# Canadian Weed Science Society
# Société canadienne de malherbologie

**64th Annual Meeting**
**November 16th-18th, 2010**

**64ième Réunion annuelle**
**16 au 18 novembre 2010**

**Delta Regina**
**Regina Saskatchewan**

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# Table of Contents

# CWSS-SCM 2010 Annual Meeting—Schedule

| Date | Time | Topic | Location |
|---|---|---|---|
| *Sunday November 14* | 12:00-17:00 | Board of Directors Meeting on Strategic Plan – review and update; determine strategic plan for upcoming year, assign responsibilities, milestones and deadlines (lunch provided). | Campania |
| **Date** | **Time** | | |
| *Monday November 15* | 08:30-17:00 | Board of Directors Meeting<br>(Continental Breakfast and Buffet Lunch in Room)<br>Committee meetings if required. | Campania |
| | 13:00-17:00 | Curling Funspiel Tartan Curling Club | Meet in pre-function area - Mezzanine |
| | 14:00-17:00 | Pre-conference Tour. Bayer Cropscience Formulation Plant | Meet in pre-function area - Mezzanine |
| | 16:00-20:00 | Registration<br>Poster and Commercial Display Setup | Pre-function area - Mezzanine |
| | 17:00-18:00 | Board Members and Graduate Students Meet & Greet | Campania, Pre-function area - Tuscany |
| | 18:00-21:00 | Board, Grad Students & General Membership Meet & Greet | Campania, Pre-function area - Mezzanine |
| | 19:00-22:00 | Invited Speakers Dinner with Executive and Session Chairs | TBA |
| **Date** | **Time** | **Topic** | **Location** |
| *Tuesday November 16* | 07:00-08:30 | Continental Breakfast<br>Commercial Displays & Poster Viewing – Authors Present | Pre-function area - Mezzanine |
| | 07:00-17:00 | Registration | Pre-function area - Mezzanine |
| | 08:30-17:00 | Poster and Commercial Display Viewing | Pre-function area - Mezzanine |
| | 08:00 | Opening Welcome & Announcements – Sue Boyetchko, President CWSS-SCM & Rick Holm and Clark Brenzil (Local Arrangements Chairs) | Lombardy - Umbria |
| | 8:15-10:00 | **Plenary Session:**<br>**"New Crops/Crops with Second-Generation Traits: Weed Management Challenges".**<br>**Chair: Hugh Beckie** | Lombardy - Umbria |
| | 10:00-10:30 | Refreshment Break and Poster Viewing | Pre-function area - Mezzanine |

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|---|---|---|---|
| | 10:30-12:00 | Plenary Session – Cont'd | Lombardy - Umbria |
| | 12:00-13:00 | Lunch | Trentino |
| | 13:00-15:00 | **Graduate Student Research Project Presentations**. The latest in weed science research from universities across Canada. | Lombardy - Umbria |
| | 15:00-15:30 | **Refreshment Break & Poster Viewing** | Pre-function area - Mezzanine |
| | 15:30-18:00 | **Graduate Student Research Project Presentations (cont'd)** | Lombardy - Umbria |
| *Wednesday November 17* | 07:00-8:30 | Continental Breakfast<br>Poster and Commercial Display Viewing | Pre-function area - Mezzanine |
| | 07:30-17:00 | Registration | Pre-function area - Mezzanine |
| | 08:00-12:00<br><br>(with Refreshment Breaks about 10:00-10:30) | **<u>Program Sessions (Concurrent)</u>**<br><br>**1. Weediness and Agronomy of New Crops.**<br>(8:00 to 10:00)<br>Chair, Steve Shirtliffe, U of Saskatchewan<br><br>**2. Weed Identification and Herbicide Mode of Action.**<br>• Hands-on Workshop. (8:00 to 12:00)<br>Chair, Trish Meyers, Monsanto Canada Inc.<br><br>**3. Getting the Most Out of Agriculture Research Manager Software.**<br>(8:00 to 12:00)<br>Steven Gylling, Gylling Data Management, Brookings, South Dakota<br><br>**4. Weed Biology / Ecology; Noxious / Invasive Weeds**. (10:30 to 12:00)<br>• Contributed papers and discussion<br>Chair, Stephen Murphy, University of Waterloo | Lombardy<br><br>Tuscany<br><br>Umbria<br><br>Lombardy |
| | 12:00-13:30 | Awards Banquet – Russ Hynes, Chair | Trentino |

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|---|---|---|---|
| | 13:30-14:30 | Poster viewing – Authors Present | Pre-function area - Mezzanine |
| | 14:30-17:00 | **Program Sessions (Concurrent)**<br><br>**1. Weed Control in Cereals, Oilseeds & Pulses.** (14:30 to 17:00)<br>• Contributed papers and discussion<br>Chair, Neil Harker, AAFC, Lacombe, AB<br><br>**2. Weed Control in Horticulture & Special Crops.** (14:30 to 17:00)<br>• Contributed papers and discussion<br>Chair, Rob Nurse, AAFC, Harrow, ON | Lombardy-Umbria<br><br>Tuscany |
| | 17:00-18:00 | Meeting of CWSS-SCM 2010 and 2011 Local Arrangements Committees | Campania |
| | 18:00 | Industry-Sponsored Reception | Trentino |
| *Thursday November 18* | 07:30-10:00 | Breakfast and CWSS-SCM Annual Business Meeting Call to Order at 8:30. | Lombardy |
| | 10:00-12:00 | **Program Sessions**<br><br>**1. Weed Control in Corn, Soybean and Edible Beans.** (10:00 to 12:00)<br>• Contributed papers and discussion<br>Chair, Peter Sikkema, U of Guelph, Ridgetown<br><br>**2. Provincial Weed Reports and Regulatory Issues.**<br>(10:00 to 12:00)<br>o Contributed papers and discussion<br>Chair, Dave Ralph, BC Ministry of Agriculture & Lands, Kamloops, BC | Umbria<br><br>Tuscany |
| | 12:00-15:00 | CWSS-SCM Board Meeting<br>(Lunch and Meeting) | Campania |
| | 12:00 | Industry meetings as required | |

## Certified Crop Advisor and Certified Crop Science Consultant CEUs

**The Conference has been approved for Certified Crop Advisor and Certified Crop Science Consultant CEUs as follows:**

| Category | Certified Crop Advisor | Certified Crop Science Consultant |
|---|---|---|
| (Integrated) Pest Management | 22 | 19.5 |
| Professional Development | 6 | 6 |
| Crop Management | 2.5 | 2.5 |
| Pesticides & Regulations | NA | 2.5 |
| **Total** | 30.5 | 30.5 |

**Note that it is not possible for any one individual to accumulate 30.5 CEUs due to concurrent sessions. Check for the sign-in sheets for these credits.**

## 2010 Local Arrangements Committee Members

| | |
|---|---|
| **Local Arrangements Committee Co-Chair & Hotel Arrangements**<br><br>Clark Brenzil<br>Saskatchewan Ministry of Agriculture<br>3085 Albert Street<br>Regina SK S4S 0B1<br><br>tel: (306) 787-4673<br>fax: (306) 787-0428<br>clark.brenzil@gov.sk.ca | **Local Arrangements Committee Co-Chair & Program Committee**<br><br>Rick Holm<br>University of Saskatchewan<br>51 Campus Dr.<br>Saskatoon SK S7N 5A8<br><br>tel: (306) 966-5009<br>fax: (306) 966-5015<br>rick.holm@usask.ca |
| **Scholarships & Awards/Awards Banquet – Russ Hynes**<br>AAFC Research Centre<br>Saskatoon, SK<br>(306) 956-7247<br>Russell.hynes@agr.gc.ca | **Photography Contest - Justin Bouvier**<br>ICMS<br>Saskatoon, SK<br>(306)-956-3855<br>bouvier@icmsinc.com |

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| **Sponsorship – Lyle Drew** (national)<br>BASF Canada Inc. Regina, SK<br>(306) 789-2459<br>lyle.drew@basf.com **and**<br><br>**Barry Rapp, (local)**<br>**Regina, SK**<br>(306) 721-6340<br>brapp@cpsagu.ca | **Treasurer – Darren Robinson**<br>University of Guelph, Ridgetown Campus<br>Ridgetown, ON<br>(519) 674-1604<br>drobinso@ridgetownc.uoguelph.ca |
| **Commercial Displays – Bill May**<br>AAFC Research Farm<br>Indian Head, SK<br>(306) 695-5225<br>mayb@agr.gc.ca | **Registration - Anita Drabyk**<br>**CWSS-SCM Executive Assistant**<br>Pinawa, MB<br>(204) 753-2915<br>assistant@cwss-scm.ca |
| **AV Equipment - Brent Flaten**<br>SK Ministry of Agriculture, Regina, SK<br>(306) 694-3714<br>brent.flaten@gov.sk.ca | **Graduate Student Presentations –**<br>**Steve Shirtliffe**<br>Plant Sciences, U of Saskatchewan<br>(306) 966-4959<br>Steve.shirtliffe@usask.ca |
| **Posters – Ken Sapsford**<br>Plant Sciences, U of Saskatchewan<br>(306) 966-4999<br>k.sapsford@usask.ca | **Plenary Session Program / Chair –**<br>**Hugh Beckie**<br>AAFC Saskatoon Research Centre<br>(306) 956-7251<br>hugh.beckie@agr.gc.ca |

**The Program Sections (and chairs) are**

| | |
|---|---|
| **Cereals, Oilseeds and Pulses**<br>Neil Harker<br>AAFC Research Centre, Lacombe, AB<br>(403) 782-8134<br>Neil.harker@agr.gc.ca | **Forage, Rangeland, Forestry and**<br>**Industrial Vegetative Management**<br>Michael Irvine<br>Ontario Ministry of Natural Resources<br>Sault Ste. Marie, ON<br>(705) 945-5724<br>Michael.irvine@mnr.gov.on.ca |

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|---|---|
| **Horticulture and Special Crops**<br>Rob Nurse<br>Greenhouse & Processing Crops Research Centre, Harrow, ON<br>(519) 738-1288<br>Robert.nurse@agr.gc.ca | **Weed Biology and Ecology / Invasive and Noxious Weeds**<br>Stephen Murphy<br>University of Waterloo<br>(519) 888 4567<br>stephen.murphy@uwaterloo.ca<br>(Session moderator is Clarence Swanton, University of Guelph) |
| **Soybean, Corn, and Edible Beans**<br>Peter Sikkema<br>U of Guelph, Ridgetown, ON<br>(519) 674-1603<br>Psikkema@ridgetownc.uoguelph.ca | **Provincial Reports/Regulatory Issues**<br>Dave Ralph<br>BC Ministry of Agriculture & Lands, Kamloops, BC<br>(250) 371-6062<br>David.ralph@gov.bc.ca |

## Plenary Session "New Crops/Crops with Second-Generation Traits: Weed Management Challenges"

Agenda Tuesday Morning, November 16, 2010 (Umbria Room)

| Time | Topic | Speaker |
|---|---|---|
| 08:00 | **Welcome, Announcements, Local Arrangements** | **Sue Boyetchko**, President, CWSS-SCM and **Clark Brenzil / Rick Holm** (Local Arrangement Committee) |
| 08:15 | **Introduction to "New Crops/Crops with Second-Generation Traits: Weed Management Challenges"** | **Hugh Beckie** – AAFC, Saskatoon, SK |
| 08:30 | **Industry Perspective: New Crops** | **Jack Grushcow** – Linnaeus Plant Sciences Inc., Vancouver, BC |
| 09:00 | **Industry Perspective: Crops with Second-Generation Traits** | **Michael Horak** – Monsanto, St. Louis, MO |
| 09:30 | **Regulatory Perspective** | **Krista Thomas** – CFIA, Plant Biosafety Office, Ottawa, ON |
| 10:00 | Refreshment Break | |
| 10:30 | **Research Perspective: A Promising Way Forward in Determining Weediness / Invasiveness** | **Jean Burns** – Case Western Reserve University, Cleveland, OH |
| 11:00 | **Developing Agronomic Packages for New Crops and 2nd Generation Crops with Novel Traits: Constraints and Opportunities** | **Eric Johnson** – AAFC, Scott, SK |
| 11:30 | **A Role for Post-Release Monitoring?** | **Hugh Beckie** – AAFC, Saskatoon, SK |
| 11:45 | **Summary and Concluding Remarks** | **Linda Hall** – University of Alberta, Edmonton, AB |

# Biographies of Plenary Session Speakers

## Jack Grushcow

Jack Grushcow is a founder, President and CEO of Linnaeus Plant Sciences Inc., located in Vancouver. The mission of Linnaeus is to create value-added, renewable, biodegradable industrial oils in temperate climate oilseed crops. Jack was the founder and CEO of Consumers Software Inc., one of Canada's largest software companies. The company was acquired by Microsoft in 1991, in what was then the largest transaction of its kind. The technology developed by Consumers Software provided the underpinnings of the Microsoft Mail family of products including MS Outlook. Jack served on the Science Council of British Columbia from 1991-1993. He was selected as one of British Columbia's top business people under the age of 40 by B.C. Business Magazine and has been awarded Canada's top export development award. He has authored three books on the subject of applying computer systems to business applications with Prentice-Hall and two books in the area of analyzing commodity futures with John Wiley & Sons. In September of 2010, the company entered a licensing agreement with DuPont to use gene intellectual property, advanced gene technologies and biotechnology expertise developed by DuPont to accelerate development and commercialization of value-added camelina oil.

**Industry perspective of new crops: The reward side of the risk reward equation**.
Grushcow, J. Linnaeus Plant Sciences Inc., Vancouver, BC

Assessment of a new crop's potential weediness comprises one aspect of Canada's currently evolving regulatory process. Weed scientists play a key part in the evaluation of new crops and provide a measure of possible negative impacts. This presentation will outline the key economic, environmental and health-related benefits that can be derived from the introduction of a new industrial oil seed crop – the positive side of the equation. It is hoped that the presentation may offer some perspective on the importance of these new crop initiatives and therefore provide a perspective on the reward side of the risk reward assessment.

## Michael Horak

Dr. Michael Horak is employed in the Agronomic and Environmental Assessment Sciences Center, Monsanto Company, located in St. Louis. From 1991 to 1998, Michael was a faculty member in the Department of Agronomy, Kansas State University. He has served in various capacities in the North Central Weed Science Society, including President in 2003. Dr. Horak will provide an industry perspective on the risk assessment and commercialization processes for crops with second-generation traits.

**Krista Thomas**

Krista Thomas is the National Manager of the Plant Biosafety Office, Canadian Food Inspection Agency (CFIA), located in Ottawa. The Plant Biosafety Office falls under the Plant Health and Biosecurity Directorate of CFIA. Since 2009, 61 plants with novel traits have been authorized for unconfined environmental release. In her presentation, Krista will provide an update on the status of new programs that may, in future, impact the introduction of new crops into large scale cultivation in Canada, as well as provide a regulatory perspective on future generation plants with novel traits.

## Jean H. Burns

Jean H. Burns, PhD, is an Assistant Professor at Case Western Reserve University. The Burns lab focuses on the mechanisms governing community assembly and biological invasions, including the demographic characteristics of invasive populations and the potential predictive power of phylogeny. Jean got her PhD in 2006 from Florida State University for work on the phylogeny and characteristics of invasiveness in the Commelinaceae. In 2007, she worked with Tiffany Knight as a Tyson Postdoctoral Fellow on the demography of invasive and noninvasive introduced species. She also collaborated with Sharon Strauss at the University of California, Davis from 2008-2010 as a Center for Population Biology Postdoctoral Fellow, including work on phylogenetic signal on traits associated with community assembly.

## Eric Johnson

Eric Johnson, P.Ag., is a Weed Biologist and Officer-in-Charge with Agriculture and Agri-Food Canada at Scott, SK. Eric was born and raised on a grain farm near Eston, SK. Eric received both his Bachelor and Masters of Science in Agriculture from the University of Saskatchewan. Eric worked from 1982 to 1996 in agriculture extension with Saskatchewan Agriculture. Eric's current field research includes: chemical, cultural, and mechanical weed control; pesticide minor use; and crop management. He has collaborated on agronomic projects involving genetically modified spring wheat as well as led projects on new crops such as Prairie Carnation, *Camelina sativa*, and *Brassica carinata.*

# Graduate Student Presentations Agenda

**Wednesday, November 17, 2010 (Lombardy – Umbria Room)**

| | | | |
|---|---|---|---|
| **1:00 PM** | **Introduction to session** | | |
| 1:05 PM | Jay Anderson | University of Saskatchewan, Saskatoon, SK | Aspects of Floral Structure and Pollination Ecology of White Cockle (*Silene latifolia* Poir.) |
| 1:18 PM | Hélène Munger | University of Laval, Laval, QC | Conservation tillage and low-input farming system: relation between yield, weed population and Fusarium head blight in spring wheat (*Triticum aestivum* L.) |
| 1:31 PM | Megan MacEachern | Nova Scotia Agricultural College Truro, NS | Biological control of spreading dogbane (*Apocynum androsaemifolium* L.) with the dogbane leaf beetle (*Chrysochus auratus* Fab.) |
| 1:44 PM | Chad Koscielny | University of Manitoba, Winnipeg MB | Early root growth of *Brassica napus* L. can be used to predict seed yield potential |
| 1:57 PM | Scott White | University of Guelph, Truro, NS | Emergence and development of red sorrel (*Rumex Acetosella* L.) and wild blueberry ramets (*Vaccinium angustifolium* Ait.) |
| 2:10 PM | Teketel Haile | University of Saskatchewan, Saskatoon, SK | Evaluating the effectiveness of pod Sealant products, harvest methods and genotypes to reduce seed shattering loss in canola |
| 2:23 PM | Melody De Jong | University of Guelph, Guelph, ON | Environmental conditions, growth stages and fungicides affect herbicide tolerance of winter wheat |
| 2:36 PM | Hema Duddu | University of Saskatchewan, Saskatoon, SK | Evaluation of the Morphological and Seed Persistence Changes Associated with Domestication of Cow cockle (*Saponaria vaccaria* L.) Genotypes |
| 2:49 PM | Cynthia Siva | University of Guelph, Guelph, ON | Growing turfgrass without conventional herbicides: Examining the role of alternative strategies |
| 3:02 PM | Coffee Break | | |
| 3:30 PM | Wisam Obeidat | Department of Plant Agriculture, University of Guelph, Guelph ON | Maize ( *Zea mays* L.) fitness in response to light quality and drought stress |

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| 3:43 PM | Vanessa Kavanagh | University of Alberta, Edmonton, AB | Inter- and Intraspecific Pollen-Mediated Gene Flow in Triticale (x*Triticosecale* Wittmack) |
| 3:56 PM | Lin Wu | Nova Scotia Agriculture College Truro, NS | Modeling spreading dogbane (*Apocynum androsaemifolium* L.) development in wild blueberry fields |
| 4:09 PM | Kimberly Walsh | University of Alberta Edmonton, AB | Persistence of Volunteer Camelina sativa (L.) Crantz |
| 4:22 PM | Fawn Turner | University of Guelph, Guelph, ON | Recruitment biology and ecology of large [*Digitaria sanguinalis* L. (Scop.)] and small [*Digitaria ischaemum* (Schreb.) ex Muhl.] crabgrass in turf. |
| 4:35 PM | Dean Ngombe | Agriculture and Agri-Food Canada, Saskatoon, SK | Biobeds: An Innovative Approach to Pesticide Degradation |
| 4:48 PM | Eric Tozzi | University of Guelph, Toronto, ON | The recruitment biology and facultative recruitment nature of Canada fleabane (*Conyza canadensis* L.) in the context of a changing climate |
| 5:01 PM | Dilshan Benaragama | University of Saskatchewan, Saskatoon, SK | Integration of cultural practices to enhance the competitive ability of organic oat (*Avena sativa* L.) cropping systems |
| 5:14 PM | Derek Lewis | University of Manitoba, Winnipeg, MB | Calculating Yield and Quality Losses Caused by Kochia Competition in Reduced Tillage Sunflower Production |
| 5:27 PM | Angela Hughes | Nova Scotia Agricultural College, Truro, NS | Sheep sorrel (*Rumex acetosella* L.) pollen enhances *B. cinera* incidence on immature & mature blueberry flowers |
| 5:40 PM | Session Ends | | |

# Abstracts for Graduate Student Presentations

## 1:05 PM Jay Anderson

**Aspects of Floral Structure and Pollination Ecology of White Cockle (*Silene latifolia* Poir.)** Anderson J. F.[1], Shirtliffe S. J.[1], Holm F. A.[1], & Davis A. R.[2] [1]Deptartment of Plant Sciences, University of Saskatchewan, Saskatoon, SK, Canada; [2]Deptartment of Biology, University of Saskatchewan, Saskatoon, SK

White cockle (*Silene latifolia* Poir.) is an important weed in western Canadian Agriculture. White cockle is dioecious and has annual, biennial, and short-lived perennial life history characteristics. New white cockle plants originate almost exclusively by seed. Therefore, it is important to understand the reproductive biology of the species to ascertain how infestations can occur. Experiments have been designed to evaluate if white cockle relies solely on pollinators for seed production and if so, determine the magnitude of pollen transfer and also identify when pollination is occurring (temporally). In the studies, seed set was found to be mainly a result of insect pollination. Furthermore, that pollinators are carrying pollen up 128m from pollen sources to initiate pollination and that pollination is occurring both during the day and night. Laboratory experiments have established that male and female white cockle flowers are synchronous in sexual organ development and that following deposition of pollen to stigmatic surfaces fertilization is quite aggressive. These results provide further evidence to the weedy nature of this species. It is important to study these systems and their ecological significance in order to assess the role of pollination in the establishment of white cockle in Saskatchewan agriculture.

## 1:18 PM Hélène Munger

**Conservation tillage and low-input farming system: relation between yield, weed population and Fusarium head blight in spring wheat (*Triticum aestivum* L.).** Munger H.[1], Vanasse A.[1], Rioux S.[2], Bourget N.[2], Légère A.[3] [1]Département de phytologie, Université Laval, Québec QC; [2]Centre de recherche sur les grains (CEROM), Québec QC ; [3]Agriculture and Agri-Food Canada, Saskatoon, SK

Within low-input farming systems, optimal combination of cultural practices have to minimize yield reduction and maintain grain quality of bread wheat. Fusarium head blight (FHB) is a serious disease mainly caused by *Fusarium graminearum*, a fungus potentially producing a mycotoxin called deoxynivalenol (DON). The purpose of this study was to determine the effect of tillage systems established for 20 years combined with two cropping systems on wheat yield, weed population, DON content and *F. graminearum* inoculum production in hard red spring wheat. The experimental design was a split-block with three

tillage systems (conventional-till, minimum-till and no-till) as main plots and two cropping systems (high-input: herbicide and mineral fertilizer, low-input: tine harrow and organic fertilizer) as sub-plots. Trial was conducted in 2009 in La Pocatière, QC, Canada. In high-input system, similar yields were obtained in the three soil tillages, whereas in low-input system, a significant decrease in yields was observed in minimum-till and no-till compared to conventional-till. This decrease can be explained by the higher weed density and biomass measured in minimum-till and no-till in low-input system. Protein level and DON content were significantly lower in low-input system compared to high-input whatever soil tillage systems. *F.graminearum* inoculum coming from plot residues was similar among soil tillages in high-input system, whereas in low-input system, the F.graminearum inoculum was significantly lower in no-till compared to conventional-till. Presence of broadleaf weeds appears to act as a barrier and affects inoculum dispersal reaching wheat ears, thereby reducing the incidence of FHB. In organic and low-input systems, an intercrop like red clover could have the same impact as broadleaf weeds.

**1:31 PM Megan MacEachern**

**Biological control of spreading dogbane (*Apocynum androsaemifolium* L.) with the dogbane leaf beetle (*Chrysochus auratus* Fab.).** MacEachern M., Boyd N. and Cutler C. Nova Scotia Agricultural College, Truro, NS

Spreading dogbane (*Apocynum androsaemifolium* L.) is a herbaceous, rhizomatous perennial. Considered a weed within lowbush blueberry (*Vaccinium angustifolium* Ait.) fields, it is difficult to control because of its rapid spread and extensive root system, which cannot be adequately penetrated by herbicides. The dogbane leaf beetle (*Chrysochus auratus* Fab.) feeds on the foliage as an adult, on the roots as a larva, and has been found within blueberry fields. A field in Oxford, Nova Scotia was used in the summer of 2010 to monitor the population dynamics of the dogbane beetle. Data was collected three times a week from twelve randomly quadrats, including counts of adults per dogbane ramet, mating pairs per ramet, as well as beetles on plants other than dogbane. Beetles appeared in late June, reaching a peak in mid-July, and persisted in the field until late August. Mating began several days after emergence and reached its peak in concert with the population. Preliminary no-choice specificity testing showed the dogbane beetle was unwilling to feed on common milkweed (*Asclepias syriaca* L.). A small amount of feeding damage in one replicate indicated that the beetle may attempt to feed on lowbush blueberry under starvation conditions, however, this needs to be investigated more fully.

**1:44 PM Chad Koscielny**

**Early root growth of *Brassica napus* L. can be used to predict seed yield potential.**
Koscielny C.B. and Gulden R.H. University of Manitoba, Winnipeg, MB

Substantial seed yield gains have been made in Brassica *napus* L. in the past 20 years and a significant increase in above ground biomass production has accompanied these changes. Very little research has been done in regards to the changes in the root systems of the B. *napus* L. to understand what the association between early root growth and increased seed yield. Field experiments were conducted at two locations in 2009 and 2010 to evaluate early root growth and link this to final yield of 4 hybrid and 4 open pollinated canola cultivars. Soil cores of individual canola seedlings were removed from the field at the 1, 2 and 4 leaf stages. Roots were elutriated carefully by hand from the soil cores, stained and digitized for image analysis to determine length and area. These measurements were then correlated to final yield obtained from the field plots. The 2009 results indicated a strong relationship between early root length and area and final seed yield Pearson r values of 0.79 and 0.86, respectively. In 2009, average root length at the 2 leaf stage was 50% greater at one locations compared to the other, however, the correlation among root parameters and final yield were similar. The speed at which canola roots grow early in the season seems to be essential to its ability to achieve high yield potential. Results from this project have implications for the competitive ability of canola with weeds and the competitive ability of volunteer canola populations with other crops.

**1:57 PM Scott White**

**Emergence and development of red sorrel (*Rumex acetosella* L.) and wild blueberry (*Vaccinium angustifolium* Ait.) ramets.**
White S.N.[1], Van Acker R.C.[1], Boyd N.S.[2], Swanton C.W.[1], and Newmaster, S[3]. [1]Department of Plant Agriculture, University of Guelph, Guelph, ON; [2]Department of Environmental Science, Nova Scotia Agricultural College, Truro, NS; [3]Department of Integrative Biology, University of Guelph, Guelph, ON

An experiment was established to monitor the emergence and development of red sorrel and blueberry ramet populations in sprout and crop year wild blueberry fields in Nova Scotia. Two sprout year sites were established in 2009, and data collection continued into the crop year at these sites in 2010. Two additional sprout year sites were also established in 2010. Blueberry and sheep sorrel ramet emergence was monitored in four 0.09$m^2$ quadrats at each site. Sheep sorrel emergence was also monitored in four 0.09$m^2$ quadrats in bare soil patches at each site. Blueberry ramets emerged in early to mid-May and reached 90% emergence by mid to late June at sprout year sites. Development to the tip-dieback stage began after 90% ramet emergence at all sprout year sites. Blueberry ramet populations were stable (90% survival rate) at all sprout year sites. Red sorrel ramet emergence tended to follow a linear pattern from early May until December at sprout year sites in 2009. New ramet emergence tends to follow the same pattern at sprout and crop year sites in 2010, however, data collection for 2010 is incomplete. Total net gain (emergence minus mortality) to red sorrel

ramet populations at sprout year sites was higher in blueberry clones (70% survival rate) than in bare soil patches (24% survival rate) in 2009. Survival rate of ramets in blueberry clones is about 81% while survival rate in bare soil patches is about 64% at sprout year sites in 2010. Net red sorrel ramet populations reached maximum density in late September at sprout year sites in 2009. Emergence of new ramets in crop year fields was similar to that observed in sprout year fields, but ramet survival rate was low in both blueberry clones (39% survival rate) and bare soil patches (41% survival rate).

**2:10 PM Teketel Haile**

**Evaluating the effectiveness of pod Sealant products, harvest methods and genotypes to reduce seed shattering loss in canola.** Haile[a], T.A., Shirtliffe[a] S.J., and Holzapfel[b] C. [a] Dept. of Plant Sciences, University of Saskatchewan, Saskatoon, SK, Canada;[b]; Indian Head Agricultural Research Foundation, Indian Head, SK

Seed shatter in canola leads to yield loss and the dispersal of canola seed into the seedbank. The volunteer plants can then create a weed problem in the subsequent crops and result in crop yield loss. A study was conducted to evaluate the importance of variety selection, harvest methods (swathing versus straight cutting) and pod sealant products on seed shattering loss in canola. This research was conducted at five locations across western Canada. The treatments were a factorial combination of five cultivars (5440, 4362, 45H26, 5020 and 8571 (*juncea*)) and four harvesting methods (swathing, straight-combining, straight combining with Pod Ceal DC and straight-combining with Pod-Stik) for a total of 20 treatments. The variables that were measured include plant density, lodging index, days to maturity, seed yield, seed losses due to shattering, and pod drops. Seed losses and pod drops were measured using 4 mesh catch trays (1.2m X 0.11m) that were inserted into each plot during the early pod-filling stages. The results of this study will be discussed during the presentation.

**2:23 PM Melody De Jong**

**Environmental conditions, growth stages and fungicides affect herbicide tolerance of winter wheat.** De Jong, Melody. Department of Plant Agriculture, University of Guelph, Guelph, ON

Profitable winter wheat production in Ontario is largely dependent on grain yield and as such, yield losses due to weeds and diseases will have a greater impact when crop prices are high. It is common for producers to tank-mix herbicides and fungicides to reduce application costs and save time. These applications are often made early in the season when temperatures approach freezing. In the spring of 2008, a number of producers experienced significant crop

injury when they applied herbicide-fungicide tank-mixes to winter wheat. Field studies were conducted at four Ontario locations to determine the extent of crop injury and associated yield loss, and to explore whether it was due to the environmental conditions at application, the crop stage at application, or the specific combination of herbicide and fungicide. Estaprop (dichlorprop/2,4-D), Buctril M (MCPA/bromoxynil), and Infinity (pyrasulfatole/bromoxynil) herbicides were applied singly and in combination with four fungicides and applications were made following a frost (night-time forecast of 0ºC) and at a late growth stage (Zadoks 37-39). Visual injury ratings indicated herbicide-fungicide tank-mixtures of Estaprop+Folicur (tebuconazole), Buctril M+Folicur, and Buctril M+Quilt (azoxystrobin/propiconizole) consistently caused injury at frost (2-15%) and 'late' (8-30%) application timings. Despite the level of injury, wheat plants recovered and, in the majority of cases, yields were unaffected. These results suggest that tank-mixtures containing the fungicide Folicur consistently injure winter wheat plants. In addition, herbicide-fungicide tank-mixes are more likely to injure winter wheat when applied at a late crop stage. These results contribute to profitable winter wheat production by identifying herbicide and herbicide-fungicide combinations that minimize crop injury and yield loss.

**2:36 PM Hema Duddu**

**Evaluation of the Morphological and Seed Persistence Changes Associated with Domestication of Cow cockle (*Saponaria vaccaria* L.) Genotypes.** Duddu[a], H.S.N., Shirtliffe[a] S.J., Willenborg[b], C. J. [a] Dept. of Plant Sciences, Univ. of Saskatchewan, Saskatoon, SK; [b] Dept. of Agricultural, Food and Nutritional Science, Univ. of Alberta, AB

Cow cockle (*Saponaria vaccaria* L.), is an introduced summer annual weed of Northern Great Plains. It is being considered for domestication because of its high quality starch, cyclo-peptides and saponins. The present investigation aimed at identifying the characters which aid in domestication of the crop and also to identify the seed persistence changes during this process. The morphological and adaptation study include thirteen genotypes. Among them, 06-Turk-1 was superior with high emergence, duration of flowering, biomass and yield. Manitoba lines were characterized by shorter heights, lower biomass, determinate growth and early maturing with an exception of MAB-89. In persistence study, seeds of semi-domesticated prairie carnation showed high emergence than wild cow cockle under different tillage treatments after the first year. Furthermore, tillage resulted in higher emergence compared to zero tillage. It is hoped that results of this study, would help in domestication and production of better cultivars for Canadian prairies.

Evaluating the effectiveness of pod Sealant products, harvest methods and genotypes to reduce seed shattering loss in canola.

**2:49 PM Cynthia Siva**

**Growing turfgrass without conventional herbicides: Examining the role of alternative strategies.** Cynthia Siva[1], François J. Tardif[1] and Katerina S. Jordan[1], (1) Department of Plant Agriculture, University of Guelph, Guelph, ON

Dicot weeds such as dandelion (*Taraxacum officinale* Wigg.) are major pests of turfgrass, competing for space, light, and nutrients. Conventionally, chemical herbicides (e.g. glyphosate, 2, 4-D) have been used to manage these weeds. However, in 2009, the Ontario Cosmetic Pesticide Ban was implemented, restricting the use of pesticides in urban settings and increasing the demand for alternative weed management strategies. This study examines the effectiveness of various weed management treatments as potential alternatives to conventional herbicides for site preparation (pre-renovation) and for the management of dicot weeds (post-renovation) in Ontario. The treatments are: untreated control, glyphosate, acetic acid, and flame-weeding as pre-renovation treatments and untreated control, 2,4-D/mecoprop/dicamba (Par III), chelated iron (Fiesta), lactic acid (Organo-sol), *Sclerotinia minor* (Sarritor) and corn gluten meal as post-renovation treatments. Sod is also included as an additional, stand-alone treatment. Weed populations were assessed both visually and using a point quadrat. Plots treated with alternative controls have significantly different weed populations compared with those receiving conventional treatments such as glyphosate followed by 2,4-D. While some alternative options were more effective than others, the cost of applying sufficient product to gain desired effects may become quite expensive for a home lawn owner.

**3:30 PM Wisam Obeidat**

**Maize ( *Zea mays* L.) fitness in response to light quality and drought stress.** Obeidat, W. and C. J. Swanton. Department of Plant Agriculture, Crop Science Building, University of Guelph, 50 Stone Road E., Guelph, ON

Weed competition in maize *(Zea mays)* is influenced by light quality low red-far (R: FR) light ratio signal, reflected from the leaf surface of weeds. Research has shown that light quality signalling can delay the rate of leaf appearance (RLA), reduce biomass and alter root structure. If root structure is altered, then the plants ability to withstand abiotic stresses may be compromised. To test for this possibility, we hypothesized that the presence of early season weeds will alter maize root structure and thereby reduce the ability of maize to recover from drought stress. Field studies were conducted under controlled fertigation for two growing seasons (2009, 2010) at Arkell Research Station, University of Guelph, Guelph, ON, Canada. A University of Guelph maize hybrid (CG108×CG102) was selected for the experiment and turfgrass was used as a surrogate weed. The experiment was designed such that no direct above or below ground competition occurred between the maize seedling and

the turfgrass. The turfgrass was present from emergence of the maize seedling until the 6th leaf tip stage of maize development. At this leaf stage, the turfgrass was removed and drought stress was applied until severe leaf rolling symptoms occurred approximately 14 to 21 days after initiation of the drought stress in 2010 and 2009 respectively. Water was then returned to the system and continued until the maize plants reached maturity. Maize seedlings exposed to the low R:FR light signal reflected from the turfgrass until the 6$^{th}$ leaf tip stage displayed an initial increase in plant height and a reduction in the root-to-shoot ratio, stem diameter and root biomass. At maturity, preliminary results from 2009 suggest that the yield potential of maize with altered root systems caused by the R:FR ratio was reduced and that the addition of water stress further enhanced this loss in yield potential.

**3:43 PM Vanessa Kavanagh**

**Inter- and Intraspecific Pollen-Mediated Gene Flow in Triticale (x*Triticosecale* Wittmack).** Kavanagh, V.B.[1], Hills, M.J.[2], Hall, J.C.[1], Hall, L.M.[1]. [1]University of Alberta, Edmonton, AB; [2]Grant MacEwan College, Edmonton, AB

Triticale is an animal feed crop with promising qualities for a bio-industrial crop. As part of a larger project to develop a biorefining crop for western Canada, an extensive development program is underway including the development of genetically engineered (GE) triticale varieties. Prior to release of GE triticale, the environmental biosafety needs to be assessed to ensure they can coexist with conventional varieties without causing unacceptable market or environmental harm. Pollen mediated gene flow of GE triticale is currently being assessed using a 3 tiered approach to determine hybridization potential of blue aleurone triticale with common wheats AC Barrie and AC Crystal, durum wheat AC Avonlea, and triticale variety AC Alta. Blue aleurone triticale is used as a marker since the blue trait exhibits a xenia effect that is dominant and may be observed visually in intraspecific hybrid seeds. Crossability will be determined and frequency of hybridization events with increasing distances. Tier 1 greenhouse experiments established crossability of triticale with different wheat and triticale varieties and confirmed the possibility of pollen mediated gene flow when triticale is the male parent. Tier 2 strip trials between triticale and wheat have been completed and analysis is ongoing. Methods to assist in interspecific hybrid seed confirmation are being developed including the identification of polymorphic SSR markers. Tier 3 large-scale field trials to determine intraspecific outcrossing between blue aleurone triticale and AC Alta triticale were conducted at two locations (Ellerslie and Lethbridge, Alberta) in 2008 and 2009 for a total of 4 site years. In 2008, the highest rates of outcrossing ranged from 5.5% to 0.14% at 20-40cm and 50m respectively. In 2009 the rates were 8.3% and 0.26% with higher values being observed at Ellerslie. A literature review was completed to identify wild and weedy relatives in Canada that were at risk for hybridization with triticale. The most likely outcrossing candidates are *Aegilops cylindrica* Host and *Agropyron intermedium* (Host) Beauv.

**3:56 PM Lin Wu**

**Modeling spreading dogbane (*Apocynum androsaemifolium* L.) development in wild blueberry fields.** Wu[1], L., Boyd[1], N., Sampson[1], G., and Olson[1] R. [1]Department of Environmental Sciences, Nova Scotia Agricultural College, PO Box 550, Truro, NS

Spreading dogbane (*Apocynum androsaemifolium* L.) is a common perennial weed in wild blueberry fields. It is highly competitive and spreads rapidly once established. Emergence patterns and timing of flowering of spreading dogbane was examined in 2008 and 2009 with the intent to develop ramet emergence and flowering model and predict optimum herbicide application timing. Emerging ramets and flowers were counted twice weekly in four 1 $m^2$ quadrats randomly placed in four sites in 2008 and 2009. Spreading dogbane ramet dynamics were adequately described by a three parameter nonlinear regression model ($r^2 = 0.86$) and flowering model was well fitted with Weibull four parameter model ($r^2 = 0.91$). Growing degree day was used as x-variable in the model ($T_{base} = 6$, biofix = April 1). Our results indicate that Spreading dogbane ramets peak emergence tended to occur between 327 to 419 GDD. Spreading dogbane reached peak height by about 558 GDD. Peak flowers were reached between 819 to 869 GDD. In terms of management, the best time to manage spreading dogbane by POST herbicides should be initiated between 369 to 535 GDD, when dogbane started to form flower buds and flowers.

Keyword: blueberry, weed, spreading dogbane, modeling

**4:09 PM Kimberly Walsh**

**Persistence of Volunteer *Camelina sativa* (L.) Crantz.** Walsh, Kimberly Hills Melissa, Topinka Keith, and Hall Linda. University of Alberta, Edmonton, AB

*Camelina sativa* (L.) Crantz [camelina] is a newly emergent old world oilseed crop that is being investigated to determine its potential to be weedy or invasive. This crop is currently grown on the Canadian prairies for production of biodiesel. Camelina is being genetically modified to synthesize hydroxy fatty acids similar to that in castor oil so that camelina oil may be used for industrial lubricants and greases. Research is being conducted to characterize its biology and agronomy however, there is much that remains unknown. Experiments were conducted using conventional camelina to determine the number and persistence camelina seed and volunteer populations. Seed loss at harvest in four camelina fields in central and southern Alberta found that seed loss averaged 68 kg $ha^{-1}$ (≈5 000 seeds $m^{-2}$); high seed numbers may be attributed to small seed and combine settings. No primary seed dormancy was observed. In a study of seed persistence using artificial seed banks and three seeding depths, camelina seed did not persist 9 months subsequent to October. Repeated survey of camelina fields in central and southern Alberta and Saskatchewan the year following production found that camelina volunteers on average were 1 200 plants $m^{-2}$ before seeding but declined to >5 plants $m^{-2}$ after harvest had concluded, which suggests that

camelina volunteers do not thrive in conventional cropping systems. Preliminary data concerning camelina persistence suggests a low weedy propensity.

**4:22 PM Fawn Turner**

**Recruitment biology and ecology of large [*Digitaria sanguinalis* L. (Scop.)] and small [*Digitaria ischaemum* (Schreb.) ex Muhl.] crabgrass in turf.** Turner, F.A., and Van Acker, R.C. Department of Plant Agriculture, University of Guelph, Guelph, ON

Large and small crabgrass have proven to be serious weeds in a broad variety of systems; including Canadian row crops, cultivated fields, and turfgrass. Despite this, minimal research has been conducted on either of these species nation-wide and much of the existing knowledge has been derived from agriculturally focussed investigations. In turf, crabgrass has previously been managed using herbicides, however, the Ontario-wide cosmetic pesticide ban has restricted their application on lawns, parks, school yards, and cemeteries since April, 2009. Observation of turfgrass in southern Ontario has confirmed a high incidence of crabgrass in many areas. As crabgrass has often been noted as a dominant weed without the aid of herbicides and, the efficacy of bioherbicides is not yet sufficient, this trend is hypothesized to continue. Crabgrass biotypes have been proven to exist in other research related to their emergence timing and flowering and may also act to explain some differences seen in separate studies. Consequently, observational studies of crabgrass emergence timing in southern Ontario turfgrass as well as its depth of recruitment over time are being conducted to better characterize crabgrass in this region. Experimentation of crabgrass' response to common residential cultural management techniques including fertilization and disturbance by raking is also being investigated. Previous research has revealed a positive response of both large and small crabgrass seed to treatments of $KNO_3$ by breaking dormancy prematurely and enhancing the rate of germination. Growth chamber experimentation will reveal direct effects of various fertilization rates on local large and small crabgrass seed, while field experimentation will incorporate the effects of a representative turfgrass ecosystem under fall and spring fertilization, and disturbance treatments. It is intended that a better understanding of southern Ontario's existing large and small crabgrass populations in turf, as well as the implications that common cultural management practices have on their recruitment will contribute to their adequate management without the use of herbicides.

**4:35 PM Dean Ngombe**

**Biobeds: An Innovative Approach to Pesticide Degradation.** Ngombe, D.L.[1, 2], Wolf, T.M.[1], Knight, J. D.[2], Caldwell, B.C.[1], Cessna, A.[3], and Farrell, R.E.[2]. [1]Agriculture and Agri-

Food Canada, Saskatoon, SK; [2]Dept. Soil Science, University of Saskatchewan, Saskatoon, SK; [3]National Hydrology Research Centre, Environment Canada, Saskatoon, SK

A biobed is a pit in the ground into which a mixture of compost or peat, topsoil and straw (1:1:2 v/v/v) is added and covered with a layer of grass. The biobed mix has a high moisture-holding capacity and creates an environment suitable for microbial degradation of applied pesticides. The objective of this study is to investigate if there is any correlation between active ingredient breakdown and carbon dioxide emission in a biobed and soil after pesticide application. Preliminary studies showed that the half-life of the herbicide 2,4-D was reduced five-fold in a biobed substrate compared to topsoil. Laboratory studies showed that $CO_2$ evolution lagged several days after initial application of 2,4-D, but then increased sharply above background levels for several days before returning to normal levels. Subsequent addition of 2,4-D to the same substrate caused an immediate release of $CO_2$, suggesting that populations of 2,4-D degrading microorganisms increased and were sustained after 2,4-D application. In soil, an overall increase in $CO_2$ evolution was only observed after repeated applications of 2,4-D. However, there was no immediate increase of $CO_2$ following application of 2,4-D. Microbial biomass carbon is being measured to relate $CO_2$ evolution to the microbial population and pesticide breakdown.

**4:48 PM Eric Tozzi**

**The recruitment biology and facultative recruitment nature of Canada fleabane (*Conyza canadensis* L.) in the context of a changing climate.** Tozzi E., University of Guelph, Toronto, ON

The facultative nature of some winter annuals has a large effect on the fitness or success of that organism in an area. Understanding the recruitment nature of facultative winter annuals can provide insight into the mechanisms of their success and, in some cases, their invasiveness. This may be particularly relevant in the context of accelerating climate change.

*Conyza canadensis* (Canada fleabane) is a facultative winter annual native to North America that has since spread to several different continents, with prominence in the U.S.A, Canada, Europe, Brazil, and China. Some populations have been found to be resistant to different herbicides, most recently glyphosate, in Southwestern Ontario. Canada fleabane flowers and sets seed in late summer, with some seed germinating and forming a rosette over winter, and other seed persisting and germinating in the spring of the following year.

The lack of dormancy within the seed and indeterminate flowering period suggests that microsite conditions play a large role in the persistence, emergence, and recruitment biology of Canada fleabane. The ability to germinate in spring or fall highlights how important our

understanding of these factors is to the relative success of Canada fleabane and to the potential approaches for managing this species in a changing climate.

The research project is essential to answering the questions raised by the facultative nature of Canada fleabane. It is imperative that the mechanisms controlling spring vs. fall germination are known since previous methods of control are beginning to prove themselves less effective. The objective of this study will be to investigate the ecological and physiological stresses that Canada fleabane is subjected to. With such investigation, we hope to learn more about the recruitment nature of Canada fleabane. We also hope to understand the mechanisms controlling spring emergence as well as pinpoint any microsite conditions that induce spring or fall germination.

Emergence timing, flowering timing, and fitness of plants in both spring and fall will be recorded within randomized plots at three different locations in Southwestern Ontario. Buckets containing two rosettes each will be placed in the ground at each site and removed in the winter for 72hrs and placed in growth chambers under mock warming spell conditions. Preliminary results have shown that flowering timing and seed set may play a large role in spring vs. fall germination. Warming spells appear to increase the rate of mortality if they occur closer to spring. Warming spells also had the effect of inducing flowering 2-3 months earlier than control plants.

**5:01 PM Dilshan Benaragama**

**Integration of cultural practices to enhance the competitive ability of organic oat (*Avena sativa* L.) cropping systems.** Benaragama D.I.D.S and Shirtliffe S.J. Dept. of Plant Sciences, Univ. of Saskatchewan, Saskatoon, SK

Effective weed management strategies are limited in organic oat cultivations as herbicide use is prohibited. Integrating crop competitive ability with mechanical weed control is a key strategy in managing weeds in such instances. Yet, the relative efficacy of different strategies and their interactions when combined is not known. The main objective of this research was to develop a competitive organic oat cropping system integrating both cultural and mechanical weed control techniques. Four cultural practices; two oat genotypes, CDC Baler (competitive) and Ronald (less competitive), two planting densities (250, 500 plants $m^{-2}$), two row spacings (11.5, 23 cm) and post -emergence weed harrowing were arranged in factorial structure and applied in to two organically managed oat fields in 2008 and 2009. Doubling the seeding rate significantly increased the grain yield by 10.7% and reduced the weed biomass by 52%. The competitive oat genotype CDC Baler was more weed suppressive than Ronald. Post-emergence harrowing increased the grain yield by 13% compared to the non-harrowed control. Moreover, harrowing reduced the weed density on 3 of the 4 site-years tested. On top of their individual effects, combining high crop density with post-emergence harrowing increased the grain yield up to

25%. Furthermore, high crop density when combined with competitive oat cultivar CDC Baler the weed biomass were reduced by 65%. High crop density, post-emergence weed harrowing and competitive oat cultivar were identified to be important cultural and mechanical weed control strategies. The effective components of an integrated weed management system combine additively to provide higher yield and greater weed suppression. Therefore, integrating both cultural and mechanical weed management practices was beneficial in organic oat cropping systems.

**5:14 PM Derek Lewis**

**Calculating Yield and Quality Losses Caused by Kochia Competition in Reduced Tillage Sunflower Production.** Lewis DW and Gulden RH, Department of Plant Science, University of Manitoba, Winnipeg, MB

Approximately 75% of the sunflowers grown in Manitoba are planted in wide row production systems to allow for inter-row cultivation to control weeds. Some producers are growing sunflowers in reduced tillage systems, where in-crop cultivation which is a very effective way to control otherwise difficult to manage weeds, such as kochia is no longer possible. In 2009, field experiments were initiated at Winnipeg and Melita, Manitoba. The goal of this research is to estimate the yield and seed quality losses caused by kochia and develop economic thresholds for managing kochia. A split-plot design was employed with time of kochia emergence relative to the sunflowers (early and late) as the main plot and six kochia target densities (0, 5, 25, 50, 100 and 200 plants $m^{-2}$) as the sub-plots. In 2009, maximum yield losses approached 25-30% yield when kochia emerged at the same time as the sunflowers. When kochia emerged when sunflowers were at the 4 – 6 leaf stage, maximum yield loss was substantially less. For 2009, the economic threshold for kochia was estimated to be about 5 plants $m^{-2}$ for sulfentrazone (based on herbicide and application cost of \$44 $ha^{-1}$) when kochia emerged at the same time as sunflowers. This study showed that kochia management is necessary in reduced tillage sunflower production even at low densities.

**5:27 PM Angela Hughes**

**Sheep sorrel (*Rumex acetosella* L.) pollen enhances *B. cinera* incidence on immature & mature blueberry flowers.** Hughes, A., Boyd, N., Cutler, C., Hildebrand, P. Department of Environmental Science, Nova Scotia Agricultural College, NS

*Botrytis cinerea* is a destructive fungal disease found in many crops including lowbush blueberry. It is known that blueberry flowers become susceptible to *B. cinerea* just prior to opening and that blueberry pollen can stimulate spore germination. It is possible that nutrients from pollen of other plant species may also stimulate spore germination. Sheep sorrel is a

common weed of blueberry fields that produces large amounts of wind dispersed pollen. Pollen from the male flowers can coat blueberry leaves and flowers and may trigger increased infection by *B.cinerea*. To examine this, spore suspensions of increasing concentrations of sheep sorrel pollen were mixed with spores of *B. cinerea*, allowed to incubate and then germinated spores were counted. Suspensions of spores alone or mixed with pollen were also inoculated onto mature and immature flowers of healthy greenhouse-grown blueberry plants. Germination of *B cinerea* spores increased with increasing concentrations of sheep sorrel pollen. The incidence of infected immature and mature flowers increased when inoculated with spores plus pollen compared with spores alone. Accordingly, sheep sorrel pollen may increase disease caused by *B. cinerea* in the blueberry field and further study is needed.

## Professional Development Workshops - Wednesday, Nov. 17, 2010

These concurrent classroom-style sessions will provide valuable learning opportunities for everyone. CCA and CCSC CEUs will be available.

| Time | Topic |
|---|---|
| 8:00 – 10:00 | **Weediness and Agronomy of New Crops.**<br>Chair, Steve Shirtliffe<br>Agronomy and Weediness of New Crops<br><br>8:00 AM Steve Shirtliffe – Intro to Session<br>8:05 AM Randy Kutcher – Implications of canola intensive crop rotations<br>8:30 AM Bill May – Agronomy and Weediness of *Camelina* and *Niger*<br>8:55 AM Nicholas Boersma – Agronomy and Weediness of *Miscanthus*<br>9:20 AM Rene Van Acker – Risks associated with transgenic crops<br>9:45 AM Panel Discussion<br>10:00 AM Coffee Break |
| 8:00 – 12:00 | **Weed Identification and Herbicide Mode of Action.**<br>Chair, Trish Meyers<br><br>o Linda Matthews, U of Saskatchewan, SK<br>o Julia Leeson, AAFC, Saskatoon, SK<br>o Lyle Cowell, Viterra, Tisdale, SK<br>o Darren Robinson, U of Guelph, ON<br>o Wendy Asbil, CFIA, Ottawa, ON<br>o Bruce Murray, Monsanto, Winnipeg, MB<br>o Linda Hall, U of Alberta, Edmonton, AB<br>o Peter Sikkema, U of Guelph, Ridgetown, ON |
| 8:00 – 12:00 | **Getting the Most Out of Agriculture Research Manager Software.**<br><br>Steven Gylling, Gylling Data Management, Brookings, South Dakota |

# Biographies of Professional Development Workshop Speakers

## Weediness and Agronomy of New Crops

**Randy Kutcher.** My interest in plants and food production lead me to complete a BSc in Agriculture, majoring in plant science from the University of Manitoba in 1981. I worked as an agronomist in special crop production with Northern Sales Co. Ltd for a number of years before enrolling in an MSc program in plant pathology, studying blackleg disease of canola under Dr. Roger Rimmer. In 1990, I began my PhD with Dr. Karen Bailey at Agriculture and Agri-Food Canada, Saskatoon looking at the inheritance of resistance, and for markers associated with resistance genes in barley to common root rot. My post-doctoral fellowship was in biological control of weeds working with Dr. Knud Mortensen and Dr. Gord Thomas, at both Regina and Saskatoon. My career as a research scientist started with Agriculture and Agri-Food Canada in Melfort in 1997 as the plant pathologist in the Sustainable Cropping Systems team. My research includes Integrated Pest Management solutions to manage field crop diseases and has focussed on canola, particularly blackleg disease management. Results of the research we have conducted in Saskatchewan indicate that the use of sustainable cultural practices combined with strategic use of genetic resistance is very effective for managing blackleg disease of canola.

**Nicholas Boersma** is pursuing his Ph.D. in the interdepartmental Plant Biology (IPB) major in the Agronomy Department at Iowa State University in Ames, IA. The goals of Nic's research are to inform the scientific community about basic physiology of Miscanthus while simultaneously providing useful information to future producers of Miscanthus in the Midwestern United States. As a member of the biomass crop production and physiology group headed by Dr. Emily Heaton, Nic's research focuses on the use of *Miscanthus* x *giganteus* as a dedicated biomass crop in Iowa. By using basic and applied approaches in the field, lab and greenhouse, Nic aims to answer questions concerning Miscanthus propagation, establishment and production in Iowa. Nic's greenhouse and growth chamber work will address basic issues of growth and senescence, while his three field sites will provide the first regionally specific information about the potential of Miscanthus as a biomass crop in Iowa. Nic is an active member of the IPB major, and currently serves as president of the graduate student organization of plant biologists.

**Dr. Rene Van Acker** is Associate Dean, External Relations for the Ontario Agricultural College, University of Guelph and Professor in the Department of Plant Agriculture. Rene was previously a professor of weed science and crop management at the University of Manitoba. His research interests include weed seedling recruitment biology and ecology, robust cropping systems, multifunctional agriculture and the coexistence of GM and non-GM crops. His research work on the coexistence of GM and non-GM crops has led to international

collaborations, presentations, and consulting work with governments and organizations in Denmark, Australia, Switzerland, Australia, the US and Canada. Rene serves several agricultural organizations and is currently on the board of the Ontario Institute of Agrologists. Rene grew up on a farm in southwest Ontario and attended the University of Guelph, obtaining a BSc and MSc degree in crop science and weed management, he also holds a PhD in crop-weed ecology from the University of Reading in the UK. Rene and his wife Susie have three children and live in Guelph.

## Weed Identification and Herbicide Mode of Action

**Linda Matthews** holds a BSA from the University of Saskatchewan and is a laboratory instructor in the Department of Plant Sciences and a distance education course instructor for the Centre for Continuing and Distance Education at the University of Saskatchewan. She instructs laboratory sessions for five undergraduate courses which include Weed Biology and Ecology, a portion of the agronomy field school and two distance education courses, which includes Weed Control. Linda also conducts various workshops covering topics in agronomy and horticulture. Presently, she is developing a weed garden at the University of Saskatchewan's Kernen Crop Research Farm. Once established, the weed garden will be used by students for weed identification. Weed seed will also be collected from the site and used to grow weed plants for laboratory sessions.

**Julia Leeson** completed both her BSc and MSc at the University of Saskatchewan through the Department of Biology. Since that time she has been working as a biologist in the Weed Ecology program at Agriculture and Agri-Food Canada in Saskatoon. Her areas of research include provincial weed surveys, farm management surveys and monitoring changes in weed populations in long-term cropping systems studies.

**Lyle Cowell** was raised on a grain farm at Star City, SK and is a graduate of the University of Saskatchewan. After completion of his formal training, Lyle continued to work for the Dept. Soil Science at the University of Saskatchewan. He first helped coordinate field projects in the Innovative Acres project, which examined new cropping and fertilizer management strategies with farmer cooperators. After completion of this project, Lyle worked in several research projects which focused on fertility and remediation of degraded soils. Lyle and his family returned to the family farm in northeast Saskatchewan, and he has worked with local farmers as a regional agrologist with Viterra for the past 14 years. While basic tenets of agronomy in soil fertility and pest control have not changed in this time, the evolution of farm management has required continued education in his career.

**Darren Robinson** is an Associate Professor in the department of Plant agriculture at the Ridgetown campus of the University of Guelph. He has a BSc from the U of Winnipeg, a MSc from the U of Manitoba and a PhD from the University of Guelph. The primary goal of

Darren's weed management research in horticultural crops is to implement integrated control strategies with new herbicides and new herbicide tank mixes in conventional and reduced tillage systems. His research focuses on improving the timeliness of application, obtaining new herbicide registrations through the URMULE system, determining the effect of previous cropping practices on weed population shifts, and analyzing the effect of previous herbicide use on carryover potential into high value crops.

**Wendy Asbil** has over 20 years of experience in teaching and research in agronomy. After earning her MSc from McGill University, she spent nine years working as a research assistant in the forages and weed management research programs at the Plant Science department of McGill. In 1997, she accepted a position as College Professor at Kemptville Campus of the University of Guelph where she taught various courses such as weed science, crop diagnostics, crop production, cropping systems, and organic production to Agriculture and Horticulture diploma students in as well as conducting crop/pest management research. In 2005, she joined the Canadian Food Inspection Agency in the Plant Health and Biosecurity Directorate where for four years she was involved with import, export and domestic phytosanitary issues in the Grains and Oilseeds section. Since December 2009, she has been the National Manager of the Invasive Plants section in the Chief Plant Health Office. She also maintains her affiliation with Kemptville Campus by teaching weed science courses and overseeing a small agronomy research program.

**Bruce Murray** has worked in the Ag industry for over 25 years. He has held positions within both industry and government, as a field researcher, manager and an extensionist. Currently he is a Technology Development Rep for Monsanto in Manitoba. Bruce earned three degrees at the University of Manitoba, a BSc in Agriculture (Plant Science), an MSc (Plant Breeding) and a PhD (Weed Ecology). Bruce, his wife Cindy and two boys, Scott and Connor, live in Carman, Manitoba.

## Getting the Most Out of Agriculture Research Manager Software

**Steven R. Gylling**, PhD is the CEO and original Program Author of the Pesticide Research Manager, PRM Summary Across Trials, PRM Accessory Pack, PRM EDI Export, and the data collector software. He has conducted plant science research and worked with research data management since 1972. His PhD is in Agronomy, with emphasis on weed control. He has worked at South Dakota State University as a weed researcher, state pesticide impact assessment coordinator, and Cooperative Extension Service computer specialist. He currently directs all software development projects at Gylling Data Management.

# Program Session Agenda

## Weed Biology / Ecology; Noxious / Invasive Weeds Control Section - 2010 Oral Presentations

**Wednesday, November 17th**

10:30 to 11:30 A.M. in the Lombardy Room

Contributed papers and discussion

Chair, Stephen Murphy, University of Waterloo

(Moderator on site to be announced)

| Time | Presenter | Author(s) | Title |
|---|---|---|---|
| 10:30-10:50 A.M. | Don Battiste & Virginia Battiste | Don Battiste, P.Ag., B.S.A, Program Director, Alberta Invasive Plants Council; Virginia Battiste, B.A., M.T.S., Administrative Coordinator, Alberta Invasive Plants Council | The Changing Face of Invasive Plants in Alberta: New Alberta Weed Control Act Proclaimed in 2010 |
| 10:50-11:10 A.M. | Donald Hare | Hare, D.D., Juras, L.T., McGregor, W.R., Turnbull, G.C., and Degenhardt, R.F. | Reclaim ™ Herbicide for management and control of woody species in range and pasture in Canada |
| 11:00-11:30 A.M. | Robert H. Gulden | Robert H. Gulden, Peter H. Sikkema, Al S. Hamill, Francois Tardif & Clarence J. Swanton | Glyphosate resistant vs. Conventional cropping systems in Ontario: Trait-based weed community analysis? |

# Abstracts for Weed Biology / Ecology; Noxious / Invasive Weeds Control Section

**The Changing Face of Invasive Plants in Alberta: New Alberta Weed Control Act Proclaimed in 2010.** Battiste[1], Don, P.Ag., B.S.A, and Battiste[2], Virginia, B.A., M.T.S., [1]Program Director, Alberta Invasive Plants Council; [2]Administrative Coordinator, Alberta Invasive Plants Council AB

**Reclaim ™ Herbicide for management and control of woody species in range and pasture in Canada**. Hare, D.D., Juras, L.T., McGregor, W.R., Turnbull, G.C., and Degenhardt, R.F. Dow AgroSciences Canada Inc. Calgary Alberta Canada.

Reclaim ™ Herbicide is a new herbicide that has been designed by Dow AgroSciences for management and extended control of undesirable woody species populations present in rangelands in Canada. During 2004-2010 Dow AgroSciences field research team conducted 192 trials to determine what various combinations of products and molecules would deliver consistent and extended control of 4 major woody brush species, including: Buckbrush (Western Snowberry) (*Symphoricarpos occidentalis)*, Prairie Wild Rose (*Rosa arkansana)*, Shrubby Cinquefoil, (*Potentilla fruiticosa)* and Wolf Willow (Silverberry) (*Elaeagnus commutate)*. The combination of products and molecules tested included: Milestone (Aminopyralid), 2,4-D, Grazon (Picloram+2,4-D) and Escort (Metsulfuron-methyl). Reclaim Herbicide provided superior control of target species Western Snowberry (96%), Wild Rose (93%), Shrubby Cinquefoil (89%), and Silverberry (98%) when evaluated 24-27 MAA. This level of control exceeded the control delivered by any commercial standard on these species, including Escort, 2,4-D or Grazon. Overall, trial data was collected for 58 species consisting of 604 individual species trial data points, including 213 data points on six woody shrub species and 391 data points on 32 herbaceous annual and perennial weed species.

**Glyphosate resistant vs. Conventional cropping systems in Ontario: Trait-based weed community analysis?** Robert H. Gulden, Peter H. Sikkema, Al S. Hamill, Francois Tardif & Clarence J. Swanton

Weed communities are complex and are influenced by agronomic, edaphic and environmental factors. This contributes to regionally unique weed communities that are difficult to compare among locations. A nominal trait-based reduction in weed community complexity followed by analysis of variance to compare the selection for common traits in response to the use of conventional (CONV) herbicides or glyphosate (GR) among diverse weed communities was performed. An experiment evaluating the weed community response to herbicide system in corn and soybean was conducted over 6 years at five locations in southern Ontario. Trait

values for each species were obtained from the literature and the relative densities were determined for the weed communities for the last 3 years of the study. As expected, trait-based analysis showed a relative increase in late recruiting species in the GR system compared to the CONV system in corn and soybean. Interestingly, this was primarily at the expense of weed species with medium initiation of recruitment, while the density of species with early initiation of recruitment was largely unaffected. There was a decrease in annual weeds in 5 of 8 instances with a concomitant increase in perennial weeds in the GR system and a reduction in grasses was observed in the GR system in 4 of 8 instances. The combined density of specific species expected to increase in GR systems was only observed in soybean at 3 of 5 locations. In corn, there was a direct replacement among these species resulting in no net increase in their total density at most locations. Trait-based reduction in weed communities proved an effective tool for testing hypotheses on the impacts of herbicide system among weed communities with substantial qualitative and quantitative differences.

# Program Session Agenda

## Weed Control in Cereals, Oilseeds & Pulses Section - 2010 Oral Presentations

**Wednesday, November 17th**

14:30 to 17:00 P.M. in the Lombardy-Umbria Room

Contributed papers and discussion

Chair, Neil Harker, AAFC, Lacombe, AB

| Time | Presenter | Author(s) | Title |
|---|---|---|---|
| 2:30 PM | Tom Wolf | Wolf, T.M.[1] and Hewitt, A.[2,3] [1]Agriculture and Agri-Food Canada, Saskatoon, SK; [2]Lincoln Ventures Ltd., Lincoln University, Christchurch, New Zealand; [3]University of Queensland, Gatton, Australia | Pros and cons of spray drift models for pesticide regulation |
| 2:50 PM | Neil Harker | Harker K.N.[1], O'Donovan J.T.[1], Blackshaw R.E.[2], Johnson E.N.[3], Holm F.A.[4], and Clayton G.W.[2] [1]Agriculture and Agri-Food Canada (AAFC), Lacombe, AB; [2]AAFC, Lethbridge, AB; [3]AAFC, Scott, SK; [4]University of Saskatchewan, Saskatoon, SK | Site characteristic effects on weed-crop competition |
| 3:10 PM | John O'Donovan | O'Donovan, John. Agriculture and Agri-Food Canada, Lacombe Research Centre, AB | Triallate resistance in wild oat is consistent through successive generations |
| 3:30 PM | Hugh Beckie | Beckie H.J.[1], Harker K.N.[2], Hall L.M.[3], Holm F.A.[4], Gulden R.H.[5] [1]Agriculture and Agri-Food Canada (AAFC), Saskatoon, SK; [2]AAFC, Lacombe, AB; [3]University of Alberta, Edmonton, AB; [4]University of Saskatchewan, Saskatoon, SK; [5]University of Manitoba, Winnipeg, MB | Risk assessment of glyphosate resistance in western Canada |
| 3:50 PM | Robert Blackshaw | Blackshaw, R.E. and Johnson, E.N. Agriculture and Agri-Food Canada Research Centers, Lethbridge, AB and Scott, SK | Saflufenacil efficacy in chickpea, field pea and lentil in western Canada |
| 4:10 PM | Mark Oostlander | Mark Oostlander, BASF Canada, Innisfail, AB | Evaluation of HEAT (KIXOR) as a harvest aid/ desiccant on western Canadian crops |

## Abstracts for Weed Control in Cereals, Oilseeds & Pulses Section

**Pros and cons of spray drift models for pesticide regulation.** Wolf, T.M.[1] and Hewitt, A.[2,3] [1]Agriculture and Agri-Food Canada, Saskatoon, SK; [2]Lincoln Ventures Ltd., Lincoln University, Christchurch, New Zealand; [3]University of Queensland, Gatton, Australia.

Prevention of off-target damage by pesticides is one of the primary goals of the pesticide risk assessment process. In several EU member countries, Canada, and recently Australia and soon the US, buffer zones are prescribed on product labels by federal regulators as deemed necessary by the application method and the toxicity of the active ingredient to non-target organisms. Models that predict the deposition of spray drift downwind of the application site are used to calculate no-spray areas, also known as buffer zones. One such model, AGDISP, addresses the behavior of aerially released material beginning after nozzle breakup into droplets, through interaction with the aircraft wake and the atmosphere, evaporation and transport to deposition through a canopy and onto the ground. This physics-based model follows the droplets with a Lagrangian particle solution technique. Although AGDISP is a valuable tool for learning about spray particle movement, several validation studies have shown that it over-estimates spray deposition on flat surfaces such as the ground at distances beyond a few hundred meters compared to empirical models, resulting in large buffer zone prescriptions that reduce user confidence. Adjustments to evaporation algorithms and other modifications may bring model and field data closer at such distances, as may handing of the airborne data to longer-range dispersion models such as CALPUFF. However, it has been suggested that the Gaussian diffusion equation which forms the basis of AGDISP's far-field deposition does not completely model spray deposition. Empirical data follow an exponential, not a Gaussian, decay function. Experimental data were fitted with various functions to show the differences between various models and AGDISP output.

**Site characteristic effects on weed-crop competition.** Harker K.N.[1], O'Donovan J.T.[1], Blackshaw R.E.[2], Johnson E.N.[3], Holm F.A.[4], and Clayton G.W.[2] [1]Agriculture and Agri-Food Canada (AAFC), Lacombe, AB; [2]AAFC, Lethbridge, AB; [3]AAFC, Scott, SK; [4]University of Saskatchewan, Saskatoon, SK

Herbicide-resistant, hybrid cultivars have greater competitive ability than previously popular open pollinated cultivars resulting in improved canola competition with weeds. However, no published research has compared the competitive ability of the new herbicide-resistant, hybrid cultivars with various small-grain cereal cultivars. Direct-seeded (no-till) experiments were conducted at five western Canada locations (Beaverlodge AB, Lacombe AB, Lethbridge AB, Saskatoon SK, and Scott SK) from 2006 to 2008 comparing the relative competitive ability of several open pollinated- and hybrid-spring canola cultivars with spring barley, rye, triticale,

and wheat. Cultivated oat was seeded across plot areas and oat biomass was used to determine the relative competitive ability of each crop cultivar. After a single pre-seeding glyphosate burn-off application, no further herbicides were applied in-crop. Generally, barley produced the greatest crop biomass and was the most competitive species; this was particularly the case when monocot weed biomass was considered. Hybrid canola produces less biomass than most cereal cultivars, but often competed well against oat. At high temperature sites most cereals were more competitive than canola. Canola was more efficient at reducing oat seed production relative to cereals at low temperature sites than at high temperature sites. Under conditions favourable to canola, several canola cultivars were more competitive with dicot weed species than any small-grain cereal. Opportunities for integrated weed management practices that rely on less frequent herbicide applications in canola are most likely in relatively low temperature environments.

**Risk assessment of glyphosate resistance in western Canada**. Beckie H.J.[1], Harker K.N.[2], Hall L.M.[3], Holm F.A.[4], Gulden R.H.[5] [1]Agriculture and Agri-Food Canada (AAFC), Saskatoon, SK; [2]AAFC, Lacombe, AB; [3]University of Alberta, Edmonton, AB; [4]University of Saskatchewan, Saskatoon, SK; [5]University of Manitoba, Winnipeg, MB

With increasing incidence of glyphosate-resistant weeds worldwide, greater farmer awareness of the importance of glyphosate stewardship and proactive glyphosate resistance management is needed. A web-based decision-support tool (http://www.weedtool.com) comprising 10 questions has been developed primarily for farmers in western Canada to assess the relative risk of selection for glyphosate-resistant weeds on a field-by-field basis. We describe the rationale for the questions and how a response to a particular question influences the risk rating. Practices with the greatest risk weighting in western Canadian cropping systems are lack of crop rotation diversity (growing mainly oilseeds) and a high frequency of glyphosate-resistant crops in the rotation. Three case scenarios are outlined – low, moderate, and high risk of glyphosate resistance evolution. Based on the overall risk rating, three best management practices are recommended to reduce the risk of glyphosate resistance in weeds.

**Triallate resistance in wild oat is consistent through successive generations**. O'Donovan, John. Agriculture and Agri-Food Canada, Lacombe Research Centre, AB

**Saflufenacil efficacy in chickpea, field pea and lentil in western Canada.** Blackshaw, R.E. and Johnson, E.N. Agriculture and Agri-Food Canada Research Centers, Lethbridge, AB and Scott, SK

A series of field experiments were conducted from 2006 through 2009 to determine the suitability of saflufenacil applied alone and in tank mixes with glyphosate for improved

preseed weed management in chickpea, field pea and lentil on the Canadian prairies. Saflufenacil has some soil residual activity so potential crop injury and residual weed control were also evaluated. Chickpea and field pea completely tolerated saflufenacil at rates up to 50 g/ha, the highest rate evaluated in our studies. However, lentil tolerance to saflufenacil was much less than these other pulse crops. Saflufenacil applied at 12.5, 18 or 25 g/ha did not injure lentil but rates of 38 or 50 g/ha often caused season-long lentil injury and concurrent yield reductions. The ranking of weed susceptibility to saflufenacil was volunteer canola > shepherd's-purse (*Capsella bursa-pastoris*) > wild mustard (*Sinapis arvensis*) > lambsquarters (*Chenopdium album*) > redroot pigweed (*Amaranthus retroflexus*) > stork's-bill (*Erodium cicutarium*) > round-leaved mallow (*Malva pusilla*) > kochia (*Kochia scoparia*) > wild buckwheat (*Polygonum convolvulus*). Saflufenacil at rates of 18 to 25 g/ha effectively improved preseed weed control compared to glyphosate alone at 450 g/ha but residual weed control was minimal at these relatively low saflufenacil rates. Saflufenacil efficacy was slightly reduced with low spray volumes of 45 L/ha compared with either 85 or 125 L/ha. Similarly, very coarse compared with medium sized spray droplets caused a slight reduction in saflufenacil efficacy. Saflufenacil tank-mixed with glyphosate can be expected to provide superior control of several weed species compared to glyphosate alone and it provides another mode of action that will aid in herbicide resistance management.

**Evaluation of HEAT (KIXOR) as a harvest aid/ desiccant on western** Canadian crops.
Oostlander, Mark, BASF Canada, Innisfail, AB

# Program Session Agenda

## Weed Control in Horticulture & Special Crops Section - 2010 Oral Presentations

**Wednesday, November 17th**

Contributed papers and discussion
14:30 to 17:00 in Tuscany Room
Chair, Rob Nurse, AAFC, Harrow, ON

| Time | Presenter | Author(s) | Title |
|---|---|---|---|
| 2:30 PM | Nathan Boyd | Boyd, N.S.[1], Burgess, P.[2] [1]Nova Scotia Agricultural College (NSAC), Truro, NS; [2]AgraPoint, Truro, NS | Rimsulfuron/Nicosulfuron use in lowbush blueberry |
| 3:30 PM | Gavin Graham | Graham, G.L., New Brunswick Department of Agriculture and Aquaculture, Fredericton, NB | Fall Glyphosate Rate and Spring Hexazinone Timing for Lambkill Control in Wild Blueberry |
| 3:50 PM | Rob Nurse | R.E. Nurse, Agriculture and Agri-Food Canada, Harrow, ON | Crop rotation and compost for weed management during the transition to organic vegetables |

# Abstracts for Weed Control in Horticulture & Special Crops Section

**Rimsulfuron/nicosulfuron use in wild blueberry (*Vaccinium angustifolium*).** Boyd, N.S.[1], Burgess, P.[2] [1]Nova Scotia Agricultural College (NSAC), Truro, NS; [2]AgraPoint, Truro, NS

Ultim 75DF (rimsulfuron/nicosulfuron) is registered for use as a spot spray on black bulrush (*Scirpus atrovirens* Willd.) in wild blueberry. Trials were conducted in commercial blueberry fields in Nova Scotia, Canada to: (1) determine the impact of application date on wild blueberry susceptibility, (2) evaluate Ultim efficacy on annual and perennial grasses, and (3) identify the adequate dose and application volume needed to control annual and perennial grasses. Damage to blueberry plants was low at all sites and yield parameters were unaffected. Blueberry plants were most susceptible at the mid June application timing and least susceptible at early application timings (mid to late May). Grass control tended to be variable across sites with greater efficacy at the 400 L $ha^{-1}$ application volume versus 200 L $ha^{-1}$. Ultim applied at 33.7 g product $ha^{-1}$ provide 70 to 100% tickle grass (*Agrostis scabra* Willd.) control. A minimum of 90% control was consistently achieved if the rate was doubled. Witch grass (*Panicum capillare* L.) control ranged between 90 and 100%. Preliminary observations suggest that in some situations Ultim may also adequately control sheep sorrel (*Rumex acetosella* L.). Our research suggests that Ultim could be registered for broadcast applications in wild blueberry fields for control of tickle grass and witch grass. We recommend that Ultim be applied at 33.7 g product $ha^{-1}$ in 400 L water $ha^{-1}$.

**Fall Glyphosate Rate and Spring Hexazinone Timing for Lambkill Control in Wild Blueberry.** Graham, G.L., New Brunswick Department of Agriculture and Aquaculture, Fredericton, NB

Lambkill (*Kalmia angustifolia*, sheep laurel) is a potentially difficult weed to control in newly established wild blueberry fields. This weed can interfere with production during subsequent cropping years if it escapes hexazinone treatment. As lambkill is still actively growing in the fall while the crop is not, a late application of glyphosate may take advantage of greater blueberry tolerance while not sacrificing the level of lambkill control. A trial was established in the fall of 2008 after the first growing cycle within a newly developed wild blueberry field in the Lavillette region of New Brunswick. The trial design was a randomized complete block with a two by five factorial treatment design, examining two rates of glyphosate and five timings of hexazinone application. Minor crop injury, represented by a delay in crop emergence, was found after glyphosate application. Recovery to commercially acceptable levels in subsequent ratings occurred. Glyphosate treatment resulted in a two-fold increase in crop yield, showing no long term effect of the early injury found. Slight activity was shown on lambkill populations with all hexazinone alone applications, provided herbicide application occurred before the rating date. The level of control from hexazinone alone is lower than what is commonly found in commercial production and would not be

commercially acceptable. All glyphosate treatments resulted in control of lambkill. There was no significant benefit to the addition of any hexazinone treatment to a previous glyphosate treatment. The use of glyphosate within early field establishment years for wild blueberry represents a safe, cost effective and efficacious management tool for lambkill control. The potential registration of this treatment through the User Requested Minor Use Label Expansion should be explored.

**Crop rotation and compost for weed management during the transition to organic vegetables.** Nurse, R.E. Agriculture and Agri-Food Canada, Harrow, ON

A field trial was established at Harrow, ON from 2007 to 2010 to evaluate the effectiveness of compost and compost plus newspaper as a weed control barrier in organic vegetables. The trial was a fully phased 4-year rotation that included processing tomatoes, pumpkins, red clover, and oats under-seeded with red clover. The compost was obtained from the municipality and contained lawn clippings, leaves, and wood chips. The newspaper was sourced as roll-ends from the local newspaper printing press and contained no ink. Compost was either applied at a 5cm thickness alone or on top of 2 layers of newspaper. Treatments included application to row middles only, crop row only, or to the entire plot. The most effective treatment in all crops was when the combination of compost and newspaper was applied to the entire plot providing >95% control of weeds 56 days after application (DAT). The least effective treatment was the application of compost alone either in the row middle or crop row which provided <50% weed control by 56 DAT. Tomato yields were 3-fold higher when compost plus newspaper was applied to the entire plot versus compost alone. Differences among treatments for pumpkin yields were less pronounced.

# Program Session Agenda

## Weed Control in Corn, Soybean and Edible Beans Section - 2010 Oral Presentations

**Thursday, November 18th**

10:00 AM to 12:00 PM in the Umbria Room

Contributed papers and discussion

Chair, Peter Sikkema, U of Guelph, Ridgetown, ON

| Time | Presenter | Author(s) | Title |
|---|---|---|---|
| | François Tardif | | Herbicide Resistance Education and Training Modules Sponsored by WSSA |
| | Kate Barrie | Barrie, Kate, Bayer CropScience, Guelph ON | Vios G3 - a concentrated, coformulated herbicide for residual weed control in RoundupReady and LibertyLink corn |
| | Clarence Swanton | Page, E.R.,W. Liu, D. Cerrudo, E.A. Lee and C. J. Swanton,. Department of Plant Agriculture, Crop Science Building, University of Guelph, 50 Stone Road E., Guelph, ON | The interaction of shade avoidance and stress |
| | Maha Afifi | Afifi, M. and C. J. Swanton. Department of Plant Agriculture, Crop Science Building, University of Guelph, 50 Stone Road E., Guelph, ON | The effect of the R:Fr ratio on maize |
| | Rob Miller | Wilson, Greg, Miller, Rob and Kraus, Trevor, BASF Canada | Saflufenacil for pre-harvest use in soybeans and drybeans |
| | Melissa McQueen | McQueen, Melissa | New residual herbicide for corn and soybeans |
| | François Tardif | | Studies on glyphosate resistant giant ragweed in Ontario |
| | Peter Sikkema | | Effect of water hardness on |

| | | | |
|---|---|---|---|
| | | | glyphosate/glufosinate activity |

## Abstracts for Weed Control in Corn, Soybean and Edible Beans Section

**Herbicide Resistance Education and Training Modules Sponsored by WSSA.** François Tardif[1], John Soteres[2], Wes Everman[3], Les Glasgow[4], Jill, Schroeder[5], David Shaw[6], and Jeff Stachler[7], [1] University of Guelph, [2]Monsanto Company, [3]Michigan State University, [4]Syngenta Crop Protection, [5]New Mexico State University, Mississippi State University, [7]North Dakota State University

Grower and agrichemical retailer herbicide resistance education and training and has been identified as a critical path in advancing the adoption of proactive best management programs to delay or mitigate the development of herbicide resistant weeds. Universities, private sector companies, crop commodity groups, and other groups have all been active in developing and distributing training materials to growers and the agricultural community at large. In February 2010, a proposal was made and accepted by the WSSA Herbicide Resistant Plants Committee (E12) and the special task force on Herbicide Resistance Education (S71) to form a team of public and private sector weed scientists (see list of authors) to review current web-based herbicide resistance training modules, with the intent to update and modify these modules as appropriate. The broad goals of the effort are to: (1) provide the most up-to-date information on causes and best methods for managing resistance, (2) increase consistency of basic messages to growers and retailers, (3) demonstrate to the public a unified public and private sector message of a science-based approach to managing resistance, and (4) increase incorporation of herbicide resistance training into formal certification programs such as the Certified Crop Advisor program. The team is developing five modules around the following questions: (1) Why is proactive resistance management important? (2) How do herbicides work and what is herbicide site-of-action? (3) What is herbicide resistance? (4) How do I identify resistance to herbicides? , and (5) How do I manage resistance? In addition, the team, in cooperation with other weed scientists and agronomists, is developing a separate module to address the specific issue of the impact of resistance management practices on conservation tillage. Each of these modules will be developed in multiple formats (web-based training, PowerPoint slides, and videos). The modules will be made available to all who wish to use them and will be maintained and freely distributed by the WSSA. WSSA will also work with grower organizations and others to develop and distribute these materials.

**Vios G3 - a concentrated, coformulated herbicide for residual weed control in RoundupReady and LibertyLink corn**. Barrie, Kate, Bayer CropScience, Guelph ON

**Examining the interaction of shade avoidance and stress on the growth, development and yield of maize (Zea mays L.).** Page, E.R.,W. Liu, D. Cerrudo, E.A. Lee and C. J. Swanton,. Department of Plant Agriculture, Crop Science Building, University of Guelph, 50 Stone Road E., Guelph, ON

The red to far-red ratio (R/FR) is a light quality signal that has been shown to alter plant growth under non-resource limiting conditions. In a previous study we confirmed that the low R/FR ratio reflected from the stem and leaf surface of weeds reduced total root volume and root biomass in maize. In addition, by the fourth leaf tip stage of maize development, roots originating from seed versus stem tissue differed in their response to the R/FR ratio. In order to provide a more mechanistic understanding of this change, we tested the hypothesis that the rate of root development up to an including the 4th leaf tip stage of maize would be reduced by the above ground reduction of the R/FR ratio. Laboratory experiments were conducted under non-resource limiting conditions using perennial ryegrass as the model weed species. In addition, the effect of the R:FR ratio on the root system of maize was tested using a non-biological far red refelectant. Under non-resource limiting conditions, the above-ground R/FR ratio reflected from the stem and leaf surface of perennial ryegrass delayed the emergence of the root radicle and initially reduced the mean relative growth rate of the entire root system from emergence until the fourth leaf tip. By the fourth leaf tip stage of maize, however, no differences in length was observed for either the radicle or seminal roots. Under weedy conditions, a delay in crown root emergence contributed to a reduction in root length. By the fourth leaf tip stage of maize, crown root length, diameter, surface area, and number were all reduced compared to crown roots grown under weed-free conditions. These results were confirmed using the non-biological Far Red reflectant. These changes in rate of root development will influence the ability of a plant to explore for limited resources and may reduce the ability of maize to respond to environmental stress.

**The effect of the R/FR ratio on maize root morphology.** Afifi, M. and C. J. Swanton. Department of Plant Agriculture, Crop Science Building, University of Guelph, 50 Stone Road E., Guelph, ON

The red to far-red ratio (R/FR) is a light quality signal that has been shown to alter plant growth under non-resource limiting conditions. In a previous study we confirmed that the low R/FR ratio reflected from the stem and leaf surface of weeds reduced total root volume and root biomass in maize. In addition, by the fourth leaf tip stage of maize development, roots originating from seed versus stem tissue differed in their response to the R/FR ratio. In order to provide a more mechanistic understanding of this change, we tested the hypothesis that the rate of root development up to an including the 4th leaf tip stage of maize would be reduced by the above ground reduction of the R/FR ratio. Laboratory experiments were conducted under non-resource limiting conditions using perennial ryegrass as the model weed species. In addition, the effect of the R:FR ratio on the root system of maize was tested using a non-

biological far red reflectant. Under non-resource limiting conditions, the above-ground R/FR ratio reflected from the stem and leaf surface of perennial ryegrass delayed the emergence of the root radicle and initially reduced the mean relative growth rate of the entire root system from emergence until the fourth leaf tip. By the fourth leaf tip stage of maize, however, no differences in length was observed for either the radicle or seminal roots. Under weedy conditions, a delay in crown root emergence contributed to a reduction in root length. By the fourth leaf tip stage of maize, crown root length, diameter, surface area, and number were all reduced compared to crown roots grown under weed-free conditions. These results were confirmed using the non-biological Far Red reflectant. These changes in rate of root development will influence the ability of a plant to explore for limited resources and may reduce the ability of maize to respond to environmental stress.

**Saflufenacil for pre-harvest use in soybeans and drybeans.** Wilson, Greg, Miller, Rob and Kraus, Trevor, BASF Canada.

The presentation will focus on results on small and field scale (research authorization) results from 2010 where Eragon (saflufenacil) was evaluated as a harvest aid product in soybeans and dry beans. Weed control and crop desiccation results will be discussed.

**New residual herbicide for corn and soybeans**. McQueen, Melissa, Valent USA Corporation

Subject matter to include summary data on Fierce herbicide containing flumioxazin and pyroxasulfone.

# Program Session Agenda

## Provincial Weed Reports and Regulatory Issues - 2010 Oral Presentations

**Thursday, November 18th**
10:00 AM to 12:00 PM in the Tuscany Room
Contributed papers and discussion
Chair, Dave Ralph, BC Ministry of Agriculture & Lands, Kamloops, BC

| Time | Presenter | Title |
|---|---|---|
| 10:00 –10:05 | Dave Ralph | Welcome and introductions |
| **10:05 - 11:40** | **Reports and Report Questions** | |
| 10:05 – 10:15 | Joe Calder | Nova Scotia |
| 10:15 – 10:25 | Gavin Graham | New Brunswick |
| 10:25 – 10:35 | Mike Cowbrough | Ontario |
| 10:35 – 10:45 | Nashir Shaikh | Manitoba |
| 10:45 – 10:55 | Clark Brenzil | Saskatchewan |
| 10:55 – 11:05 | Chris Neeser | Alberta |
| 11:05 – 11:15 | Dave Ralph | BC |
| 11:15 – 11:35 | **Questions to Report Reps All** | |
| 11:35 – 11:55 | Wendy Asbil | CFIA |
| 11:55 – 12:00 | **Questions to CFIA – All** | |

# Poster Presentations

| | |
|---|---|
| D.L. Benoit*, M.Leblanc, and E. Abel | Impact of stale seedbed and nitrate levels on weed emergence patterns in organic horticultural production system |
| Hugh J. Beckie, Chris Lozinski, Scott Shirriff | Susceptible wild oat (*Avena fatua*) endangered in Manitoba |
| Hugh J. Beckie | Predicting prairie weeds at risk of glyphosate resistance |
| Blackshaw, R.E., Molnar, L.J. and Moyer, J.R. Agriculture and Agri-Food Canada, Lethbridge, AB | Weed suppression and soil nitrogen benefits associated with legume cover crop-winter wheat intercrops. |
| Victoria Brookes and Cezarina Kora | Pest Management Centre: Successes in weed control |
| C. Swanton and K. Chandler | New herbicides for weed control in potato |
| Glenda Clezy | Weed control in SU Sunflowers |
| Mechanda, S. M., Darbyshire, S.J., Simard, M.-J., Bégin, G., and Nurse, R.E. | Preliminary investigations of genetic variation in *Eriochloa villosa* in Quebec. |
| Bailey K.L., 1 James B., 2 Melzer M, 2 Boland G, and 3 Falk S. 1 Agriculture and Agri-Food Canada, 107 Science Place, Saskatoon, SK S7N 0X2; 2 University of Guelph, Guelph, ON N1G 2W1; 3 The Scotts Company, 14111 Scottslawn Rd., Marysville, OH 43041 | Do fertilizers affect the efficacy of the bioherbicide *Phoma macrostoma*? |
| Michael Downs | The Canadian regulatory approach to herbicide resistance management |
| Pat Forsyth | Invasive weed control with Aminocyclopyrachlor |
| Donald Hare | Reclaim herbicide - Control of invasive perennial weed and brush species in range and pasture |
| Brian M. Jenks | Crop desiccation with saflufenacil |
| S. Phelps, H. Schell, C. Gampe, E. Johnson, T. | Aminocyclopyachlor controls leafy spurge (*Euphorbia esula* L.) in grassland |

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| Wolf, and B. Caldwell | |

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| Leeson, Julia and Neeser, Chris | Weed populations shifts in Alberta - 1970s to 2010 |
| Légère A, Beckie HJ, Hrynewich b, Lozinski C, Johnson, E, Warwick SI, Stevenson FC | Kochia growth according to ALS mutations (Pro197 & Trp574) and geographical origin (AB, SK, MB) |
| Légère A, Beckie HJ, Hrynewich b, Lozinski C, Johnson, E, Warwick SI, Stevenson FC | Kochia with ALS mutations: the Manitoba conundrum |
| Légère A, Stevenson FC, Vanasse A, Lalonde O | Conservation tillage in organic and herbicide-free corn and soybean: the weed management challenge |
| Lisa Raatz, Richard Krygier, Alexander Pswarayi, and Linda Hall | Herbicide tolerance screening in biomass crops, willow and poplar |
| K.L. Sapsford, F.A. Holm, E.N. Johnson and H.J. Beckie | Searching for a herbicide to Control Group 2 (ALS) resistant cleavers (*Galium aparine*) in pulse crops |
| Simard, M.-J, Darbyshire, S.J, Nurse, R.E. and Owen, M.D.K. | Comparative seed predation of woolly cupgrass (*Eriochloa villosa*) and yellow foxtail (*Setaria glauca*) along a field border in Québec. |
| Soltani, N., Shropshire, C., and Sikkema, P.H. | Tolerance of spring cereals to mesotrione |
| Soltani, N., Nurse, R.E. , Shropshire, C. , and Sikkema, P.H. | Weed management in cranberry bean with linuron |
| Sikkema, P.H., Wilson, G.C., Robinson, D.E., Swanton, C.J., Tardif, F.J., Shropshire, C., and Soltani, N. | Competitiveness and control of volunteer cereals in corn |
| F. J. Tardif, M. J. Cowbrough and P. J. Smith | Giant hogweed and wild chervil are effectively controlled by aminocyclopyrachlor |
| Ulrich, D.J., Johnson, E.N., and Ford, G.A. Agriculture and Agri-Food Canada (AAFC), Scott, SK. | Screening herbicides to control broadleaf weeds in common buckwheat (*Fagopyrum esculentum*) |
| Thomas Wolf | Water balance comparison for two biobed designs |
| Robert H. Gulden | Where's the brome? |

# Abstracts for Posters

**Predicting prairie weeds at risk of glyphosate resistance**. Beckie H.J. Agriculture and Agri-Food Canada, Saskatoon, SK

Main risk factors for the evolution of herbicide-resistant weeds are recurrent application of highly efficacious herbicides with the same site of action and annual weed species that occur at high population densities, are widely distributed, prolific seed producers, and have efficient gene (seed or pollen) dissemination. Selection pressure (efficacy, soil persistence, frequency of application) has the greatest impact on herbicide resistance evolution. Herbicide applied in-crop generally result in the greatest selection pressure compared with other application timings. Other factors controlling the evolution of resistance include initial frequency of resistance alleles prior to herbicide use, fitness of resistant vs. susceptible biotypes, and seed bank longevity (buffering capacity). Making predictions is risky business, but 'best guesses' or speculation may spur discussion and debate. Glyphosate selection pressure for a weed was estimated based on the (1) relative abundance of the top ten species (plus wild mustard, *Sinapis arvensis* L.) in the semiarid Grassland and subhumid Parkland regions of the Canadian prairies; (2) proportional weed emergence (as a function of soil growing degree-days (GDD) base 0 C under conservation tillage) at glyphosate application at preseeding (early May, 250 GDD), in-crop (early June, 650 GDD and late June, 850 GDD), and post-harvest (September, >1000 GDD); and (3) glyphosate efficacy for each weed based on weed expert consensus. The risk ranking of a species was calculated as total selection pressure divided by average seed bank longevity. In the Grassland region, the top three weeds predicted at greatest potential risk of glyphosate resistance are kochia [*Kochia scoparia* (L.) Schrad.], wild oat (*Avena fatua* L.), and green foxtail [*Setaria viridis* (L) Beauv.], respectively; in the Parkland region, wild oat, green foxtail, and cleavers (*Galium aparine* L.) are the top three species.

**Susceptible wild oat (*Avena fatua* L.) endangered in Manitoba**. Beckie H.J., Lozinski C., Shirriff S. Agriculture and Agri-Food Canada, Saskatoon, SK

A survey of weeds resistant to herbicides in 300 randomly selected fields was conducted across the major agricultural ecoregions of Manitoba in 2008. All residual weed species with mature seeds were mapped and sampled before harvest. Selected fields were cropped to cereals, oilseeds, or pulses. Samples of weed species were subsequently screened in the greenhouse with herbicides with different modes of action. Herein, we summarize results of group 1 (ACCase inhibitor) and group 2 (ALS inhibitor) testing. Of 198 fields where wild oat samples were collected, 62% had a herbicide-resistant population: group 1, 55% (vs. 40% in 2002); group 2, 18% (vs. 13% in 2002); group 8, 11% (not tested in 2002); group 1 and 2, 13% (vs. 8% in 2002); group 1 and 8, 8%; group 2 and 8, 5%; and group 1 and 2 and 8, 4%.

Therefore, just over one-third of fields with wild oat in Manitoba have herbicide-susceptible populations. Of 91 fields where green foxtail [*Setaria viridis* (L.) Beauv.] samples were collected, 44% had a group 1-resistant population. The incidence of group 1 resistance in green foxtail has doubled in six years; in the 2002 survey, 22% of fields with green foxtail had a herbicide-resistant population. Incidence of group 2 resistance in broadleaf weed species was low, with a single resistant population of chickweed [*Stellaria media* (L.) Vill.], cleavers (*Galium aparine* L.), and wild mustard (*Sinapis arvensis* L.). The results of this survey highlight the continuing rapid decline in field frequency of herbicide-susceptible wild oat and green foxtail, the two most abundant weeds in Manitoba.

**Impact of fall green manure on weed emergence, microbial activity and total soil nitrogen.** Benoit D.L.[1], Abel È.[2], Leblanc M.[3] and Jobin É.[4]. [1]Agriculture et Agroalimentaire Canada (AAC), Centre de recherche et développement en horticulture, Saint-Jean-sur-Richelieu (Québec); [2]Département de phytotechnie, Université Laval, Québec (Québec); [3]Institut de recherche et de développement en agroenvironnement (IRDA), Saint-Hyacinthe (Québec); [4]Centre de recherche agroalimentaire de Mirabel (CRAM), Sainte-Scholastique (Québec).

Full season or inter cropping green manure is used extensively to maintain soil fertility and improve soil structure. Little is known about the interaction between soil nitrogen availability, microbial activity and weed emergence in fall green manure. A study was set up in 2004 and 2005 at 3 locations (L'Acadie, Mirabel and Saint-Bruno) in the Saint-Lawrence valley near Montreal in Quebec where the objective was to document these interactions in two fall seeded green manure (buckwheat & red clover). The experimental design was a split-plot with three repetitions. The main plot was the two green manure crops, each seeded at 350 grains/m² and a control with no green manure. Data collected was 1) weekly weed emergence counts and biomass harvesting in two 25 cm x 50 cm quadrats/plot, 2) two composite soil samples collected 3 times (after summer crop harvest, before seeding green manure & 15 days after incorporating green manure) to measure microbial activity as phosphotase alkaline levels and to measure total nitrogen by Kjeldahl method in soil subsamples and 3) total nitrogen in dried biomass tissues. There were no statistical differences in total soil nitrogen between plots with or without green manure at all sites. There were no statistical differences in weed densities between buckwheat, red clover or unseeded control at all three locations. The choice between red clover, buckwheat and a weedy fallow is dictated by the soil properties, the site location, and the average fall and winter climatic conditions. The choice between buckwheat and red clover had no influence on total nitrogen supplied by the green manure biomass, on soil microbial activity in the fall and on fall weed emergence in the green manure.

**Weed suppression and soil nitrogen benefits associated with legume cover crop-winter wheat intercrops.** Blackshaw, R.E., Molnar, L.J. and Moyer, J.R. Agriculture and Agri-Food Canada, Lethbridge AB

A series of multi-year field experiments were conducted at Lethbridge, Alberta to determine the merits of establishing alfalfa, red clover, or Austrian winter pea cover crops in fall or in spring with winter wheat. Main plots were the various under-seeded legumes and subplots were the seeding date of the legumes. Data collected included winter wheat and cover crop densities, weed biomass, winter wheat yield, soil nitrogen, and following canola yield. Spring-planted legumes emerged well within the winter wheat crop but their growth was limited under these semi-arid conditions. Fall-planted red clover suffered winter kill in 2 of 3 experiments. Fall-planted winter pea survived the winter conditions but reduced winter wheat yield by 23 to 37% compared to the no cover crop control. In contrast, fall-planted alfalfa exhibited good winterhardiness, did not reduce winter wheat yield, and contributed an extra 18 to 20 kg $ha^{-1}$ of available soil N at the time of seeding the following spring canola crop. Additionally, fall-planted alfalfa caused a 50-60% reduction in biomass of flixweed (*Descurainia sophia*), annual sowthistle (*Sonchus oleraceus*) and kochia (*Kochia scoparia*). Succeeding canola yield was increased in 2 of 3 experiments with the alfalfa-winter wheat intercrop; primarily due to higher soil nitrogen levels. Further research is warranted to better understand the agronomic and economic benefits of alfalfa-winter wheat intercrops under a wider range of environmental conditions.

**Pest Management Centre: Successes in weed control.** Brookes, Victoria and Kora, Cezarina. Pest Management Centre, Agriculture and Agri-food Canada. 960 Carling Ave., Ottawa ON

The PMC's Minor Use and Pesticide Risk Reduction Programs work together to improve grower access to new minor uses and reduced risk pest management tools in grower-identified priority areas. Since its inception, the Minor Use Pesticides Program has completed over 95 submissions for new uses of 34 different herbicide products. This has resulted in 59 registrations on 38 crops. The Pesticide Risk Reduction Program has provided funding for 23 projects to develop and refine alternative and reduced risk approaches to integrated weed control issues in a number of crops. Highlights of a few of many successful outcomes achieved to date through PMC activities in the weed management area are presented.

**Do fertilizers affect the efficacy of the bioherbicide, *Phoma macrostoma*?** Derby, J.[1], Bailey, K.L.[1], James, B.[1], Boland, G.[2], Melzer, M.[2], and Falk, S.[3] [1]Agriculture & Agri-Food Canada, Saskatoon, SK; [2]Department of Environmental Biology, University of Guelph, Guelph, ON; [3]The Scotts Company, Marysville, OH

- *Phoma macrostoma* (Montag.) is a fungus that is being developed as a bioherbicide for control of broadleaved weeds in turfgrass.
- High-quality lawns require maintenance that often includes the use of commercial fertilizers and synthetic herbicides.

- However, bioherbicides have living components which may be affected by high concentrations of minerals and salts in commercial fertilizers.
- The objective of this study was to evaluate the effect of commercial fertilizers on the efficacy of P. macrostoma under natural dandelion infestations in turfgrass.

**The Canadian regulatory approach to herbicide resistance management.** Downs, M.P., Pest Management Regulatory Agency (PMRA), Health Canada, Ottawa ON

Health Canada's Pest Management Regulatory Agency (PMRA) is responsible for pesticide regulation in Canada under the authority of the *Pest Control Products Act*, which states that it is in the national interest that pest control products be regulated in a manner that supports sustainable development, and that the federal regulatory system be designed to encourage the development and implementation of sustainable pest management strategies. The PMRA registers pesticides only if science-based evaluations show they have value and will pose no unacceptable risks to human health or the environment. Pesticide resistance risk and resistance management are considered during the value assessment when scientists review information related to how effectively the pesticide controls the target pests, any adverse effects on the host crop, its contribution to sustainability, and any related social or economic impacts.

Regulatory Directive DIR99-06 (Voluntary Pesticide Resistance-Management Labelling Based on Target Site/Mode of Action) provides a framework for pesticide classification schemes based on target site/mode of action, identifies a standard format for displaying group identification symbols on product labels, and includes guidance for the preparation of resistance management wording to include in the use directions on product labels. At present, approximately 80% of currently registered commercial class herbicides contain resistance management statements.

Regulators can only influence sources of resistance risk related to how pesticides are used, and this is limited to the registration process – little influence is possible when the products are being used. Therefore, it is important that regulators work in partnership with researchers, extension specialists, industry and growers to ensure that product labels are being read and understood, best practices to delay or manage herbicide resistance are being followed, and that regulatory recommendations are consistent with these best practices.

**Invasive weed control with Aminocyclopyrachlor** Forsyth P.G[1]., Hunter L.E[2]., Summers W.J[2]. [1]E.I. DuPont Canada Co., Wetaskiwin, AB., [2]E.I. DuPont Canada Co., Mississauga, ON., 3 E.I. DuPont Canada Co., Mississauga, ON

Aminocyclopyrachlor is a new broad-spectrum herbicide discovered by DuPont Crop Protection.

**Reclaim ™ Herbicide control of invasive perennial weed and brush species in range and pasture in Canada**. Hare, D.D., Juras, L.T., McGregor, W.R., Turnbull, G.C., and Degenhardt, R.F. Dow AgroSciences Canada Inc. Calgary, AB

Reclaim ™ Herbicide is a new herbicide that has been designed by Dow AgroSciences for management and extended control of undesirable woody species populations present in rangelands in Canada. During 2004-2010 Dow AgroSciences field research team conducted 192 trials to determine what various combinations of products and molecules would deliver consistent and extended control of 4 major woody brush species, including: Buckbrush (Western Snowberry) (*Symphoricarpos occidentalis)*, Prairie Wild Rose (*Rosa arkansana)*, Shrubby Cinquefoil, (*Potentilla fruiticosa)* and Wolf Willow (Silverberry) (*Elaeagnus commutate)*. The combination of products and molecules tested included: Milestone (Aminopyralid), 2,4-D, Grazon (Picloram+2,4-D) and Escort (Metsulfuron-methyl). Reclaim Herbicide provided superior control of target species Western Snowberry (96%), Wild Rose (93%), Shrubby Cinquefoil (89%), and Silverberry (98%) when evaluated 24-27 MAA. This level of control exceeded the control delivered by any commercial standard on these species, including Escort, 2,4-D or Grazon. Overall, trial data was collected for 58 species consisting of 604 individual species trial data points, including 213 data points on six woody shrub species and 391 data points on 32 herbaceous annual and perennial weed species.

**Crop desiccation with saflufenacil**. Jenks, Brian M., Willoughby, Gary P., and Hoefing, Jordan L. North Dakota State University, Minot, ND

Paraquat is the primary desiccant used in North Dakota and is labeled for use in dry pea, lentil, chickpea, sunflower, dry bean, and soybean. Diquat is labeled for use only in canola and potato. There is no desiccant labeled for use in flax or safflower. Glyphosate is labeled for pre-harvest weed control in many crops. In recent years, flumioxazin and saflufenacil have been labeled for desiccant use in dry bean and sunflower, respectively. The objective of this study was to evaluate saflufenacil as a pre-harvest desiccant in lentil, dry pea, chickpea, dry bean, safflower, and flax. Treatments included an untreated control, saflufenacil (50 g/ha), saflufenacil + glyphosate (25 g + 840 g ae), and glyphosate (840 g ae) compared to paraquat (420 g), diquat (420 g), or flumioxazin (72 g) depending on the crop. Treatments were evaluated visually 3, 7, 10, and 14 days after treatment (DAT). Evaluations included percent desiccation of leaves, stems, heads, and pods. Diquat and paraquat generally provided faster desiccation than other treatments 3 and 7 DAT. Saflufenacil alone or tank mixed with glyphosate generally required 10-14 days to achieve equivalent desiccation as paraquat or diquat. Crop desiccation with glyphosate was generally slower compared to other treatments, but provided faster activity than normally expected likely due to warm conditions after application. Saflufenacil alone or tank mixed with glyphosate desiccated dry bean leaves, stems, and pods similar to or faster than flumioxazin.

**A Preview of Residual Weed Population Shifts in Alberta – 1970s to 2010. Leeson[1], Julia Y. and Neeser[2], Chris.** [1]Agriculture and Agri-Food Canada, Research Centre, Saskatoon, SK; [2]Alberta Agriculture and Rural Development (AARD), Brooks, AB

Objectives

•Compare the relative abundance of weeds in Alberta in 2010 with results from the 2001, 1997, 1987-1989 and 1973-1977 provincial surveys
•Identify recent shifts in selected weed populations

**Preliminary investigations of genetic variation in *Eriochloa villosa* from four sites in Quebec.** Mechanda, S.[1], Darbyshire, S.J.[1], Simard, M.-J.[2] Bégin, G.[2] and Nurse, R.E.[3].[1]Agriculture and Agri-Food Canada (AAFC), Ottawa, ON, .[2]AAFC, Québec, QC,.[3]AAFC, Harrow, ON

Woolly cup grass (*Eriochloa villosa*), is a weedy grass introduced to North America from eastern Asia and now a relatively common weed in the northern corn and soybean growing areas in the United States. Since 2001, it has been found at a number of sites in southern Quebec. Once established woolly cup grass mangement is difficult, requiring sequential herbicide application, sanitation, cultivation and crop rotation to suppress infestations and reduce further spread. Genetic structure within and between weed populations is influenced by various intrinsic and external factors and understanding these is important in developing effective mangement strategies. Microsatellites are short tandemly repeated DNA sequences occurring in the nuclear and chloroplast genomes. Since they are usually within non-coding regions, they tend to be highly variable. Microsatellite analysis was used as an estimate the genetic structure and diversity in *E. villosa* populations from four sites in Quebec and one from the United States (Iowa). Examination of 3 nuclear and 2 chloroplast loci detected a total of 38 alleles. All samples, within and between populations, showed identical patterns across the five loci, except at one chloroplast locus in one population from Quebec. The limited variation observed may be attributable to a genetic bottle-neck associated with the species' introduction and the apparently complete cleistogamous reproduction of North American populations.

**Aminocyclopyachlor Controls Leafy Spurge (*Euphorbia esula* L.) in Grassland**
**S.M. Phelps[1], H.J. Schell[2], C.A. Gampe[2], E.N. Johnson[2], T.M. Wolf[3] and B.C. Caldwell[3].**
[1]Saskatchewan Ministry of Agriculture, 1192 102nd Street, North Battleford, SK S9A 1E9; [2]Agriculture and Agri-food Canada, Scott Research Farm, Scott, SK; [3]Agriculture and Agri-food Canada, Saskatoon Research Centre, Saskatoon, SK

Leafy spurge (*Euphorbia esula* L.) is a perennial noxious weed that is problematic in forages and rangeland in the Northern Great Plains. Aminocyclopyrachlor, a new pryimidine carboxylic acid herbicide under development by E.I. DuPont Canada Company, has exhibited activity on a wide range of non-cropland broadleaf weed species. It is formulated as a methyl-ester (DPX-KJM44) or free-acid (DPX-MAT28). Three field experiments were conducted near Battleford, SK in 2007, 2009 and 2010 to determine the optimum rate of aminocyclopyrachlor to control leafy spurge and to determine if the two formulations provide equivalent control of leafy spurge. Herbicide treatments in the 2007 study included: DPX-KJGM44 applied at rates of 15, 30, 60, 120, and 240 g ai $ha^{-1}$; and DPX-KJM44 tank-mixed

with metsulfuron at respective rates of 30 and 15 g ai $ha^{-1}$. The treatments in the 2009 and 2010 test included: DPX-MAT28 at rates of 30 and 60 g ai $ha^{-1}$; DPX-KJM44 applied at a rate of 30 g ai $ha^{-1}$; and DPX-MAT28 applied in combination with either chlorsulfuron or metsulfuron at various rates. In all studies, picloram / 2,4 D at 2135 g ai $ha^{-1}$ was used as an industry standard for phytotoxicity and efficacy comparisons. Both formulations of aminocylcopyrachlor were slower acting the picloram/ 2,4-D standard but provided similar or better long-control of leafy spurge 58 to 110 weeks after application. Aminocylcopyrachlor was less injurious to grasses than the industry standard. A 60 g ai ha-1 rate of either formulation of aminocyclopyrachlor was required for long-term control of leafy spurge. Tank-mixing aminocyclopyrachlor with sulfonylurea herbicides did not improve long-term control. Efficacious control of leafy spurge and the favourable environmental profile of aminocylopyrachlor should provide producers and vegetation managers with an effective option for controlling this invasive species in future years.

**Searching for a Herbicide to Control Group 2 (ALS) Resistant Cleavers (*Galium aparine*) in Pulse Crops.** Sapsford K.L.[1], Holm F.A.[1], Johnson E.N.[2] and Beckie H.J.[3] [1]Dept of Plant Sciences, University of Saskatchewan, Saskatoon, Sk., [2]Agriculture and Agri-Food Canada, Scott, Sk., [3]Agriculture and Agri-Food Canada, Saskatoon, SK.

Cleavers, *Galium aparine*, has increased in frequency in Western Canada over the past 4 decades, from the 43rd most abundant weed in the 1970's surveys to the 9th most abundant weed in the 2000's surveys. The 2001 Alberta survey for herbicide-resistant weeds found no Group 2-resistant cleavers. In the 2007 survey, 17% of the cleavers fields were found to have Group 2-resistant cleavers. Most herbicides that are registered to control broad-leaved weeds in pulse crops are Group 2 (ALS inhibitors). Therefore they will not control Group 2-resistant cleavers. The non-Group 2 herbicides that are registered on pulse crops are not effective against cleavers or, at best, only suppress this species. Trials in Saskatchewan were started in Saskatoon, Scott, Melfort and Choiceland in 2010 to look at alternative products to control Group 2-resistant cleavers. These included sulfentrazone (Group 14), linuron (Group 7), ARY-ALS7HPPS (Group 15) plus other non- registered herbicides that may be available to Western Canadian pulse crop producers in the future. All of these herbicides were applied with and without the addition of bentazon (Group 6). In the fall of 2010, trials will be initiated to evaluate these herbicides in combination with ethalfluralin (Group 3) to determine if the combination of products and modes of action will be the best strategy to control Group 2-resistant cleavers. Initial trial results from 2010 have shown good cleavers control with sulfentrazone, however, the rate may have to vary depending on soil organic matter level. Linuron did not control cleavers; ARY-AlS7HPPS showed some activity, but did not control this weed. The addition of bentazone did not significantly increase cleavers control. These trials will continue over the next few years. Hopefully, we will have an answer to a growing problem for pulse crop producers in Western Canada in the not-too-distant future.

**Comparative seed predation of woolly cupgrass (*Eriochloa villosa*) and yellow foxtail (*Setaria pumila*) along a field border in Québec.** Simard, M.-J.[1], Darbyshire, S.J.[2], Nurse, R.E.[3] and Owen, M.D.K.[4] [1]Agriculture and Agri-Food Canada (AAFC), Québec, QC, [2]AAFC, Ottawa, ON, [3]AAFC, Harrow, ON, [4]Iowa State University, Ames, IA.

Although post-dispersal seed predation can lower weed seed banks and modify weed community dynamics, it receives limited attention in weed science. The seed predation of weeds that are currently expanding their distribution to geographic regions located far away from their native range, like woolly cupgrass (*Eriochloa villosa*), has received even less attention. Of East Asian origin, this species is now present in the United-States and Canada. Our goal was to compare seed loss attributed to ground seed predation, of woolly cupgrass to that of an established weed introduced from Europe, yellow foxtail (*Setaria pumila*). The experiment was set in a field border located in Bedford (Quebec, Canada) where woolly cupgrass was discovered in 2008. "Predation cards" that included 20 glued seeds of each species were placed either a) on the ground unprotected, b) under a 1.2 cm mesh cage (to exclude vertebrate predation) or c) 10 cm from the ground, in a 0.1 cm mesh box lined with sticky tape (to exclude all predators). The experimental design included three factors, 1) predation type (vertebrate or invertebrate), 2) species (woolly cupgrass and yellow foxtail) and 3) plot composition/management (cards were installed in 1 $m^2$ plots that had different crops or weed management practices, for a total of seven plots types). The design also included four blocks, two years (2009 & 2010) and repeated measures (sampling dates from July to September). Higher yellow foxtail seed loss was observed compared to woolly cupgrass, especially on ground cards protected by 1.2 cm mesh ($p<0.001$). Results suggest invertebrate seed predation was higher for yellow foxtail than woolly cupgrass.

**Weed management in cranberry bean with linuron**. Soltani, N.[1], Nurse, R.E.[2], Shropshire, C.[1], and Sikkema, P.H.[1]. [1]University of Guelph Ridgetown Campus, Ridgetown, ON; [2]Agriculture and Agri-Food Canada, Harrow, ON.

Field studies were conducted at the Huron Research Station near Exeter, Ontario in 2006 to 2009 to determine if the sequential application of trifluralin plus imazethapyr applied preplant incorporated (PPI) followed by linuron applied preemergence (PRE) at various doses can be used as an effective weed management strategy in cranberry bean production. There was minimal crop injury (6% or less) with various herbicides evaluated at 1 and 4 weeks after emergence (WAE). Trifluralin plus imazethapyr applied PPI provided 97 to 100% control of *Chenopodium album*, 100% control of *Amaranthus retroflexus*, 99 to 100% control of *Sinapis arvensis*, 93 to 100% control of *Ambrosia artemisiifolia*, and 97 to 100% control of *Setaria viridis*. Linuron applied PRE provided 11 to 100% control of *C. album*, 90 to 100% control of *A. retroflexus*, 78 to 100% control of *S. arvensis*, 71 to 100% control of *A. artemisiifolia*, and 20 to 100% control of *S. viridis.* The sequential application of trifluralin plus imazethapyr applied PPI followed by linuron applied PRE at various doses provided 100% control of *C.*

*album*, 100% control of *A. retroflexus*, 100% control of *S. arvensis*, 96 to 100% control of *A. artemisiifolia*, and 97 to 100% control of *S. viridis.* Weed density and shoot dry weight correlated well with the level of weed control. All of the herbicide treatments evaluated increased cranberry bean yield compared to the weedy control. Based on these results the sequential application of imazethapyr plus trifluralin applied PPI followed by linuron applied PRE at 1000 and 2500 g ai $ha^{-1}$ provides a safe and efficacious weed management strategy in cranberry bean production.

*Keywords:* Crop injury; 'Etna'; imazethapyr; linuron; *Phaseolus vulgaris* L.; trifluralin

**Tolerance of spring cereals to mesotrione**. Soltani, N., Shropshire, C., and Sikkema, P.H. University of Guelph Ridgetown Campus, Ridgetown, ON.

There is little information on the response of spring planted barley (*Hordeum vulgare* L.), oats (*Avena sativa* L.) and wheat (*Triticum aestivum* L.) to mesotrione under Ontario environmental conditions. Four field studies were conducted in Ontario, Canada over a two year period (2008 and 2009) to evaluate the sensitivity of spring planted cereals (barley, oats, and wheat) to pre-emergence (PRE) and post-emergence (POST) applications of mesotrione at 50, 100, and 150 g ai $ha^{-1}$. Mesotrione applied PRE caused minimal injury at 3, 7, 14 and 28 days after emergence (DAE) and had no adverse effect on plant height or yield of barley, oats and wheat. Mesotrione applied POST caused as much 11% injury and reduced plant height as much as 6% in spring planted cereals. Injury was higher in wheat compared to barley or oats. Mesotrione applied POST had no adverse effect on the yield of barley or oats but decreased the yield of wheat as much as 14%. Based on this study, mesotrione applied PRE at 50, 100 or 150 g ai $ha^{-1}$ can be safely used in spring planted barley, oats, and wheat. Mesotrione applied POST at the proposed dose of 50, 100 or 150 g ai $ha^{-1}$ can also be safely used in spring planted barley and oats. However, mesotrione applied POST results in unacceptable injury in spring planted wheat.
*Keywords:* Barley; height; herbicide sensitivity; oats; tolerance; yield; wheat

**New herbicides for weed control in potato.** Swanton, C.J. and Chandler, K. . Department of Plant Agriculture, Crop Science Building, University of Guelph, 50 Stone Road E., Guelph, ON

Potato growers in Canada rely on a very limited number of herbicides for broadleaf weed control. Metribuzin and linuron are two of the most important herbicides used by growers to control these weeds. Throughout Canada, weed resistance has been reported in several potato growing areas to both herbicides. Field research has been conducted in Ontario to obtain new herbicide registrations with the assistance of the Agriculture and Agri-Food Canada minor use program. This research has identified several new herbicides that will be of benefit to growers once registration has been achieved.

**Giant hogweed and wild chervil are effectively controlled by aminocyclopyrachlor**.
Tardif, F. J., Cowbrough, M. J. and Smith, P. J.

**Screening herbicides to control broadleaf weeds in common buckwheat (*Fagopyrum esculentum*).** Ulrich, D.J., Johnson, E.N., and Ford, G.A. Agriculture and Agri-Food Canada (AAFC), Scott, SK.

The federal pesticide minor use program has identified broadleaf weeds as a major pest in tame buckwheat through the priority setting process. A crop tolerance field screening study was initiated at the Scott research farm to identify herbicides that exhibit acceptable crop safety. Trials were conducted on a medium textured loam soil with 3.6% organic matter and pH of 6.1. Pre emerge treatments consisted of clomazone at 140 and 280 ai ha-1, KIH-485 at 209 and 512 g ai ha-1, mesotrione at 140 and 280 g ai ha-1, s-metolachlor at 1582 and 3164 g ai ha-1, and linuron at 1500 and 3000 g ai ha-1. Post emerge treatments at the 4 leaf growth stage included quinclorac at 100 and 200 g ai ha-1, metribuzin at 150 and 300 g ai ha-1 and metsulfuron at 4.45 and 8.9 g ai ha-1. In terms of ranking for crop safety, clomazone applied pre-emergence provided the lowest injury; however, the 2X rate failed to provide <10% crop injury until 54 days after emergence. Quinclorac applied at the 4-lf stage ranked second with 52 days required after treatment to recover from initial injury. Mesotrione ranked third but injury was unacceptable. S-metolachlor, linuron applied PRE-, and metribuzin and metsulfuron applied post resulted in unacceptable levels of crop injury. General crop injury took the form of stunted growth, reduction in flowering and delayed maturity or mortality. A trend of increasing days to maturity was associated with increasing levels of visual crop injury (r=0.83) across all treatments. Quinclorac and the high rate of clomazone delayed maturity by 2 days relative to the untreated check. Despite unacceptable early season injury quinclorac treatments averaged 37% more seed production than the untreated check, reflecting possible growth regulatory affects, followed by clomazone treatments that produced 8% more and mesotrione with 11% less than the untreated check. A high seed yield coefficient of variability of 35% was likely a function of sloped land, potential lateral/vertical movement of active ingredient from high rainfall and incomplete weed control. The lack of season long crop safety among the products evaluated and clomazone's limited spectrum of broad leaf weed control suggests a need for further screening work to evaluate other broadleaf herbicide chemistries and herbicide mixes, and to investigate the impact of lower application rates and seed mutagenesis to search for buckwheat herbicide resistance.

**Competitiveness and control of volunteer winter cereals in corn**. Wilson, G.C., Sikkema, P.H., Robinson, D.E., Swanton, C.J., Tardif, F.J., Shropshire, C., and Soltani, N. University of Guelph Ridgetown Campus, Ridgetown, ON.

Fourteen field experiments were conducted over a two-year period (2006-2007) at four Ontario locations to evaluate volunteer winter cereal competitiveness and control in corn. The level of competitiveness was dependent on the density of volunteer wheat and environmental conditions. Volunteer wheat competition in corn resulted in the reduced emergence of corn leaf collars. Furthermore, volunteer wheat competition reduced total leaf area by 66%, leaf dry weight by 54%, shoot dry weight by 66%, plant and ear height by 49%, and yield as much

as 66% compared to the weed-free control. Foramsulfuron, nicosulfuron and nicosulfuron/rimsulfuron provided greater than 70% control of volunteer cereals, while primisulfuron and rimsulfuron provided greater than 60% control. The early application timing provided greater than 82% control of the volunteer cereals. Volunteer cereal control at the late application timing was 61% and higher. Hard red winter wheat control ranged from 84 to 93%, soft red and soft white winter wheat control ranged from 76 to 87%, and fall rye control was 56 to 71% at 56 days after treatment. Early herbicide application resulted in improved control of volunteer cereals and higher corn yield.

**Water balance comparison for two biobed designs.** Wolf, T.M.[1], Caldwell, B.C.[1], Belyk, M.[2], Cessna, A.J.[3], Knight, J.D.[4], Farrell, R.[4] and Ngombe, D.L.[1,4] [1]Agriculture and Agri-Food Canada, Saskatoon, SK; [2]Bayer CropScience, Regina, SK, [3]National Hydrology Research Centre, Environment Canada, Saskatoon, SK; [4]Dept. of Soil Science, University of Saskatchewan, Saskatoon, SK.

Biobeds were established in Saskatoon and Indian Head, SK, in 2009 to measure pesticide degradation, microbial biomass, and moisture dynamics in the biobed matrix. Three biobeds, measuring approximately 3 m x 3 m x 1 m deep, were lined with an impermeable geo-membrane to prevent leaching of pesticide to ground water. Two biobeds were built below ground: one was built above ground. A lysimeter was installed to remove free water from the bottom of each biobed, and moisture status of the biobed matrix was measured at various depths throughout the season. Grass cover was established on the biobed surfaces. In 2010, rainfall between April 1 and August 31 contributed 509 L/m$^2$ to the biobeds in Saskatoon (one above, one below ground), and 854 L/m$^2$ in Indian Head. At Saskatoon, water pumped from the lysimeters was discarded early in the season (238 and 77 L/m$^2$ for below- and above-ground biobeds, respectively), whereas all water pumped from the Indian Head biobed was eventually recirculated to the biobed matrix Additional water was added to the biobeds when herbicide treatments were made. It was estimated that evapotranspiration by grass cover removed 320 and 498 L/m$^2$ in the Saskatoon below- and above-ground biobeds, respectively, and 1224 L/m$^2$ in the Indian Head biobed. Soil moisture measurements showed increased moisture with depth in the Saskatoon biobeds and that saturated conditions occurred in only the below-ground biobed and only at the 100-cm depth. At Indian Head, saturated conditions existed at all depths for part of the season. The biomix of the above-ground biobed had a lower overall moisture content than either below-ground biobed. These results show that design of biobeds (above- vs. below-ground) and water recirculation practices are important considerations in the creation of conditions which encourage microbial activity and prevent formation of saturated conditions.

**Where's the brome?** Robert H. Gulden

Downy (*Bromus tectorum* L.) and Japanese brome (*B. japonicum* L.) grass are invasive winter annual weeds that recently have been detected in winter wheat fields in Manitoba. To determine the extent of the invasion of these and presence of other weeds, a residual weed community survey was conducted in 84 winter wheat fields in mid-summer 2009 in Manitoba. Downy and Japanese brome were not found in any of the surveyed winter wheat fields indicating that these invasives remain isolated to few fields. The three major weeds in winter wheat included foxtail species (*Setaria* spp.), wild buckwheat (*Polygonum convolvulus* L.) and wild oats (*Avena fatua* L.). In contrast to a winter wheat survey conducted in Saskatchewan in 1985-1988, volunteer canola (*Brassica* spp.), dandelion (*Taraxacum officinale* Weber), Canada thistle (*Cirsium arvense* L.), biennial wormwood (*Artemisia biennis* L.), and foxtail barley (*Hordeum jubatum* L.) were in the top 10 species in this survey. Changes in the production system (volunteer canola, Canada thistle, and dandelion) and generally increased growing season precipitation (biennial wormwood and foxtail barley) likely contributed to the relatively high densities of these species. Subdominant and locally abundant species differed among the three ecoregions in which winter wheat is grown in Manitoba. For example, biennial wormwood was a subdominant species in the Aspen Parkland and Interlake Plain ecoregions, however, was considered a locally abundant weed species in the Lake Manitoba Plain ecoregion

# INDEX OF AUTHORS AND AFFILIATIONS

## S



## T



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## V



## W

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