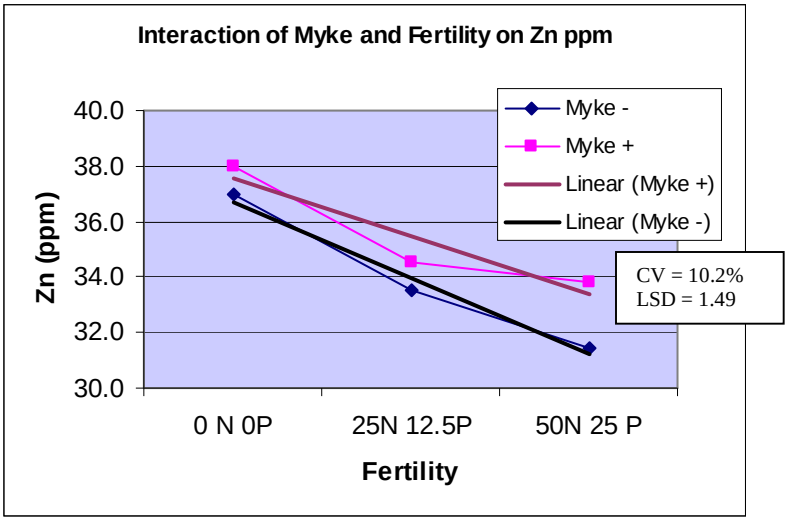

Figure 2: Interaction of fertility level and zinc concentrations in flax roots.

Discussion

The use of mycorrhizae appears to have little or no use considering agronomic, economic, or food quality outcomes in flax production. Mycorrhizae use did not affect Cd uptake in flax under these protocols and site conditions. Additional research sites under a variety of soil and climatic conditions may be needed to fully examine if Cd or other nutrient uptake is or is not affected by the use of mycorrhizae in field conditions.

Sulfur accumulations in mycorrhizae inoculated plants at higher fertility rates may suggest disease-like responses to mycorrhizae. It may be possible that these plants are producing disease like responses. Further research may be required to confirm these findings.

Human diets are often deficient in Zinc (Zn) and the impacts of crop management on Zn in grains are rarely examined. According to this study, use of mycorrhizae assisted in the uptake of Zn combined with increased rates of fertilizer, most likely correlated to phosphate rates. Similar relationships have been found by Ryan *et al.* 2008 in wheat. Even if uptake was significantly different with the use of mycorrhizae, it is unlikely that increased Zn in flax products will make a real difference in the market place.

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Kenaf Demonstration

Cooperators and Locations

Keith Watson and Jeff Kostuik	PCDF – Roblin and Dauphin, MB
Paula Halabicki, Roger Burak and James Lindal	PESAI - Arborg, MB
Scott Day and Scott Chalmers	WADO – Melita, MB
Craig Linde	CMCDC – Carberry, MB

Background

Kenaf is a late maturing fiber plant that is being evaluated in Manitoba. Production and Marketing information is limited. Information below is gleaned from Research institutions in USA.

Kenaf (*Hibiscus canabinus* L.)

Kenaf *(Hibiscus canabinus* L.) is an annual plant, native to central Africa, and related to hibiscus (Hibiscus hibiscum L), okra (*Hibiscus esculentus*), hollyhock (*Althaea rosea*) and cotton (*Gossypium hirsutum* L.).

Individual plants can grow up to 12 - 18 ft in 6 months with few side branches when grown in dense stands. Kenaf is being developed as a nonwood fiber crop.

The bark, which contains long soft bast fibers, makes up 30 to 40% of the dry weight of the stem. The central core of the stem contains weakly disbursed pith cells surrounded by a thick cylinder of short woody fibers. The Kenaf plant has an ideal blend of long and short fibers for many paper and paperboard products. Kenaf is cultivated worldwide as a fiber crop, with the vast majority grown in China as a substitute for jute.

Most Kenaf cultivars are photoperiod sensitive. For example, the cultivars Everglades 41 and 71 don't flower until day length decreases to 12.5 hours. Some varieties begin to flower within 60 days of planting, produce seed and are dead at the end of 100 days. Later-maturing varieties produce higher yields. Leaf shape and stem color vary widely among varieties. Kenaf has two distinct leaf shapes, palmatified and entire. The palmatified-shaped leaf closely resembles hemp. The entire-leaf type looks much like okra and cotton. Stem color can be various shades of red, green, or purple. The plant has a long effective taproot system and a relatively deep, wide-ranging lateral root system making the plant drought tolerant.

Potential uses for Kenaf fibers

Early efforts to commercialize Kenaf centered on using Kenaf fibers to produce newsprint. Demonstration work has shown Kenaf newsprint to have many desirable qualities, including potentially lower costs than newsprint made from wood fiber. Additional efforts to build mills dedicated to making newsprint and other papers from Kenaf or Kenaf blended with other fibers have so far failed from a lack of financing.

Commercialization of Kenaf as a cash crop is just beginning. Bast fibers are used for specialty papers, tea bags, and grass mats (biodegradable mats impregnated with grass and/or flower seeds). The bast fibers may also be used as a fibreglass substitute, blended with plastic, or blended with cotton for fabrics. Core fibers are currently being marketed for animal bedding, cat litter, poultry litter, as an extrusion aid in plastics, an industrial absorbent (oil spill cleanup), a filter medium for fruit juices, as an additive in drilling mud and in "lite" bread dough, and for manufacture of particleboard (acoustic tiles)

Kenaf has also been investigated as a forage crop for cattle feed. When harvested at an immature stage of growth (about 6 ft). Crude protein in Kenaf leaves ranged from 21 to 34 percent, stalk crude protein ranged from 10 to 12 percent, and whole-plant crude protein ranged from 16 to 23 percent.

Potential for growing Kenaf

Kenaf is a tropical plant. Kenaf needs a soil temperature of around 12° C for germination and growth. Kenaf is adapted to a wide range of soils.

Cultural Practices

Planting depth, seeding rates, and plant population - Planting depth should be in the range of 1.5 to 2". Shallower depths are possible with good soil moisture and a fine-textured seedbed. Efforts should be made to get good seed-soil contact. With good soil conditions, optimal temperature, and moisture, plants will emerge in 3 to 6 days. Specific row spacing will likely be dictated by requirements of harvesting equipment. Kenaf has a deep taproot and an extensive lateral root

system making the crop relatively drought tolerant. Kenaf is extremely sensitive to frost.

Seed counts average about 16,000 per pound. Taking into account germination rates and seedling losses, a planting rate in the range of 8 to 12 lb/A is recommended. Beginning plant counts of 100,000 to 150,000/A are desired. Kenaf is self-thinning and will reduce its population during the growing season. A final plant count of 80,000 to 100,000/A is desired. Lower plant populations result in undesirable branching and thicker trunks.

Varieties In the U.S., the varieties used most extensively are those developed by ARS researchers in Florida - 'Everglades 41' and 'Everglades 71'. Both varieties are resistant to anthracnose.

Fertilization – It is suggested Kenaf will need a rate of 120 to 140 lb/ac actual N.

Weed control - A combination of chemical weed control and mechanical cultivation has been used for weed control in Kenaf. At the present time only Treflan®, a pre-emergent grass killer, is registered for use on Kenaf in Florida. Fusilade has been registered for use in Kenaf in Mississippi. Poast, Assure II, have been tried on Kenaf in Mississippi and look promising. Cobra, Goal*, Karmex, Lorox*, Bladex, Basagran, Scepter, Cadre, and Pursuit have been screened in Mississippi and show injury to the Kenaf.

Kenaf is a vigorously growing plant and under optimum growing conditions can form a canopy over the row middles in as little as 5 weeks. Once Kenaf shades the row middles, low growing weeds and grasses are shaded out and there is no need for additional weed control.

Insect pests - Most insect problems with Kenaf are likely to occur at seedling emergence and during young seedling growth. Cut worms, leaf miners, and other chewing/sucking insects are potential problems. Late in the season, the plant will tolerate a relatively high population of leaf-chewing insects
Diseases - Kenaf is resistant to most plant diseases. One serious disease of Kenaf, anthracnose, was reported in the U.S. in 1950. USDA plant breeders were successful in breeding and selecting Kenaf cultivars and accessions for resistance. Both Everglades 71 and 41 are highly resistant, as are Tainung varieties, and lines developed in Cuba and Guatemala.

Harvest methods - A number of harvest methods are possible. The USDA has developed a whole stalk harvesting system that cuts the stalks and lays them in an orderly fashion at right angles to the row. Stalks are allowed to dry for around two weeks and are then gathered by a machine that picks up the stalks and arranges them in large bundles; the bundles are transferred to field trailers. The tractor-drawn field trailers haul the bundles to the field margin where they are stacked for shredding

Another method is to use forage choppers to harvest the crop. This method can be used in colder areas where the crop is allowed to dry after being killed by frost or by a desiccant. This method has been used in Mississippi. The chopped Kenaf is stored and transported in cotton modules with the same equipment used for harvesting cotton

The crop may also be chopped and baled with forage equipment and, if covered, can be stored as large round or rectangular bales on field edges.

Use of sugarcane harvesting equipment on Kenaf is another harvesting method mentioned in the literature. Storage problems from high moisture content were cited when sugarcane harvesting equipment was used.

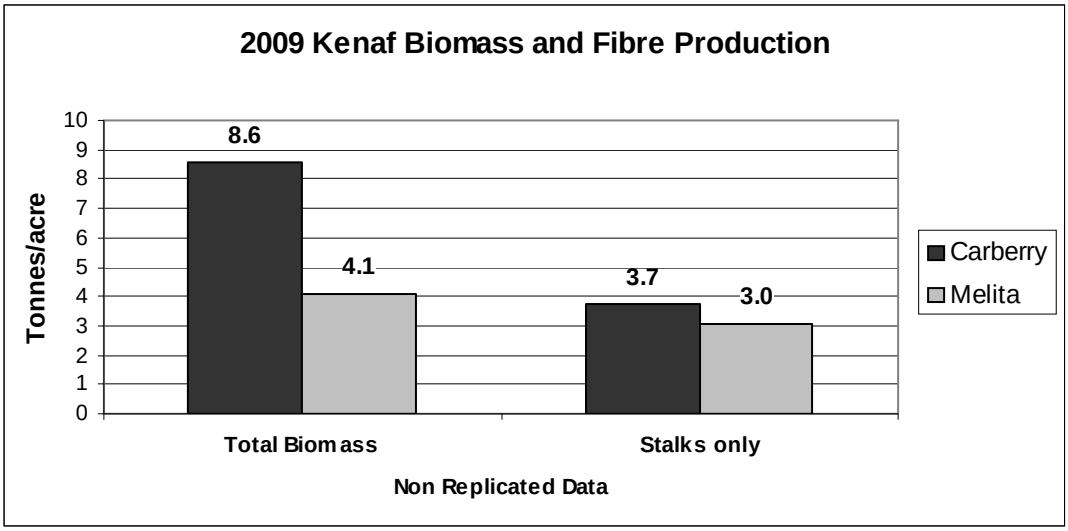
Kenaf must be “retted” in the field, a necessarily precise drying period in which the inner fiber begins to loosen from the outer bark.

Kenaf Facts

1. Kenaf is not related to hemp or marijuana, but there is a striking similarity in the leaf shape of some varieties.
Kenaf may yield 6 to 10 tons of dry fiber per acre per year. This is 3 to 5 times greater than the yield for Southern pine trees, which require seven to 40 years before they’re ready for harvest.
3. The outer fiber or bast makes up 40% of the stalk’s dry weight; the inner fiber or core makes up the other 60%.
4. In the right climate, Kenaf grows 14 feet tall in four to five months.
5. Kenaf flowers at the end of the growing season, producing showy hibiscus-like blossoms.
6. Kenaf has been cultivated for at least 4000 years, with its roots in Egypt.
7. Kenaf reportedly has more than 129 different names world wide.
8. Kenaf was introduced into America during World War II as a result of the disruption of the jute and abaca trade from Asia.
9. While the flowering can last 3 to 4 weeks, or more, per plant, each individual flower blooms for only one day.

Results

Chart. 1



Kenaf was planted in 4 locations in Manitoba to observe growing characteristics to determine the need for further investigation.

Important Considerations and Recommendations

This first year of testing, the weather was cool and dry. The yield range was unexpectedly high.

Conclusions

Further evaluation is required to determine the potential as a bast crop in Manitoba.

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Fruit Tree Demonstration

Site Information

Location: Melita (Barker Site)
Cooperator: University of Saskatchewan, Dept. of Plant Sciences

Background

Opportunities for fruit production on the Prairies

By Dr. Bob Bors, Plant Sciences Department, U. of S.

It may be surprising to some that fruit breeding and research has been ongoing at the University of Saskatchewan since the early 1920's. Fruit breeding takes at least a decade between generations, so improvement in both hardiness and fruit quality has taken a while to achieve. For some crops, notably apples and sour cherries, the quality of some of the new varieties equals or surpasses what is commonly found in grocery stores. These achievements as well as research done on producing native fruits have greatly reduced the risks a fruit farmer needs to take. With any crop there is always a risk. I get alarmed when someone asks, “What crop should I grow?” To grow only one crop is rather risky. A better question would be “What crops would be good to grow together?” Having a diversity of crops helps to make every year a good year. 2000 was a good year for strawberries and cherries, but a disaster for saskatoons. 2001 was a disaster for strawberries, good for cherries, but a bumper crop for saskatoons. Diversity also spreads the cost of equipment, labour and facilities. Fruit farms that have diversified are mainly pick-your-own farms or take produce to market. There are also a number of farms which specialize in native fruits which have wide appeal locally and make interesting products for niche markets internationally. Particularly exciting is the possibility of using the same harvesting and processing equipment on Haskap, Saskatoons, and Sour cherries. These 3 crops have different ripening seasons and can be made into similar products and marketed to the same customers!

Objective

A demonstration of haskap, dwarf sour cherry and saskatoon fruit trees as a crop and/or landscape opportunity for Parkland producers.

Methods

A small orchard was established at the PCDF site in the spring of 2009. The site was tilled and sprayed with glyphosate prior to tree planting. The plants were purchased from Prairie Plant Systems in Saskatoon Saskatchewan. Once planted the trees were watered weekly and mulched with wood chips purchased from Roblin Forest Products to retain moisture and inhibit weed growth. The plot

is for demonstration and is available for your observation anytime. Plots are well staked and tree species identified.

Table 7. Varieties Grown

Haskap	Dwarf Sour Cherry	Saskatoon
Tundra	Romeo	Martin
Borealis	Juliet	Thiessen
9-92	Cupid	JB 30
9-15	Valentine	Smoky
Berry Blue (pollinator)	Carmine Jewel	Honeywood

Results

Fruit Tree Description:

Haskap is the Japanese name for *Lonicera caerule*a, also known as 'Blue Honeysuckle'. It is estimated that there are 400,000 plants in the ground across Canada, with about 70% of new plants found in commercial fruit orchards in western Canada. These are new varieties developed by plant breeder Bob Bors at the University of Saskatchewan from crosses made in 2001. Ongoing breeding and research is aimed at developing a new fruit crop suitable for Canadian growers using cultivars from Asia and Europe and wild plants from Canada. Two varieties, Borealis and Tundra, were released in 2007 and branded 'Haskap' because the Japanese consider them to be of high enough quality for the Japanese market. Haskap plants are high yielding, extremely cold hardy, early maturing and have a long harvest window. (L. Stevenson, 2009). Haskap has a flavour commonly described as a combination of blueberries and raspberries and ripens in mid-June, weeks before strawberries. (Haskap Canada Association, 2009) However, late ripening varieties are being developed that could extend the harvest season into July and August.

Berry Blue ™ is an older variety, bred in Czech Republic, that pollinates well with the parent plants of the new University of Saskatchewan varieties. It is one of the fastest growing and tallest varieties so it will quickly make many flowers. Therefore, it has been recommended by Dr. Bors to be an option for a pollinator in a haskap orchard setting. It offers a high yield of berries, which are not as sweet as the U of S haskap. Pollinators should be 10 – 20% of commercially grown plants, although with Berry Blue it could be more like 10%. (Prairie Plant Systems Inc., 2009)

Dwarf sour cherry varieties are being developed by University of Saskatchewan breeders to combine the hardiness and dwarf stature of Mongolian cherries with the high quality of Northern European sour cherries. Some of the cherries even have a bit of sweet cherry in the lineage! These new dwarf sour cherries have many advantages, from their cold-hardiness, to the short stature of the bush. The first cultivar, developed by University of Saskatchewan breeders, was released in 1999 and named SK Carmine Jewel for its dark red colour. A principal advantage for growers of the new dwarf varieties is that they were developed to be machine-harvestable with small, over-the-row harvesters used for saskatoon berries. Compared to sweet cherries, the dwarf sour cherry varieties tend to hold their shape and texture better in cooking, and their tartness mellows into a deep, sweet flavour making them highly prized for all processed cherry products. Canada's average annual production between 1997 – 2006 was 5,844 tonnes. (A. Montgomery, Statistics Canada, April 2009)

Saskatoon commercialization started in the 1980's with the first commercial orchard planted in the 1990's. They are now the second largest commercial fruit crop in Manitoba; next to strawberries. Saskatoons begin to bear fruit when 3 to 5 years old and are used fresh, quick frozen, as ingredients and processed into pie filling, toppings, jams and beverages. Fruit production by a mature orchard can average 3000-4000 lbs/acre (irrigated) but can vary drastically if blossoms are lost due to a late spring frost. (MAFRI, 2009)

Important Considerations and Recommendations

Although haskap trees do not seem to have very many disease issues and are a very hardy shrub, birds really enjoy the berries and consideration should be made to erect bird netting if planning on commercial production.

Along the same line, deer find the sour cherry trees particularly tasty and can also become a problem.

Conclusions

There are many options available to diversify with small fruit trees suitable for production on the prairies. In addition to good agronomic practices, developing a business plan and determining a solid marketing plan is essential to a successful business venture.

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Plant Sciences
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Saskatoon, SK S7N 5A8
http://www.fruit.usask.ca/index.html

Haskap Canada Association
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Battleford, SK
S0M 0E0
http://www.haskap.ca/index.html

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A. Montgomery, Statistics Canada, “Sour cherries in Canada,” available at http://www.statcan.gc.ca/pub/96-325-x/2007000/article/10775-eng.htm; Internet; accessed 30 November 2009

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Manitoba Agriculture, Food and Rural Initiatives, “About Agriculture, Saskatoons,” available at http://www.gov.mb.ca/agriculture/consumer/aboutag/saskatoons.html; Internet; accessed 30 November 2009.

Haskap Fruit Set

Photos courtesy of University of Saskatchewan Fruit Program: http://www.fruit.usask.ca/Photos

Reglone® Desiccant for Calendula Production

Cooperators:

Westman Agricultural Diversification Organization
Technology Crops International
Calendula Oil Ltd. (Netherlands) http://www.calendula-oil.com/en/olie

Site Info

Land Cooperator: Wayne White Previous Crop: Spring Wheat
Soil texture: Loamy

Spring soil test prior to seeding:

Legal Land Location	Depth	N lbs/ac	P ppm (olsen)	K ppm	S lbs/ac	pH
NE 36-3-27 W1	0-6"	13	13	358	14	8
	6-24"	36			30	
	0-24"	49			44	

Background

Calendula is a popular garden flower which is now in the spotlight for it potential use in the industrial and medicinal oil industries. Methyl esters of calendula oil possess reactive qualities useful in alkyd-based paints to replace traditional Tung oil which has been found harmful to painters. Also, calendula oil has been found to be a valuable ingredient as a resin in wood preservation. Research has shown that softwood treated with calendula based resin exhibits qualities and hardness that of hardwood.

The calendula crop is just being developed in Manitoba. Calendula Oil Ltd, based in the Netherlands, has chosen Manitoba as an area of potential crop production to help fulfill the need for calendula oil, a product in high demand in Europe.

Little is known about calendula production in North America. Registration of herbicides for new crops is a must; however data must be collected in order to achieve a minor-use registration for most new crops.

A trial was conducted in Melita to determine the effects of Reglone desiccant use in the production of calendula seed. Results were sent to Technology Crops International where the data may be used for a minor use registration for Reglone on calendula production in Manitoba.

Methods

Three large plots (1.44 m x 9 m) of the calendula variety 'Corolla' were seeded at a rate of 10.6 lbs/ac at a depth of 5/8". Fertilizer was sideband at seeding and applied at a rate of 60 lbs/ac N and 30 lbs/ac P. Plots were kept weed free by hand weeding. These large plots were divided into smaller plots for treatment applications of Reglone desiccant herbicide. Treatments were arranged in a randomized complete block design replicated three times. Treatments were as follows:

1. Check (No Reglone Application)
2. 1.35 L/ac Reglone
3. 2.1 L/ac Reglone
4. 2.7 L/ac Reglone.

Reglone (diquat 240 g/L) herbicide and Agral 90 (surfactant) was applied with water on September 23 using a $C0_2$ powered hand sprayer with four fan nozzles rated at 10 gal/ac and arranged 50 cm apart. Grain was hand harvested on September 30. Plant material was harvested with a hedge trimmer, low to the ground, on October 5th. Grain yield and plant moisture content was determined. Estimations on a per plot basis were taken on approximate percentage of plant area desiccation. An analysis of variance was used to determine statistical differences among treatment means.

Results

There were not statistical differences in mean grain yield. As expected, Reglone should not have contributed to a yield loss or gain. Despite obvious differences in estimated plant area desiccation ratings, these values did not correlate (inversely) to plant moisture content. This was likely due to damp weather experienced after time of desiccation, skewing plant moisture content values determined after the weather passed.

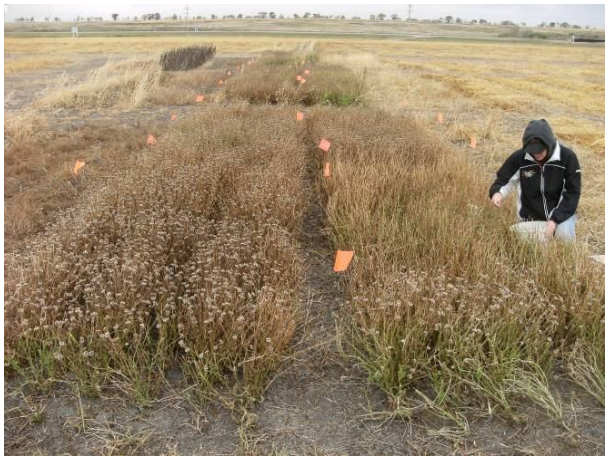
	Grain Yield	Plant Moisture	Estimated Desiccation
Treatment	kg/ha	%	% of plant
Check (no Reglone)	501	50	13.3
1.35 L/ac Reglone	511	40	28.3
2.1 L/ac Reglone	425	48	31.7
2.7 L/ac Reglone	436	40	46.7
CV%	28	17	15.5
LSD ($p<0.05$)	ns	ns	9.3
Grand Mean	468	44	30

Conclusions

Calendula flowers indeterminately and normally requires desiccation prior to harvest. Contrary to that in 2009, it appears to end flower production suddenly in late August and ripen uniformly. The use of Reglone desiccant for calendula production may prove useful in certain years where maturity seems to be indeterminate and dry down of seed is needed prior to harvest.

Grasshoppers do not bother calendula and pose no threat to the crop. Picture taken August 13, showing the crop in full bloom.

Calendula crop has finished flowering and seed is near ready to harvest. Picture taken September 9th.



Calendula plots being hand harvested for yield. Application of Reglone took place a week prior to photo. Picture taken September 30.

Harvest Management Strategies for Conventional and Shatter Tolerant Canola

Background

There is no doubt that straight cut canola will out yield swathed canola under normal circumstances. However, most Argentine varieties of canola are prone to shattering in late maturity and usually require the need to swath to obtain maximum yield. The popularity of straight cut argentine canola has brought about a market for industrial products that assist in the shatter tolerance of these varieties. On the contrary, straight cut canola has prompted the need for improved shatter tolerant varieties of canola.

Recently, breeders have developed a canola variety suited for straight cut harvest management. Viterra, distributors of the variety Xceed™, have developed this canola-quality oil variety from a *Brassica juncea* ancestory. Xceed canola provides qualities such as improved frost, heat and drought tolerance, the Clearfield™ tolerant herbicide system, as well as improved shatter tolerance; suitable for straight cut harvest systems.

A research trial was initiated in Manitoba by, Manitoba Agriculture Food and Rural Initiatives to compare shatter tolerant canola to conventional Argentine canola managed with anti-shatter pod protection products currently in the industry, compared to conventional harvest management strategies such as swathing and straight cut production systems.

Objectives

- To verify the suitability of new canola quality *Brassica juncea* (XCEED) in Manitoba compared to a standard canola (*Brassica napus*) variety
- To verify the economic impact of pod sealant products on XCEED and canola for straight-cutting

Methods

Locations (Manitoba):

- Carman
- Melita
- Carberry (non-irrigated)
- Arborg

Design

- Treatment factors would be the 2 canola types - XCEED and B.napus canola varieties and second factors would be harvest treatment – swathed with or without application of pod sealant, straight-cut with or without application of pod sealant. Replicated 3 times.

Treatments:
X = XCEED canola quality *Brassica juncea*
C = canola *Brassica napus*
1 = swathed canola, no pod sealants applied
2 = swathed canola, Pod Stik applied
3 = swathed canola, Pod Ceal applied
4 = straight-cut canola, no pod sealants applied
5 = straight-cut canola, Pod Stik applied
6 = straight-cut canola, Pod Ceal applied

Example of plot layout.

Results

X1	X2	X3	X4	X5	X6	C1	C2	C3	C4	C5	C6
C1	C2	C3	C4	C5	C6	X1	X2	X3	X4	X5	X6
X1	C1	X2	C2	X3	C3	X4	C4	X5	C5	X6	C6

Results are currently being compiled from the 2009 harvest and will be available at a later date upon request.

Information Source:

http://www.canola-council.org/news/1804/straight_cut_or_swath_know_your_fields.aspx

Nitrogen Rate Calibration Strip Validation in Manitoba

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Background

Nitrogen Ramp Calibration Strips (NRCS)

- A method proposed by Oklahoma State University researchers[1] to assess nitrogen (N) supply from the soil through observations of N sufficiency of the growing crop.

-It may be a suitable tool for crop advisors and extension agronomists in aiding growers to:

1. Determine replacement N value of manure or previous legume crops
2. Quantify in-season N losses due to excess rainfall
3. Assess suitability of new fertilizer management strategies, like zone fertilization or the Manitoba N rate calculator for cereals and canola.
5. Determine the amount of supplemental in-season N required to optimize yield for crops

Method

- Before or shortly following seeding select a non-fertilized, representative area of the field some 10' by 80-120' long (Figure 1).

-Individual 10' by 10' cells in the strip are hand fertilized with N rates increasing from 0 to a high, N Rich rate in "ramped up" increments of 10-30 lb N/ac

- Strips are visually inspected in mid-season to identify the N rate required for maximum biomass production and/or N sufficiency (Figure 2).

-N sufficiency is presumed to be at the lowest N rate producing growth/colour etc. similar to N Rich rate.

Figure 1. An N ramp applied to seedling spring wheat.

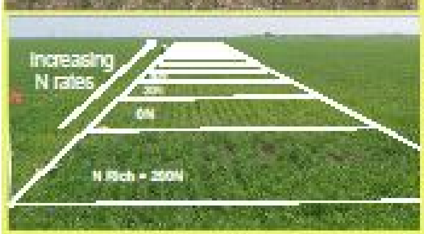

Figure 2. An N ramp at timing of mid-season assessment

Assessments

-Strips may be assessed visually but usually N sufficiency determination is aided using one of a number of methods either in-season or at harvest.

Table 1. Potential criteria used to assess N sufficiency

Measurement*	N sufficiency
Biomass	Similar to N Rich
Plant height	Similar to N Rich
Plant N concentration %	Book values
SPAD Chlorophyll Index (Fig. 3)	95-100% of N Rich
Leaf colour (Fig. 4)	Similar to N Rich
Pre-sidedress soil nitrate test for corn (Fig. 5)	100 lb N/ac for corn (0-12" depth)
GreenSeeker NDVI (Fig. 6)	Similar to N Rich
Grain yield	Similar to N Rich
Post harvest residual nitrate-N (lb N/ac 0-24")	Not established
Corn stalk nitrate-N ppm (Fig. 7)	750-2000
Wheat grain protein content %	CWRS >13.5 % W wheat >11.5%

*References on diagnostic methods are available[2].

Figures 3-7. Some of the methods used to assess N sufficiency referred to in Table 1 above.

Field validation

-In 2008 we established 24 NRC Strips in crops of spring and winter wheat, barley, oats, canola and corn

- Many were taken to harvest to evaluate the utility of the N sufficiency tools.

Findings

1. When N fertilizer is pre-weighed, labeled and bagged, it takes 15-20 minutes to measure, stake and apply N to each ramp strip.
2. The most promising in-season measurements in identifying N sufficiency were plant height, SPAD Index, leaf colour and NDVI[3].
3. Figures 8-9 illustrate the yield and N sufficiency observations for N responsive and non-responsive (manured) NRCS sites.

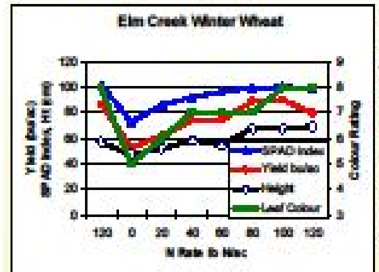

Figure 8. Site with suspected losses from fall applied N. In-season methods identified N sufficiency at 80 lb N/ac or similar to the measured yield.

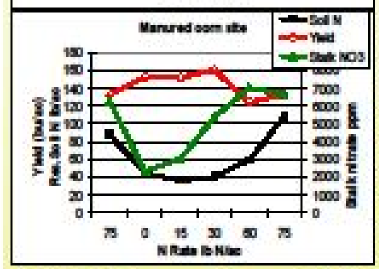

Figure 9. Site where grower mistrusted N contribution of manure. Yields did not increase, but residual soil N and stalk nitrate did.

4. NRC Strips were often useful in identifying and quantifying N supply of soil and needs of the crop
5. They are suitable for a number of extension and N sufficiency verification purposes.
6. Details on conducting NRC Strips are available[2].

Acknowledgements

Agricultural Sustainability Initiative — Tone Ag Consulting

Crop Diagnostic School — B. Irvine, AAFC — AgVise Laboratories

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[1] Edmonds D.E., M.C. Daft, W.R. Raun, J.B. Solie, and R.K. Taylor. 2008. Determining Mid-Season Nitrogen Rates with Ramp Calibration Strip Technology. Better Crops with Plant Food. Vol. 92. 2008 No.1 [illegible]

[2] Heard, J. 2009 Nitrogen Ramp Calibration Strips in Manitoba. MAFRI Crop Topics 2009. [illegible]

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Potential yields from Intercropping Field Pea and Canola

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Introduction

Intercropping is the agricultural practice of cultivating two different crops in the same place at the same time (Andrews & Kassam 1976). Benefits of intercropping can lead to greater than expected yields compared to the sole crop. Reasons for additional yield may be the result of greater efficiency in the use of nutrients, light and water (Szumigalski & Van Acker 2008). Intercropping may improve pest control and provide structural support advantages when compared to each being grown as a sole crop. Intercropping is not a new concept and has been used by farmers for several generations. However, recent improvements in farm machinery and individual variety characteristics have once again tweaked producer's interests in intercropping.

Often, intercropping is not only measured by total yield of products, but as a total economical value (total $/acre) by combining each crop value, or by Land Equivalent Ratio (LER). The LER is a measure of how much land would be required to achieve intercrop yields with crops grown separately as pure stands. When the LER is greater than 1.0, over-yielding is occurring and the intercrop is more productive than the component crops grown as sole crops. When the LER is less than 1.0, no over-yielding is occurring and the sole crops are more productive than the intercrop. For example, a LER rating of 1.20 from an intercrop of pea-canola means it would take 20% more land to equal that final yield if each crop was planted as separate components.

The purpose of this trial was to examine the effect of seeding rate combinations of pea-canola intercropping in regards to total yield, separate crop yield components, Land Equivalent Ratio (LER), and final stand characteristics compared to that of the sole crop characteristics.

Picture: WADO's Pea-Canola Intercropping Trial at Melita, July 2009 late flowering stage

Methods

Plots were direct seeded with a dual knife system on May 14, 2009 at Melita, MB. Seeding depth was 1" into a loam type soil that was previously spring wheat. Six rows per plot were spaced at 9.5". Fertilizer was placed in a side band at a rate of 50 lbs/ac N and 30 lbs/ac P. All pea treatments were inoculated with proper granular based *Rhizobium leguminosarum* bv. *Viciae*. Residual soil fertility was relatively low (Table 1). Treatments were arranged in a Randomized Complete Block Design (RCBD) and replicated three times. Seeding rate treatments were as follows:

1. Canola Full rate (6 lbs/ac) - variety 71-30 CL
2. Peas Full (120 lbs/ac) - variety CDC Striker
3. Canola 2/3 + Peas Full
4. Canola 1/2 + Peas Full
5. Canola Full + Peas Full
6. Canola 2/3 + Peas 1/2
7. Canola 1/2 + Peas 1/2
8. Canola Full + Peas 1/2
9. Canola 2/3 + Peas 2/3
10. Canola 1/2 + Peas 2/3
11. Canola Full + Peas 2/3

Methods cont.

Table 1: Soil fertility of site prior to seeding.

Depth	N lbs/ac	P ppm (olsen)	K ppm	S lbs/ac	pH
0-6"	12	14	429	18	8.2
6-24"	21			36	
0-24"	33			54	

Weeds were controlled using Odyssey™ (35% imazamox + 35% imazethapyr) at a rate of 17g/ac+ adjuvant merge applied July 15. Plots were desiccated with Reglone™ (0.91 L/ac) prior to harvest and left standing. Emergence counts were taken June 12 on a single 1 m row. Plots were harvested with a Hege plot combine set at a cylinder speed of 910 rpm, with about 1" cylinder-concave gap. Wind was adjusted for canola. Plot samples were separated using a fanning-mill, then they were weighed and moisture determined. Weights were re-calculated to a constant moisture of 10%.

Harvest values were converted to partial and total LER using the following equation:

Total LER = Ia/Sa + Ib/Sb = Partial LER Peas + Partial LER Canola

Where total LER is the total Land Equivalent ratio, I is the intercrop yield, S is the sole crop yield, and a and b refer to the crop components.

All data (Total Yield, LER's and Emergence) was analyzed with a two-way analysis of variance (ANOVA) and coefficient of variation and Fisher's unprotected Least Significant Difference (LSD) at the 0.05 level of significance was calculated if the ANOVA was significant.

Results

There were significant differences in total yield, both crop's partial LER, total LER, and final stand germination (canola only). (Table 2).

Table 2: Final Yield, LER, and stand germination values for each intercrop combination and sole crop treatments.

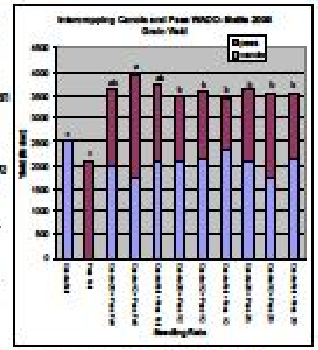
Trmt.	Seeding Rate Combination	Final Yield (lbs/ac) Canola	Pea	Total	Land Equivalent Ratio Canola	Pea	Total	Germination (%)* Pea	Canola
1	Canola Full	[illegible]	-	[illegible]	1.00	-	1.00	-	[illegible]
2	Peas Full	-	[illegible]	[illegible]	-	1.00	1.00	[illegible]	-
3	Canola 2/3 + Peas Full	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	Canola 1/2 + Peas Full	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.77	[illegible]	[illegible]
5	Canola Full + Peas Full	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	Canola 2/3 + Peas 1/2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	Canola 1/2 + Peas 1/2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	Canola Full + Peas 1/2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	Canola 2/3 + Peas 2/3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	Canola 1/2 + Peas 2/3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	Canola Full + Peas 2/3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	CV%			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	LSD (p<0.05)			[illegible]	[illegible]	[illegible]	[illegible]	ns	[illegible]
	R-squared			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Grand Mean	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*Germination based on sole crop emergence values and not actual seed quality

Total grain yield was significantly higher (p<0.001) for all intercropped treatments compared to their sole crop derivatives (Graph 1). Treatments 4,5,and 3 (in order of highest to lowest) were the highest yielding treatments. Treatments 5 and 3 were statistically similar to all other intercrop treatments.

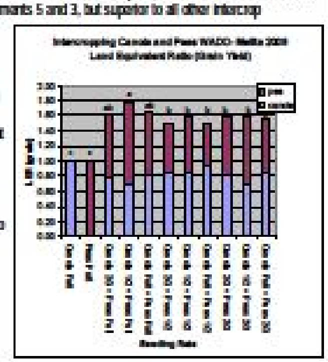
Results cont.

Graph 1 (Right): All crop grain components in intercrops were lower yielding than their sole crop derivatives indicating some sort of competitive effects between each crop co-existing together. Treatment No. would be ascending left to right.



Total LER generally followed the same conclusions as total yield. Treatment 4 (1/2 rate canola, full rate peas) with a total LER of 1.77 was similar to treatments 5 and 3, but superior to all other intercrop combinations.

Graph 2 (Right): Total LER composed of each partial LER component for all treatments. Treatment No. would be ascending left to right.



Despite a low coefficient of variation value in both total yield and LER components, error still may have been caused by wildlife browsing during the bolting and early flower stages of crop development. Scare-crows and moth balls were used as deterrents and appeared to be successful.

Interestingly, the plant counts show that canola emergence was possibly inhibited when intercropped with peas. Although there was considerable variation in the data it appears that significant reductions in the canola stand occurred in all intercrop combinations (Table 2, far right). We do not know if this reduction in the canola stand occurred during germination or emergence, or both. The reductions in pea germination were determined to be statistically insignificant. The Coefficient of Variation (CV) in the plant counts was very high in both crops (39% & 38%) and this casts doubt on our observations, regardless, something unique was occurring. This large variability may have been caused from a single count per plot or spatial bias within the plot during counts. Multiple counts per plot may have helped improve this error. However, there may have just been considerable plant stand variation between the plots, as well.

Conclusions

According to this evidence, significant yield increases are achievable by intercropping canola and peas compared to their sole crop derivatives. Despite stand reductions in canola when intercropped with any pea combination, total yield accumulations with both crops were more than sole crop values. Their component grain yields were less when intercropped compared to sole crop yields but when they were combined the intercrop yields were always superior.

Total LER maintained similar results to that of total grain yield. The combination that resulted in maximum production, whether in total grain yield or LER, was when peas were seeded at their full rate and canola at 1/2, 2/3 or the full rate. Canola maintained a rather large partial LER despite the high population of pea plants in these intercrop plots.

We observed that the emergence of canola was negatively affected by pea intercropping. However, the very high CV's in the plant counts detracts from the certainty of this observation. Possibly there was an unforeseen variable in the seeding operation or maybe there were allelopathic pea exudates of root or seed chemicals inhibiting the growth of canola, or some sort of root or seedling disease issue. Similar topics have been discussed by Markes et al. (2008) when weathered pea extracts are used to suppress canola germination in both the lab and greenhouse setting. A similar bioassay would assist in answering this question.

Harvest samples indicated that peas were higher moisture content compared to canola (14.5% moisture vs. 9.8%, respectively). On-farm adoption would need to stress grain separation prior to storage.

Future research considerations should be focused on the effects of pod shatter in this system, possible allelopathic relationships, nutrient, water and light dynamics and economic gain. Further site years of work are needed to confirm these results.

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Potential of Intercropping Peas and Oats for Grain and Silage Production

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Introduction

Intercropping is an agricultural practice of cultivating two different crops in the same place at the same time (Andrews & Kassam, 1976). Benefits to intercropping can lead to greater yield and quality compared to the sole crop. However, carefully planning and suitable conditions need to occur for each crop to be complimentary (creating a higher overall yield), rather than antagonistic (lowering yields). Reasons for additional yield with intercropping may be the result of greater efficiency in the use of nutrients, light, and water (Szumigalski & Van Acker, 2008). Feed Quality parameters such as crude protein (CP), neutral detergent fiber (NDF) generally improve compared to sole crop parameters (Strydhorst et al. 2008). Harvest timing can be delayed with oat/pea intercrop silage as the peas will maintain a higher moisture value than oats. This intercrop helps lengthen the optimum time period for silage harvesting. Intercropping is not a new concept and has been used by farmers for several generations. However, recent improvements in farm machinery and individual variety characteristics have once again tweaked producer's interests in intercropping.

Often, intercropping is not only measured by total yield of products, but as a total economical value (total $/acre) by combining each crop value, or by Land Equivalent Ratio (LER). The LER is a measure of how much land would be required to achieve intercrop yields with crops grown as pure stands. When the LER is greater than 1.0, over-yielding is occurring and the intercrop is more productive than the component crops grown as sole crops. When the LER is less than 1.0, no over-yielding is occurring and the sole crops are more productive than the intercrop. For example of an intercrop LER of pea-oat yield was 1.20, it would take 20% more land to equal that final yield as separate components.

The purpose of this trial was to examine the effect of several seeding rate combinations of pea-oat intercropping on total silage yield, forage feed quality characteristics, and final grain yield.

Pictures: WADO's Pea-Oat Intercropping Trial at Melita MB, oats near early milk stage

Methods

Six rows per plot were direct seeded May 12th into wheat stubble at a depth of 1" using Seedhawk™ dual knife openers with 9.5" spacing. Soil test was taken prior to seeding". Fertilizer was side band at a rate of 40 lbs/ac N and 30 lbs/ac P. All pea treatments were inoculated with proper granular based *Rhizobium leguminosarum* bv. *Viciae*. Residual soil fertility was relatively low (Table 1). Treatments were arranged in a Randomized Complete Block Design (RCBD) and replicated three times. Through a calculation error the "full rate" for oats was about 33 % more than normal and the full rate for Peas was about 33 % less than normal. Seeding rates were as follows:

1. Oats full rate (120 lbs/ac) - variety 'Furlong'
2. Peas full (120 lbs/ac) - variety 'CDC Striker'
3. Oat 1/2 rate+ Pea 1/2 rate
4. Oat 2/3 rate + Pea 2/3 rate
5. Oat full rate + Pea full rate

Methods cont.

Table 1: Soil fertility of site prior to seeding.

Depth	N lbs/ac	P ppm (olsen)	K ppm	S lbs/ac	pH
0-6"	12	14	429	18	8.2
6-24"	21			36	
0-24"	33			54	

Weeds, although were not a major concern, were controlled with some minor hand weeding. Plots were split into halves by length, one half for silage harvest and the other half for grain harvest.

Plots were harvested for silage using a plot flail mower at the soft dough stage of the oats on August 5th. Total dry matter was calculated by determining total plot wet weight and subtracting moisture percentages from subsamples taken at harvest and dried. Dried subsamples were combined into composite samples from all three replicates and sent to Central Testing Labs (Winnipeg, MB) to determine feed quality characteristics.

Plots were harvested August 26 for grain with a Hege plot combine set at a cylinder speed of 910 rpm, with about 1" cylinder-concave gap. Wind was adjusted for oats. Plot samples were separated using a fan-mill, and separated crop components were weighed. Data collected included crop emergence, leaf disease, dry matter silage yield, feed quality characteristics, and final grain yield.

Crop components were converted to partial and total LER using the following equation:

Total LER = Ia/Sa + Ib/Sb = Partial LER Peas + Partial LER Oats

Where total LER is the total Land Equivalent ratio, I is the intercrop yield, S is the sole crop yield, and a and b refer to the crop components. All data (Total Yield, total LER) was analyzed with a two-way analysis of variance (ANOVA). Coefficient of variation and Fisher's unprotected Least Significant Difference (LSD) at the 0.05 level of significance was calculated.

Results

There were significant differences in silage yield ($p<0.0085$) among treatments but not total grain yield and total LER (Table 2).

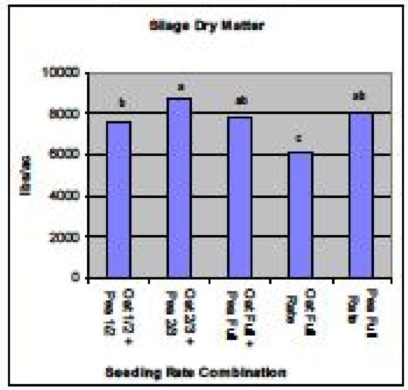
Table 2: Crop component grain yield, total grain yield, total LER values, and silage dry matter (DM) for each intercrop combination and sole crop treatments.

Seeding Rate	Grain (lbs/ac) Peas	Oats	Total	Grain TLER	Silage DM lbs/ac
Oat 1/2 + Pea 1/2	[illegible]	[illegible]	[illegible]	1.3	[illegible]
Oat 2/3 + Pea 2/3	508.7	3743.6	4251.3	1.0	8637.8
Oat Full + Pea Full	605.1	4865.0	5470.1	1.2	7793.0
Oat Full Rate	-	4897.8	4897.8	1.0	6138.2
Pea Full Rate	[illegible]	-	[illegible]	1.0	[illegible]
		CV%	30.0	30.4	7.7
		LSD (p<0.05)	ns	ns	1108.0
		R-squared	0.37	0.45	0.96
		Grand Mean	[illegible]	1.1	7811.9

Coefficient of variation (CV) was low for silage DM indicating a solid data set. All intercrop silage treatments with pea significantly yielded more DM than the sole oat crop. Seed combination oat 2/3 + pea 2/3 maximized the most silage DM but was not significantly different from using full rates of intercrops or simply peas (Graph 1). The CV on the grain yields from this trial were too high to consider a good data set.

Results cont.

Graph 1: Silage dry matter yields of various oat and pea intercrop combinations compared to sole crops of oat and pea.



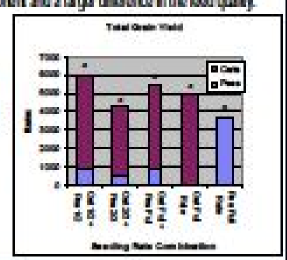
Forage quality characteristics generally improved for oats when intercropped with peas (Table 3). Multiple parameters such as Crude protein, Ca, Mg, K, NaCl, and RFV improved when oats were intercropped with peas.

Table 3: Feed Quality parameters of various oat and pea intercrop combinations compared to sole crops of oat and pea.

Seed Rate Treatment	CP	Ca	P	Mg	K	Na	NaCl	ADF	NDF	Non Fiber Carb	TDN	NEG	RFV
Oat 1/2 + Pea 1/2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Oat 2/3 + Pea 2/3	7.76	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Oat Full + Pea Full	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Oat Full Rate	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Pea Full Rate	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

There were no significant difference in total grain yield (graph 2) and total LER. However, the variation (CV) was too high (30%) to have confidence in this data. Despite this we did observe that the competitive nature of oats greatly suppressed the yield potential of pea in intercropped treatments (graph 2). Further skewing the results was the higher than normal Oat seeding rate and lower than normal rate for Peas in the trial. By reducing the population of oats significantly (ex. 25% rate), it is likely that there would have been a more even intercrop ratio within the grain component and a larger difference in the feed quality.

Graph 2: Total grain yield from combined partial yield values of intercropped pea-oat seeding rate combinations compared to sole crop grain yield.



Conclusions

Intercropping oats and peas proved to boost overall silage dry matter yield and their respective feed quality characteristics compared to sole crop oats. Oats proved to be highly competitive and dominated the final grain sample when intercropped with peas. A more in-depth combination of seeding rates with less oats in the mixture may encourage a greater potential of peas in the system, and therefore a higher overall yield.

Picture: This intercrop stand is dominated by oats despite the full rate of peas.

Grain harvesting issues may arise from threshing limits on harvest equipment when peas and oats are intercropped. Peas require a larger threshing gap between the concave and the threshing drum and a lower threshing drum speed compared to oats. Producers will have to take extra care with peas to insure that splitting is not an issue. Like was observed with our Pea/Canola intercrop the separation of the two crops prior to storage would be very important.

Within the raw data, peas contributed 5 to 10% more moisture in the silage sample compared to the sole oat plots (results not shown). This may allow for a longer optimum period for silage harvest to occur with this pea/oat intercrop mixture.

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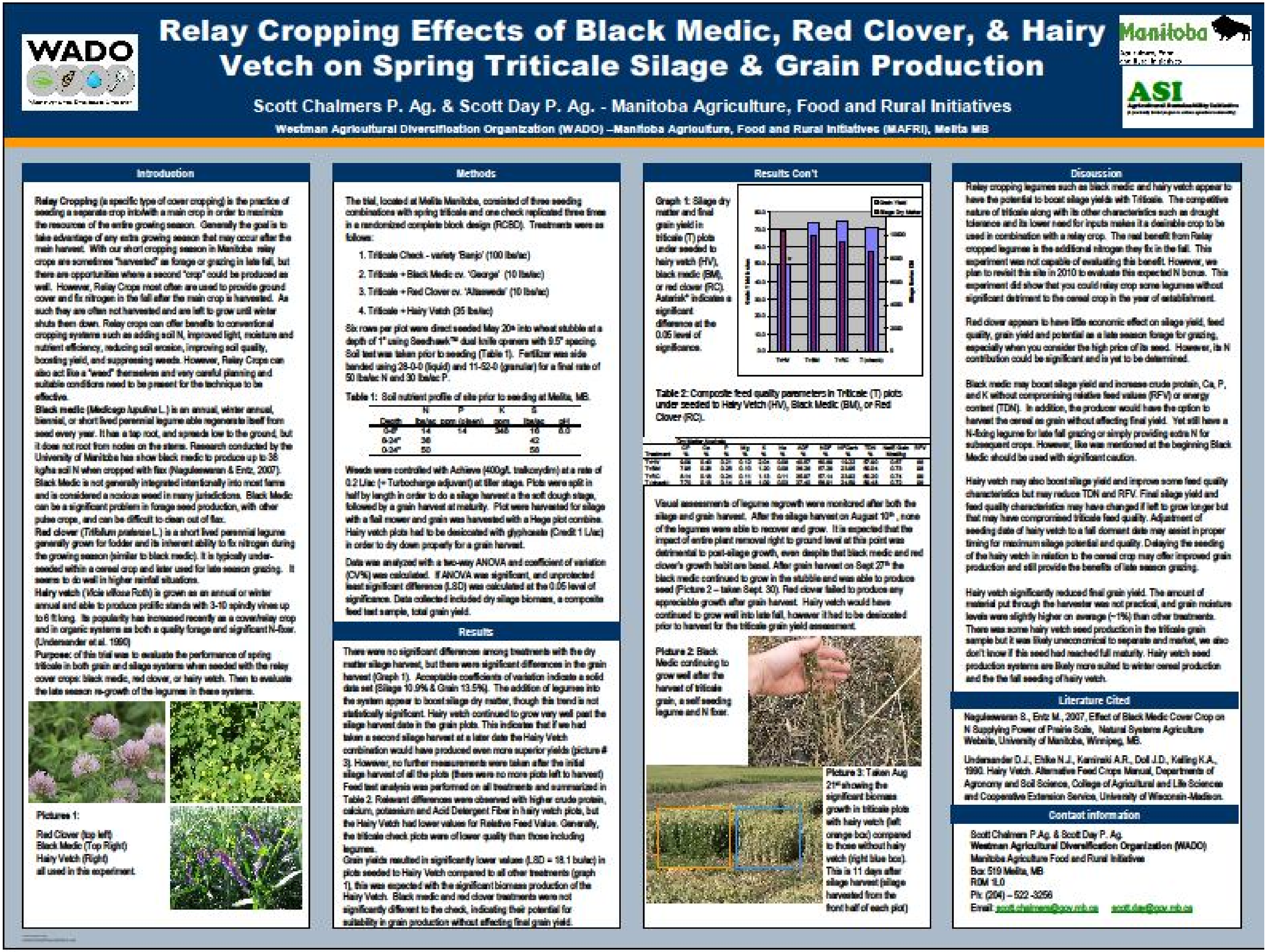

WADO

Relay Cropping Effects of Black Medic, Red Clover, & Hairy Vetch on Spring Triticale Silage & Grain Production

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Manitoba

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Introduction

Relay Cropping (a specific type of cover cropping) is the practice of seeding a separate crop into/with a main crop in order to maximize the resources of the entire growing season. Generally the goal is to take advantage of any extra growing season that may occur after the main harvest. With our short cropping season in Manitoba relay crops are sometimes "harvested" as forage or grazing in late fall, but there are opportunities where a second "crop" could be produced as well. However, Relay Crops most often are used to provide ground cover and fix nitrogen in the fall after the main crop is harvested. As such they are often not harvested and are left to grow until winter shuts them down. Relay crops can offer benefits to conventional cropping systems such as adding soil N, improved light, moisture and nutrient efficiency, reducing soil erosion, improving soil quality, boosting yield, and suppressing weeds. However, Relay Crops can also act like a "weed" themselves and very careful planning and suitable conditions need to be present for the technique to be effective.

Black medic (*Medicago lupulina* L.) is an annual, winter annual, biennial, or short lived perennial legume able regenerate itself from seed every year. It has a tap root, and spreads low to the ground, but it does not root from nodes on the stems. Research conducted by the University of Manitoba has show black medic to produce up to 38 kg/ha soil N when cropped with flax (Naguleswaran & Entz, 2007). Black Medic is not generally integrated intentionally into most farms and is considered a noxious weed in many jurisdictions. Black Medic can be a significant problem in forage seed production, with other pulse crops, and can be difficult to clean out of flax.

Red clover (*Trifolium pratense* L.) is a short lived perennial legume generally grown for fodder and its inherent ability to fix nitrogen during the growing season (similar to black medic). It is typically under-seeded within a cereal crop and later used for late season grazing. It seems to do well in higher rainfall situations.

Hairy vetch (*Vicia villosa* Roth) is grown as an annual or winter annual and able to produce prolific stands with 3-10 spindly vines up to 6 ft long. Its popularity has increased recently as a cover/relay crop and in organic systems as both a quality forage and significant N-fixer. (Undersander et al. 1990)

Purpose: of this trial was to evaluate the performance of spring triticale in both grain and silage systems when seeded with the relay cover crops: black medic, red clover, or hairy vetch. Then to evaluate the late season re-growth of the legumes in these systems.

Pictures 1:

Red Clover (top left)
Black Medic (Top Right)
Hairy Vetch (Right)
all used in this experiment.

Methods

The trial, located at Melita Manitoba, consisted of three seeding combinations with spring triticale and one check replicated three times in a randomized complete block design (RCBD). Treatments were as follows:

1. Triticale Check - variety 'Banjo' (100 lbs/ac)
2. Triticale + Black Medic cv. 'George' (10 lbs/ac)
3. Triticale + Red Clover cv. 'Altaswede' (10 lbs/ac)
4. Triticale + Hairy Vetch (35 lbs/ac)

Six rows per plot were direct seeded May 20th into wheat stubble at a depth of 1" using Seedhawk™ dual knife openers with 9.5" spacing. Soil test was taken prior to seeding (Table 1). Fertilizer was side banded using 28-0-0 (liquid) and 11-52-0 (granular) for a final rate of 50 lbs/ac N and 30 lbs/ac P.

Table 1: Soil nutrient profile of site prior to seeding at Melita, MB.

	N	P	K	S	
Depth	lbs/ac	ppm (olsen)	ppm	lbs/ac	pH
0-6"	14	14	348	16	8.0
6-24"	36			42	
0-24"	50			58	

Weeds were controlled with Achieve (400g/L tralkoxydim) at a rate of 0.2 L/ac (+ Turbocharge adjuvant) at tiller stage. Plots were split in half by length in order to do a silage harvest a the soft dough stage, followed by a grain harvest at maturity. Plot were harvested for silage with a flail mower and grain was harvested with a Hege plot combine. Hairy vetch plots had to be desiccated with glyphosate (Credit 1 L/ac) in order to dry down properly for a grain harvest.

Data was analyzed with a two-way ANOVA and coefficient of variation (CV%) was calculated. If ANOVA was significant, and unprotected least significant difference (LSD) was calculated at the 0.05 level of significance. Data collected included dry silage biomass, a composite feed test sample, total grain yield.

Results

There were no significant differences among treatments with the dry matter silage harvest, but there were significant differences in the grain harvest (Graph 1). Acceptable coefficients of variation indicate a solid data set (Silage 10.9% & Grain 13.5%). The addition of legumes into the system appear to boost silage dry matter, though this trend is not statistically significant. Hairy vetch continued to grow very well past the silage harvest date in the grain plots. This indicates that if we had taken a second silage harvest at a later date the Hairy Vetch combination would have produced even more superior yields (picture # 3). However, no further measurements were taken after the initial silage harvest of all the plots (there were no more plots left to harvest) Feed test analysis was performed on all treatments and summarized in Table 2. Relevant differences were observed with higher crude protein, calcium, potassium and Acid Detergent Fiber in hairy vetch plots, but the Hairy Vetch had lower values for Relative Feed Value. Generally, the triticale check plots were of lower quality than those including legumes.

Grain yields resulted in significantly lower values (LSD = 18.1 bu/ac) in plots seeded to Hairy Vetch compared to all other treatments (graph 1), this was expected with the significant biomass production of the Hairy Vetch. Black medic and red clover treatments were not significantly different to the check, indicating their potential for suitability in grain production without affecting final grain yield.

Results Con't

Graph 1: Silage dry matter and final grain yield in triticale (T) plots under seeded to hairy vetch (HV), black medic (BM), or red clover (RC). Asterisk* indicates a significant difference at the 0.05 level of significance.

Grain Yield
Silage Dry Matter
T+HV T+BM T+RC T (check)

Table 2: Composite feed quality parameters in Triticale (T) plots under seeded to Hairy Vetch (HV), Black Medic (BM), or Red Clover (RC).

Treatment	CP %	Ca %	P %	Mg %	K %	Na %	ADF %	NDF %	NFC %	TDN %	[illegible]	RFV
T+HV	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
T+BM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
T+RC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
T (check)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Visual assessments of legume regrowth were monitored after both the silage and grain harvest. After the silage harvest on August 10th, none of the legumes were able to recover and grow. It is expected that the impact of entire plant removal right to ground level at this point was detrimental to post-silage growth, even despite that black medic and red clover's growth habit are basal. After grain harvest on Sept 27th the black medic continued to grow in the stubble and was able to produce seed (Picture 2 – taken Sept. 30). Red clover failed to produce any appreciable growth after grain harvest. Hairy vetch would have continued to grow well into late fall, however it had to be desiccated prior to harvest for the triticale grain yield assessment.

Picture 2: Black Medic continuing to grow well after the harvest of triticale grain, a self seeding legume and N fixer.

Picture 3: Taken Aug 21st showing the significant biomass growth in triticale plots with hairy vetch (left orange box) compared to those without hairy vetch (right blue box). This is 11 days after silage harvest (silage harvested from the front half of each plot)

Discussion

Relay cropping legumes such as black medic and hairy vetch appear to have the potential to boost silage yields with Triticale. The competitive nature of triticale along with its other characteristics such as drought tolerance and its lower need for inputs makes it a desirable crop to be used in combination with a relay crop. The real benefit from Relay cropped legumes is the additional nitrogen they fix in the fall. This experiment was not capable of evaluating this benefit. However, we plan to revisit this site in 2010 to evaluate this expected N bonus. This experiment did show that you could relay crop some legumes without significant detriment to the cereal crop in the year of establishment.

Red clover appears to have little economic effect on silage yield, feed quality, grain yield and potential as a late season forage for grazing, especially when you consider the high price of its seed. However, its N contribution could be significant and is yet to be determined.

Black medic may boost silage yield and increase crude protein, Ca, P, and K without compromising relative feed values (RFV) or energy content (TDN). In addition, the producer would have the option to harvest the cereal as grain without affecting final yield. Yet still have a N-fixing legume for late fall grazing or simply providing extra N for subsequent crops. However, like was mentioned at the beginning Black Medic should be used with significant caution.

Hairy vetch may also boost silage yield and improve some feed quality characteristics but may reduce TDN and RFV. Final silage yield and feed quality characteristics may have changed if left to grow longer but that may have compromised triticale feed quality. Adjustment of seeding date of hairy vetch to a fall dormant date may assist in proper timing for maximum silage potential and quality. Delaying the seeding of the hairy vetch in relation to the cereal crop may offer improved grain production and still provide the benefits of late season grazing.

Hairy vetch significantly reduced final grain yield. The amount of material put through the harvester was not practical, and grain moisture levels were slightly higher on average (~1%) than other treatments. There was some hairy vetch seed production in the triticale grain sample but it was likely uneconomical to separate and market, we also don't know if this seed had reached full maturity. Hairy vetch seed production systems are likely more suited to winter cereal production and the the fall seeding of hairy vetch.

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Seeding Crew using new Auto Steer – no flags!
All one pass seeding, Dual knife system with liquid and dry Fertilizer

Desiccation of WADO's Melita River Site prior to Harvest

Grain Corn trials at Melita (Tori Elliot)

12 foot high Hemp Fibre Trials (dormant seeded)

On the road between our 10 research sites

Seeding Black Beans with Auto Steer and packing all at once

Hairy Vetch & Winter Wheat - Nesbitt

Black Bean Breeder Seed Plot at Boissevain

Testing the thermal value of Hemp

Beef Manure Compost application to Winter wheat Nov ’09 (data available in 2010)

Strip Tillage trial setup Nov ’09

Evaluating different canola harvesting options

Explaining the phenology cereal trial Mike Grenier CWB & Weather Bug

Wawanesa WADO tour – different special crops