2002 Project Summaries

Saskatchewan Conservation Learning Centre Inc.

2003
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A. Introduction

Background

The Conservation Learning Centre (CLC) was established in the spring of 1993. Founding partners contributed land (Ducks Unlimited Canada), finances (Parkland Agriculture Research Initiative) and management (Saskatchewan Soil Conservation Association). Agriculture and Agri-Food Canada, Saskatchewan Agriculture and Food and Prairie Farm Rehabilitation Agency were also instrumental in the establishment of the CLC. The Royal Bank (1996-1999) and the Saskatchewan Canola Development Commission (2000-2001) joined as partners through their involvement with the school program. In April 1997, the Centre incorporated as the non-profit organization, the Saskatchewan Conservation Learning Centre Inc.

The CLC is a demonstration farm which showcases farming practices that conserve soil, water and wildlife in the Parkland region. The site, chosen for its variable landscape, covers three quarter sections of land. Each year a wide variety of research and demonstration projects are established. The focus is sustainable farming practices including direct seeding, precision farming strategies, incorporation of forages, development of shelterbelts and enhancing wildlife habitat.

As a demonstration facility, the CLC offers an opportunity for visitors of all ages and expertise to learn the basics of conservation through to the latest technological advances in agricultural production. The information is highlighted during tours, workshops, presentations, in annual project reports and through the media. Youth participate through the CLC’s school program that combines in-class curriculum with on-site activities.

2002 Review

The optimal growing season for 2002 was again dry. This lack of timely moisture, combined with a frost on August 1 and greater than average rainfall and snow during August and September, had a significant negative impact on the harvestability and yield of crops. Subsequently, as in 2001, many demonstrations were not evaluated for performance.

In 2002, organized field tours and workshops included:
- Direct Seeding Demonstration, Inner Mongolia Delegation (CIDA / PFRA)
- Agricultural Institute of Canada
- CLC General Tour
- Provincial Council of ADD Boards
- Saskatchewan Forestry Centre

The delegation from Inner Mongolia was composed of scientists and technicians who were in Canada to learn about direct seeding. As a follow-up to factory visits, they spent one day at the CLC gaining hands-on experience with direct seeding equipment.
Direct seeding methods were demonstrated using the CLC's Edwards hoe drill and Flexi-Coil air drill. The group were keen observers and participants, confirming and comparing seed depth, packing and seed-fertilizer separation on their hands and knees. The sheer size of equipment in Canada, including our Flexi-Coil seeder and Farm World's New Holland 8770 tractor, was overwhelming to them. Each had an opportunity to "ride the tractor" as the demonstrations were seeded. Both seeders were used to emphasize the point that direct seeding can easily be implemented using smaller scale equipment. Comments received by the PFRA organizers indicated that the stop at the CLC was the highlight of their two week tour in Canada.

Other extension events included:
- Agriculture in the Classroom (Saskatchewan) Annual Meeting
- Ag Ed Showcase (Prince Albert Exhibition Association)
- Discoveries Children's Festival "Seed to Treat"
- Seeding Trends, Seager Wheeler Farm
- Chamber of Commerce luncheon meetings
- Agriculture and Agri-Food Canada Field Day, Melfort
- Agri-ARM forage and commodity meetings
- Provincial Science Teachers' Conference
- Biodiversity Action Plan session
- Saskatchewan Advisory Council on Forage Crops
- Environmental Farm Planning sessions
- Crop Production Show
- Crop Talk
- SSCA Annual Conference
- Nipawin Agri-Forum
- Prairie Canola Variety System meetings
- Meetings with Ernie Barber, Dean, College of Agriculture
- Prince Albert Farm Fair
- Numerous media articles and interviews.

The school program continues to expand. In 2002, 1,679 students participated in the school program for a **total of 11,325 since** the program started in 1994. We had three groups that took advantage of our multi-day programs. We thank the Saskatchewan Canola Development Commission for continuing to support this program financially as well as contributing many materials distributed to the participants. We also acknowledge the project funding received from CARDS (funding from Agriculture and Agri-Food Canada).

It is important to recognize that without the farm, there would be no school program. Therefore, we attribute a large amount of the success of the school program to the organizations that continue to support the agronomic programs at the CLC.

In total, over 30 projects were planned or continued in 2002. Some projects were for demonstration only with no reportable results and are not included. Results of completed projects are updated or summarized in the following sections.
B. Acknowledgements

The Conservation Learning Centre (CLC) continues to operate through a partnership of producers, government and non-government organizations and industry. The CLC is grateful for the support it receives from its many cooperators, including the help of surrounding neighbours. It is sincerely appreciated.

2002 – 2003 PARTNERS AND SPONSORS

Current Partners
Ducks Unlimited Canada
Saskatchewan Canola Development Commission

Founding Partners
Ducks Unlimited
Saskatchewan Soil Conservation Association
Royal Bank of Canada

Silver Sponsors
Simplot Canada Limited
BASF Canada Inc.
Farm World

Contributors
Saskatchewan Agriculture and Food
PFRA
Monsanto Canada Inc.
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Proven Seed (Agricore United)
CropMate (ConAgra)
Saskatchewan Wheat Pool
K & K Seeds
Agriculture and Agri-Food Canada
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Aventis / Bayer CropScience
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Gustafson
Canamaize

Donations
CanAmera
Crop Development Centre
Crop Life Canada
Dupont
Hugh Skotheim Trucking
Nufarm
Quality Assured Seeds
Terramax
Trawin Seeds
Wheat Belt Industries
PROJECT FUNDING
Canadian Adaptation and Rural Development Saskatchewan
Technology Adoption and Demonstration Program (Saskatchewan Agriculture, Food and Rural Revitalization)
Centennial Student Employment Program (Saskatchewan Culture, Youth and Recreation)

The CLC is guided by a board of directors comprised of producers, industry representatives and researchers. Their devotion ensures that the CLC continues to operate successfully. Their support and guidance is greatly appreciated.

Producer Board Members: Clarence Brulé, Albertville (Vice Chair)
Grant Martin, Shellbrook
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Duane Hill, Ducks Unlimited Canada

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School Program Coordinator: Colleen Smith Acorn, BSA
Assistant School Coordinator: Janna Foster-Willfong, B.Sc.
Summer Field Assistants: Nicki Krupp
Orest Kinash
C. Annual Crops Projects

1. Impact of Topography, Nitrogen Fertility and Fungicides on Canola and Wheat Diseases – Final Report

Introduction:
Crop production is influenced by landscape position in hummocky terrain (a complex pattern of knolls and depressions) primarily as a result of water distribution, which affects nutrient cycling and movement, soil quality, and crop yield. These differences among slope positions influence crop stand and canopy microenvironment, which influence susceptibility to plant diseases and therefore yield. Normally, lower slope positions have greater water and nutrient content, and produce higher crop yield. Control of some crop diseases is achieved with application of fungicides, which at present are usually applied uniformly over a field. However, new technology based on global positioning systems and geographical information systems may allow application of fungicides to only those parts of a field where they have the greatest likelihood of benefit.

Information on crop response to fertilization and fungicide application at different slope positions on a landscape is needed to develop appropriate recommendations and for successful adoption of precision agriculture on hummocky landscapes in prairies.

Purpose:
To determine how diseases of canola and wheat vary with slope position, to examine the interaction of nitrogen (N) fertilization with disease development, and to understand the interaction of fungicides with N fertility and slope position.

Methods:
Two field experiments each year from 1998 to 2001 were established on hummocky terrain and seeded to *Brassica napus* canola or hard red spring wheat. Prior to seeding, a blanket fertilizer application of phosphate, potassium and sulphur was made over the entire experiment so that none of these nutrients was limiting. The experimental treatments consisted of four nitrogen rates: 0, 40, 80 and 120 kg N/ha [0, 36, 72 and 108 lbs/ac] applied as urea (46-0-0) side-banded at seeding. Each nitrogen treatment was split and fungicide applied to one half of the plot to control blackleg (*Quadris* 125 g ai/ha) and sclerotinia (*Ronilan* 500 g ai/ha) in canola and leaf spots (*Tilt* 125 g ai/ha) in wheat. Plots were approximately 3 X 100 metres replicated four times. Disease severity ratings and yield samples were taken from two slope positions (upper and lower) within each plot for both wheat and canola. Canola diseases were assessed on 100 plants and wheat diseases on 25 plants in each slope position of each plot.

Results:
Canola
As N rate was increased, yield, blackleg incidence, protein content and % green seeds increased, while emergence and thousand kernel weight (TKW) decreased. The lower slope position tended to have greater yield and sclerotinia stem rot incidence than
upper slopes, but lower incidence of blackleg. Emergence and TKW did not vary between slope positions. Yield without N fertilization was less at the upper slope position than the lower, but yield response to N fertilization was greater at the upper slope position. Application of fungicides reduced both blackleg and sclerotinia incidence, tended to increase yield but had no effect on TKW and % green seeds. Fungicide application to control blackleg tended to be more beneficial at higher N rates and on upper slope positions since blackleg incidence was greatest under these conditions. The benefit of fungicide application to control sclerotinia stem rot was dependent on disease level, and since sclerotinia incidence was generally low there appeared to be no strong association with N rate or slope position, although in some years more sclerotinia symptoms were found in lower slope positions. The results suggest that for maximum yield lower slope positions would require less fertilizer N (55 kg N ha⁻¹) compared to the upper slope positions (83 kg N ha⁻¹) when fungicide is applied to the crop.

Wheat
As N rate increased, leaf spotting diseases, yield and protein content usually increased, while in some years, emergence and thousand kernel weight (TKW) declined. Common root rot did not show a consistent response to N rate but tended to be slightly less on upper slopes than lower. Compared to the lower slope position, the upper slope consistently had greater leaf spot severity and lower TKW and seed protein. Emergence and yield were similar between slope positions. The yield response to increased N was relatively better at upper slope position than at lower slope position in one year, but showed no influence of slope position in other years. Fungicide application reduced leaf spot symptoms, increased TKW and protein content in seed, and increased yield in 3 of 4 years. Fungicide had the greater impact on leaf spots at the higher N rates. Although leaf spot symptoms were greatest on the upper slope, yield response to fungicides was not related to slope position, in most years lower slopes also had increased yield with fungicide application. The results do not consistently support any preference for N fertilization or fungicide application at upper or lower slope positions.

Conclusions:
In this study, blackleg disease of canola was usually greater on upper slopes than lower, while the opposite trend was observed for sclerotinia stem rot, and both increased with increased N rate. The results suggest that fungicide application targeting these positions, particularly under high N fertility, may be a viable strategy in years of severe infection. Application of N at each slope position over the 4 years indicated that somewhat less N should be added to lower slope positions than to upper slope positions in order to maximize yield of canola. For wheat, the application of fungicide resulted in a positive yield response in 3 of the 4 years. Although leaf spots were observed to be more severe on upper slopes than lower, yield responded well to fungicide application at both slope positions. The relationship between N rate and slope position for yield maximization was not consistent for wheat.
Cooperators: H. R. Kutcher, Agriculture and Agri-Food Canada, Melfort
S. S. Malhi, Agriculture and Agri-Food Canada, Melfort
Saskatchewan Canola Development Commission Funding
Matching Investment Initiative, AAFC Funding
Colleen Kirkham Technical assistance
Darwin Leach Technical assistance

2. SSCA Post Emergent Burn-off Demonstration

Purpose: To demonstrate the impact of timing of post emergent burn-off application of glyphosate on seed emergence.

Background:
Direct seeders trying to fine-tune their production systems have found that if a spring burn-off application of glyphosate is delayed until just before the crop emerges, they often have a much cleaner crop and sometimes can reduce in-crop herbicide costs. This works particularly well on early-seeded pulse crops that, due to cool soils and deeper seeding depth, emerge slowly. However, this wait also increases the risk that wind or rain will further delay the burn-off application until after the crop is emerged. Some producers claim that they have had enough emergence to be able to see rows and applied glyphosate without any damage. Research conducted at Saskatoon and Scott in 1996 and 1997 concluded that delaying the burn-off application later than 24 hours after ground crack reduced plant stand enough to significantly reduce yield.

Methods:
SSCA has had several demonstration sites showing the effects of post emergent glyphosate application. At the CLC, the treatments were applied to wheat. The first treatment was sprayed at ground crack and another three treatments were sprayed one, two and three days after ground crack. Plots were sprayed June 14, 15, 16 and 17. Water rates were 10 gal/ac with an application ½ L/ac of Transorb. Spraying conditions were good each day.

To determine the effect on specific plants, 0.5 metre to 1 metre segments of specific rows were flagged and each individual plant in the segment tagged with a colored wire loop, a length of which was pushed into the soil to anchor it. The plants were tagged just prior to spraying.

Results:
The application of glyphosate severely affected the photosynthesizing plants, killing between 83-93% of the plants emerged at the time of spraying (Table 1). A higher proportion of emerged plants were killed in the ground crack plus three days treatment than the day after emergence. As well, a higher number of plants emerged after the herbicide application in the ground crack plus one day treatment.
Table 1. Plants emerged before and after spraying and live plants one (1) month after spraying

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Plants emerged at spraying time</th>
<th>Live plants 1 month after spraying</th>
<th>Plants emerged after spraying</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground Crack plus 1 day</td>
<td>36</td>
<td>6</td>
<td>80</td>
</tr>
<tr>
<td>Ground Crack plus 2 days</td>
<td>124</td>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td>Ground Crack plus 3 days</td>
<td>122</td>
<td>8</td>
<td>6</td>
</tr>
</tbody>
</table>

*Plants per m²*

**Conclusions:**
Producers must weigh the risks of reduced crop stands especially if weather delays glyphosate application 24 hours after ground crack against the benefits of enhanced weed control. If a high percentage of crop plants emerge after application, yield may not be affected. If most of the crop is emerged at application, yield will be significantly reduced.

**Cooperator:** Garry Mayerle, Saskatchewan Soil Conservation Association

3. Caraway Direct Seeded With No Cover Crop (third year)

**Purpose:**
To establish caraway without a cover crop using direct seeding methods.

**Methods:**
The caraway was seeded directly into heavy wheat stubble, at least 10” tall, without a cover crop. The following management practices were applied:
- Seeded May 26, 2000 at 15 lb/ac with no fertilizer; Afolan applied July 18; tall weeds (over 10” high) “wicked” with Roundup Transorb August 4
- Fertilized May 18, 2001 with 50# N and 20# P using a coulter; no weed control
- Fertilized May 28, 2002 with 50# N and 20# P dribbled from the seeder; no weed control.

**Results:**
The stand appeared quite well established. As in 2001, Crop Insurance deemed that it was not sufficiently established to warrant coverage. The caraway was straight cut August 10 using a TR 85. There were no problems with settings.
Net production was 336 kg per acre (740 lb per acre), on 4.5” of rain to the end of July. Dockage was 12%. A closer examination of the dockage showed 4-5% flax (the combine had not be cleaned out properly from the previous year), 1-2% weed seeds and the remaining dockage immature, small and shriveled seeds and some straw.

Despite the fact that the caraway still appeared very good, productivity does diminish with each year and the caraway was terminated at the end of the third year with a post-harvest application of 1.0 L/acre of Roundup Transorb.
Some interesting points:

- The heavy stubble in which the caraway was seeded served as well as a cover crop.
- There was very low dockage attributed to weeds despite the fact that no herbicides had been applied for two years.
- The crop was straight cut without any apparent impact on yield or harvestability.

Cooperators: Martin Gareau Seed

4. Aster Yellows in Canola and Common Families of Cultivated Crops

Introduction:
Aster yellows, a phytoplasma disease of plants, has in some years been a serious source of crop loss in Saskatchewan canola. The highest level of aster yellows incidence in Saskatchewan canola was in 2000 when aster yellows levels approached 30% in some canola fields (Pearse and Hartley, 2000).

Like all phytoplasma organisms, aster yellows is an obligate parasite and relies on insects to be vectored to new plant hosts (Agrios, 1997). The most important vector of aster yellows on the Canadian prairies is the six-spotted leafhopper, also known as the aster leafhopper (Macrosteles fascifrons Stal) (Hemiptera) (Hwang et al., 1996). Only by feeding on phloem sap can the aster leafhopper acquire and vector aster yellows to new plant hosts (Chaput and Sears, 1998). It is only in the correct vectors and in plant phloem that aster yellows can survive (Agrios, 1997).

To date there is no known trait in canola that prevents leafhopper feeding and, thus, protects canola from aster yellows infections.

Over the past two summers I have examined the incidence of aster yellows in a number of canola trials designed to compare leafhopper preferences among different plant families. I have also studied the leafhopper population in the agricultural zone in Saskatchewan.

Objectives:
1. To identify traits or breeding lines of canola resistant to leafhopper feeding
2. To compare leafhopper feeding preferences across plant family lines
3. To monitor leafhopper populations in Saskatchewan.

Methods:
In the summers of 2001 and 2002, three separate field trials were undertaken at the Agriculture and Agri-Food Canada Research Farm (AAFC) in Saskatoon and at the Conservation Learning Centre (CLC) near Prince Albert. In each of the trials, four repetitions of each entry were seeded. In each plot 4 rows of 200 plants were seeded, with the exception of potato that had 26 plants in each of its 4 rows. At both locations in 2001, each plot had two guard rows of barley. In 2002, the plots at the AAFC had two guard rows while those at the CLC had one, in order to save space.
Trial 1. Representative Crops From Different Families Trial
In Trial 1, nine entries from seven different plant families (Table 1) were compared in terms of aster yellows incidence. Each of the seven different plant families has member species that are common field crops in Saskatchewan and therefore the results will be relevant to agriculture in the province.

Trial 2. Crucifer Species Trial
Trial 2 is an attempt to determine differences in leafhopper preferences among five commonly grown field crop crucifer species. Entries were selected on the basis of well-known genetic and agronomic traits (Table 2). Each species had one entry in trial 2.

Trial 3. Crucifer Variety Trial
In Trial 3, five entries (Table 3) from each of the species in Trial 1 were planted in order to measure leafhopper preferences among and within crucifer species. Aster yellows levels, as well as leafhoppers collected on sticky traps, will suggest which plant traits or breeding lines within a species leafhoppers prefer.

Trial 4. Brassica rapa Trial
This trial was undertaken due to the fact that, in 2002. Brassica rapa had the highest aster yellows infection rates in the crucifers in Trial 2. Trial 4 replaces Trial 2 from 2001 and was conducted only in 2002, not 2001.

Results and Discussion:
Trial 1. Representative Crops From Different Families Trial
In both years, at both locations, carrot and flax had the highest levels of aster yellows, with the exception of flax at the AAFC in 2002 (Table 1). It does appear that aster leafhoppers prefer certain plant families that are subsequently more likely to become infected with aster yellows.

Table 1. Aster yellows infection (%) and plant survival rates (%) of representative crops from different families in 2001 and 2002 at the Conservation Learning Centre

<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
<th>Cultivar</th>
<th>Common name</th>
<th>2001 % infected</th>
<th>2001 % survival</th>
<th>2002 % infected</th>
<th>2002 % survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brassicaceae</td>
<td><em>Brassica napus</em></td>
<td>AC Excel</td>
<td>Canola</td>
<td>2</td>
<td>1.56</td>
<td>0</td>
<td>X</td>
</tr>
<tr>
<td>Brassicaceae</td>
<td><em>Brassica chinensis</em></td>
<td>Mei qing choi</td>
<td>Pak choi</td>
<td>0</td>
<td>2.34</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Asteraceae</td>
<td><em>Lactuca sativa</em></td>
<td>Ideal COS</td>
<td>Lettuce</td>
<td>0</td>
<td>0.06</td>
<td>0</td>
<td>11</td>
</tr>
<tr>
<td>Asteraceae</td>
<td><em>Callistephus chinensis</em></td>
<td>Mixed powderpuffs</td>
<td>Aster</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Poaceae</td>
<td><em>Hordeum vulgare</em></td>
<td>Harrington</td>
<td>Barley</td>
<td>0</td>
<td>53.25</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Apiaceae</td>
<td><em>Daucus carota</em></td>
<td>Danvers 126</td>
<td>Carrot</td>
<td>100</td>
<td>1.06</td>
<td>96.48</td>
<td>6</td>
</tr>
<tr>
<td>Solanaceae</td>
<td><em>Solanum tuberosum</em></td>
<td>Red Russet</td>
<td>Potato</td>
<td>0</td>
<td>91.96</td>
<td>0</td>
<td>69</td>
</tr>
<tr>
<td>Linaceae</td>
<td><em>Linum usitatissimum</em></td>
<td>Vimy</td>
<td>Flax</td>
<td>2.65</td>
<td>10.59</td>
<td>0.3</td>
<td>31</td>
</tr>
</tbody>
</table>

1. % infected: number of infected plants compared to number of surviving plants
2. % survival: number of surviving plants compared to total plants seeded
3. Plant count was not possible due to large amount of volunteer canola
Trial 2. Crucifer Species Trial

The rates of aster yellows varied in both years and at both locations. In 2001 aster yellows was not seen in Trial 2 at AAFC, but was seen in the AC Excel (Brassica napus) and AC Sunbeam (Brassica rapa) at the CLC (Table 2). In 2002 aster yellows was seen only in the AC Sunbeam at AAFC and not at all in Trial 2 at the CLC.

Unfortunately, due to the large amount of volunteer canola at the CLC in 2002, it is difficult to differentiate between plants in the study and the volunteer. Therefore, the number of plants that survived at the CLC in 2002 could not be determined.

Table 2. Aster yellows infection (%) and plant survival rates (%) of different crucifer species in 2001 and 2002 at the Conservation Learning Centre

<table>
<thead>
<tr>
<th>Species</th>
<th>Cultivar</th>
<th>Trait studied</th>
<th>2001 % infected</th>
<th>2001 % survival</th>
<th>2002 % infected</th>
<th>2002 % survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brassica carinata</td>
<td>Dodolla</td>
<td>High erucic acid level</td>
<td>0</td>
<td>0</td>
<td>X^3</td>
<td></td>
</tr>
<tr>
<td>Brassica juncea</td>
<td>Cutlass</td>
<td>High glucosinolate level</td>
<td>0</td>
<td>0</td>
<td>X^3</td>
<td></td>
</tr>
<tr>
<td>Brassica napus</td>
<td>AC Excel</td>
<td>Low erucic acid and glucosinolate level</td>
<td>0.50</td>
<td>0</td>
<td>X^3</td>
<td></td>
</tr>
<tr>
<td>Brassica rapa</td>
<td>AC Sunbeam</td>
<td>Low erucic acid and glucosinolate level</td>
<td>0.22</td>
<td>0</td>
<td>X^3</td>
<td></td>
</tr>
<tr>
<td>Sinapis alba</td>
<td>AC Base</td>
<td>Early maturation</td>
<td>0</td>
<td>0</td>
<td>X^3</td>
<td></td>
</tr>
</tbody>
</table>

1 % infected: number of infected plants compared to number of surviving plants
2 % survival: number of surviving plants compared to total plants seeded
3 Plant count was not possible due to large amount of volunteer canola

Trial 3. Crucifer Variety Trial

Trial 3 only was undertaken in 2001. It was replaced by Trial 4, the Brassica rapa Trial in 2002.

There were no incidences of aster yellows at AAFC and low levels at the CLC (Table 3). It also appears that the Brassica rapa, which had the lowest survival rate, had the highest overall aster yellows rate.

Based on the results of Trials 2 and 3, it appears that Brassica carinata and Brassicaceae juncea have the lowest rates of aster yellows infection. The next highest levels of aster yellows were found in the Brassica napus, Sinapis alba and Brassica rapa, respectively. The reasons for these results are not readily apparent.

If the levels of erucic acid and glucosinolates in each species and entry are considered, in Trial 3, there is some evidence to support the hypothesis that these phytochemicals do influence leafhopper feeding, as indicated by aster yellows levels. The Brassica rapa species have low levels of erucic acid and glucosinolates and had the highest incidence of aster yellows, but the Echo variety, which has high levels of both erucic acid and glucosinolates, had the highest aster yellows infection rate at 0.58% of all entries in Trial 3. Brassica napus, which also has low levels of erucic acid and glucosinolates,
had a low level of aster yellows infection, in fact, lower than that found in *Sinapis alba*, which generally has high levels of both phytochemicals. Therefore it does appear that erucic acid and glucosinulates do influence leafhopper feeding, but other factors must also be involved.

**Trial 4. Brassica rapa Trial**

In Trial 2 in 2001, *Brassica rapa* had the highest rate of aster yellows infection (Table 3). Therefore, in 2002, trial 2 was replaced by a *Brassica rapa* trial. The change was made in anticipation of obtaining higher aster yellows levels and to remove any influences of canola species traits on leafhopper feeding. This would enable clearer identification of any differences in leafhopper preference based on plant traits.

At the CLC, no infection or survival rates were compiled as the large amount of volunteer canola present made it difficult to determine which plants were part of the study. The only canola plant with aster yellows symptoms found at the CLC was in this trial. The plant was removed and identified by plant breeders at the AAFC Research Centre in Saskatoon as Yellow Sarcen. The results and discussion here deal with the experiments at the AAFC.

In Trial 4 the infection level reached more than 1% in Torch at AAFC, the only time it did so in canola with a survival rate of 10% or more. Torch does have low levels of erucic acid and this may relate to the level of aster yellows infection by influencing leafhopper feeding. However, TR4, Hysyn 110 and AC Sunbeam varieties of *Brassica rapa* with low erucic acid levels had varied rates of aster yellows infection. TR4 had an infection rate of 0.24%, while Hysyn 110 and AC Sunbeam showed no infection. In addition, Yellow Sarcen, which has high levels of erucic acid, did become infected with aster yellows. It appears that erucic acid may not be the only factor involved in leafhopper feeding preferences in canola.
Table 3. Aster yellows infection (%) and plant survival rates (%) of different crucifer varieties in 2001 at the Conservation Learning Centre

<table>
<thead>
<tr>
<th>Species</th>
<th>Cultivar</th>
<th>Trait or breeding accession studied</th>
<th>% infected</th>
<th>% survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brassica carinata</td>
<td>21276</td>
<td>Breeding accession</td>
<td>0</td>
<td>6.7</td>
</tr>
<tr>
<td>Ethiopian mustard, high erucic acid and high glucosinolate levels</td>
<td>200417</td>
<td>Breeding accession</td>
<td>0</td>
<td>3.7</td>
</tr>
<tr>
<td>Dodolla</td>
<td>S67</td>
<td>Yellow seeded</td>
<td>0</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>S71</td>
<td>Brown seeded</td>
<td>0</td>
<td>4.8</td>
</tr>
</tbody>
</table>

Mean infection rate: 0

Brassica juncea

<table>
<thead>
<tr>
<th>Trait or breeding accession studied</th>
<th>% infected</th>
<th>% survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oriental mustard</td>
<td>0</td>
<td>5.4</td>
</tr>
<tr>
<td>JS01-204</td>
<td>0.12</td>
<td>6.5</td>
</tr>
<tr>
<td>Oriental mustard</td>
<td>0</td>
<td>4.9</td>
</tr>
<tr>
<td>Cutlass</td>
<td>0</td>
<td>4.3</td>
</tr>
<tr>
<td>Commercial Brown</td>
<td>0</td>
<td>5.2</td>
</tr>
<tr>
<td>Arid</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Mean infection rate: 0.02

Brassica napus

<table>
<thead>
<tr>
<th>Trait or breeding accession studied</th>
<th>% infected</th>
<th>% survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hybrid</td>
<td>0</td>
<td>3.9</td>
</tr>
<tr>
<td>Invigor 2263</td>
<td>0.17</td>
<td>4.5</td>
</tr>
<tr>
<td>Open-pollinated</td>
<td>0</td>
<td>4.3</td>
</tr>
<tr>
<td>JS01-37</td>
<td>0</td>
<td>4.7</td>
</tr>
<tr>
<td>Open-pollinated</td>
<td>0.20</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Mean infection rate: 0.07

Brassica rapa

<table>
<thead>
<tr>
<th>Trait or breeding accession studied</th>
<th>% infected</th>
<th>% survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC Parkland</td>
<td>0</td>
<td>2.5</td>
</tr>
<tr>
<td>Hysyn 110</td>
<td>0.27</td>
<td>2.9</td>
</tr>
<tr>
<td>AC Sunbeam</td>
<td>0.38</td>
<td>2.2</td>
</tr>
<tr>
<td>TR7</td>
<td>0</td>
<td>2.1</td>
</tr>
<tr>
<td>Echo</td>
<td>0.58</td>
<td>2.7</td>
</tr>
</tbody>
</table>

Mean infection rate: 0.25

Sinapis alba

<table>
<thead>
<tr>
<th>Trait or breeding accession studied</th>
<th>% infected</th>
<th>% survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC Base</td>
<td>0</td>
<td>3.5</td>
</tr>
<tr>
<td>Ochre</td>
<td>0</td>
<td>4.7</td>
</tr>
<tr>
<td>Svalof</td>
<td>0.33</td>
<td>4.7</td>
</tr>
<tr>
<td>JS00-540</td>
<td>0.27</td>
<td>3.3</td>
</tr>
<tr>
<td>SJ00-541</td>
<td>0</td>
<td>3.2</td>
</tr>
</tbody>
</table>

Mean infection rate: 0.12

1 % infected: number of infected plants compared to number of surviving plants
2 % survival: number of surviving plants compared to total plants seeded

Cooperators: Dr. J. Soroka and T. Saretski, Agriculture and Agri-Food Canada
D. Field-scale Results

All field-scale crops were seeded with a 27' Flexi-Coil 5000 air drill, equipped with stealth openers and carbide tips, sprayed with 60' Flexi-Coil Series 55 sprayer and combined with 1985 TR83 New Holland combine.

1. AC Barrie Hard Red Spring Wheat

Purpose: To produce a crop of hard red spring wheat using direct seeding and precision agriculture techniques.

Crop: AC Barrie hard red spring wheat seeded at 1.75 bu/ac (105#/ac) May 20-21

Previous Crop: 2663 Invigor canola. Heavy weed competition early but effectively controlled with a second application of herbicide. Straw and chaff chopped and spread well. No crop residue problems encountered during seeding.

Methods:
The field has been subdivided into plots (Figure 1). The fertilizer rates varied based on wet versus dry season recommendations and landscape. The liquid fertilizer rate was varied through a computerized prescription using a Raven system. In 2002, we did not have access to equipment that could vary two products. Therefore, the granular phosphate fertilizer was varied manually – the north half of the field was seeded first at 30# P per acre and the south half of the field was seeded second at 15# P per acre.

Due to limitations of the software, an “as applied” map was not generated. However, the monitor alarm sounded each time the equipment passed into a new management zone signifying the rate change and this corresponded exactly with the prescribed changes on the prescription map. The monitors showed the changes in rates and we are confident that the prescription was applied and the liquid fertilizer rate varied accordingly.

Fertilizer: Side-banded liquid N and seed-placed granular P fertilizers. Conventional and variable (1.5X and 0.5X recommended) rates based on landscape and potential precipitation (“season”):

<table>
<thead>
<tr>
<th>Area</th>
<th>Application</th>
<th>Fertilizer (in lbs)</th>
<th>Season</th>
<th>Slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Conventional (blanket)</td>
<td>65 N 30 P</td>
<td>Wet</td>
<td>All</td>
</tr>
<tr>
<td>2</td>
<td>Variable (0.5X recommended)</td>
<td>33 N 30 P</td>
<td>Wet</td>
<td>Lower</td>
</tr>
<tr>
<td>3</td>
<td>Variable (1.5X recommended)</td>
<td>98 N 30 P</td>
<td>Wet</td>
<td>Upper</td>
</tr>
<tr>
<td>4</td>
<td>Conventional (blanket)</td>
<td>35 N 15 P</td>
<td>Dry</td>
<td>All</td>
</tr>
<tr>
<td>5</td>
<td>Variable (0.5X recommended)</td>
<td>18 N 15 P</td>
<td>Dry</td>
<td>Upper</td>
</tr>
<tr>
<td>6</td>
<td>Variable (1.5X recommended)</td>
<td>53 N 15 P</td>
<td>Dry</td>
<td>Lower</td>
</tr>
</tbody>
</table>
Figure 1. Map delineating fertilizer applications

**Pesticides:**
- Dividend seed treatment
- Target (40 ac/case) June 21
- Horizon (40 ac/case) June 21
- Roundup Transorb (1 L/ac) August 27

**Results:**

There were no crop residue problems encountered during seeding. The seed used (with permission from SeCan) was produced on Agriculture and Agri-Food plots in Melfort. Germination had been tested and was high. Emergence was poor and the stand through the growing season was thin. The drought had a significant negative impact on productivity.

A partial yield map was created but no trends are evident. As in 2001, it is likely that the dry conditions had an impact on fertilizer use. The portion of the field not combined in the fall of 2002 was combined in May 2003. A map of the remainder of the field harvested in the spring of 2003 has not been completed to date. Straw and chaff were chopped and spread well.

**These measurements are not replicated scientifically and are based on the results of one year only.**
**Cooperators:**

- SeCan / Agriculture & Agri-Food Canada
- Simplot
- CropMate (ConAgra)
- Syngenta
- Monsanto
- K & K Seeds
- Doug Schmuland, Moker & Thompson
- PFRA

**Seed**
- Liquid fertilizer
- Granular fertilizer
- Dividend, Horizon
- Roundup Transorb
- Spraying
- Expertise
- Expertise

---

**2. Field-scale 3345 Roundup Ready Canola**

**Purpose:** Field-scale production of direct-seeded canola

**Crop:** 3345 Roundup Ready canola seeded at 5#/ac May 10-11

**Previous Crop:** CDC Bethune flax. Good crop emergence. Problems with cleavers. Crop was straight-cut. Straw and chaff chopped and spread well.

**Fertilizer:** Side-banded 70# N 28# P 13# S per acre as liquid fertilizer

**Pesticides:** Roundup Transorb (0.5 L/ac) June 23

**Results:** Yield: ~5 bu/ac. Sample results: Grade: 1. Dockage: 18%.

Problems were encountered at seeding. The seeder was plugged for the majority of the field and therefore, actual initial seeding rate is unknown. The field was reseeded on the diagonal with the correct seeding rate. The fertilizer was applied correctly.

Crop emergence was very poor with only a few spots affected by last year’s flax residue. Days to maturity for this variety is listed as 99 days but maturity seemed delayed. A frost occurred on day 81 (August 1) and over 70% of the seeds in the pods were too immature to withstand the frost. There was also substantial emergence of weeds after the in-crop application of Roundup Transorb. These two factors combined resulted in high dockage. A high percentage of the dockage was attributed to volunteer wheat (wheat had last been seeded on this field in 2000).

The crop was swathed on August 25 and combined September 16. There had been a large amount of rainfall and second growth canola did interfere with combining. To prevent picking up green plant material, the end belts were taken off the header and only the three middle belts were used to pick up the swath. Straw and chaff were chopped and spread well.

There was one interesting note. In an aerial photograph taken on August 2, 2002, rows were seen running parallel to the sides of the field, not diagonally as seeded. The rows as photographed mirrored where the fertilizer was applied rather than where the seed was.

**These measurements are not replicated scientifically and are based on the results of one year only.**
Cooperators: Monsanto
Simplot
Seed, Roundup Transorb
Liquid fertilizer

3. Field-scale Prodigy Hard Red Spring Wheat

Purpose: Evaluate the effect of different rates of fertilizer in current and previous years on production of Prodigy hard red spring wheat

Crop: Prodigy hard red spring wheat seeded at 105#/ac (1.75 bu/ac) May 15-16

Previous Crop: Delta semi-leafless yellow peas. Vines were low and a higher-than-usual percentage of pods were left in the field. Straw and chaff was chopped and spread well.

Fertilizer: In 2001, the field was divided into three sections, each with a different fertilizer rate. In 2002, soil samples from each were analyzed and each section was fertilized to a level that would negate the previous year’s differences (Table 1). This means that, over the two years, the same amount of fertilizer would have been applied to all sections of the field, based on requirements identified by the soil samples. Fertilizer (in liquid form) was side-banded.

Table 1. Fertilizer rates (lb/ac) in 2001 and 2002

<table>
<thead>
<tr>
<th>Section</th>
<th>Area (ac)</th>
<th>Fertilizer rate (lb/ac)</th>
<th>2001</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>15.5</td>
<td>8# N 28# P</td>
<td>0# N</td>
<td>28# P</td>
</tr>
<tr>
<td>2</td>
<td>17.0</td>
<td>4# N 14# P</td>
<td>25# N</td>
<td>18# P</td>
</tr>
<tr>
<td>3</td>
<td>12.5</td>
<td>0# N 0# P</td>
<td>30# N</td>
<td>23# P</td>
</tr>
</tbody>
</table>

Pesticides: Puma120 Super (0.268L/ac) June 21
Curtail-M (0.8L/ac) June 21
Buctril-M (0.4L/ac) June 21
Preharvest Roundup Transorb (1.0 L/ac) September 10


Emergence was good. Growth was very good despite the dry conditions. Straw and chaff was chopped and spread well. As in 2001, differences in rates of fertilizer did not influence yield. While the three sections were not harvested separately, examination of the yield map shows there was no difference. This can be attributed to the extremely dry conditions during the growing season that would have affected the utilization of the phosphorus.

**These measurements are not replicated scientifically and are based on the results of one year only.**
Cooperators: Saskatchewan Wheat Pool, Gustafson, Simplot, Aventis, Dow AgroSciences, Monsanto, K & K Seeds

4. 45A77 SMART Canola

Purpose: Establishment of canola using direct-seeding techniques

Crop: 45A77 SMART canola seeded at 5#/ac May 12-14


Fertilizer: Side banded 60# N 23# P 13# S per acre as liquid fertilizer

Pesticides: Odyssey (40 acres/case) June 23

Results: Yield: Incomplete (estimate <10 bu/ac); 20 acres yet to combine. Sample results: Grade: 1. Dockage: 6%.

Emergence was good in the spring. Days to maturity for this variety is listed as 98 days. While it was seeded one to three days after the 3455 (maturity 99 days), it was more mature when the frost came on August 1 (day 79). Less than 30% of the seeds in the pods were damaged by the frost. Approximately 70% were mature enough to withstand the frost.

Swathing on this field began August 24 but was interrupted by rainfall and equipment problems. The remainder of the field was swath 10 days later. The parts of the field swath early were combined September 17 and 18. Combining on the late swathed portion began on September 24 but the canola was still too tough. The remaining 20 acres will be harvested in the spring of 2003.

There had been significant rainfall and second growth canola. To prevent picking up green plant material, the end belts were taken off the header and only the three middle belts were used to pick up the swath. Straw and chaff were chopped and spread well.

**These measurements are not replicated scientifically and are based on the results of one year only.**

Cooperators: Proven Seeds (AgriCore United), BASF, Simplot

Seed Odyssey

Liquid fertilizer
E. Forage Projects

1. Potential Forages for Use as Dense Nesting Cover

**Purpose:**
To evaluate the persistence of several forages over-seeded within existing dense nesting cover (DNC).

**Species:**
Ten varieties and/or species were over-seeded into traditional dense nesting cover mixture 1993 and evaluated for persistence in 1996 and 2002. The traditional DNC mixture consisted of 37% intermediate wheatgrass, 37% tall wheatgrass, 10.5% slender wheatgrass, 10.5% meadow brome grass and 5% alfalfa. The over-seeded species included: S-7133K smooth brome grass, greenleaf pubescent wheatgrass, S-9051 intermediate wheatgrass, James Dahurian wild ryegrass, Lodorn green needlegrass, common sheep's fescue, S-1755 hard fescue, Oxley cicer milkvetch, Yellowhead alfalfa and Anik alfalfa.

**Results:**
Dahurian wild ryegrass and pubescent wheatgrass did not establish in the over-seeded plots. All other species established well particularly the legumes such as *falcata*-type alfalfas and cicer milkvetch. S-9051 intermediate wheatgrass showed promise as DNC due to its height and leaves which grew higher on the stem. The original seed plants of S-7133K smooth brome grass remained in rows but out-competed other adjacent grasses. In addition, new seedlings from S-7133K were found more than 20 feet away from the parent plants.

**Cooperators:**  Phil Curry, Ducks Unlimited Canada
Dr. Scott Wright, Melfort Research Station

2. Dense Nesting Cover

In 1993, a dense nesting cover (DNC) was sown, containing a mixture of 37% intermediate wheatgrass, 10.5% slender wheatgrass, 10.5% meadow brome grass, and 37% tall wheatgrass and 5% alfalfa. The area is managed for habitat for ducks, birds and other wildlife species.

The DNC was managed in 2002 through a contractor. It was swathed and baled for hay production. The production was 100 – 1200 pound bales on approximately 60 acres (~1 ton per acre). The DNC had not been managed since it was grazed in 1998 and the contractor reported that the hay contained a large amount of old dead plant material. Consequently the hay was low to poor quality. Another problem is that the DNC is the ideal habitat for moles (pocket gophers) and this piece, as much of the...
surrounding area, has been invaded and is infested. As a result, the hay was cut very high to avoid the mounds or "hills" created by the moles.

Regrowth in 2003 will be evaluated.

Cooperators:    Ducks Unlimited Canada

3. Direct-Seeded Forage Grass and Legume Variety Garden

Purpose:
♦ To demonstrate the establishment of forages in a direct seeding system
♦ To showcase grass and legume varieties and species of interest to producers in the Parkland region.

Method:
Saskatchewan Forage Council established the forage plots in 1999. Thirty varieties and species of grasses (22) and legumes (8) were seeded into 4’ x 20’ plots, with four replications of each. Varieties and species included are:

<table>
<thead>
<tr>
<th>Grass/Clover Variety</th>
<th>Seed Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leo birdsfoot trefoil</td>
<td>9240 crested wheatgrass</td>
</tr>
<tr>
<td>Cree birdsfoot trefoil</td>
<td>Fairway crested wheatgrass</td>
</tr>
<tr>
<td>Oxley cicer milkvetch</td>
<td>Orbit tall wheatgrass</td>
</tr>
<tr>
<td>Nova sainfoin</td>
<td>Revenue slender wheatgrass</td>
</tr>
<tr>
<td>Rangelander alfalfa</td>
<td>Chief intermediate wheatgrass</td>
</tr>
<tr>
<td>Apica alfalfa</td>
<td>Clarke intermediate wheatgrass</td>
</tr>
<tr>
<td>AC Grazeland alfalfa</td>
<td>Rodan western wheatgrass</td>
</tr>
<tr>
<td>Beaver alfalfa</td>
<td>Elbee northern wheatgrass</td>
</tr>
<tr>
<td>Fleet meadow bromegrass</td>
<td>AC Parkland</td>
</tr>
<tr>
<td>Paddock meadow bromegrass</td>
<td>Arthur ryegrass</td>
</tr>
<tr>
<td>9197 meadow bromegrass</td>
<td>Prairieland ryegrass</td>
</tr>
<tr>
<td>Carlton smooth bromegrass</td>
<td>Swift ryegrass</td>
</tr>
<tr>
<td>Signal smooth bromegrass</td>
<td>Kay orchardgrass</td>
</tr>
<tr>
<td>Magna smooth bromegrass</td>
<td>Courtney tall fescue</td>
</tr>
<tr>
<td>Kirk crested wheatgrass</td>
<td>Climax timothy</td>
</tr>
</tbody>
</table>

Results:
As in 2001, the lack of moisture in 2002 negatively affected the productivity. As a result, no data were collected and no observations were kept.

Cooperators:    Agri-Food Innovation Fund
                Saskatchewan Forage Council
                Newfield Seeds
                Agriculture and Agri-Food Canada
                Project funding
                Seeding and spraying
                Seed
                Expertise
4. Native Plant Diversity Study

Purpose:
The goal of this project is to develop a diverse, stable, perennial cover stand (a mimic of wild grassland ecosystems) that preserves soil, requires minimal or no fossil fuel inputs, yields adequately, and does not rely on synthetic chemicals for fertility or pest management. This experiment, established in 1998, uses initial diversity treatments containing from four to 16 perennial grassland species.

Species:
The species included:

<table>
<thead>
<tr>
<th>Mix #1</th>
<th>Mix #2</th>
<th>Mix #3</th>
<th>Mix #4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little bluestem</td>
<td>Little bluestem</td>
<td>Little bluestem</td>
<td>Little bluestem</td>
</tr>
<tr>
<td>Green needlegrass</td>
<td>Green needlegrass</td>
<td>Green needlegrass</td>
<td>Green needlegrass</td>
</tr>
<tr>
<td>Purple prairie clover</td>
<td>Purple prairie clover</td>
<td>Purple prairie clover</td>
<td>Purple prairie clover</td>
</tr>
<tr>
<td>Yellow coneflower</td>
<td>Yellow coneflower</td>
<td>Yellow coneflower</td>
<td>Yellow coneflower</td>
</tr>
<tr>
<td>Blue grama</td>
<td>Blue grama</td>
<td>Blue grama</td>
<td>Blue grama</td>
</tr>
<tr>
<td>Fringed bromeegrass</td>
<td>Fringed bromeegrass</td>
<td>Fringed bromeegrass</td>
<td>Fringed bromeegrass</td>
</tr>
<tr>
<td>Peavine</td>
<td>Peavine</td>
<td>Peavine</td>
<td>Peavine</td>
</tr>
<tr>
<td>Yarrow</td>
<td>Yarrow</td>
<td>Yarrow</td>
<td>Yarrow</td>
</tr>
<tr>
<td>Plains rough fescue</td>
<td>Canada wild ryegrass</td>
<td>Indian breadroot</td>
<td>Plains rough fescue</td>
</tr>
<tr>
<td>Canada wild ryegrass</td>
<td>Indian breadroot</td>
<td>Gaillardia</td>
<td>Canada wild ryegrass</td>
</tr>
<tr>
<td>Indian breadroot</td>
<td>Gaillardia</td>
<td>Northern wheatgrass</td>
<td>Indian breadroot</td>
</tr>
<tr>
<td>Gaillardia</td>
<td>Northern wheatgrass</td>
<td>Canada bluegrass</td>
<td>Gaillardia</td>
</tr>
<tr>
<td>Northern wheatgrass</td>
<td>Canada bluegrass</td>
<td>Dotted blazingstar</td>
<td>Northern wheatgrass</td>
</tr>
<tr>
<td>Canada bluegrass</td>
<td>Dotted blazingstar</td>
<td>Black-eyed Susan</td>
<td>Canada bluegrass</td>
</tr>
</tbody>
</table>

C3 cool season grasses: green needlegrass, plains rough fescue, Canada wild ryegrass, fringed bromeegrass, northern wheatgrass, Canada bluegrass

C4 warm season grasses: little bluestem, blue grama

Composites: yellow coneflower, yarrow, gaillardia, dotted blazingstar, black-eyed Susan

Legumes: purple prairie clover, peavine, Indian breadroot

Results:
Overall, diversity, percentage of legumes and composites, and establishment success increased in the plots with higher species diversity. In general, weeds declined faster in the high-diversity plots, with the exception of sheep's fescue that spread by seed from the border areas. In times of drought, the composites fare the best, followed by the legumes. Grasses do not do well, with the exception of the warm season grasses, little bluestem and blue grama. The plots will continue to be monitored in 2003.

Cooperators: Phil Curry, Ducks Unlimited Canada
F. Tree Projects

1. Woodlot

A three-acre woodlot was developed in 1994 to demonstrate species with potential for cash value, wildlife habitat, aesthetic value and yard shelter: buffaloberry, chokecherry, rose, sea-buckthorn, red elder, dogwood, hybrid poplar, white spruce, Siberian larch, Jack pine, Scots pine, green ash, paper birch, and Siberian larch. Grass growth between trees and rows has been effective in controlling weeds. Many Jack pine and Scots pine were planted in an area where the water table is high and have died. In that area, acute leaf willows have been planted, with wood chips applied to control weeds.

Several Siberian larch were planted as part of a “line” test, evaluating parent lines. As there has been good growth at the CLC, it has been proposed that these trees be used as seed stock for future trials. This would necessitate removing not only the poor ones but also more to get adequate spacing for seed production.

Cooperators: PFRA
Canadian Forest Service

2. Tree Establishment and Vegetation Control Trial

Purpose:
To evaluate different methods of controlling weeds within newly planted trees.

Method:
A randomized block design with five treatments and five replications was used to evaluate several methods of controlling weeds within newly planted trees. White spruce were planted and the five weed control methods are:
- herbicides only, directed spraying with Roundup
- roto-tilling to within three inches of the tree stems
- perforated plastic blankets
- jack pine wood shavings mulch, four inches deep
- no weed control

Results and Discussion:
The impact of the various vegetation control treatments is readily visible:
- The trees in the control (no weed control) are very small (less than two feet in height after eight years growth) or have died.
- The wood shavings have served the initial purpose of aiding establishment of the trees. Some “weeds” are starting to invade but the majority of the growth is crested wheatgrass, a situation that may be beneficial in itself. The development of an established grass stand would also control weeds until the canopy covers and kills plant growth under the branches of the trees.
The perforated blankets are beginning to tear but have, as the wood chips, served the initial purpose.

Tillage depth and proximity to the roots appeared to negatively impact tree establishment.

The best method of weed control was the application of herbicides.

In 2002, tree height (Figure 1) and trunk diameter at four feet above the ground (Figure 2) were measured.

Figure 1: Tree establishment (height) as influenced by vegetation control

![Height bar chart](chart1)

Figure 2: Tree establishment (diameter) as influenced by vegetation control

![Diameter bar chart](chart2)
3. Shelterbelt Species Garden

Twenty-four of the shelterbelt species recommended for yard, field, wildlife shelterbelts, and forest belts in the parkland region were planted in 1994 and 1995.

Results:
Survivability (dead / planted) measured in 2001 is:

<table>
<thead>
<tr>
<th>Species</th>
<th>1994 Plantings</th>
<th>1995 Plantings</th>
<th>Survivability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dogwood</td>
<td>21 / 22</td>
<td></td>
<td>24 / 28</td>
</tr>
<tr>
<td>Lilac</td>
<td>22 / 22</td>
<td></td>
<td>23 / 23</td>
</tr>
<tr>
<td>Saskatoon</td>
<td>23 / 24</td>
<td></td>
<td>19 / 21</td>
</tr>
<tr>
<td>Red Pine</td>
<td>12 / 17</td>
<td></td>
<td>9 / 10</td>
</tr>
<tr>
<td>Jack Pine</td>
<td>11 / 11</td>
<td></td>
<td>9 / 9</td>
</tr>
<tr>
<td>Paper Birch</td>
<td>11 / 12</td>
<td></td>
<td>12 / 14</td>
</tr>
<tr>
<td>Russian Olive</td>
<td>5 / 11</td>
<td></td>
<td>11 / 12</td>
</tr>
<tr>
<td>Aspen</td>
<td>7 / 13*</td>
<td></td>
<td>0 / 21*</td>
</tr>
<tr>
<td>Hedge Rose</td>
<td></td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Sea Buckthorn</td>
<td>23 / 23</td>
<td></td>
<td>22 / 22</td>
</tr>
<tr>
<td>Pin Cherry</td>
<td>19 / 21</td>
<td></td>
<td>16 / 16</td>
</tr>
<tr>
<td>White Spruce</td>
<td>9 / 10</td>
<td></td>
<td>11 / 11</td>
</tr>
<tr>
<td>Colorado Spruce</td>
<td>9 / 9</td>
<td></td>
<td>9 / 9</td>
</tr>
<tr>
<td>Green Ash</td>
<td>12 / 14</td>
<td></td>
<td>11 / 11</td>
</tr>
<tr>
<td>Silverleaf willow</td>
<td>11 / 12</td>
<td></td>
<td>10 / 10</td>
</tr>
<tr>
<td>Assiniboine poplar</td>
<td>0 / 21*</td>
<td></td>
<td>2 / 11*</td>
</tr>
<tr>
<td>Red Elder</td>
<td></td>
<td>12 / 20</td>
<td></td>
</tr>
<tr>
<td>Buffaloberry</td>
<td>22 / 22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chokecherry</td>
<td>16 / 16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Siberian Larch</td>
<td>11 / 11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scots Pine</td>
<td>9 / 9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manitoba Maple</td>
<td>11 / 11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute Willow</td>
<td>10 / 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walker Poplar</td>
<td>2 / 11*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* In 1997, some trees were killed by spray drift.

4. White Spruce Field Shelterbelt

White spruce was planted in the spring of 1994 along the northern boundary of the northwest quarter to establish an evergreen shelterbelt (one-half mile). Survival was very good with growth slow, but constant. Some trees in the low-lying areas have drowned.

Cooperators: PFRA

5. Green Ash Field Shelterbelt

Green ash trees were planted in 1994 along the northern boundary of the southeast quarter (one-half mile) to establish a deciduous tree shelterbelt. On one section, the growth rate and survival of the green ash has been adversely affected by the lack of a buffer strip to the north. In 2002, new green ash trees replaced ones that had died. Weeds were sprayed with Roundup.

Cooperators: PFRA
6. Forest Belt

In the distant past, a field shelterbelt was planted between quarter sections of the farm. Parts of the shelterbelt are starting to die out and some of the surrounding land has become overgrown with grasses.

A forest belt was designed to incorporate existing bush and wetland, providing a wildlife corridor. It consists of three to five rows of a mixture of poplar, white spruce, Siberian larch, willow, and fruit-bearing shrubs. Species were selected for future harvest value, high wildlife habitat potential and to fit with the landscape provided.

Survival has varied depending on site preparation, location and tree species, but overall, the trees are healthy and grasses have filled in the areas between trees and rows. In the outermost row, new Colorado spruce replaced trees that had died.

Cooperators:  PFRA

7. Fruit Shrubs

Purpose:
To demonstrate a small area that is planted to fruit-producing shrubs.

Results:
A half-acre area was planted to chokecherry, pin cherry, and saskatoon bushes in 1996 with plastic mulch applied to control weeds. Clover was direct seeded between the rows. Grass and clover have grown in to cover the area between rows and are effectively controlling weeds. Some of the plastic mulch is beginning to wear and will need to be mended.

In 2001, two types of honeysuckle were planted by the University of Saskatchewan for evaluation. All trees appear to be established, despite the drought conditions.

Sponsorship:  PFRA
G. Monitoring of the Environment

1. Wildlife Survey

The Conservation Learning Centre continues to survey wildlife species identified at the Centre. The survey provides awareness of the diversity of species present, as well as providing a checklist for wildlife enthusiasts.

**Birds:**
- Alder Flycatcher
- American Goldfinch
- American Wigeon
- Black-billed Magpie
- Bobolink
- Canada Goose
- Clay-coloured Sparrow
- Common Grackle
- Common Snipe
- Eastern Phoebe
- Hermit Thrush
- Great Blue Heron
- Horned Grebe
- Hungarian Partridge
- Leconte's Sparrow
- Mallard
- Mourning Dove
- Northern Shoveler
- Redhead
- Ring-billed Gull
- Ruby-throated Hummingbird
- Sharp-tailed Grouse
- Song Sparrow
- Tree Swallow
- Vesper Sparrow
- Willet
- American Coot
- American Kestrel
- Bald Eagle
- Black-capped Chickadee
- Brewer's Blackbird
- Canvasback
- Common Crow
- Common Pintail
- Eastern Cowbird
- Franklin's Gull
- Gadwall
- Green-winged Teal
- House Sparrow
- Killdeer
- Lesser Scaup
- Marbled Godwit
- Northern Harrier
- Piping Plover
- Red-tailed Hawk
- Robin
- Ruddy Duck
- Savannah Sparrow
- Sora
- Trumpeter Swan
- Warbler Species
- Yellow-headed Blackbird
- American Crow
- American Robin
- Barn Swallow
- Blue-winged Teal
- Bufflehead
- Chipping Sparrow
- Common Goldeneye
- Common Raven
- Eastern Kingbird
- Mountain Bluebird
- Gray Partridge
- Hairy Woodpecker
- House Wren
- Least Flycatcher
- Lesser Yellow Legs
- Marsh Hawk
- Northern Pintail
- Red-eyed Vireo
- Red-winged Blackbird
- Rose-Breasted Grosbeak
- Sandhill Crane
- Snow Goose
- Tree Sparrow
- Turkey Vulture
- Widgeon
- Yellow Warbler

**Amphibians and Animals**
- Chorus Frog
- Pocket Gopher
- Skunk
- White-tailed Jack Rabbit
- Porcupine
- Leopard Frog
- Wood Frog
- Fox
- Badger
- White-tailed Deer
- Bear
- Garter snake
- Coyote
- Raccoon
- Snowshoe Hare
- Muskrat
- Gray Squirrel
- 13-Striped Squirrel
2. Vegetation Survey

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa</td>
<td>Alum Root</td>
</tr>
<tr>
<td>American Wild Strawberry</td>
<td>American Vetch</td>
</tr>
<tr>
<td>Balsam Poplar</td>
<td>Baltic Rush</td>
</tr>
<tr>
<td>Beaked Willow</td>
<td>Black Medic</td>
</tr>
<tr>
<td>Blue-Eyed Grass</td>
<td>Canada Thistle</td>
</tr>
<tr>
<td>Canary Reed Grass</td>
<td>Cleavers</td>
</tr>
<tr>
<td>Cream-coloured vetchling</td>
<td>Curled Dock</td>
</tr>
<tr>
<td>Dandelion</td>
<td>Doorweed</td>
</tr>
<tr>
<td>Field Chickweed</td>
<td>Field Mint</td>
</tr>
<tr>
<td>Giant-Hyssop</td>
<td>Goat’s Beard</td>
</tr>
<tr>
<td>Goldenbean</td>
<td>Graceful Goldenrod</td>
</tr>
<tr>
<td>Hairy Golden Aster</td>
<td>Harebell</td>
</tr>
<tr>
<td>June Grass</td>
<td>Kentucky Blue Grass</td>
</tr>
<tr>
<td>Lesser Duckweed</td>
<td>Long-Fruited Anemone</td>
</tr>
<tr>
<td>Low Pussytoes</td>
<td>Marsh Hedge-Nettle</td>
</tr>
<tr>
<td>Meadowsweet</td>
<td>Northern Bedstaw</td>
</tr>
<tr>
<td>Northern Gooseberry</td>
<td>Philadelphia Fleabane</td>
</tr>
<tr>
<td>Prairie Purple Milk Vetch</td>
<td>Pussy / Diamond Willow</td>
</tr>
<tr>
<td>Rough Cinquefoil</td>
<td>Saskatoon Berry</td>
</tr>
<tr>
<td>Short-Awned Foxtail</td>
<td>Slender Wheat Grass</td>
</tr>
<tr>
<td>Small-Flowered Yellow Lady’s Slipper</td>
<td>Smooth Aster</td>
</tr>
<tr>
<td>Smooth Brome Grass</td>
<td>Sowthistle</td>
</tr>
<tr>
<td>Stiff Goldenrod</td>
<td>Sunflower</td>
</tr>
<tr>
<td>Tall Manna Grass</td>
<td>Trembling Aspen</td>
</tr>
<tr>
<td>Water Smartweed</td>
<td>Water Parsnip</td>
</tr>
<tr>
<td>Western Dock</td>
<td>Western Red Lily</td>
</tr>
<tr>
<td>Western Snowberry</td>
<td>White Cockle</td>
</tr>
<tr>
<td>Wild Red Raspberry</td>
<td>Wild Buckwheat</td>
</tr>
<tr>
<td>Wild Blue Flax</td>
<td>Wood’s Rose</td>
</tr>
<tr>
<td>Wormseed Mustard</td>
<td>Yarrow</td>
</tr>
</tbody>
</table>

3. Meteorological Data

The Pessl Instruments μMetos meteorological (weather) station was operational again this year. On an hourly basis, this equipment recorded the following weather data: air temperature (C), relative humidity (%), radiation (watts/metre²), brightness (minutes), leaf wetness (minutes), wind speed (miles per hour), precipitation (inches) and soil temperature (C) and using these data sets, could calculate evapotranspiration (inches) and sclerotinia infection risk and progress. The following figures summarize the 2002 meteorological data at the CLC.
Figure 1. Precipitation (inches)

Monthly Precipitation
May 7 - October 21, 2002

Figure 2. Air temperature (°C)

Air Temperature (°C)
Daily Maximum and Minimum

Maximum
Minimum
Figure 3. Accumulated precipitation and evapotranspiration (inches)

Precipitation and Evapotranspiration
May 7 - October 21, 2002

Evapotranspiration: the sum total of the moisture that is evaporated from the soil naturally and transpired from the plant.

Figure 4. Wind speed (mph)
Figure 5. Solar radiation (watts/metre$^2$)

Average Monthly Solar Radiation (watts/metre$^2$)

<table>
<thead>
<tr>
<th>Month</th>
<th>Solar Radiation (watts/m$^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
<td>300</td>
</tr>
<tr>
<td>June</td>
<td>250</td>
</tr>
<tr>
<td>July</td>
<td>350</td>
</tr>
<tr>
<td>August</td>
<td>200</td>
</tr>
<tr>
<td>September</td>
<td>150</td>
</tr>
<tr>
<td>October</td>
<td>100</td>
</tr>
</tbody>
</table>

Figure 6. Soil temperature (C)

Average Daily Soil Temperature

Soil Temperature (°C)

<table>
<thead>
<tr>
<th>Month</th>
<th>Soil Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>May-02</td>
<td>30</td>
</tr>
<tr>
<td>Jun-02</td>
<td>25</td>
</tr>
<tr>
<td>Jul-02</td>
<td>20</td>
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<tr>
<td>Aug-02</td>
<td>15</td>
</tr>
<tr>
<td>Sep-02</td>
<td>10</td>
</tr>
<tr>
<td>Oct-02</td>
<td>5</td>
</tr>
</tbody>
</table>
1. Herb garden
2. Woodlot
3. Siberian larch line test
4. Tree establishment and vegetation control
5. Fruit shrubs
6. 45A77 SMART canola
7. Shelterbelt species garden
8. Maize maze
   a. Canamaize BRC
   b. Dekalb DKC27-12
9. Termination of established alfalfa stand
10. Potential forages for use as Dense Nesting Cover
11. Dense nesting cover
12. AC Prodigy wheat
13. Liquid copper trial (Gates Fertilizers)
   a. Foliar copper
   b. Aqua Blue liquid copper
   c. No copper
14. Establishment of direct-seeded forage grasses and legumes
15. White spruce field shelterbelt - wood shavings
16. 2733 Invigor canola
17. DKB 3455 canola
18. 45H21 canola
19. Meteorological station
20. GG469 and Ustia soybeans
21. CDC Major coriander, Mammoth dill and CDC Quatro fenugreek
22. Native plant diversity study
23. Cereal demonstrations:
   a. Forage barley varieties: AC Ranger, Westford, Dillon, AC Rosser, AC Harper, CDC Dolly
   b. Forage oat varieties: CDC Baler, CDC Boyer, AC Murphy, AC Morgan
   c. Golden German foxtail millet
   d. AC Superb hard red spring wheat
24. Aster yellows in vegetables, canola and barley (Agriculture and Agri-Food Canada)
25. Forest belt
26. AC Barrie wheat – Precision farming
   a. Conventional recommended rates for wet season 65# N 30# P
   b. Variable rates for wet season
      i. Upper slopes 98# N 30# P (1.5X recommended)
      ii. Lower slopes 33# N 30# P (0.5X recommended)
   c. Conventional recommended rates for dry season 35# N 15# P
   d. Variable rates for dry season
      i. Upper slopes 18# N 15# P (0.5X recommended)
      ii. Lower slopes 53# N 15# P (1.5X recommended)
27. Green ash field shelterbelt
28. Saskatchewan Forage Variety Trial test plots
29. SSCA Do’s and Don’ts of preseed burn off
30. Impact of precision farming on disease control and nitrogen fertilizer use efficiency
    in canola (Agriculture and Agri-Food Canada)
31. Caraway direct seeded with no cover crop (third year)
32. 45H21 canola treated with Titan
33. 45H21 canola (preparation for establishment of riparian areas around wetlands)
Saskatchewan Conservation Learning Centre Inc.
PO Box 3003, 800 Central Avenue
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