Canadian Weed Science Society

Société canadienne de malherbologie

66th Annual Meeting
November 12th-15th, 2012

66e Réunion annuelle
12 au 15 novembre 2012

The Fairmont
Winnipeg, Manitoba

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CWSS-SCM 2012 Annual Meeting Agenda

November 12, 2012 – Monday		
Time	**Topic/Event**	**Room**
07:00 - 17:00	Board Meeting with breakfast Breakfast at 7:00; meeting starts at 7:45	York
10:00 - 10:15	Board AM Break	York
12:00 - 13:00	Board Lunch	York
13:00 - 17:00	Pre-Conference activities (curling)	Meet in the Hotel Lobby @ 1 PM
15:15 - 15:30	Board PM Break	York
16:00 - 19:00	Registration	West Foyer / Lancaster
16:00 - 19:00	Exhibit & Poster Board Set-Up	East Ballroom
17:00 - 18:00	Board members / Graduate Student Meet & Greet	East Ballroom
18:00-21:00	General Membership Meet & Greet Appetizers and Hors d'oeuvres	East Ballroom
18:30-21:30	President's Dinner – Plenary Speakers	Velvet Glove Restaurant

November 13, 2012 – Tuesday		
Time	**Topic/Event**	**Room and/or Speakers**
07:00 - 08:00	Continental Breakfast	West Ballroom
07:00 - 17:00	Exhibits & Poster Boards	East Ballroom
07:00 - 18:00	Registration	West Foyer / Lancaster

08:00-08:15	Welcome to 66th Annual Meeting for the CWSS-SCM	Midway Ballroom Bill Summers, President, CWSS-SCM Frances Boddy, Brent Wright, Local Arrangements Co-Chairs

08:15-12:00	Plenary Session	Midway Ballroom
1) 8:30	Steven Shirtliffe, University of Saskatchewan	Intro + Evolution of crops from wild plants and weeds
2) 9:00	Leslie Campbell, Ryerson University	Evolution of weeds from crops
3) 9:30	J C Cahill, University of Alberta	Evolution of social behavior in plants
10:00 - 10:30	AM Break	East Ballroom
10:00 - 10:30	Exhibits & Poster Viewing (authors present for judges)	East Ballroom
10:30 - 12:00	Plenary Session continued	Midway Ballroom
4) 11:00	Len Juras, Dow AgroSciences	Industry response to weed evolution
5) 11:15	Carol Mallory-Smith, Oregon State University	Mechanisms contributing to the evolution of glyphosate resistance
6) 11:30	Neil Harker, AAFC Lacombe	Slowing weed evolution with integrated weed management

12:00 - 13:00	Lunch (Buffet)	West Ballroom
13:00 - 15:30	Grad Student Presentations	Midway Ballroom
7) 13:00	Sunil Sikoriya	Red Fescue (*Festuca rubra*) Management in Wild Blueberry
8) 13:15	Breanne Laturnus	Pyroxasulfone application timing and efficacy on cleavers (*Galium aparine*) and wild oats (*Avena fatua*)
9) 13:30	Valerie Roy-Fortin	Resistance Weed Management in Carrot Production
10) 13:45	Goutam Kuwar	Weed management options for organic wild blueberry production
11) 14:00	Teketel A. Haile	Can harvest methods affect seed loss in canola?
12) 14:15	Joanna Follings	Control and Distribution of Glyphosate Resistant Giant Ragweed in Ontario
13) 14:30	Cory E. Jacob	Evaluating the competitive ability of semi-leafless field

pea (*Pisum sativum* L.) cultivars and identifying competitive traits

14) 14:45 Colleen N. Redlick — Does lentil seeding rate influence response of wild mustard to fluthiacet-methyl?

15) 15:00 Caroline Halde — No-till field crop production without herbicide

16) 15:15 Todd Larsen — Japanese knotweed (*Fallopia japonica*) management: Aminopyralid vs imazapyr applications at various phenological stages.

15:30 - 15:45	PM Break – Fairmont Peace	East Ballroom
15:45 - 18:00	Grad Student Presentations - continued	Midway Ballroom

17) 15:45 Ryan H. Low — Pre-seeding and Post-harvest control of *Kochia scoparia* for Management of Glyphosate Resistance

18) 16:00 Holly P. Byker — Glyphosate Resistant Canada Fleabane (*Conyza canadensis*) in Ontario: Distribution and Control in Soybean (*Glycine max* L.)

19) 16:15 Taylor M. Jeffery — Investigation into the Molecular and Biochemical Mechanisms of Resistance to Glyphosate in Two Populations of Giant Ragweed (*Ambrosia trifida*)

20) 16:30 Andrew McKenzie-Gopsill — When Does a Soybean Seedling Meet its Neighbour?

21) 16:45 Hema S. Duddu — Evaluation of the domestication status of cow cockle (*Vaccaria hispanica* (Mill.)Rauschert) genotypes

22) 17:00 Zhenyi Li — Hexazinone Alternatives and Resistance in Wild Blueberry Production

23) 17:15 Jichul Bae — Germination behaviors of common ragweed (*Ambrosia artemisiifolia* L.) and other roadside ground cover species subjected to a range of heavy metal levels

24) 17:30 Brendan Alexander — Quantifying the relative invasive potential of PNT using demographic analysis.

25) 17:45 Sid Darras — Effects of Field Pea (*Pisum sativum* L.) Genotypic Mixtures on Yield and Competitive Ability.

18:00 Adjourn

18:30 - 21:30	Free night Optional networking supper	If interested meet in the Hotel Lobby @ 6:30 PM to arrange groups and head out.

November 14, 2012 – Wednesday

Time	Topic/Event	Room
07:00 - 08:00	Continental Breakfast	West Ballroom
07:00 - 17:00	Exhibits & Posters	East Ballroom
07:00 - 18:00	Registration	West Foyer / Lancaster
8:00 - 9:30	Grad Student Presentations - continued	Midway Ballroom

26) 8:00	Gareth Davis	Resistance to linuron in Ontario Carrot fields
27) 8:15	Eric Tozzi	Germination of a variety international populations of *Conyza canadensis.*
28) 8:30	Angelena D. Syrovy	Cultivar Mixtures and the Role of Leaf Type in Weed Management for Organic Field Pea
29) 8:45	Kimberly Walsh	Transient Seed Bank of *Camelina sativa* (L.) Crantz. Contributes to a Low Weedy Propensity in Western Canadian Cropping Systems
30) 9:00	Eileen F. Beaton	Wild Chervil (*Anthriscus sylvestris* (L.) Hoffm.) Management on Nova Scotia Dykes
31) 9:15	Andrew Reid	Early Season Weed Control Shortens ASI and Prevents Kernel Loss in a Drought Tolerant Maize Hybrid

9:30 - 10:00	AM Break	East Ballroom
Continuing Education Sessions (Concurrent)		
32) 10:00- 11:30	<u>Concurrent Session</u> - Multivariate Statistics for Agriculture Dr. Norm Kenkel University of Manitoba	Midway Ballroom
<u>OR</u>		
33) 10:00- 10:45	<u>Concurrent Session</u> - Invasive Species Dr. Doug Cattani University of Manitoba	Harrow / Essex / Canterbury (combined)

34) 10:45-11:30	Concurrent Session - The Art of Motivating your Employees Michele Rogalsky Director School of Agriculture, University of Manitoba	Harrow / Essex / Canterbury (combined)
35) 11:30-12:15	Concurrent Session - AgWorld is an online agricultural production, management, communication and reporting platform for farmers, consultants, contractors, suppliers and researchers that will launch soon in Canada. Matt Powell, AgWorld	Midway Ballroom
OR		
36) 11:30-12:15	Concurrent Session - Graduate Student Paper Publishing Workshop Scott White, Dr. Bob Blackshaw, Dr. Neil Harker	Harrow / Essex / Canterbury (combined)
12:15-14:00	Awards Banquet	West Ballroom
37) 14:00 – 17:00	Concurrent Program Sessions – Contributed Papers	
	1. **Weed Control in Corn, Soybean and Edible Beans**. Chair: **François Tardif**	Midway Ballroom
38) 14:00	Clarence J. Swanton, Department of Plant Agriculture, University of Guelph, Guelph ON	Enhancement of Herbicide Activity with Nano Technology
39) 14:15	Al McFadden, Dow AgroSciences, Guelph, ON	Development of the Enlist™ Weed Control System for Corn and Soybean
40) 14:30	Brian Legassicke, Monsanto Canada, Cambridge, ON	Roundup Ready 2 Xtend Weed Management System Update
41) 14:45	Clarence J. Swanton, Department of Plant Agriculture, University of Guelph, Guelph ON	Early physiological mechanisms of weed competition.
15:10 - 15:30	PM Break – Twist of Lemon	East Ballroom
42) 15:30	Peter Sikkema, Department of Plant Agriculture and Ridgetown Campus, University of Guelph, Ridgetown ON	Two-pass Weed Control In Glyphosate-resistant Corn -Efficacy, Environmental Impact, Yield And Profitability.

43) 15:45	François Tardif, Department of Plant Agriculture, University of Guelph, Guelph ON	Comparison of Weed Management Programs for Food grade, Non-GMO Soybean
44) 16:00	Rob Miller, BASF Canada, London, ON	OpTill Herbicide for Weed Control in Soybeans
45) 16:15	Clarence J. Swanton, Department of Plant Agriculture, University of Guelph, Guelph ON	Thiamethoxam as a seed treatment alters the physiological response of maize seedlings to neighbouring weeds.
OR		
	2. **PMRA, CFIA Regulatory Issues and Provincial Weed Reports** Chair: **Kristen Callow**	Harrow / Essex / Canterbury (combined)
46) 14:00	Wendy Asbil, National Manager/Gestionnaire nationale Invasive Plants Section/Section des plantes envahissantes Plant Health and Biosecurity Division/Division de la protection des végétaux et biosécurité Canadian Food Inspection Agency/Agence Canadienne d'Inspection des Aliments	Canadian Food Inspection Agency Update
47) 14:15	Chris Neeser, Weed Scientist, Alberta Agriculture and Rural Development Pest Surveillance Branch	Alberta Weed Report
48) 14:30	Clark Brenzil, Provincial Specialist, Weed Control Saskatchewan Government	Saskatchewan Weed Report
49) 14:45	Nasir Shaikh, Provincial weed specialist Manitoba Agriculture, Food and Rural Initiatives Crops Knowledge Centre	Manitoba Agriculture, Food and Rural Initiatives (MAFRI) Report
15:10 - 15:30	PM Break – Twist of Lemon	East Ballroom
50) 15:30	Kristen Callow, Weed Management Program Lead, Horticulture Crops, Ontario Ministry of Agriculture, Food and Rural Affairs	Ontario Weed Report
51) 15:45 – 16:00	Danielle Bernier, agronome-malherbologiste Direction de la phytoprotection, MAPA	RAPPORT DU QUÉBEC À LA SOCIÉTÉ CANADIENNE DE MALHERBOLOGIE
18:30 - 23:00	CropLife Reception – Multicultural Event – A Taste of Winnipeg	West Ballroom

November 15, 2012 – Thursday		
Time	**Topic/Event**	**Room**
07:00 - 12:00	Exhibits & Poster Boards – take down	East Ballroom
07:00 - 8:30	Registration	West Foyer / Lancaster
07:30 - 9:00	Hot Buffet Breakfast	West Ballroom
8:30 - 10:00	CWSS-SCM Annual Business Meeting Call to Order at 8:30	Midway Ballroom
10:00 - 10:15	AM Break – A Splash of Orange	East Ballroom
10:15 - 12:00	Concurrent Program Sessions – Contributed Papers	
	1. Weed Control in Cereals, Oilseeds & Pulses	Midway Ballroom
52) 10:15	Andrea Cavalieri (U of Manitoba)	Pod drop and seed shatter in canola.
53) 10:30	Sara Freeman (Dow AgroSciences, Saskatoon)	Weed control strategies in canola breeding programs.
54) 10:45	Hugh Beckie (AAFC, Saskatoon)	Site-specific wild oat (*Avena fatua*) management.
55) 11:00	Bob Blackshaw (AAFC, Lethbridge)	Glyphosate-resistant kochia in Alberta.
56) 11:15	Eric Johnson (AAFC, Saskatoon)	Effect of crop management, glufosinate rate, and application parameters on weed control and yield of Liberty-Link canola
	2. Weed Control in Horticulture & Speciality Crops	York
57) 10:15	Clarence Swanton, University of Guelph	New Solutions for the control of herbicide resistant redroot pigweed (Amaranthus retroflexus L.) in carrot.
58) 10:30	Robert Nurse, AAFC, Harrow	Weed management options in organic pumpkins.

59) 10:45	Darren Robinson, University of Guelph, Ridgetown Campus	Weed management during the critical period of red beet.
60) 11:00	Darren Robinson, University of Guelph, Ridgetown Campus	Recropping with high value crops after Trilogy.
	3. Weed Biology and Ecology	Harrow / Essex / Canterbury (combined)
61) 10:15	David R. Clements*; Trinity Western University, Langley BC	Predicting how far mile-a-minute (Mikania micrantha Kunth.) will invade.
62) 10:30	Diane L. Benoit*[1], Marie-Josee Simard[2], Elizabeth Masson[3]; [1]Agriculture and Agri-Food Canada, Saint-Jean-sur-Richelieu, QC, [2]Agriculture and Agri-Food Canada, Quebec, QC, [3]Direction de santé publique, Longueuil, QC	Relationship between urban habitat characteristics and *Ambrosia artemisiifolia* abundance.
63) 10:45	Scott N. White*[1,] Nathan S. Boyd[2], Rene C. Van Acker[3], Clarence J. Swanton[4], Steven Newmaster[3]; [1]University of Guelph, Truro, NS, [2]Dalhousie Faculty of Agriculture, Truro, NS, [3]University of Guelph, Guelph, ON, [4]University of Guelph, Guelph, ON	Demography of red sorrel (*Rumex acetosella* L.) ramets in lowbush blueberry (*Vaccinium angustifolium* Ait.) fields in Nova Scotia.
64) 11:00	Donald D. Hare*; Dow AgroSciences Canada, Edmonton, AB	Sightline- A New Herbicide for Control of ALS Resistant Kochia in Non-Crop Areas in Canada.
65) 11:15	Robert H. Gulden*[1], Susan Mitchell[2], Tim J. Daniell[2]; 1University of Manitoba, Winnipeg, MB, [2]James Hutton Institute, Invergowrie, Scotland	Do weeds affect functional soil microbes?
66) 11:30	Eric R. Page*[1], Hugo Gonzalez[2], Diego Cerrudo[2], Clarence J. Swanton[3]; [1]Agriculture and Agri-Food Canada, Harrow, ON, [2]University of Guelph, Guelph, ON, [3]University of Guelph, Guelph, ON	Intra and interspecific competition effects on stand uniformity, development and yield in maize (*Zea mays* L.).
12:00 - 13:00	Board Working Lunch	York
12:00 - 15:00	Board Meeting	York

2012 Local Arrangements Committee Members

Task	Person(s) Responsible (1st named is Lead)	Company	e-mail
Local Arrangements Committee Co-Chair (& Hotel Arrangements)	Frances Boddy	DuPont	frances.boddy@dupont.com
Local Arrangements Committee Co-Chair (& Pre-Conference Tour/Activity)	Brent Wright	ICMS	wright@icms-inc.com
Plenary Session Co-Chair & Publications	Chris Willenborg	U of Saskatchewan	chris.willenborg@usask.ca
Plenary Session Co-Chair & Publications	Steve Shirtliffe	U of Saskatchewan	steve.shirtliffe@usask.ca
CropLife Reception	Mike Hutton	Syngenta	michael.hutton@syngenta.com
Photo Contest	Marty Gaudet	ICMS	gaudet@icms-inc.com
Media and Local Publicity	Joe McNulty	IPCO	jmcnulty@ipco.ca
Graduate Student Session Chair	Rob Gulden	U of M	gulden@cc.umanitoba.ca
Posters	Nasir Shaikh	MAFRI	Nasir.Shaikh@gov.mb.ca
Continuing Education and Professional Development Workshop / CCA & CCSC CEUs	Gary Martens	U of M	gary_martens@umanitoba.ca
Local Sponsorship / Commercial	Allan Froese	Monsanto	Allan.t.froese@monsanto.com

Displays			
Local Sponsorship	**Kristen Hacault**	**Pioneer Hybrid**	**KRISTIN.HACAULT@Pioneer.com**
Local Sponsorship / Signage	**Harold Brown**	**Bayer**	**harold.brown@bayer.com**
A/V	**Mike Wall**	**AgQuest**	**mike.wall@agquest.com**
Registration Desk, Publicity - CWSS-SCM	**Anita Drabyk**	**CWSS-SCM**	**drabykra@mts.net**
CWSS Board - Budget / Finance	**Darren Robinson**	**U of Guelph**	**darrenr@uoguelph.ca**
CWSS Board - National Sponsorship	**David Forster**	**Syngenta**	**david.forster@syngenta.com**
CWSS LAC Board Contact - 1st Vice Pres	**David Clements**	**TWU**	**clements@twu.ca**
CWSS Board - Scholarships and Awards	**Nathan Boyd**	**NSAC**	**nboyd@nsac.ca**
CWSS Board - Scholarships and Awards	**Chris Willenborg**	**University of Saskatchewan**	**chris.willenborg@usask.ca**

The Program Sections (and chairs) are

Cereals, Oilseeds and Pulses Dr. Robert (Bob) Blackshaw Weed Management Research/ Recherche de la gestion en malherbologie Agriculture and Agri-Food Canada/Agriculture et Agroalimentaire Canada, Lethbridge, Alberta (403) 317-2268 robert.blackshaw@agr.gc.ca	**Forage, Rangeland, Forestry and Industrial Vegetative Management** This session was not planned for 2012.
Horticulture and Special Crops Rob Nurse Greenhouse & Processing Crops Research Centre, Agriculture and Agri-Food Canada, Harrow, ON (519) 738-1288 Robert.nurse@agr.gc.ca	**Weed Biology and Ecology / Invasive and Noxious Weeds** Eric Page Agriculture and Agri-Food Canada Harrow, ON Telephone: 519-738-1229 eric.page@agr.gc.ca
Soybean, Corn, and Edible Beans François J. Tardif Crop Science Building Department of Plant Agriculture University of Guelph, Guelph, ON Phone: 519-824-4120 ext 53395 ftardif@uoguelph.ca	**Provincial Reports/Regulatory Issues** Mike Cowbrough Weed Management Lead Ontario Ministry of Agriculture and Food Guelph, ON mike.cowbrough@omaf.gov.on.ca

Abstracts for Plenary Session

1)	**The evolution of crops from wild plants and weeds**. S.J. Shirtliffe, Department of Plant Sciences, University of Saskatchewan, Saskatoon, SK. It is widely recognized that agriculture forms the basis of civilization and that crop domestication was one of the pivotal developments in history. Weeds are important in the evolution of domesticated plants, as most of our crops have evolved from wild plants with weedy characteristics, which some crops still possess. The un-conscious selection model of crop domestication postulates that the practices of sickle harvesting and re-planting seed of wild cereals in new areas rapidly selected for non-shattering and non-dormant crops. However, new archeological evidence suggests that early humans cultivated wild plants with weedy characteristics for 1000-2000 years before they evolved into fully domesticated crops. Cultivation of wild plants may be achieved by modifying the agronomy that is used. This is done in fully wild plants such as wild rice and in partially domesticated crops such as canola. Furthermore, some weeds seem pre-adapted to cultivation. The weed cow cockle does not possess self-dispersal and has relatively low seed dormancy and is therefore pre-adapted to domestication as the crop Prairie Carnation. Crops also differ in their weedy ability to become volunteers or feral. Although canola self disperses its seed and it can be induced into dormancy, it is uncertain if canola can become fully feral such as the crop species rye has. A model in which crop domestication is viewed as a continuum instead of discreetly may aid in our understanding.
2)	
3)	**Plants behaving badly: Integrating social behavior into weed research**. Cahill, J.F. Department of Biological Sciences, University of Alberta, Edmonton AB. Outside of plant biology, the study of competition is viewed as an inherently social process – one that involves games, strategies, and evolutionary responses. I suggest that viewing plant interactions as deterministic and fundamentally "different" from those of animals has been detrimental to our understanding of plant competition. In this talk I will discuss the emerging field of plant behavioral ecology, with a specific focus on competitive interactions. Through examples from my own lab, and of others in Canada and elsewhere, I will discuss interactions among plant foraging decisions, allelopathy and kin recognition, and the potential importance of resource sharing within common mycorrhizal networks. Specifically, I will present data demonstrating that the fine-scale placement of plant roots is highly dependent upon local variation in the soil – including resources, neighbors, and mutualists. Further, the genetic identity of one's neighbor can also be 'read' by many plant species, allowing plants to respond different to kin than to unrelated individuals. Rather than

	obscure bits of natural history, I will suggest these issues are central to how plants deal with competition, and have potential implications both for weed control and plant breeding. Following the ideas of Jacob Weiner, I will advocate for the emergence of "Darwinian Agriculture", an approach in which the evolutionary constructed competitive behaviors may be useful in confronting agronomic challenges.
4)	**Industry response to weed evolution**. Len Juras, Dow AgroSciences, Saskatoon SK
5)	**Mechanisms contributing to the evolution of glyphosate resistance**. Mallory-Smith, Carol, Oregon State University, OR. Glyphosate was touted as the herbicide that was resistance proof. At the same time this message was being delivered by Monsanto, the first glyphosate resistant weed was identified in 1996 in no-till grain system in Australia. It has been argued that the evolution of glyphosate resistant weeds was much slower than resistance to other herbicides and that glyphosate is a unique herbicide. In reality, glyphosate resistant biotypes were not selected in annual cropping systems due to the built-in resistance management plan. As a nonselective herbicide, glyphosate could not be used in annual crops so another herbicide or other management practice was required during the cropping phase. The diversity of weed management methods reduced the selection pressure from glyphosate and therefore delayed the selection of resistant biotypes. Once glyphosate-resistant crops were planted and sprayed repeatedly with glyphosate, resistance occurred in a fairly short time frame and the number of resistant species continues to increase. At present, glyphosate resistance has been confirmed in at least 24 species. One unique aspect of the evolution of glyphosate resistance is the number of resistance mechanisms that have been reported. In addition to target site resistance, other mechanisms responsible for glyphosate resistance include reduced translocation, sequestration and gene amplification that resulted in increased expression of EPSPS protein which is the target site for glyphosate. It is unclear if it is really the case that there are more mechanisms responsible for glyphosate resistance or if glyphosate resistance has commanded so much attention that there has been a greater investment to study glyphosate resistance.
6)	**Slowing weed evolution with integrated weed management**. Neil Harker, AAFC Lacombe, AB

Abstracts for Graduate Student Presentations

7)	**Red Fescue (*Festuca rubra*) Management in Wild Blueberry**. Sunil Sikoriya. NSAC, Truro, NS Red fescue is a common, cool season, sod forming grass that spreads via seeds and rhizomes. Its recent spread into agricultural fields has made it an emerging weed, especially in blueberry. This unwanted vegetation inhibits rhizome growth, reduces yield, and hinders harvest operations. Field studies will be conducted in 2012 and 2013 to evaluate efficacy of different herbicides and their application timings on red fescue suppression as well as blueberry tolerance. Recent findings have shown that pre-emergence application of Casaron and Glyphosate show significant damage on red fescue in approximately 5 weeks. There was no significant loss in biomass of either blueberry or red fescue. The present study is continued until next summer, with an insight to find control measures including potential herbicide selection based on their temporal efficacy.
8)	**Pyroxasulfone application timing and efficacy on cleavers (*Galium aparine*) and wild oats (*Avena fatua*).** B.D. Laturnus, Department of Agriculture, Food and Nutritional Sciences, University of Alberta, Edmonton, AB. Pyroxasulfone, a group 15 herbicide, has potential to control group 2 resistant cleavers and wild oats. Split plot trials were initiated at five sites across Alberta and Saskatchewan to test pyroxasulfone efficacy on cleavers and wild oats at rates from 0-400 g ai/ha, and to determine if application in fall or spring is most effective. Organic matter at the sites ranged from 2.9% in Scott to 10.6% in Edmonton. There was no reduction in crop biomass at the Edmonton site at any rate or application timing, but at Scott crop injury resulted in a biomass reduction of 75% and 63% at the 400 g ai/ha rate for fall and spring applications respectively. Cleavers biomass was reduced by 50% at the 50 g ai/ha application for the Scott fall and spring applications while 400 g ai/ha was required for a similar biomass reduction in Edmonton in the fall. No consistent efficacy difference was found between fall and spring applications. Response differences between sites are likely due to differences in organic matter and moisture received, and soil zone will need to be taken into account when determining effective rates. Future research will focus on determining effective rates for each soil zone.

9) **Resistance Weed Management in Carrot Production.** Roy-Fortin, V. and Leroux, G.D. Department of Plant Science, Laval University, Quebec, QC. Benoit, D.L. Agriculture and Agri-Food Canada, Saint-Jean-sur-Richelieu, QC

Carrots (*Daucus carota*) are an important fresh market and processing vegetable crop is grown on a wide range of soil types, from light sand to clay loam soils and high organic muck soils, primarily in Ontario and Quebec. Weed control in carrots is important as this crop is a poor competitor and in the absence of control, yields are often reduced by more than 90 per cent. However, herbicide options are limited for weed control in carrots, especially in organic soils, where a typical herbicide weed management program includes Lorox (Linuron) – the only available for broadleaf weed control - applied preemergent followed by a postemergent application of this herbicide. This practice has led to problems of resistance in some species such as common ragweed (*Ambrosia artemissifolia* L.) in Quebec and redroot pigweed (*Amaranthus retroflexus* L.) in Ontario. Lower risk options and integrated approaches were needed. Carrots have basal leaves with compact internodes forming a rosette compared to most weeds which have longer internode length. The mechanical control technique evaluated in this project takes advantage of the morphological difference between carrots and weeds to develop a selective mowing method to achieve maximum damage to weeds with minimal impact to carrots. A precision cutting weeder was used in a two year trial (2011 & 2012) in organic soil in Quebec. A randomized complete block design with four repetitions was set up for treatments combining pre and/or post herbicide applications with cutting at approximately 6 cm height at 3 or 4-leaves carrot stage. Although being cost effective, the use of precision cutting tool results in partial control of weeds since cutting stimulates regrowth and secondary branching of common ragweed. Consequently, carfentrazone (Aim) applied at two rates (14 & 28 g ai/ha) was evaluated, as an interrow banding treatments to complement the proposed weed control program. Even if the broadcast linuron application was superior to all other treatments providing the highest weed control and carrot yield at the lowest cost, the combination of linuron applied prior to carrot emergence, followed by a single cutting at three leaves stage of carrots and an interrow application of carfentrazone four days later seems to be an interesting approach for producers.

10)	**Weed management options for organic wild blueberry production.** Goutam Kuwar, Dalhousie University, Halifax, NS Weeds are considered a major problem for organic wild blueberry (*Vaccinium angustifolium* Ait.) production due to their excessive growth and limited management options available. Therefore, the main objective of this study was to investigate burning in combination with sulphur application as a weed management option for organic blueberry production. Experiments were conducted in two commercial blueberry fields in Collingwood and Earltown, Nova Scotia. A 2 x 2 factorial design with four blocks was established after harvesting blueberry in 2009. Treatments included pruning method (burning versus mowing) and soil pH modification (sulfur versus no-sulfur). The Results showed that the burned plots and sulphur application plots had higher blueberry stem density, blueberry cover and yield as compared to mowed and no-sulphur plots, respectively. Similarly, soil moisture and mycorrhizal colonization, NPK and soil moisture were higher in burned plots.
11)	**Can harvest methods affect seed loss in canola?** Teketel A. Haile*[1], Steven J. Shirtliffe[2], Robert H. Gulden[3]; [1]Graduate student, Saskatoon, SK, [2]University of Saskatchewan, Saskatoon, SK, [3]University of Manitoba, Winnipeg, MB Seed loss in canola leads to a considerable yield loss and dispersal of canola seeds into the soil seedbank. The volunteer canola can then create weed problems in the subsequent crops and result in crop yield loss. Gene dispersal in time particularly from genetically modified volunteer canola can be another undesirable consequence. A study was conducted in Saskatchewan in 2010 and 2011 to determine seed loss in canola from windrowing and direct harvesting operations and to determine factors that contribute to canola seed loss in western Canada. A total of 66 canola fields were surveyed within 3 weeks of harvest. Three random samples were taken from each field using a vacuum cleaner and seed loss per unit area was determined for each field. Data concerning agronomic and harvest specific information were collected for each field using short survey questionnaires. The average seed loss was found to be 184 kg ha^{-1}, which is equivalent to 7.3% of the total yield and resulted in seedbank addition of approximately 5821 viable seeds m^{-2}. Seed loss among producers ranged from 4.9 to 9% of the total yield and resulted in seedbank addition which is many times more than the normal seeding rate of canola. There was no difference in yield and seed loss between windrowed and direct harvested canola. This indicates that direct harvesting can be a viable option to harvest canola in western Canada.

12) **Control and distribution of glyphosate resistant giant ragweed in Ontario**.
Joanna Follings*[1], Peter Sikkema[2], François Tardif[1], Darren Robinson[2], Mark Lawton[3]; [1]University of Guelph, Guelph, ON, [2]University of Guelph - Ridgetown Campus, Ridgetown, ON, [3]Monsanto Canada, Guelph, ON

Giant ragweed (*Ambrosia trifidia*) was the first glyphosate resistant weed in Canada. Giant ragweed interference in soybean has resulted in yield losses of greater than 90%; therefore, control of this competitive weed is essential. The objectives of this research were; a) to conduct an expanded field survey to document the distribution of glyphosate resistant giant ragweed in Ontario, b) to determine effective control options for glyphosate resistant giant ragweed in soybean, and c) to ascertain the biologically effective rate of 2,4-D for the control of glyphosate resistant giant ragweed. In 2011, giant ragweed seed was collected from 51 sites in Essex (16), Kent (20), Lambton (10), Middlesex (2), Elgin (2) and Lennox & Addington (1) counties. Glyphosate was applied to giant ragweed seedlings at 1800 g ae/ha and resistant or susceptible ratings were taken at 1,7,14 and 28 days after application. Results from the 2011 survey concluded that there were 23 additional sites with glyphosate resistant giant ragweed in Ontario. An additional survey will be conducted in the fall of 2012. Field trials were conducted at 5 sites in 2011 and 2012 to determine the most effective control options. Based on these experiments, glyphosate tankmixes with 2,4-D or amitrole provide the most effective control. These two tankmixes provided greater than 90% control. The minimum dose of 2,4-D required for acceptable control of glyphosate resistant giant ragweed is 500 g/ha.

13) **Evaluating the competitive ability of semi-leafless field pea cultivars.** Jacob, C.E.[1], Lawless, M.E.[1], Dyck, M.[2], Shirtliffe, S.J.[1], Warkentin, T.[1], and Willenborg, C.J.[1] [1]Department of Plant Sciences, University of Saskatchewan, Saskatoon, SK; [2]Department of Renewable Resources, University of Alberta, Edmonton, AB

Field pea (*Pisum sativum* L.) is an important grain legume in Western Canada. Growers can, however, be reluctant to include pulse crops in their rotation because they are poor competitors with weeds. Developing more competitive field pea cultivars is important to ameliorate weed competition. The identification of competitive cultivars and the traits conferring competitive ability should lead to the development of more competitive field pea cultivars. The objective of this research was to evaluate the ability of semi-leafless field pea cultivars to suppress and withstand weed competition and to identify traits that may confer competitive ability in field pea. Field experiments were conducted in 2012 at Floral, Saskatchewan and St. Albert, Alberta. Fourteen semi-leafless field pea cultivars with divergent pedigree, vine length, seed size, and market classes were seeded at a target density of 75 plants m^{-2} under weedy and weed-free conditions. Imidazolinone-tolerant wheat (c.v. CDC Imagine) and canola (c.v. 45H73) were planted as pseudo weeds at a target density of 20 plants m^{-2} in the weedy plots. Variables measured were leaf area index, plant height, pea biomass, weed biomass, pea yield, and weed seed production. Data were subjected to ANOVA using the mixed model procedure in SAS. There was a cultivar by treatment interaction for pea yield at Floral with Striker producing the greatest pea yield under weed competition and CDC Dakota producing the greatest pea yield under no weed competition. CDC Dakota produced the greatest pea biomass at Floral and was among the best at St. Albert; Striker followed with the next greatest pea biomass at both sites. However, Striker and CDC Dakota were among the best and intermediate in their weed suppressive ability compared to CDC Mozart, SW Midas, and CDC Sage, which were among the best for weed suppressive ability across both sites.

14) **Does lentil seeding rate influence mustard response to fluthiacet-methyl?**

Colleen Redlick, S.J. Shirtliffe, and C.J. Willenborg, Department of Plant Sciences, University of Saskatchewan, Saskatoon SK.

In recent years concern over the development of herbicide resistant weeds has lead to interest in integrated weed management systems. These systems seek to relieve selection pressure for herbicide resistance by utilizing mechanical and cultural controls in addition to herbicides. The cultural practice of increasing crop seeding rate has been identified as having potential to provide non-chemical weed control and enhance the effects of herbicide application. The objective of this study was to examine the interaction between increasing seeding rate and the dose response relationship of weeds to herbicide application. Lentil was chosen to represent the

	crop, with wild mustard as the weed, and fluthiacet-methyl the herbicide. The experiment was a factorial design with four levels of seeding rate (70, 140, 280, and 560 seeds m^{-2}) and seven levels of herbicide application rate (0, 0.94, 1.87, 3.75, 7.5, 15, and 30 g ai ha^{-1}). The study was conducted at two locations near Saskatoon, Sk. in 2012. Results of the experiment show that increasing lentil seeding rate decreased the total mustard biomass when herbicides were not applied or were applied at low rates. In addition increasing lentil seeding rate lowered the herbicide dose required to result in a 50% reduction in mustard biomass. These results suggest that the practice of increasing seeding rate can work with herbicide application to increase herbicide efficacy.
15)	**No-till field crop production without herbicide.** Halde, C.[1], Gulden, R.H.[1], Hammermeister, A.M.[2], Ominski, K.H.[3], Tenuta, M.[4], and Entz, M.H.[1] [1]Department of Plant Science, University of Manitoba, Winnipeg, MB; [2]Organic Agriculture Centre of Canada, Truro, NS; [3]Department of Animal Science, University of Manitoba, Winnipeg, MB; [4]Department of Soil Science, University of Manitoba, Winnipeg, MB. In recent years, efforts have been invested in developing ways to reduce tillage and herbicide use on grain farms while maintaining good weed control. The objective of the research project was to examine the possibilities of implementing no-till practices in herbicide-free field crop production systems in Manitoba. A 2-year field study was conducted twice in Carman, MB. In year 1 (Y1), ten different combinations of various green manures (GM) species were seeded in the spring and rolled using a roller-crimper in mid-summer, at the flowering stage. The GM species tested included barley, hairy vetch, pea, oilseed radish, and sunflower. These rolled mulches were then left on the soil surface over the fall and the winter. In year 2 (Y2), spring wheat was seeded directly into these mulches (no-till). Mulches with hairy vetch (*Vicia villosa*) showed the most promising results. GM treatments with hairy vetch had the highest mulch biomass in September Y1 (9.1-11.5 t ha^{-1}), and in the spring Y2 (6.0-7.6 t ha^{-1}). Green manure mulches with hairy vetch were effective at reducing weeds biomass by 50% to 90% in the no-till spring wheat, in 2011 and 2012, compared to other mulches and a tilled control treatment. Spring wheat yields reached 2.4-2.7 and 3.9 t ha^{-1} in 2011 and 2012, respectively, in herbicide-free no-till production with mulches containing hairy vetch. Yields obtained in these research plots were comparable to the average regional yields of 2.8 t ha^{-1} (2011) and 3.4-4.7 bu ac^{-1} (2012). Spring wheat in plots with mulches without hairy vetch yielded poorly both years, yielding 21 to 92% less than in plots with hairy vetch mulches. In conclusion, the use of mulches (in particular those including hairy vetch) in no-till field crop production is an option for farmers interested in reducing tillage and herbicide use on their farms.

16) **Japanese knotweed (*Fallopia japonica*) management: Aminopyralid vs imazapyr applications at various phenological stages.** Larsen T.G., Boyd N.S., Nams V.O., and Brewster G. Department of Environmental Science, Faculty of Agriculture, Dalhousie University, Truro, NS

Japanese knotweed is a non-native invasive weed in North America where it readily establishes in riparian areas, dump sites, and along roadways. Its rapid growth causes mono-specific stands of knotweed to proliferate in the newly established range. Management options include pulling, cutting, covering with tarps, and herbicide application, however all methods require a long-term integrated management plan. For this project, herbicide application was studied in terms of type and timing of application. Herbicide was applied at various times throughout the 2011 growing season: early emergence (May); maximum plant growth (July); flowering (August); and prior to senescence (October). All possible combinations of these treatment stages were tested, for a total of 16 different 4 m^2 plots with three blocks at two sites. Aminopyralid (Milestone) was applied at early emergence, and imazapyr (Arsenal) was applied to the three other stages. Herbicide efficacy was evaluated over time by measuring damage ratings, height, density, and leaf area index (LAI) at 2, 4, and 8 weeks after treatment. A final damage assessment was conducted the following growing season (June 2012) with the same variables, as well as biomass of each plot. Results suggest that aminopyralid alone did not provide effective control against knotweed the following year, whereas all treatments with imazapyr gave significant control. Furthermore, imazapyr application when the plant was at its maximum growth (July) expressed the most significant damage the following year with reduced density, height, leaf area index, and biomass when compared with other application timings. At the two sites in Nova Scotia, untreated knotweed reached maximum growth (205 cm) in early July, density of 17 shoots per m^2, and fresh weight of 8.28 kg per m^2. This biological information allows weed management teams to create effective plans for knotweed control.

17) **Pre-seeding and post-harvest control of *kochia scoparia* for management of glyphosate resistance**. Ryan H. Low*; University of Alberta, Edmonton, AB

In 2012 glyphosate-resistant (GR) kochia populations were confirmed in chemical fallow fields in southern Alberta. Pre-seeding and post harvest trials were conduced on susceptible kochia to evaluate the effectiveness of commercially available herbicides to supplement or replacement glyphosate. In 6 pre-seeding trials conducted in 2011 and 2012, 2,4-D ester, pyrasulfotole/bromoxynil, dicamba, gluphosinate ammonium, diflufenzopyr/dicamba, diquat and bromoxynil/2,4-D were less effective than glyphosate alone; carfentrazone-ethyl and saflufenacil provided similar control; and fluroxypyr/MCPA ester enhanced

	control when applied after kochia emergence and before wheat seeding. In the 4 post harvest trials eight herbicides, pyrasulfotole/bromoxynil, dicamba, saflufenacil, carfentrazone-ethyl, fluroxypyr/MCPA ester, glufosinate ammonium, diquat, and diflufenzopyr/dicamba were applied at two different intervals after the planted crop was harvested. While biomass was not affected at these late applications, seed production and viability are being examined to determine if late herbicide application effect could affect fecundity and spread of resistance.
18)	**Glyphosate resistant canada fleabane (*Conyza canadensis*) in Ontario:distribution and control in soybean (*Glycine max l.*)**. Holly P. Byker*[1], Peter Sikkema[2], François Tardif[3], Darren Robinson[2], Mark Lawton[4]; [1]University of Guelph, Ridgetown Campus, Ridgetown, ON, [2]University of Guelph - Ridgetown Campus, Ridgetown, ON, [3]University of Guelph, Guelph, ON, [4]Monsanto Canada, Guelph, ON Canada fleabane is a genetically diverse weed which adapts to no till and Roundup Ready soybean agricultural practices, disbursing easily via windblown seed. In 2010, populations of Canada fleabane were confirmed to be resistant to glyphosate at 8 locations in Essex County in Ontario. Seeds from Canada fleabane were collected in the fall of 2011 and an additional 76 resistant populations were identified as glyphosate resistant (GR) within the counties of Essex (48), Kent (19), Elgin (7), Lambton (1), and Niagara (1). Four field trials in Roundup Ready soybeans were conducted in 2011 and 2012 at sites with confirmed GR Canada fleabane. The objectives of these trials were a) to determine the biologically effective rate of glyphosate on these resistant populations, b) to evaluate glyphosate tankmixes for the control of GR Canada fleabane, and c) to determine the efficacy of dicamba for the control of GR Canada fleabane in dicamba-resistant soybean (Roundup Ready 2 Extend soybean). Saflufenacil, saflufenacil/dimethenamid-p, metribuzin, and flumetsulam tankmixed with glyphosate provided greater than 90% control of GR Canada fleabane. None of the post-emergence tankmixes provided acceptable control of GR Canada fleabane. Dicamba was found to be a very effective herbicide for control for of GR Canada fleabane in a fifth trial established in confined trials with Roundup Ready 2 Extend soybean.
19)	**investigation into the molecular and biochemical mechanisms of resistance to glyphosate in two populations of giant ragweed (*Ambrosia trifida*)**. Taylor M. Jeffery*[1], Christopher Hall[2], Mark Lawton[3], Peter Sikkema[4], François Tardif[2]; [1]The University Of Guelph, Guelph, ON, [2]University of Guelph, Guelph, ON, [3]Monsanto Canada, Guelph, ON, [4]University of Guelph - Ridgetown Campus, Ridgetown, ON There are two phenotypes associated with resistance to glyphosate in giant ragweed (*Ambrosia trifida*). The most common in Canada is the “rapid necrosis

	response" which shows treated leaves rapidly reacting to glyphosate while the growing point remains unaffected. Plants with the "slow recovery response" stop growing for about 14 days and turn slightly chlorotic before resuming growth. Our aim is to examine the genetic and biochemical factors that confer resistance. The target site of glyphosate has been PCR amplified and sequencing analysis is being conducted. We are also examining the role free radicals play in the rapid response plants. Using spectrophotometry we are examining free radical production in response to glyphosate application. In addition semi-quantitative PCR we will be used to investigate changes in expression of genes associated with free radical control. Finally crosses have been made between resistant and susceptible plants, as well as between resistant plants with the two phenotypes. We will determine the inheritance and dominance of the resistant traits. Results from this study will provide insight on new resistance mechanisms that will lead to a better understanding of the selection process leading to resistance.
20)	**When does a soybean seedling meet its neighbour**? Andrew G. McKenzie-Gopsill*[1], Clarence J. Swanton[2], Elizabeth A. Lee[1], Lewis Lukens[1]; [1]University of Guelph, Guelph, ON, [2]University of Guelph, Guelph, ON Plants perceive their neighbours through changes in light quality. This change in light quality is brought about by alterations in the red/far-red ratio detected by plant phytochrome, which in turn will induce a shade avoidance response. The shade avoidance response has been reported to be an important variable defining the critical period for weed control. Previous work has shown that this period occurred from the first to third trifoliate of soybean development. No work, however, has been done to quantify how early a soybean seedling can detect the presence of neighbouring weeds. We hypothesized that a soybean seedling can detect the presence of aboveground neighbouring weeds upon emergence and this detection will be evident through changes in seedling morphology. Growth chamber studies were conducted using the soybean cultivar OAC Wallace grown in the presence of ryegrass. Seedling measurements were recorded at 72 hours after planting, VE, VC, unifoliate, first trifoliate, and second trifoliate stage of growth. Morphological changes in stem height were observed upon seedling emergence. This alteration in carbon allocation between weedy and weed free treatments persisted throughout all growth stages sampled. The results of this study suggest that detection of changes in light quality induced by aboveground neighbouring weeds occurs at time of seedling emergence. The ability of soybean seedlings to detect changes in light quality at such an early stage of development further suggests that molecular and physiological changes were occurring prior to seedling emergence.

21)	**Evaluation of the domestication status of cow cockle** (*Vaccaria hispanica* (Mill.) Rauschert) **genotypes**. Hema S. Duddu*[1], Steven J. Shirtliffe[2], Eric Johnson[3], Christian Willenborg[4]; [1]University of Saskatchewan, Saskatoon, SK, [2]University of Saskatchewan, Saskatoon, SK, [3]Agriculture and Agri-Food Canada/Agriculture et Agroalimentaire Canada, Scott, SK, [4]Assistant Professor, Saskatoon, SK Domestication is the process by which a wild plant undergo several modifications such as morphological, physiological, biochemical and molecular. These evolutionary changes are often used to understand the domestication trend from wild to cultivated plant. To understand the domestication status of cow cockle, we compared fifteen lines for phenotypic variability, seed dormancy and seed persistence in both field and laboratory experiments. Several morphological and agronomic traits were recorded to estimate the phenotypic variability. Seed dormancy was measured based on their response to temperature and photoperiod treatments. Artificial ageing technique was followed to quantify the seed persistence. Most lines obtained from Saskatchewan and Manitoba had weedy characteristics including early maturity, small seeds with a wider window of seed germination. White beauty and Florist rose were found to have ornamental traits as well as greater dormancy, which suggests the role of artificial selection. Though Mongolia registered wild characters such as poor emergence and late maturity, it was found to be completely non-dormant. This study emphasized the importance of selection pressures and organ of interest during the process of evolution. In most of the genotypes, natural selection pressures were observed to have been imposed to adapt the native or non-native habitat conditions.
22)	**Hexazinone alternatives and resistance for wild blueberry production.** Li Z.Y.[1], Boyd N.S.[2], McLean N.[3], Pruski K.[4].[1,2,] Department of Environmental Sciences, Dalhousie Agricultural Campus, Truro, N.S.; [3,4]Department of Plant and Animal Sciences, Dalhousie Agricultural Campus, Truro, NS. Weeds compete for resources with blueberries and lower yields and reduce berry quality. Hexazinone is the most commonly used herbicide in wild blueberry fields, and may have the potential to create herbicide-resistant weeds. It is important to evaluate new herbicides that can be applied before blueberry emergence (PRE) and after blueberry emergence (POST) that have modes of action different than hexazinone. Herbicides, including Velpar, Ultim, Sinbar and other tank mixes, were applied to experimental plots to determine their effect on blueberries, weeds, and grass biomass. Herbicides were applied in early May (PRE) and mid June (POST). Preliminary results show Sinbar WDG has the best grass control in the general weedy trial. Red sorrel seeds were collected at 4 different sites to evaluate herbicide resistance. Seeds were collected from old blueberry fields, new blueberry fields and none-blueberry areas. All plants were treated with 6 different rates of hexazinone: 0, 0.25x, 0.5x, x, 2x and 4x. Preliminary results show red

	sorrel seeds were resistant to hexazinone in blueberry fields where hexazinone had been sprayed for several years. In most cases, triazine resistance is caused by a Ser_{264} to Gly mutation in *psb*A gene that alters the conformation of the Q_B and herbicide binding niche. After sequencing 16 resistant and 16 non-resistant red sorrel plant leaves, preliminary results show the triazine-resistance in red sorrel was not caused by Ser_{264} to Gly mutation.
23)	**Germination behaviors of common ragweed (*Ambrosia artemisiifolia* L.) and other roadside ground cover species subjected to a range of heavy metal levels.** Jichul Bae[1], Diane L. Benoit[2], Alan K. Watson[1]. [1] Department of Plant Science, McGill University (Macdonald Campus), Ste. Anne de Bellevue, QC; [2] Agriculture and Agri-Food Canada, Saint-Jean-sur-Richelieu, QC Common ragweed (*Ambrosia artemisiifolia* L.) is not only a noxious agricultural weed, but also the most prevalent allergenic weed in Canada. As one of the most common invasive species along roadside, *A. artemisiifolia* particularly forms dense linear populations within the first few meters of a roadside. The roadside population of common ragweed serves as the means of entry into urban settings and agriculture fields. Identifying potential mechanisms to explain the prevalence of common ragweed along roadside can help in controlling this problematic weed and preventing its dispersal. Roadside environments often receive deposits of anthropogenic sources of heavy metals at concentrations toxic to plants via atmospheric fallouts and road runoff. Given that seed germination and seedling growth occur on the surface soil, the successful establishment and colonization along roadsides are probably dependent on species' capacity to tolerate heavy metal contamination. Such ability may afford the species a competitive advantage over other neighboring species. A research project was set up to investigate germination behaviors of common ragweed (*Ambrosia artemisiifolia* L.), and common roadside ground cover legume species (*Coronilla varia* L., *Lotus corniculatus* L., and *Trifolium arvense* L.) exposed to a range of heavy metal levels. Lead (Pb), copper (Cu), nickel (Ni), zinc (Zn), and cadmium (Cd) were evaluated because they are the most common metal elements found in roadside soils. The concentrations of heavy metal were determined based on the background values in soils in southern Québec (0 – 50 – 100 – 200 ppm for Zn, Pb, Ni, and Cu, and 0 – 5 – 10 ppm for Cd). Single seeds of each species were germinated on agar media with selected heavy metal treatments in the growth chamber (6 replicates of 25 seeds/replicate/species-heavy metal combination). Germination behaviors (T_{50}: germination rate and TG: final germination percentage) were monitored over 2 weeks. All heavy metal treatments did not induce any inhibitory effects on TG of *A. artemisiifolia*. There was no significant delay in germination of *A. artemisiifolia* by heavy metal exposures except for Cu treatment. The degree to delay in germination by Cu was the lowest in *A. artemisiifolia*, suggesting the species was more tolerant to Cu than other test species. The germination rate (T_{50}) of *A. artemisiifolia* was promoted by Pb (at 50

	and 200 ppm) and Ni (at 50 ppm), suggesting its adaptation to contaminated environments. As heavy metal concentration increases, decreases in TG and increases in T_{50} of other species were observed with varying threshold level for each species and heavy metal types. The degree of tolerance to the selected heavy metals was as follow: *A. artemisiifolia* > *L. corniculatus* ≥ *C. varia* > *T. arvense*. Given that seed stage is very sensitive to external environmental stress, the present research is of value to outline the potential mechanisms that may drive the successful establishment of *A. artemisiifolia* along roadside. It provides insight on appropriate roadside vegetation and soil management practices for controlling common ragweed.
24)	**Quantifying the relative invasive potential of PNT using demographic analysis**. Brendan C. Alexander*[1], Hugh J. Beckie[2], David R. Clements[3], Robert E. Nurse[4], Marie-Josee Simard[5], Linda M. Hall[1]; [1]University of Alberta, Edmonton, AB, [2]Agriculture and Agri-Food Canada, Saskatoon, SK, [3]Trinity Western University, Langley, BC, [4]Agriculture and Agri-Food Canada, Harrow, ON, [5]Agriculture and Agri-Food Canada, Quebec, QC Demographic analysis using field based experiments as a method of quantifying the relative invasiveness potential of plants with novel traits (PNT) from a regulatory perspective has not been evaluated. Common garden sites were established in 5 ecological regions of Canada in disturbed, ruderal and natural areas, and compared 6 species at 2 densities. Experiments were initiated twice a year, fall to assess overwintering seed viability and emergence, spring to measure plant survival, growth and fecundity. Data collection included weekly survival counts, height and staging, and a measure of fecundity in the fall. Projected population growth rate (λ) and the sensitivity/elasticity of λ to vital rates were derived using a matrix modeling approach. λ values vary considerably between disturbance regimes and environments, high λ values are generally associated with the high disturbance regimes and low λ values are generally associated with low disturbance regimes. Preliminary data shows higher sensitivity/elasticity of λ to the seed-to-seedling overwintering vital rate compared to the fecundity vital rates. Demographic analysis provides a simple metric based on field data for determining the relative invasiveness of a plant that could be used by regulators in addition to the current *apriori* trait-based methods.
25)	**Effects of field pea (*Pisum sativum* l.) Genotypic mixtures on yield and competitive ability**. Sid Darras*[1], Dean Spaner[2], Ross McKenzie[3], Mark Olson[4], Christian Willenborg[5]; [1]Student, Edmonton, AB, [2]Professor, Edmonton, AB, [3]Research Scientist - Agronomy, Lethbridge, AB, [4]Unit Head-Pulse Crops, Research and Innovation Division, Stony Plain, AB, [5]Assistant Professor, Saskatoon, SK Field pea breeding programs have been very successful at improving plant

	standabiltiy and disease resistance; however, limited success has been achieved in improving the competitive ability of field pea. Finding a practical solution that improves field pea competitive ability could lead to a substantial increase in the crop's profitability and acreage in western Canada. We conducted a study to determine whether growing field pea in two-way genotypic mixtures could improve the crop's yield and competitive ability. We were also interested in whether genetic relatedness had any effect on the mixing ability of genotypes and thus, genotypes were chosen on the basis of pedigree and included two sister lines (CDC 1987-3 and CDC 1897-14), their common parent (Eclipse), and a distantly related genotype (Midas). The four genotypes were grown as monocultures and as all possible two-way mixtures in field experiments conducted at two locations in Alberta from 2010 to 2011. The results of this study revealed that CDC1897-3 x Eclipse (the common parent) was found to suppress the pseudo-weed (barley); it reduced seed production by 47% (442 kg ha^{-1}) and 61% (391 kg ha^{-1}) compared to the respective components monocultures at Lethbridge 2010 and Lethbridge 2011, respectively. However, for field pea grain yield and thousand seed weight (TSW), mixtures were not different than monocultures both in the presence or absence of weed competition. In general, field pea mixtures had inconsistent performance throughout different site-years of this study and they had provided no evidence of higher ecosystem functions compared to monocultures.
26)	**Resistance to linuron in Ontario carrot fields**. Gareth Davis*, Francois J. Tardif; University of Guelph, Guelph, ON A survey of linuron-resistant *Amaranthus* sp. in Southern Ontario Carrot is an important fresh market and processing vegetable crop in southern Ontario. Yield losses of 92 to 100% can result from weed competition. This makes weed control a crucial part of this industry. Linuron and prometryn are two photosystem 2 inhibiting herbicides that are widely used by carrot growers. Overreliance on herbicides, especially linuron, has lead to the development of resistance in pigweeds (*Amaranthus* sp.) which was first confirmed in 1999. Lack of alternatives meant that producers still rely on linuron. Recent field observations suggest resistance has continued to evolve in many carrot fields. Our aim is to survey carrot fields in Ontario and collect samples of pigweeds in order to confirm resistance to linuron and other herbicides. Each suspected accession will be grown from seed and sprayed with a diagnostic herbicide dose. Upon confirmation of resistance status, DNA will be extracted and the target site gene (psbA) will be sequenced. Resistance status will be correlated with herbicide use history from each field. This project will reveal the extent of resistance to linuron in Ontario and will confirm its molecular basis. It is hoped that this will help growers decide on more sustainable production practices.
27)	**Germination of a variety international populations of *Conyza canadensis*.**.

	Eric Tozzi*; University Of Guelph, Guelph, ON Canada fleabane (*Conyza canadensis (L.) Cronq. var. canadensis)* is a surface-germinating ruderal facultative winter annual with recruitment that is highly susceptible to changes in microsite conditions. Temperature and light play the largest roles in germination and emergence timing of this species. Base germination temperatures for Canada fleabane are unknown and have only been estimated at 13^{0}C in a Knoxville, Tennessee population. In this experiment the germination of Canada fleabane seed was investigated using the Thermo-gradient Plate (TGP) at the University of Saskatchewan in Saskatoon, SK, Canada in January and February of 2012. The TGP machines consist of 96 and 176 individually controlled cells that are accurate within 0.1^{0}C. An international collection of seed from varying climatic zones was used. Seed sources included populations from San Joaquin Valley, CA, Hertfordshire, UK, Shiraz, Iran, and Southern Ontario, Canada. Seeds from each of the 4 populations were counted and counted and placed into 40 petri dishes with wet filter paper within the Thermo-gradient Plate cells. The seeds were subjected to temperatures from 6.5-20^{0}C at 1.5^{0}C increments. Cumulative daily germination counts for 30 days were recorded. Results indicated that temperature and source have a significant effect on germination. Base germination temperatures were significantly different between all populations (Ontario (~9.5^{0}C), Iran (~11^{0}C), Spain (~14^{0}C), UK (~12.5^{0}C)) as well as literature values. The results suggest a genetic difference between these international populations and suggest rapid evolutionary change since the introduction of Canada fleabane 200-300 years ago to Europe and the Middle East. The results also have implications for management especially in no-till situations where Canada fleabane populations are the most problematic. Germination at such low temperatures may require altered approaches to controlling this species.
28)	**Cultivar mixtures and the role of leaf type in weed management for organic field pea**. Angelena D. Syrovy*, Steven J. Shirtliffe; University of Saskatchewan, Saskatoon, SK Within Saskatchewan's organic industry there is a need for improved tools to minimize yield losses due to weeds. Cultivar mixtures may improve the ability of organic pulse crops to suppress weeds and maintain yields in the presence of weeds. While semi-leafless peas are known for their lodging resistance and high yield potential in the absence of weeds, conventional "leafed" peas may provide better weed suppression and yield stability in the presence of weeds. A replicated field experiment was conducted on organic land over four site-years to test the hypothesis that cultivar mixtures of semi-leafless and leafed field pea would improve weed suppression and yields compared with single-cultivar crops. The experiment tested factorial combinations of five ratios of semi-leafless pea cultivar CDC Dakota and leafed cultivar CDC Sonata (0:100, 25:75, 50:50, 75:25,

	and 100:0, respectively), and two seeding rates (conventional and organic recommended). Plots were monitored for crop and weed emergence, biomass, and yields. Weed suppression and yield benefits were seen in pure stands of the semi-leafless cultivar compared with the leafed. As the canopy composition progressed from a pure leafed canopy towards increasing percentages of semi-leafless pea, weed biomass decreased. The semi-leafless cultivar out-yielded the leafed by approximately 148%. A highly significant quadratic effect indicated that yields were maximized in the mixture dominated by the semi-leafless cultivar, an effect observed in three of four site-years. Results indicate that mixtures of semi-leafless and leafed cultivars can be used as an organic tool to increase crop productivity. Additionally, this study calls into question the notion that leafed peas have a competitive edge over semi-leafless under weedy conditions.
29)	**Transient seed bank of *Camelina sativa* (L.) Crantz. contributes to a low weedy propensity in western Canadian cropping systems**. Kimberly Walsh*, Linda M. Hall; University of Alberta, Edmonton, AB Small seeded Brassicaceae crop camelina, is being developed as a genetically engineered (GE) bioproduct crop for the Canadian Prairies. Seed-mediated gene flow from GE camelina could impact the ability to co-exist with conventional agriculture and thus is a significant hurdle towards unconfined environmental release. Field experiments were conducted 2008 to 2011 to quantify aspects of camelina seed bank dynamics through a three part study that looked at seed lost at the time of harvest (seed bank inputs), persistence of camelina seed in the soil (seed bank longevity) and emergence of volunteer populations from the seed bank. Harvest losses were variable and ranged from 1,202 to 43,430 seeds m^{-2}; the respective weights were 12.0 to 434.3 kg ha^{-1}, approximately 0.7 to 25.5 % of total yield losses. Artificial seed banks were established to test for differences in seed persistence on soil surface (0 cm) and buried (3 and 10 cm) for two cultivars (Calena and CN101985). There were no significant differences between cultivar and seed on the soil surface persisted the longest. Buried samples were 99 % non-viable after 8 mo whist surface persisted up to 15 mo. Lastly, 11 commercial fields, one year post-camelina cultivation, were surveyed for the emergence of volunteer populations. Initial surveys showed variable high densities (9 to 4839 plants m^{-2}) however populations sharply declined over time and were near extinct after 2 yrs. Results from this study report that camelina forms transient seed banks and volunteer populations can be extinguished within 2 yrs by employing herbicide application.
30)	**Wild chervil (*Anthriscus sylvestris* (L.) Hoffm.) management on Nova Scotia dykes.** Beaton E.F.[1], Boyd N.S.[2], Hoyle J.[3], and McLean N.[4]. [1,2,3]Department of Environmental Sciences, Dalhousie Agricultural Campus, Truro, NS; [4]Department of Plant and Animal Sciences, Dalhousie Agricultural Campus, Truro, NS

	Wild chervil is an invasive weed that frequently occurs on Nova Scotia dykes causing soil erosion and destabilization. New management methods are being explored for this weed because current practices, such as mowing in late summer and spot herbicide applications, are no longer effective. A field screening experiment was conducted in 2011-2012 on a dyke in Masstown, Nova Scotia where herbicide products recommended by DuPont were evaluated for efficacy including the tank mixes: MAT 50 SG (aminocyclopyrachlor)/Escort 60 WG and MAT 50 SG/ Telar 75 DF along with the following herbicides: Milestone, Clearview and Overdrive. Herbicide treatments were applied once to both trials when plants were in full bloom. Ground cover measurements and damage ratings were taken throughout the experiment and were used to evaluate the efficacy of these products. The data collected supports that MAT 50 SG (aminocyclopyrachlor)/Escort 60 WG and Clearview are the most effective herbicides to manage wild chervil on dykes. Another field experiment was conducted in 2011-2012 on another dyke in Masstown, Nova Scotia where MAT 50 SG (aminocyclopyrachlor)/Escort 60 WG was applied at four different times throughout the summer and fall in 2011. These times include: when wild chervil was in full bloom, at seed maturity, in early fall, along with an early fall application and a single mowing at full bloom. Ground cover, damage ratings, and biomass were collected throughout the experiment and were used to evaluate the efficacy of each application time. Preliminary results suggest that spraying at full bloom is the optimal time to apply MAT 50 SG (aminocyclopyrachlor)/Escort 60 WG.
31)	**Early season weed control shortens ASI and prevents kernel loss in a drought tolerant maize hybrid**. Andrew Reid*[1], Elizabeth A. Lee[1], Lewis Lukens[1], Peter Sikkema[2], Clarence J. Swanton[3]; [1]University of Guelph, Guelph, ON, [2]University of Guelph - Ridgetown Campus, Ridgetown, ON, [3]University of Guelph, Guelph, ON Early season weed control in maize is essential to protect yield potential. The presence of uncontrolled weed seedlings is known to trigger a shade avoidance response in maize seedlings. This response has been observed to delay in reproductive development and a subsequent decline in kernel number. Such changes in reproductive development and kernel number may limit the ability of a maize hybrid to express novel traits such as drought tolerance. In this study, we hypothesized that if weed control was delayed, an increase in the anthesis-to-silking interval (ASI) would occur in both a drought tolerant and non-drought tolerant maize hybrid compared to these hybrids growing under weed free conditions. In order to test this hypothesis, we compared a drought tolerant hybrid with its non-drought tolerant isoline. Field studies were conducted over two years at the Ridgetown Campus (2011 and 2012) and one year at the Woodstock Research Station (2012).Weed control treatments included a season long weedy and weed-free treatment, and weed removal at the 1st, 3rd, 5th, 7th and 10th leaf tip

	stage of maize development. No differences were observed in height or rate of leaf appearance in either of the two years of study. ASI was found to be shorter in the drought tolerant hybrid when compared to the non-drought tolerant hybrid across all treatments. A delay in weed control, however, increased ASI and kernel number loss for both hybrids. No difference in final yield was observed between hybrids in 2011. The lengthening of ASI caused by delayed weed control may limit the effectiveness of the drought tolerant trait. Further studies are required to confirm this result.

Workshop –- Wednesday, Nov. 14, 2012

32)	Concurrent Session - **Multivariate Statistics for Agriculture** Dr. Norm Kenkel, University of Manitoba
33)	Concurrent Session - **Invasive Species** Dr. Doug Cattani, University of Manitoba
34)	Concurrent Session - **The Art of Motivating your Employees** Michele Rogalsky Director School of Agriculture, University of Manitoba
35)	Concurrent Session - **AgWorld is an online agricultural production, management, communication and reporting platform for farmers, consultants, contractors, suppliers and researchers that will launch soon in Canada**. Matt Powell, AgWorld
36)	Concurrent Session - **Graduate Student Paper Publishing Workshop** Scott White, Dr. Bob Blackshaw, Dr. Neil Harker

Weed Control in Corn, Soybean and Edible Beans

37)	**Enhancement of herbicide activity with nano technology**. Clarence J. Swanton*[1], Kevin Chandler[1], Christopher Hall[1], Jordon Dinglasan[2], Darren Anderson[2]; [1]University of Guelph, Guelph, ON, [2]Vive Crop Protection, Toronto, ON Decreasing the particle size of herbicides can influence biological activity in several ways including improved cuticular penetration and stomatal uptake. Decreased particle size can also result in improved coverage on the leaf surface. The combination of these effects can improve efficacy of herbicides at lower rates. The objective of this research was to compare the standard (Excel Super, 80.5 gai/L EC) and nano (37% WP) formulations of fenoxaprop-p-ethyl for the control of selected annual monocot species. Species selected included green foxtail (*Setaria viridis*) , corn (*Zea mays*)) and oat (*Avena sativa*). These species were selected based on known susceptibility to fenoxaprop-p-ethyl with green foxtail the most susceptible, corn, (moderate susceptibility) and oat being the most tolerant of the three species

	tested. The nano formulation of fenoxaprop-p-ethyl had greater efficacy consistently on green foxtail and corn than the standard formulation. For green foxtail and corn, the dose required of the nano formulation to reduce plant biomass by 50 % (GR_{50}) was approximately 50% of the commercial formulation of fenoxaprop-p-ethyl. In addition, the nano-formulated fenoxaprop-p-methyl was equal to or better for the control of the more tolerant oat species compared to the standard commercial formulation.
38)	**Development of the Enlist Weed Control System for corn and soybean**. McFadden, A.G. Dow AgroSciences Canada Inc. Guelph, ON The Enlist Weed Control System provides effective broader spectrum weed control of hard-to-control and glyphosate resistant weeds in corn and soybeans. This system will give growers the tools to maintain current tillage systems by combining the power of 2,4-D with other leading weed control programs. The Enlist Weed Control System exhibits robust crop tolerance in both corn and soybean. The system will be introduced with a comprehensive Product Stewardship Program.
39)	**Roundup Ready 2 Xtend Weed Management System Update**. Brian Legassicke*; Monsanto Canada Inc, Guelph, ON The Roundup Ready 2 Xtend weed management system utilizes glyphosate and dicamba as a new tool for weed management in soybeans. The system was tested in small plot replicated trials in Ontario and Quebec from 2008-2012 and in Manitoba in 2012. The data to be presented is a summary of 2008-2011 trials. Glyphosate and dicamba combinations showed effective weed control with enhanced control of several species. Crop tolerance was also excellent.
40)	**Early physiological mechanisms of weed competition**. Maha Afifi, Clarence J. Swanton*; University of Guelph, Guelph, ON Early physiological mechanisms that occur in crop plants in response to neighboring weeds are not well understood. In this experiment, it was hypothesized that, in the absence of direct competition for resources, low red to far red ratio (R:FR) reflected from neighboring weeds will modulate the phenylpropanoid pathway, increase hydrogen peroxide (H_2O_2), and up-regulate the expression of ethylene biosynthesis and auxin transport genes. Laboratory experiments were conducted under conditions of non-limiting resources using perennial ryegrass as a model weed species. We discovered that the detection by phytochrome of low R:FR signals reflected from both biological and non-biological sources triggered an up-regulation of ethylene biosynthesis genes and stimulated an auxin transport gene. The low R:FR also modulated the phenylpropanoid pathway resulting in a reduction in anthocyanin content and an enhancement of lignin synthesis. The presence of neighboring weeds

also caused an accumulation of H_2O_2 in the first leaf and crown root tissues of the maize seedling. Stomata were observed to be closed as H_2O_2 accumulated in leaf tissue. This is the first study to report the modulation of phenylpropanoid pathway and the accumulation of H_2O_2 attributed to low R:FR. We further suggest that these physiological changes which occur in response to early weed competition, result in a physiological cost to the crop plant, which contributes to the rapid loss in yield observed in weed competition studies conducted under field conditions.

41) **Two-pass weed control in glyphosate-resistant corn - efficacy, environmental impact, yield and profitability**. Peter Sikkema*[1], Robert E. Nurse[2], Chris Gillard[3], Nader Soltani[3]; [1]University of Guelph - Ridgetown Campus, Ridgetown, ON, [2]Agriculture and Agri-Food Canada, Harrow, ON, [3]University of Guelph Ridgetown Campus, Ridgetown, ON

Field trials were conducted over a three-year period (2010 - 2012) at various locations in Southwestern Ontario, Canada to compare various two-pass weed management strategies in glyphosate-tolerant corn for weed control, crop injury, corn yield, environmental impact and profit margin. No visible injury resulted from the herbicide treatments evaluated. One early postemergence application of glyphosate provided good full season control of pigweed species and lady's thumb and fair control of velvetleaf, common ragweed, lambsquarters, barnyard grass and green foxtail. Glyphosate (LPOST) provided excellent control of all the weed species evaluated but corn yield was reduced due to early weed interference. The sequential application of glyphosate (EPOST fb LPOST) provided excellent control of all weed species evaluated with no adverse effect on corn yield. The sequential application of a preemergence herbicide followed by an application of glyphosate LPOST (at 6-8 leaf stage) provided excellent full season control of all the weed species evaluated and corn yield was equal to the weed free control. Among the sequential programs the lowest environmental impact was glyphosate EPOST fb LPOST and saflufenacil/dimethenamid-p, isoxaflutole + atrazine and rimsulfuron + s-metolachlor + dicamba applied PRE fb glyphosate LPOST. Based on this study, the most efficacious and profitable weed management programs in glyphosate-resistant corn are a sequential application of glyphosate or a two-pass program of a preemergence herbicide followed by glyphosate LPOST. The two-pass programs have glyphosate stewardship benefits.

42) **Comparison of weed management programs for food grade, non-GMO soybean.** François Tardif*[1], Mike Cowbrough[2], Connie A. Sauder[3], Peter Smith[1], Gilles Quesnel[4], Peter Sikkema[5]; [1]University of Guelph, Guelph, ON, [2]Ontario Ministry of Agriculture Food and Rural Affairs, Guelph, ON, [3]Agriculture and Agri-Food Canada, Nepean, ON, [4]OMAFRA, Guelph, ON, [5]University of Guelph - Ridgetown Campus, Ridgetown, ON

43)	**OpTill Herbicide for weed control in soybeans.** Rob Miller, BASF Canada, London, ON
44)	**Thiamethoxam as a seed treatment alters the physiological response of maize seedlings to neighbouring weeds**. Maha Afifi, Clarence J. Swanton*; University of Guelph, Guelph, ON Thiamethoxam, is a broad-spectrum neonicotinoid insecticide which when applied to seed, has been observed to enhance seedling vigour under environmental stress conditions. Stress created by the presence of neighbouring weeds is known to trigger the accumulation of hydrogen peroxide (H_2O_2) in maize seedling tissue. No previous work has explored the effect of thiamethoixam as a seed treatment on the physiological response of maize seedlings emerging in the presence of neighbouring weeds. In this study, we hypothesized that the enhancement in seedlings vigour reported in seedlings emerging from seeds treated with thiamethoxam is the result of a reduction in H_2O_2 accumulation. We further hypothesized that the mode of action of thiamethoxam involves the alteration of gene expression linked to anthocyanin biosynthesis pathway and antioxidant scavenging genes. In this study, thiamethoxam was found to enhance seedling vigour and to overcome the expression of typical shade avoidance characteristics in the presence of neighbouring weeds. These results were attributed to an increase in seed germination, the maintenance of anthocayanin content, and the activation of scavenging genes which reduced the accumulation of H_2O_2 in maize seedling tissues. These results suggest the possibility of new chemistries and modes of action be explored as novel seed treatments to up-regulate free radical scavenging genes and to maintain the antioxidant system within plants. Such an approach may provide an opportunity to enhance crop competitiveness with weeds.

PMRA, CFIA Regulatory Updates and Provincial Weed Reports

See Appendix A for some of the detailed reports.

45)	**Canadian Food Inspection Agency's Invasive Plants Program: Prevention, pathways and partnerships. Wend**y Asbil*; CFIA, National Manager/Gestionnaire nationale Invasive Plants Section/Section des plantes envahissantes Plant Health and Biosecurity Division/Division de la protection des végétaux et biosécurité Canadian Food Inspection Agency/Agence Canadienne d'Inspection des Aliments Ottawa, ON
46)	**Alberta Weed Report** Chris Neeser, Weed Scientist, Alberta Agriculture and Rural Development Pest Surveillance Branch
47)	**Weed Control Saskatchewan Government Saskatchewan Weed Report** Clark Brenzil, Provincial Specialist,
48)	**Manitoba Agriculture, Food and Rural Initiatives (MAFRI) Report** Nasir Shaikh, Provincial weed specialist Manitoba Agriculture, Food and Rural Initiatives Crops Knowledge Centre
49)	**Ontario Weed Report** Kristen Callow, Weed Management Program Lead, Horticulture Crops, Ontario Ministry of Agriculture, Food and Rural Affairs
50)	**MAPARAPPORT DU QUÉBEC À LA SOCIÉTÉ CANADIENNE DE MALHERBOLOGIE** Danielle Bernier, agronome-malherbologiste Direction de la phytoprotection,

Weed Control in Cereals, Oilseeds & Pulses

51)	**Pod drop and seed shatter in canola**. Andrea Cavalieri*, Robert H. Gulden; University of Manitoba, Winnipeg, MB Pod-drop and seed shatter in canola are important issues related to harvest loss, yield, profitability, and the problem of volunteer canola. Traditional methods tend to be time consuming and no universal method to measure these has been developed. To facilitate canola breeders and reduce harvest losses and seedbank additions, efficient methods for the evaluation of pod-drop and seed shatter need to be developed. In these studies, different methods to evaluate seed shatter and pod drop in canola including catch trays, soil vacuum, pod retention resistance and visual ratings were evaluated and compared. Eight varieties of canola (four hybrids and four open pollinated), have been tested two locations over the past two years. The research is also evaluating whether there is a trade-off between pod drop and seed shatter. Preliminary result indicate that total harvest losses measured using catch trays were similar to total harvest losses determined using the vacuum method. Visual estimates of seed shatter agreed best with the amount of shattered seeds retrieved from catch trays.
52)	**Weed control strategies in canola hybrid breeding programs**. Sara C. Freeman*; Dow AgroSciences Canada Inc, Saskatoon, SK
53)	**Site-specific wild oat (*Avena fatua*) management**. Hugh J. Beckie*[1], Scott Shirriff[2]; [1]Agriculture and Agri-Food Canada, Saskatoon, SK, [2]AAFC, Saskatoon, SK Site-specific wild oat (*Avena fatua* L.) management. Beckie H.J., Shirriff S.W. Agriculture and Agri-Food Canada, Saskatoon, SK Variation in soil properties, such as soil moisture, across a hummocky landscape may influence wild oat emergence and growth. To evaluate wild oat emergence, growth, and management according to landscape position, a study was conducted from 2006 to 2010 in a hummocky field in the semiarid Moist Mixed Grassland ecoregion of Saskatchewan. The hypothesis tested was that wild oat emergence and growth would be greater in lower than upper slope positions under normal or dry early growing season conditions. Three herbicide treatments were imposed on the same plots each year of a two-yr canola (*Brassica napus* L.) – wheat (*Triticum aestivum* L.) sequence: (1) nontreated (weedy) control; (2) herbicide application to upper and lower slope positions (i.e., full or blanket application); and (3) herbicide application to lower slope position only. Slope position affected crop and weed densities before in-crop herbicide application in years with dry spring growing

	conditions. Site-specific wild oat herbicide application in hummocky fields in semiarid regions may be justified based on results of wild oat control averaged across slope position. In year 2 of the crop sequence (wheat), overall (i.e., lower and upper slope) wild oat control based on density, biomass, and dockage (i.e., seed return) was similar between site-specific and full herbicide treatment in 2 of 3 yr. Because economic thresholds have not been widely adopted by growers in managing wild oat, site-specific treatment in years when conditions warrant may be an appropriate compromise between no application and blanket herbicide application.
54)	**Glyphosate-resistant kochia in Alberta**. Robert E. Blackshaw*[1], Hugh J. Beckie[2], Ryan Low[3], Linda M. Hall[3]; [1]Agriculture and Agri-Food Canada, Lethbridge, AB, [2]Agriculture and Agri-Food Canada, Saskatoon, SK, [3]University of Alberta, Edmonton, AB A report of poor kochia *(Kochia scoparia*) control with glyphosate was received in August, 2011 and we subsequently investigated suspected glyphosate-resistant (GR) kochia in three chemfallow fields (each farmed by a different grower) in southern Alberta. In greenhouse dose-response experiments, the three kochia populations exhibited a resistance factor ranging from 4 to 6 based on shoot biomass response (GR_{50} ratios) and 5 to 7 based on survival response (LD_{50} ratios). A field confirmation dose-response experiment at Lethbridge in 2012 indicated a resistance factor of 6.2 (GR_{50} ratios). An additional 46 fields within a 20-km radius of the original three fields were surveyed in October, 2011 and 7 of 46 populations were found to be glyphosate-resistant. In the spring of 2012, another kochia population >100 km away from the original site was also confirmed to be glyphosate-resistant. Greenhouse studies indicated that all GR kochia populations are Group 2 (thifensulfuron/tribenuron) resistant but Group 4 (dicamba) susceptible. A field experiment at Lethbridge evaluating alternative herbicides for GR kochia control in the absence of crop competition found that 2,4-D ester, bromoxynil, and bromoxynil/MCPA only provided moderate growth suppression. In contrast, excellent GR kochia control was attained with fluroxypyr, dicamba, dicamba/diflufenzopyr, sulfentrazone, and MCPA/dichlorprop/mecoprop-P. These findings will be utilized to provide growers with advice on management of GR kochia.
55)	**Effect of crop management, glufosinate rate, and application parameters on weed control and yield of Liberty-Link canola.** E. N. Johnson[1] and T. M. Wolf[2]. [1]Agriculture and Agri-Food Canada, Scott, SK; [2]Agriculture and Agri-Food Canada, Saskatoon, SK. The efficacy of contact herbicides such as glufosinate can be sensitive to application parameters such as carrier volume and spray quality. Many growers prefer to apply

	at low carrier volumes and relatively coarse spray quality to increase efficiency and reduce drift, which may have a negative effect on efficacy. A 3-year study was conducted at the Scott Research Farm from 2007 to 2009 to determine if optimum input management (seeding rate, hybrid vs OP cultivar, soil fertility) could offset reductions in efficacy from low volume, coarse sprays. The 4 factor experiment include input level [high (hybrid cultivar, 150 seeds m^{-2} planting density, fertility at 100% target yield) vs low (OP cultivar, 75 seeds m^{-2}, fertility at 50% target yield)], glufosinate rate (400 g ai ha^{-1} vs 200 g ai ha^{-1}), carrier volume (125, 85, and 45 L/ha), and spray quality (medium, coarse, and very coarse). The 2 input levels were arranged in a split-block design, with the other 3 factors arranged in a RCBD within the blocks. When combined over 3 years, there was a rate X carrier volume X spray quality interaction for weed biomass. When 0.5 X rate glufosinate was applied, weed biomass was significantly higher with very coarse qualities and 125 l ha^{-1} carrier volume compared to medium and coarse spray qualities at the same volume; whereas, at 1.0 X rate, the very coarse quality and 125 l ha^{-1} had similar weed biomass to the medium and coarse spray qualities. For canola seed yield, there was a rate X carrier volume interaction. At 0.5X rate, increasing carrier volume did not increase yield; however, a linear yield increase resulted with increasing carrier volume at 1X rate. The absence of an input level by application parameter interaction for seed yield indicated that reductions in efficacy from low volume, coarse sprays could not be overcome with input management; however, the overall impact of application parameters on weed biomass and yield were small relative to the impact of glufosinate rate and low vs high inputs. Growers should consider application parameters such as spray quality and carrier volume as fine-tuning their herbicide application, but they should not expect that they will provide compensatory weed control for poorly managed crops.

Weed Control in Horticulture & Special Crops

56)	**New solutions for the control of herbicide resistant redroot pigweed (*Amaranthus retroflexus* l.) in carrot**. Clarence J. Swanton*[1], Darren Robinson[2], Kristen Callow[3], Robert E. Nurse[4]; [1]University of Guelph, Guelph, ON, [2]University of Guelph - Ridgetown Campus, Ridgetown, ON, [3]Ontario Ministry of Agriculture, Food and Rural Affairs, Harrow, ON, [4]Agriculture and Agri-Food Canada, Harrow, ON In Ontario, the occurrence of pigweed populations resistant to herbicides is a significant threat to carrot producers on muck and mineral soils. Linuron and prometryne are the only broad-spectrum herbicides registered in carrots. Alternative herbicides were evaluated for efficacy on redroot pigweed and crop tolerance in carrots grown on muck and mineral soil. Trials were conducted at 3 sites in Ontario: on muck soil at MCRS (70-80% O.M) near Bradford; and mineral soils at Ridgetown (82.4% sand; 10.5% silt; 7.1% clay; 4.1% O.M.); and Harrow (82.5% sand; 5% silt; 12.5% clay; 2% O.M.). Preemergence treatments of pendimethalin (ME formulation), ethofumesate, pyroxasulfone, flufenacet, and s-metolachlor were applied at 1X the proposed use rate: 3000, 3960, 89, 450, and 1373 g ai ha^{-1}, respectively, for control of redroot pigweed. Herbicide efficacy and crop tolerance was influenced by soil type. At MCRS all herbicides gave ≤50% control of pigweed at 2 WAT (weeks after treatment) compared to 75-90% control at 5 WAT (weeks after treatment) on mineral soils except for reduced control with flufenacet and s-metolachlor at Harrow. When applied PRE to carrots at 2X, herbicide tolerance was excellent at MCRS and Ridgetown. At Harrow, however, all herbicides except pendimethalin caused injury and yields were reduced except with pendimethalin and ethofumesate. When applied POST to carrots at the 2-3 leaf stage, tolerance was excellent and no yield loss incurred at all locations with 2X rates of pendimethalin (ME formulation), pyroxasulfone, flufenacet, and s-metolachlor. Below label treatments of oxyfluorfen (EC formulation), acifluorfen, fluthiacet-methyl, and fomesafen, at doses of 60, 18.75, 1.875, and 5 g ai ha^{-1}, respectively, gave postemergence control of 2-4 leaf redroot pigweed. Carrot tolerance to 2X rates of these herbicides applied when carrots were at the 2-3 and 4-5 leaf stage was commercially acceptable, and did not reduce total or marketable carrot yield.
57)	**Weed management options in organic pumpkins**. Robert Nurse, AAFC, Harrow
58)	**Weed management during the critical period of red beet**. Darren Robinson, University of Guelph, Ridgetown Campus

59)	**Recropping with high value crops after Trilogy**. Darren Robinson, University of Guelph, Ridgetown Campus

Weed Biology and Ecology

60) **Predicting how far mile-a-minute (*Mikania micrantha* kunth.) will invade**. David R. Clements*; Trinity Western University, Langley, BC

Mikania micrantha, known as "mile-a-minute" (Asteraceae), is a perennial creeping vine capable of both rapid growth and rapid geographic spread through seed dispersal and vegetative propagation. It readily colonizes a wide variety of agricultural and natural habitats, severely impacting growth of other plants through shading or smothering. Native to Central and South America, mile-a-minute reached Asia about 1910 and was subsequently introduced throughout the Indo-Pacific region. I have witnessed mile-a-minute's rapid spread in Yunnan Province, China, with an increasing level of infestation on an annual basis. This rapid spread follows the same pattern seen in other Chinese provinces such as Guangdong. Given this rapid invasion potential, it is imperative that we develop methods of forecasting further spread. CLIMEX models have been applied to the spread of mile-a-minute in Papua New Guinea and Australia utilizing climate data from its world distribution. As well as climate matching, other factors need to be considered such as which habitats are most invasible, factors impacting dispersal mode (e.g., fragmentation vs. seed), relationship of spread to land use patterns, evolutionary adaptation or ecotype variation, and the impact of emerging management strategies. I will describe our present state of understanding of these factors with respect to mile-a-minute. A more proactive approach to its management across Asia and the South Pacific will require a thorough understanding of the biology of this invader and collaboration among jurisdictions threatened by new invasions and further spread.

61) **Relationship between urban habitat characteristics and *Ambrosia artemisiifolia* abundance.**. Diane L. Benoit*[1], Marie-Josee Simard[2], Elizabeth Masson[3]; [1]Agriculture and Agri-Food Canada, Saint-Jean-sur-Richelieu, QC, [2]Agriculture and Agri-Food Canada, Quebec, QC, [3]Direction de santé publique, Longueuil, QC

Common ragweed (*Ambrosia artemisiifolia* L.), a monoecious indigenous weed, is responsible for seasonal rhinoconjunctivitis ("hay fever") . A four year study (2007 – 2010) was carried out in July of each year in two municipalities south of Montréal, Quebec to survey ragweed density in different urban habitats and associate their presence with edaphic and environmental characteristics of each habitat. Each municipal territory was divided into sectors of 1.5 km², Salaberry-de-Valleyfield (**SV**) with 13 sectors and Saint-Jean-sur-Richelieu (**SJR**) with 18 sectors. Four habitat types were identified within each municipality: residential (street, boulevard), industrial (industrial sites, train yard, quarry), landscaped (park, golf, green area) and disturbed (construction site, snow deposit site, railroad & hydro land). Ragweed plants were counted in quadrats (50 X 50 cm) randomly positioned in each habitat per sector along roadside (for a total of 312 to 432 quadrats per municipality). Visual

	assessment of overall soil components, % weed cover and soil component under ragweed canopy were also collected. A mixed model ANOVA was carried out on transformed (ln (√ (x+0.5) + 1) values. At the onset of the project in 2007, both municipalities had similar ragweed populations (7.8 ± 0.5 plants/m² in **SJR** and 8.0 ± 0.5 plants/m² in **SV**). Ragweed density was statistically lower in residential areas than in any other habitat (landscaped, industrial or disturbed) in both municipalities throughout the study. The importance of ragweed densities varied with urban habitats and ragweed densities can be ranked as follows: Residential << landscaped <= industrial < disturbed. Industrial and disturbed habitats were identified as the most problematic habitats within municipalities for ragweed management.
62)	**Demography of red sorrel (*Rumex acetosella* L.) in lowbush blueberry (*Vaccinium angustifolium* Ait.) fields in Nova Scotia, Canada.** White, S.N.[1], Boyd N.S.[2], Van Acker R.C.[1], Swanton C.J.[1], and Newmaster S.[3]. [1]Department of Plant Agriculture, University of Guelph, Guelph, Ontario; [2]Department of Environmental Sciences, Dalhousie Faculty of Agriculture, Truro, Nova Scotia; [3]Department of Integrative Biology, University of Guelph, Guelph, Ontario. Seasonal patterns of red sorrel ramet emergence, mortality, and phenological development were determined in three sprout year and three crop year lowbush blueberry fields in Nova Scotia between 2009 and 2011. Ramet data were collected weekly or bi-weekly from May until December in four 0.09m^2 quadrats located within blueberry clones and four 0.09m^2 quadrats located within bare soil patches between blueberry clones at each site. New ramets were marked with colored elastics to keep cohorts separate, and flowering was related to time of ramet emergence based on the elastic color associated with each flowering ramet. Emergence of new ramets in the sprout year was season-long with the density of new ramets emerging generally higher in blueberry than in bare soil patches. Sprout year ramet mortality was lower in blueberry than in bare soil patches, resulting in a large net gain to ramet populations in blueberry patches at all sprout year sites. Approximately 88% of the final net ramet population in the sprout year survived over winter into the crop year. Crop year ramet emergence was also season-long, but mortality was high (>60%) in both blueberry and bare soil patches. As a result, little net gain to ramet populations was observed at crop year sites. The majority of flowering ramets (>70%) were from the overwintering cohort, with the remaining percentage comprised of ramets emerging early in the season. No plants established from seed or root fragments under controlled conditions flowered when grown under constant 8 or 16-hour photoperiods. Less than 20% of plants established from seed flowered after vernalization for 5 weeks at 4^{o}C. Vernalization for 10 or 15 weeks at 4^{o}C resulted in an average of 60 and 80% flowering, respectively. Field and greenhouse data have been used to develop a life-cycle model of red sorrel for the 2-year lowbush blueberry production cycle.

63) **Sightline- A New Herbicide for Control of ALS Resistant Kochia in Non-Crop Areas in Canada.** Hare, D.D. Dow AgroSciences Canada Inc. Calgary Alberta Canada.

Dow AgroSciences has recently received registration of Sightline™ Herbicide Tank-Mix, a new selective post-emergent herbicide that will provide kochia control, including ALS resistant biotypes, for vegetation managers across Canada. Sightline combines highly effective kochia control with broad-spectrum control of annual and perennial broadleaf weeds, invasive plants and shrubs – resulting in a wide spectrum of control. Sightline is designed for controlling vegetation on rights-of-way, industrial areas, roadsides and other non-crop areas. Sightline offers low use rates and a favourable environmental and user safety profile compared to current industry standards. It combines three active ingredients and two herbicide groups for effective control of kochia including ALS and glyphosate resistant bio-types. Sightline controls an extensive list of weeds, but also controls kochia, which continues to be a problem species for vegetation managers in many areas of Canada. Sightline is designed from Dow AgroSciences Reduced Risk Aminopyralid chemistry. Sightline is easy to use, and has a favourable environmental and user safety profile. Sightline can be applied alone or tank-mixed with Vantage™ XRT for bare ground applications in areas such as oil and gas sites, electrical sub stations, and rail lines.

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64) **Do weeds affect functional soil microbes?** Robert H. Gulden*[1], Susan Mitchell[2], Tim J. Daniell[2]; [1]University of Manitoba, Winnipeg, MB, [2]James Hutton Institute, Invergowrie, Scotland

Within agricultural systems, weeds are a source of plant diversity. Soil function is mediated by soil microbes and these are influenced by the surrounding plant community. Weeds, therefore, may influence below ground function in agricultural systems. A 10 year old field study with different equilibrium weed seedbank densities was sampled to evaluate the effect of weed seedbank density relative to previous crop on functional soil microbes. Soils were sampled after a canola and a flax crop in these rotations with three different levels of weed seedbank densities that, with the exception of different in-crop herbicide use in some crops, have been otherwise managed identically. Soil functional microbe responses that were investigated included denitrification and arbuscular mycorrhizal fungi in a durum trap crop. Increasing weed densities increased early above ground dry matter production, root length accumulation and root length colonized by AMF in durum wheat. Weed seedbank densities were more influential to these responses than previous crop. The intraradicle AMF community structure was also affected by weed seedbank density, previous crop, and durum developmental stage. Potential denitrification was lower at higher weed densities suggesting differences in nutrient cycling and nutrient pools in response to weed seedbank densities. Initial results

	indicate that weeds play an important role in soil function that warrants further investigation.
65)	**Intra- and interspecific competition effects on stand uniformity, development and yield in maize (*Zea mays* l.).** Eric R. Page*[1], Hugo Gonzalez[2], Diego Cerrudo[2], Clarence J. Swanton[3]; [1]Agriculture and Agri-Food Canada, Harrow, ON, [2]University of Guelph, Guelph, ON, [3]University of guelph, Guelph, ON In production agriculture, it is not uncommon for a crop seedling to experience both intra- and inter-specific interference during the normal course of growth and development. Although the interference between crop seedlings (intraspecifc) is often considered independently of that among crop and weeds (interspecific), the physiological mechanisms through which yields are reduced may be common to both. In this study, we will compare and contrast the impacts of intra and interspecific interference on the growth and development, stand uniformity in maize and examine their impact on yield determination. Specifically, we will review literature pertaining to the two widely recognized critical periods of maize development: 1) the critical period for weed control, lasting from the 4th to the 13th leaf tip stage of development, and 2) the critical period for kernel set, lasting from around 1 week before to 2 weeks after silking. While the acquisition of light, water and nutrients is critical during the early stages of crop establishment, little is known regarding the differences/commonalities of early physiological responses to stresses occurring during this period and their impact on grain yield at maturity. We hypothesize that early stressors will differentially impact the advancement of developmental stages (i.e., leaf appearance and ear development), coupled with changes in biomass accumulation. Secondly, the degree of association between growth and development may change depending on the stress considered. Overall, the comprehensive study of early factors influencing stand uniformity and competitiveness will bring to light new opportunities to improve general stress tolerance and yield in maize.

Posters

66)	**Chasing ghosts? Range and abundance of *Camelina* sp. in the Canadian Prairies.** Sara L. Martin, Agriculture and Agri-Food Canada and Connie A. Sauder, Agriculture and Agri-Food Canada. False-Flax (*Camelina sativa*) is an emerging oilseed for the Canadian prairies known to have formed feral populations in the past, and which has had two congeners reported within Canada (Large Seeded False-Flax *C. alyssum* and Small Seeded False-Flax *C. microcarpa*). However, no records of *C. alyssum* or *C. sativa* from the past five and four decades, respectively were seen by FNA authors who concluded that is unlikely either species is still established in North America. Given the limited field collections over this period, and the difficulty distinguishing *Camelina* species, this lack of records may not reflect absence of the species. Herbicide resistant False-flax is being developed making it important to determine the range and abundance of *Camelina* species within Canada as first step for environmental risk assessment. During 2011 and 2012, we visited 40 (of 51) sites in Alberta, Saskatchewan and Manitoba where DAO herbarium records of *Camelina* sp. originated.We were unable to locate *C. alyssum*, supporting the conclusion that the species is no longer present within Canada. We located *C. sativa* at two sites in Saskatchewan, but only one site (Kyle, Saskatchewan), appears to have a viable population. This indicates that gene flow between False-Flax and naturalized *C. alyssum* is unlikely, but there may be limited potential for gene flow between cultivated False—Flax and feral False—Flax. We also located 18 populations of *C. microcarpa* indicating it has the greatest opportunity for hybridization with cultivated False-Flax. Interestingly, individuals of *C. microcarpa* fall into two classes of DNA content with individuals containing 0.96pg or 1.45pg DNA per nucleus. The potential of both types of individuals to hybridize with False-Flax will need to be assessed.
67)	**Be On The Lookout for These Pest Plants**. Wendy Asbil, CFIA and Cory Lindgren, CFIA.
68)	**Do unseeded corn or soybean rows have more weeds?** Marie-Josée Simard, Agriculture and Agri-Food Canada, Bernard Panneton, Agriculture and Agri-Food Canada, Corinne Tardif-Paradis, Université Laval Gilles Leroux, Université Laval, Robert E. Nurse Agriculture and Agri-Food Canada and Anne Vanasse Université laval.

	Site-specific spot spraying coupled with real time weed detection could reduce herbicide input in field crops without increasing fuel and time expenses (e.g. mechanical weeding) or yield reduction risks (e.g. reduced herbicide rates). However, real time weed detection is constrained by weed/crop discrimination. This hurdle could be bypassed if weeds were detected in the inter-row only. However, weed cover could be higher on the row than on the inter-row due to increased weed germination from soil disturbance by the seeding equipment at seeding. Higher weed density on the row could however be offset by crop competition, leading to lower or equal weed cover on the row. Our goal was to determine if the disturbance generated by the seeding equipment modifies weed emergence and growth in fields under conventional tillage. The experimental design included two crops (corn and soybean), two years (2011 and 2012), four fields (+ 2 extra field in 2012), three treatments (SR, UR and IR) and four blocks. The treatments were: 1) seeded row (SR), the row is seeded with a planter based on standard practices, 2) unseeded row (UR), the seeding unit is blocked so that the planted disturbs the soil but no seed is planted and 3) undisturbed inter-row (IR), no interference by the planter or crop. For each treatment, we evaluated weed cover, density, and biomass in 75 cm X 15 cm quadrats (long side parallel to the row, short side centered on treatment) at the time of herbicide application (V2 to V4 growth stage of corn and soybean). In general, seeded and unseeded rows had equal weed cover and biomass and inter-rows had lower weed counts. Therefore, the seeding equipment potentially stimulated weed seed germination but this increase did not translate into significant increases in weed biomass, even without crop competition (unseeded rows).
69)	**Glyphosate-resistant Canada fleabane in Ontario.** Nader Soltani (University of Guelph, Ridgetown Campus), Holly P. Byker (University of Guelph, Ridgetown Campus), Mark Lawton (Monsanto Canada), Darren Robinson (University of Guelph - Ridgetown Campus), François Tardif University of Guelph), and Peter Sikkema (University of Guelph – Ridgetown) Seed collected in the fall of 2010 confirmed glyphosate resistant (GR) Canada fleabane (Conyza canadensis) in 8 fields in Essex County in southwestern Ontario, Canada. A survey conducted in 2011 identified 76 additional fields in Essex, Kent, Elgin, Lambton, and Niagara counties in southern Ontario with GR Canada fleabane. Field studies were conducted during summer of 2011 and 2012 to determine a) the biologically effective rate of glyphosate, b) the efficacy of herbicide tankmixes applied preplant, c) the efficacy of herbicides applied preemergence for full season residual weed control, and d) the efficacy of postemergence herbicide tankmixes in soybean for the control of GR Canada fleabane in soybean. GR Canada fleabane survived glyphosate rates as high as 43,200 g ai/ha which is 48 times the manufacturer's recommended rate. Among the preplant herbicide tankmixes evaluated, saflufenacil (97%) and saflufenacil/dimethenamid-p (96%) provided the

	best control while amitrole (87%) and 2,4-D (86%) were also effective in controlling GR Canada fleabane. Glyphosate alone or tankmixed with carfentrazone, glufosinate, paraquat, cloransulam-methyl, chlorimuron, flumioxazin, chlorimuron+flumioxazin provided poor/inconsistent control of GR Canada fleabane in soybean. Among the preemergence residual herbicide treatments evaluated, metribuzin (99%) and flumetsulam (94%) provided the best control while cloransulam-methyl (89%) was also effective in control GR resistant Canada fleabane. Glyphosate alone or in combination with chlorimuron, linuron, imazethapyr, clomazone, flumioxazin, flumioxazin+chlorimuron or pyroxasulfone+flumioxazin provided poor/inconsistent control of GR Canada fleabane in soybean. Among the postemergence herbicide tankmixes evaluated, cloransulam-methyl (51%) and chlorimuron (45%) provided marginal control of GR Canada fleabane in soybean. Glyphosate alone or in combination with acifluorfen, fomesafen, bentazon, thifensulfuron, imazethapyr, imazethapyr+bentazon or glyphosate/fomesafen applied POST provided poor/inconsistent control of GR Canada fleabane in soybean. In dicamba tolerant soybean, dicamba provided good to excellent control of GR Canada fleabane depending on rate.
70)	**Herbicide-resistant weeds in the Canadian prairies: 2007 to 2011**. Beckie H.J.[1], Lozinski C.[1], Shirriff S.W.[1], Brenzil C.A.[2] [1]Agriculture and Agri-Food Canada, Saskatoon, SK; [2]Saskatchewan Ministry of Agriculture, Regina, SK A late-summer survey of herbicide-resistant (HR) weeds was conducted in Alberta in 2007, Manitoba in 2008, and Saskatchewan in 2009, totaling 1,000 randomly selected annually-cropped fields. In addition, we screened 1,091 weed seed samples (each sample from one field) submitted by prairie growers between 2007 and 2011. Of 677 fields where wild oat (*Avena fatua* L.) samples were collected, 298 (44%) had an HR biotype. Group 1 (acetyl CoA carboxylase inhibitor)-HR wild oat was confirmed in 275 fields (41%), up from 15% in previous baseline surveys (2001-2003). Group 2 (acetolactate synthase)-HR wild oat was found in 12% of fields (vs. 8% in 2001-2003). Group 8 (triallate, difenzoquat)-HR wild oat was identified in only 8% of fields (not tested in 2001-2003); the frequency of occurrence of group 1+2-HR wild oat was similar (8%, vs. 3% in 2001-2003). Group 1-HR green foxtail [*Setaria viridis* (L.) Beauv.] was found in 27% of 209 fields sampled for the weed (vs. 6% in 2001-2003). Group 2-HR spiny annual sowthistle [*Sonchus asper* (L.) Hill] was confirmed in all Alberta fields sampled (vs. 67% in 2001); chickweed [*Stellaria media* (L.) Vill.] was found mainly in Alberta in 40% of fields (vs. 17% in 2001). Group 2-HR weed biotypes not previously detected in the baseline surveys included cleavers [*Galium* spp.] mainly in Alberta (17% of fields) and Saskatchewan (21%), Powell amaranth (*Amaranthus powellii* S. Wats.) in Manitoba (16% of fields), wild mustard (*Sinapis arvensis* L.; three populations in Saskatchewan and Manitoba), and wild buckwheat (*Polygonum convolvulus* L.; one population in Alberta). No sampled weed populations across the prairies were found to be resistant to herbicides from Group 4 (synthetic auxins), 9 (glyphosate), or 10 (glufosinate). Based on the

	proportion of total field area at each site infested with HR weeds, it is estimated that 7.7 million ha (29% of annually-cropped land) are infested with HR weeds (eight-fold increase from 2001-2003), in a total field area of 9.9 million ha (37%) – over a two-fold increase. Of 816 cases of HR wild oat identified from submitted samples, 69% were Group 1-HR, 15% Group 2-HR, and 16% Group 1+2-HR. Additionally, there were 10 populations of Group 1-HR green foxtail in Saskatchewan or Manitoba, and six populations of Group 1-HR Persian darnel (*Lolium persicum* Boiss. & Hohen. ex Boiss.] in southern Alberta or Saskatchewan. Various Group 2-HR broadleaf weeds were identified, including 17 wild mustard populations mainly from Saskatchewan and 39 cleavers populations across the three prairie provinces. Herbicide-use data from 2006 to 2010 indicated continued reliance on Group 1 herbicides in cereal crops and Group 2 herbicides in pulse crops.
71)	**International Movement of Grain: A Study of Weed Seed Presence in some exported Canadian Commodities.** Willy A. Aarts, Canadian Grain Commission, and Blaine H. Timlick Canadian Grain Commission The Canadian Grain Commission (CGC) inspects export shipments of grains from Canada, part of which is the monitoring of cargo samples for the presence of weed seeds. Grains exported and moving in commercial handling systems are under increased scrutiny for many phytosanitary factors including regulated weed seeds. The CGC analyzed over 2300 samples from 2001 through 2011 to identify and classify weed seeds associated with western wheat, durum and canola. The results indicate that the most frequently found seeds from samples analyzed were wild buckwheat, wild oats, green foxtail and kochia in western wheat and durum while lambs quarters, green foxtail, cleavers, smartweed, wild mustard and stinkweed are most prevalent in canola. No prohibited noxious (class 1) weed seeds (Canadian schedule) were discovered in any of the samples. Weed seeds will always be part of commercial shipments of grains and information such as this can assist brokers and regulators to develop risk assessments to mitigate establishment of invasive species.
72)	**Allelopathic potential of hairy vetch, fall rye and winter wheat**. Charles M. Geddes (University of Manitoba) and Robert H. Gulden (University of Manitoba) Allelopathy is the effect of one plant on another through the release of chemicals into the environment. Aqueous extracts of aboveground and belowground biomass of hairy vetch (*Vicia villosa*), fall rye (*Secale cereale*), and winter wheat (*Triticum aestivum*) were prepared at three different concentrations to determine their allelopathic potential. Canola (*Brassica napus*), kochia (*Kochia scoparia*), lambsquarters (*Chenopodium album*), wheat (*Triticum aestivum*), and wild oats (*Avena fatua*) were used as test species to evaluate the allelopathic potential of the extracts. Allelopathic potential was measured by determining germination and radicle elongation when imbibed with each extract relative to control treatments. The full strength aqueous extracts showed suppression in both germination and radicle

	elongation, while the 0.10X and 0.01X strength extracts had no effect on these response variables. Hairy vetch and winter wheat aboveground biomass aqueous extracts both resulted in significant suppression of germination and radicle elongation in all five germination species. Fall rye and winter wheat belowground biomass aqueous extracts were the least suppressive.
73)	**Thresholds for kochia and biennial wormwwod control in sunflowers.** Derek W. Lewis (University of Manitoba) and Robert H. Gulden (University of Manitoba) Kochia and biennial wormwood are two weeds found growing in Manitoba sunflower fields that can be difficult to manage. Field experiments were conducted across southern Manitoba from 2009 to 2011 to determine the effect of kochia and biennial wormwood density and relative time of weed seedling recruitment on sunflower yield and to determine an action threshold for each weed. Early emerging kochia (plants that emerged at about the same time as the sunflowers) reduced sunflower yield by as much as 82%, which was greater than early emerging biennial wormwood plants, which reduced yield by as much as 27%. At low weed densities, each kochia plant reduced sunflower yield by 0.52% and each biennial wormwood plant reduced sunflower yield by 0.17%. The action threshold (5% sunflower yield loss) for early emerging kochia was 10 plants m^{-2} and the action threshold for early emerging biennial wormwood was 36 plants m^{-2}. Kochia and biennial wormwood plants that recruited after the 4-leaf stage of the sunflower crop did not reduce sunflower yield. The results of this research indicate that kochia and biennial wormwood both have the ability to reduce sunflower yield when these weeds emerge at about the same time as sunflowers and control measures should be implemented when densities approach threshold levels.
74)	**Tolerance of canaryseed (*Phalaris canariensis* L.) to combinations of MCPA, clopyralid, fluroxypyr and florasulam.** William E. May (Agriculture and Agri-Food Canada), Eric N. Johnson (Agriculture and Agri-Food Canada), Ken L. Sapsford (University of Saskatchewan), Guy P. Lafond (Agriculture and Agri-Food Canada), Christopher B. Holzapfel (Indian Head Agricultural Research Foundation), and F. A. Holm (University of Saskachewan) Annual canarygrass or canaryseed (*Phalaris canariensis* L.) is a cereal crop whose primary purpose is feed for caged birds. Canada produces approx. 69 to 79% of the world's annual canarygrass production. The seeded area in Saskatchewan has ranged from 87 000 to 332 000 ha over the past 20 years, representing 89 to 98% of the production in Canada. Before this research was conducted the only herbicide options for broadleaf weed control were combinations of MCPA with bromoxynil or dicamba. To widen the herbicide options open to producers, two studies were

	conducted. In the first trial, nine herbicide combinations were evaluated with a weed-free check (WFC): single and doubled applications of MCPA (560) + clopyralid (100) (Curtail M); MCPA (562) + fluroxypyr (108)(Trophy); and MCPA (560) + clopyralid (100) + fluroxypyr (144) (Prestige); florasulam (5) + MCPA (420) (Frontline); difenzoquat (700) + MCPA (560) + clopyralid (100) (Avenge + Curtail M); and a single application of difenzoquat (700) with all application quantities in parentheses expressed as (g ai/ha). This study was conducted at Indian Head, Scott and Melfort, Saskatchewan (SK) in 2001, and 2002. A second study was conducted at these three locations in 2003 using the same treatments applied at two growth stages, 2 to 3, or 4 to 5 leaves. Crop injury and grain yield were measured. Results of the first study indicate that crop injury and grain yield varied by location with a significant site x herbicide treatment interaction (P<0.001). All the herbicide treatments were similar or better than the WFC at Indian Head in 2001, Saskatoon in 2002 and Scott in 2001. At Saskatoon in 2001 the double applications of Prestige ad Curtail M reduced grain yield compared to the WFC. At Scott in 2002, most of the broadleaf herbicide treatments were lower than the WFC; however grain yield was 10% of normal with below normal precipitation. At Indian Head in 2002 wild oat (*Avena fatua* L.) escaped control; this resulted in all treatments containing Avenge having yields similar to the WFC while all other treatments had grain yields that were lower than the WFC. In the second experiment visible injury from Avenge and Frontline was significant when applied at the 2 to 3 leaf stage; however, double applications of all the herbicide locations had grain yields that were lower than the WFC when they were applied at the 3 to 4 leaf stage. In conclusion, more research is required to investigate the tolerance of canaryseed to Frontline and on the sensitivity of canaryseed to the application timing of herbicides. Canaryseed is tolerant to combinations of MCPA, clopyralid,and fluroxypyr. In addition, Avenge while causing visual injury maintained or increase grain yield.
75)	**Weeds filling the void. Why weed management is critical in low input systems as tillage is reduced.** Anne Legère (AAFC), Craig Stevenson (Private Consultant) and Anne Vanasse Université laval According to the theory of Constant Final Yield (CFY), total plant biomass increases with density, then levels off, and will remain constant even if density increases further. If growth of a crop sown at optimal density is challenged, weeds may "fill the void" and use available resources. Nutrient sources used in low-input cropping systems may affect timing of nutrient availability, delay crop growth, and thus create an opportunity for weed growth. Our objectives were: 1) to test whether the law of CFY applies to mid-season total biomass (crop + weed) across cropping systems applied to mature tillage plots; 2) confirm the capacity of weeds in "filling the void" created by poor crop growth; and 3) determine the relationship, if any, between mid-season weed biomass and harvestable crop yield. Mid-season crop and weed biomass and crop yield data from corn (2009) and soybean (2010) grown in a cropping system (CONV: conventional; GM: using herbicide tolerant crops; HF: herbicide-free; ORG:

	organic) by tillage (MP: moldboard plow; CP: chisel plow; NT: no-till) study at la Pocatière, QC were submitted to ANOVA and regression analyses. Total biomass in corn was similar across cropping system and tillage (p=0.221), in spite of cropping system and tillage effects on crop biomass (CS x T: p=0.004). Lower corn biomass in CP-ORG, NT-HF and NT-ORG could not be explained by a change in crop density (treatment effects: NS). CFY at mid-season was achieved because of weed biomass (over-) compensation. Weed proportion reached 50-70% in these treatments compared to <25% in other treatments. Total biomass production in ORG (fertilized with granular poultry manure) was similar or greater than that in other treatments with mineral fertilization, likely because of the N after-effect from the previous red clover crop (2008). Total biomass in soybean varied with cropping system and tillage (p=0.001), in spite of no effect on crop density. CFY at mid-season was achieved across all four cropping systems with MP, but also in CP-HF, CP-ORG, NT-HF and NT-CONV because of weed biomass compensating poor soybean growth. Proportion of weed biomass was less than 20% only in MP-CONV and MP-GM, but reached 80% in NT-ORG. Fertilization may have failed to give the soybean crop a good initial start, particularly in CP and NT, and more so when these tillage practices were combined with ORG. Crop yield loss was directly proportional to the ratio of weed in total biomass at mid-season in both corn (R^2=0.73) and soybean (R^2=0.84). Each one percent weed contribution to total biomass at mid-season was equivalent to a loss of 216 kg of silage corn yield and 26 kg of soybean seed yield. Weed contribution to total mid-season biomass allowed the achievement of CFY in certain low input/reduced tillage treatments where crop biomass was reduced. This indicated weeds were capturing resources unused by crops, thus suggesting resources were available. This mid-season situation had drastic consequences for crop yield. It is essential that early growing conditions for crops and weed control operations be optimized through agronomic practices in order for these cropping systems to generate adequate yields and be economically viable.

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Publications Director Stephen Darbyshire Eastern Cereal and Oilseed Research Centre Agriculture and Agri-Food Canada 960 Carling Avenue Ottawa ON K1A 0C6 tel: (613) 759-1389 fax: (613) 759-1599 stephen.darbyshire@agr.gc.ca	**Provincial Extension Representative** Gavin Graham NB Department of Agriculture and Aquaculture, Box 6000 Fredericton NB E3B 5H1 tel: (506) 453-3486 fax: (506) 453-7978 gavin.graham@gnb.ca
Croplife Canada Representative (East) Greg Wilson Field Biologist Syngenta Canada Inc. 946863 Twp. Rd. 14 Plattsville ON N0J 1S0 tel: (519) 696-2269 greg.wilson@syngenta.com	**Croplife Canada Representative (West)** David Forster Field Development Biologist Syngenta Crop Protection #8-4003 Millar Ave Saskatoon SK S7K 2K6 tel: (306) 653-7301 david.forster@syngenta.com
Research Representative Nathan Boyd Nova Scotia Agricultural College PO Box 550 Truro NS B2N 5E3 tel: (902) 896-2421 fax: (902) 893-1404 nboyd@nsac.ca	**Graduate Student Representative** Scott White University of Guelph Department of Agriculture Guelph ON N1G 2W1 tel: (902) 896-2407 swhite09@uoguelph.ca
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Local Arrangements Co-Chair (2012) Frances Boddy Field Biologist E.I. du Pont Canada Company Oakville MB R0H 0Y0 tel: (204) 267-7069 fax: (204) 267-7089 frances.boddy@can.dupont.com	**Local Arrangements Co-Chair (2012)** Brent Wright President ICMS, Inc. 2375 Saskatchewan Ave. E. Box 67 Portage la Prairie MB R1N 3B2 tel: (204) 857-6609 fax: (204) 239-4478 wright@icms-inc.com

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