Canadian Weed Science Society
Société canadienne de malherbologie

69th Annual Meeting
November 23rd to 26th, 2015

69e Réunion annuelle
23 au 26 novembre 2015

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2015 Local Arrangements Committee Members

For further information about the meeting please contact the Chair or a Local Arrangements Committee member as listed below:

Position	Name	Affiliation
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Local Arrangements Committee Chair	Rory Degenhardt	Dow AgroSciences
Hotel Arrangements	Rory Degenhardt	Dow AgroSciences
Hotel Arrangements	Teresa Lin	Westin
Plenary Session Co-Chair & Publications	Linda Hall	University of Alberta
Plenary Session Co-Chair & Publications	Rob Nurse	AAFC
Pre-Conference Events	Breanne Tidemann	University of Alberta
Graduate Student Presentations	Kristina Polziehn	
Awards Banquet	Chris Willenborg/ Rory Degenhardt	University of Saskatchewan
Industry Reception	Don Hare	Dow AgroSciences (Retired)
Photo Contest	Nicole Kimmel	AARD
Poster Session	Pat Forsyth	duPont
Continuing Education and Professional Development Workshop	Pat Forsyth	duPont
Sponsorship - National	Greg Wilson	Syngenta
Sponsorship - National	Joe McNulty	IPCO
Sponsorship - Local	Bill Hamman	Hamman Ag Research
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A/V	Matt Crooks	Monsanto
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Local Arrangements Advisor and Pre-Conference Events	Neil Harker	AAFC
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CWSS Grad Student Representative	Katherine Stanley	University of Saskatchewan

PROGRAM CONCURRENT SECTION CHAIRS

Cereals, Oilseeds and Pulses Steve Shirtliffe University of Saskatchewan	**Soybean, Corn and Edible Beans** Allan Kaastra Bayer CropScience
Horticulture and Specialty Crops Darren Robinson University of Guelph – Guelph	**Weed Biology and Ecology / Invasive and Noxious Weeds** David Clements Trinity Western University
Provincial Reports /Regulatory Issues Chris Neeser Alberta Agriculture and Forestry / Pest Surveillance Branch	**Forage, Rangeland, Forestry and Industrial Vegetative Management** Milo Mihajlovich Mihajlovich Enterprises Ltd

BIOGRAPHIES OF PLENARY SESSION SPEAKERS

Linda Hall

Dr. Linda Hall is an associate professor in the Faculty of Agriculture Life and Environmental Science at the University of Alberta. She conducts research in the environmental impacts of transgenic crops, gene flow via pollen and seeds, weed science and agronomy. She is interested in quantifying the invasive potential of novel weeds and crops. In addition to research, she teaches weed science and cropping systems. Dr. Hall is an editor of GM Crops and has recently received awards for excellence in Weed Science and graduate student supervision.

She teaches Weed Science, Herbicide Physiology and Alberta Cropping Systems. She currently has three Ph.D. students conducting research on the environmental biosafety of transgenic crops.

Hugh Beckie

Dr Hugh Beckie has been employed as a Research Scientist with Agriculture and Agri-Food Canada since 1992, and is an Adjunct Professor in the Department of Agricultural, Food and Nutritional Science at the University of Alberta in Edmonton. He obtained his BSc, BSA and MSc degrees from the University of Saskatchewan in Saskatoon, and his PhD from the University of Manitoba in Winnipeg in 1992. Dr Beckie is also affiliated with the Canadian Weed Science Society (Past-President), the Weed Science Society of America (Chair, Early Career Outstanding Science Award Committee; Associate Editor; Finance Committee), and the Saskatchewan Institute of Agrologists (Past President).

Dr Beckie has authored or co-authored 81 refereed journal publications, 15 contributed chapters, and two books. His area of expertise includes ecological crop protection, management of herbicide-resistant weeds, and the environmental, agronomic and economic impact of crops with novel herbicide resistance traits.

Dr Beckie's research program deals with monitoring, risk assessment, and management of herbicide-resistant weeds as well as impact assessment of crops with novel traits. His current research focus is on management of herbicide-resistant weeds in pulse crops, and assessment of glyphosate- + ALS-resistant *Kochia scoparia* across Western Canada; occurrence, pollen- and seed-mediated gene flow, population and seed bank dynamics, resistance mechanisms, and best management practices. Dr Beckie is also examining the impact of gene flow at a commercial field scale from genetically modified (GM) oilseed (Brassica) crops to non-GM oilseed crops and wild relatives by investigating the potential for outcrossing, the survival of hybrid plants in the field and the inheritance of GM traits; and quantifying the invasiveness potential of new crops and crops with novel traits using demographic analysis, in support of regulation.

Doug Sammons

Dr. Doug Sammons obtained his PhD from Ohio State University in 1982 and completed a National Institutes of Health postdoctoral fellowship at Penn State University with Dr. Stephen Benkovic before joining Monsanto in 1984. Starting in the Herbicide Discovery Program his work focused on the molecular mechanism of glyphosate inhibition of the target enzyme EPSPS. Dr. Sammon's studied methods to control corn rootworm while leading the insecticidal protein discovery team and he completed the required characterization studies for the Cry1Ac Bt toxin for the registration of Bollgard® cotton. Dr. Sammon's studied glyphosate herbicide physiology using Roundup Ready® soybean to elucidate the major barriers to glyphosate delivery and efficacy. His studies on Roundup Ready® soybean determined that sufficient glyphosate in soybean was metabolized to aminomethylphosphonate to induce Yellowflash. Dr. Sammon's studies on glyphosate physiology supported the WeatherMax™ launch and he has been involved in training field sales teams and distributors on the best use of glyphosate. In the past 27 years Doug has worked on several major commercial products and is now a Senior Fellow in the Chemistry Unit leading a discovery research team focusing on the mechanisms and management of glyphosate resistant weeds.

Todd Gaines

Todd Gaines is an assistant professor at Colorado State University in molecular weed science. He completed his PhD at CSU, followed by post-docs in Western Australia and Germany. His research goal is to support sustainable weed management that helps contribute to sustainable cropping systems, including identifying the molecular and genetic basis of complex herbicide resistance mechanisms; utilizing next-generation sequencing to study complex traits in weeds; and developing molecular markers for rapid resistance diagnostics.

Kevin Price

Dr. Kevin Price grew up working on a farm/ranch in the very rural area of Green River, Utah. He is currently a Professor with joint appointments in the Departments of Agronomy and Geography at Kansas State University (KSU). His Ph.D. is in Geography with specialty in remote sensing/GIS and his Master's and Bachelor's are in Range Science. He is an author of over 200 publications. He has multiple publications on remote sensing of crop and grasslands of Inner Mongolia, China; environmental impacts of coffee plantations on rainforests of El Salvador; and studied cropping, deforestation and modeling of dark earth soil distributions in the Amazonian region of Brazil, but the bulk of his work on the crop and grasslands of the Central Great Plains.

Kevin is receiving much national and international attention for his work on the use of remote sensing of crop and grasslands using small unmanned aircraft systems (SUAS), with specific focus on crop stressors such as disease, insects, weeds and inadequate nutrients.

Franck Dayan

Franck Dayan is a Research Plant Physiologist at the Natural Products Utilization Research Unit of USDA, ARS. His work focuses on the mechanisms of action of natural and synthetic herbicides. Franck was born in France came to the USA as an exchange student. He obtained his B.S. (1988) and M.S. (1992) in Botany from Stephen F. Austin State University in Texas. He then received his Ph.D. in Plant Physiology from Auburn University in Alabama in 1995.

He is currently serving as treasurer for the International Weed Science Society. He has served as treasurer of the Phytochemical Society of North America from 2006 to 2011 and will assume the presidency of that society in August 2014. He is a Regional Editor for the *Allelopathy Journal* and an Associate Editor for *Weed Science* and *Pesticide Biochemistry and Physiology*.

Franck has published 172 publications that include 114 peer-reviewed scientific articles and 48 book chapters and reviews in scientific journals. Dr. Dayan's authorship has a google h-index of 46, which reflects his sustained research productivity and significant impact on the research of other scientists (at least 6317 citations as of July 2015). He has been invited to numerous national and international conferences and symposia.

SYMPOSIUM (EDMONTON) PLENARY THEME: NEXT

Topic	Speaker	Affiliation
Introduction	Dr. Linda Hall	Faculty of Agriculture Life and Environmental Science at the University of Alberta, Edmonton AB
Plenary Session Chairs -	Dr. Linda Hall Dr. Rob Nurse	University of Alberta, Edmonton Agriculture and Agri-Food Canada, Harrrow ON
Brief retrospective	Dr. Hugh Beckie	Agriculture and Agri-Food Canada, Saskatoon SK
RNAi – Opportunities for resistant weed control	Dr. Doug Sammons	Monsanto
Molecular Weed Science – Down the rabbit hole of big data	Dr. Todd Gaines	Colorado State University
The latest developments in weed science and control MB/SK	Dr. Kevin Price	RoboFlight Systems, Inc.
Next Gen Herbicides – Natural Products MB/SK	Dr. Franck Dayan	Natural Products Utilization Research Unit of USDA, ARS

	Grad Student Presentation Title	Speaker
1	Glyphosate-resistant common ragweed: two-pass herbicide programs in Roundup Ready and Roundup Ready Xtend Soybean	Byker, Holly
2	Evaluating a two-pass herbicide system for managing glyphosate-resistant canola in glyphosate-resistant soybean crops	Mierau, Ally
3	Volunteer Canola in Soybean: Shifting the competitive balance	Geddes, Charles
4	Interaction Between Xtendimax™ and Group 1 Herbicides for the Control of Volunteer Corn in Soybean.	Underwood, Matthew
5	Halosulfuron tank mixes applied PPI and PRE in white bean	Li, Zhenyi
6	Sulfentrazone Tank-mix Partners for Grass Control in Ontario Dry Beans (*Phaseolus vulgaris* L.)	Taziar, Allison
7	How to improve the consistency of glyphosate-resistant Canada fleabane (*Conyza canadensis* L. Cronq.) control with saflufenacil: an investigation of tank mix partners and optimal time of day	Budd, Christopher

	application	
8	Singlet oxygen signals response of soybean seedlings to neighbouring weeds	McKenzie-Gopsill, Andrew
9	Unique subcellular discoveries in glyphosate resistant giant ragweed, a role for programmed cell death?	Lesperance, Mackenzie
10	Below ground activities as influenced by crops and weeds: the case of extracellular DNA (eDNA)	Kamino, Leila
11	Unlocking the potential of spectroscopy in herbicide research	Pajic, Vladimir
12	The Role of Olfaction in Brassicaceous Weed Seed Predation	Kulkarni, Sharavari
3:30 pm - 3:45 pm	**BREAK**	BC/AB
13	Linking seed bank composition and spatial variation in vegetation to pipeline disturbance in mixed-grass prairie	Pyle, Lysandra
14	Exploiting Weaknesses in Weeds Life Cycles in Order to Optimise Herbicide Resistance Prevention Strategies	Valente, Tasha
15	Evaluating Seed Shatter of Economically Important Prairie Weed Species	Burton, Nikki
16	Potential Effects of Harvest Weed Seed Control on Wild Oat (*Avena fatua*) Populations Based on Demographic Modelling	Tidemann, Breanne
17	Wild oat *(Avena fatua L.)* populations resistant to triallate may also be resistant to pyroxasulfone and sulfentrazone	Mangin, Amy R
18	Evaluation of new herbicide options for control of foxtail barley (*Hordeum jubatum*) in spring wheat	Vercaigne, Mathew
19	Comparision of Artificial Neural Network (ANN) and Logistic Regression as potential models for predicting weed populations in dryland winter wheat fields in Kurdistan province, Iran	Mansourian, Sahar
20	Improving weed management in flax with integrated weed management	Petruic, Moria
21	Determining optimum plant populations in different lentil classes	Kasper, Kali
22	Inter-row Cultivation in Organic Pulse Production	Stanley, Katherine
23	Manuka Oil: A Potential Herbicide for Organic Vegetable Production	Harris, Sierra

24	Weeds in organic vs. conventional cropping systems:What we have learned after 18 years of research	Benaragama, Dilshan

CWSS/AISC Joint Plenary II Topics	Speaker
Breakfast & Poster Viewing with authors present	
Introduction to CWSS-SCM	Eric Johnson
Introduction to the Alberta Invasive Species Council (AISC)	AISC Chair - Oscar Anderson
Weed Control Act Overview	Nicole Kimmel - AARD
New AISC Prevention Programs	Don Hare
Industry Perspective on Vegetation Management	Matthew Gibson, Encana
Impacts of Climate Change on Invasive Species	Shauna-Lee Chai, AITF
Introduction to the Canadian Council of Invasive Species	CCIS Co-chair Barry Gibbs

BIOGRAPHIES FOR AISC AND CWSS-SCM

Eric Johnson

President of the Canadian Weed Science Society

Eric Johnson is the current President of the Canadian Weed Science Society. Eric works as a Research Assistant for the Weed Research Program in the Department of Plant Sciences at the University of Saskatchewan. He was born and raised on a grain farm near Eston, Saskatchewan and received both his Bachelor and Masters of Science in Agriculture at the University of Saskatchewan. Eric has over 30 years of research and technology transfer experience, working as a Weed Biologist and Officer-In-Charge for Agriculture and Agri-Food Canada in Scott, as well as an Extension/Soils and Crops Agrologist for the Saskatchewan Ministry of Agriculture.

Oscar Anderson

Chairman of Alberta Invasive Species Council, Agriculture Fieldman, MD of Ranchland, Alberta Association Agriculture Fieldman

Oscar Anderson grew up in Claresholm, Alberta and has a bachelor of science in biology from the University of Lethbridge. He worked with the Municipal District of Willow Creek starting in 1996 doing weed control. He moved over west of the fifth meridian in 2014 to work for the MD of Ranchland. He has a passion for weed control, nearly surpassing his passion for fly fishing and rugby. He sits on the Alberta Weed Regulatory Advisory Committee (AWRAC) and participates in many community weed pulls. He has a 9 year old son that also fly fishes and pulls weeds with him.

Nicole Kimmel

Government Director – Alberta Invasive Species Council (and past-Chairman of AISC). Weed Specialist - Alberta Agriculture & Forestry - Government of Alberta

Nicole Kimmel received a B.Sc. of Environmental Conservation Sciences from the University of Alberta in 2000 with a Specialization in Wildlife and Rangeland Sciences. She began working with Alberta Agriculture, upon graduation, as a research assistant. Her work involved addressing weed management issues in forages and non-traditional crops. After 15 years in agricultural research with the department, her role has evolved to Weed Specialist. Currently she supports the Alberta Weed Control Act through extension, weed mapping and weed diagnostic services.

Don Hare

Program Coordinator – Alberta Invasive Species Council

Don Hare was raised in Alberta, and received his MSc. in Soil Science from the University of Alberta. He began working with Dow AgroSciences and over a 31 year career held positions as a Sales territory manager, Regulatory Affairs Manager, Product Development Manager, and Senior Research Scientist. Since 2000, Don has been the DAS Invasive weed subject manager technical expert for Canada and has focused on control and management of invasive plant species across Canada. In 2015 he joined AISC as program coordinator to help launch 2 international invasive weed programs in Alberta – PlayCleanGo and Spotters Network (Eddmaps Alberta).

Matthew Gibson

Industry Director – Alberta Invasive Species Council

Matthew Gibson currently works at Encana Corporation as an Environment Manager in the Northern Operating Area. His team's accountabilities include spills, water, air, waste, and land management. Over the past 10 + years of supporting environmental initiatives in the Oil and Gas sector Matt has worked on a wide variety of projects. He has B.Sc. in Geography from the University of Calgary and is a registered professional Agrologist in both Alberta and British Columbia. Matt has served as an industry representative on the AISC Board of directors since 2014. In his spare time he enjoys time outdoors with his family at the lake.

Dr. Shauna-Lee Chai

NGO and Academia Director – Alberta Invasive Species Council

Dr. Shauna-Lee Chai is a research scientist with Alberta Innovates-Technology Futures. A graduate of the University of Cambridge, Shauna-Lee has worked on invasive species issues over the past 10 years - first in Jamaica, where she implemented invasive plant species control programs in a tropical rain forest national park. In 2012 she worked with Alberta Parks to develop a Needs Assessment for an Invasive Alien Plant Species Program across the provincial system of protected areas. In 2014, Shauna-Lee led research on Invasive species management in a changing climate under the Biodiversity Management and Climate Change Adaptation Project.

Barry Gibbs

Executive Director of Alberta Invasive Species Council.

Barry Gibbs graduated in Agriculture from the University of Saskatchewan. A broad range of experience and skills were gained while working 35 years for Dow AgroSciences Canada Inc. Work experience includes research, regulatory, sales, marketing and management. He has been working with invasive species and not-for-profit organizations provincially, nationally and internationally for several years. Founding director and co-chair of the Canadian Council on Invasive Species. Director and chair, Invasive Species Council of BC. Member of the Invasive Species Working Group of PNWER (Pacific North West Economic Region). He resides in Claresholm, Alberta.

Corn, Soybean and Edible Beans		
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25	Effect of herbicide residues on cover crop performance and function	Robinson, Darren
26	Glyphosate-resistant giant ragweed control in corn and wheat	Sikkema, Peter
27	Seed treatments and the enhancement of stress tolerance	Swanton, Clarence
28	Fight the Light: Reducing Herbicide Dependence with Agronomy in a Corn-Soybean-Wheat Rotation	Tardif, François
29	How to comply with new drift label statements for dicamba and 2,4-D choline	Wolf, Tom

Provincial and Regulatory Reports		
#	**Title**	**Speaker**
30	Control of Volunteer Potato	Graham, Gavin
31	Is Jimsonweed Invading Alberta?	Neeser, Chris
32	CFIA Update: Weed Seeds, Pests and Pathways	Rowan, Christina, Karen Castro, Wendy Asbil

Weed Biology and Invasive Weeds		
#	**Title**	**Speaker**
33	Puncturevine Control in the South Okakangan	Sapsford, Ken

34	Impact of post-anthesis glyphosate on woolly cupgrass seed production, seed weight and seed viability.	Nurse, Robert
35	Are there fitness consequences of EPSPS geneamplification in *Kochia scoparia*? The results of a competitive,segregating F2 greenhouse experiment	Benedict, Leshawn
36	Smartphone Application for Invasive Plant Identification and Reporting in Alberta	Hini, Elinam
37	Gene flow in kochia (*Kochia scoparia* L. Schrad.)	Beckie, Hugh
38	Using the Organic weed puller to remove tall weeds in soybean: Lessons learned from the first trial	Simard, Marie-Josee
	Break	
39	Persistence and invasiveness of genetically modified canola in Canada: A demographic comparison of open pollinated and hybrid canola	Hall, Linda
40	GIS assessment of the risk of gene flow from Brassica napus to its wild relatives in China	Wei, Wei
41	Parasitism of weeds and native species by a potential weed, the introduced exotic, *Thesium ramosum*	McLean, Mary Ann
42	Weed Legislation Has Challenges	Kimmel, Nicole
43	Linking Research with Land Managers –A Regional Perspective	Larson, Todd
44	The mechanism by which amino acid biosynthesis inhibiting herbicides control broomrapes (Orobanche and Phelipanche spp.)	Hershenhorn, Joseph
45	Biodiversity and ethnobotanical aspects of weeds: case study in an small area of Colombia, South America	Granados, Juan Carlos

Forage, Rangeland, Forestry and IVM		
#	**Title**	**Speaker**
46	A Quantitative Comparison of Risk Management Systems for Forestry Aerial Application in AB and ON	Mihajlovich, Milo
47	Forest vegetation management in boreal stands: long-term impacts of silviculture intensity on stand productivity, structure and diversity	Thiffault, Nelson
48	Environmental Fate of Aminocyclopyrachlor and the impact on non-target vegetation when using Aminocyclopyrachlor (Navius VM and Truvist) in Industrial Vegetation Management (IVM)	Chambers, Darrell
49	Impacts of single and repeated glyphosate herbicide applications on plant community diversity and spruce growth in an Alberta spruce plantation.	Comeau, Phil

Forage, Rangeland, Forestry and IVM		
#	**Title**	**Speaker**
50	Cultural techniques for integrated wild oat management	Harker, Kenneth N
51	The effect of mechanical weeding and cover crop on weed control and seed yield in organic flax (*Linum usitatissimum* L.)	Duddu, Hema
52	Factors affecting spray deposition in mature canopies	Wolf, Tom
53	Control of Volunteer Canola in Sunflower with Sulfentrazone and Imazamethabenz	May, William
54	Managing seed production of herbicide resistant weeds in lentil with pre-harvest herbicide application	Johnson, Eric
55	Arylex™ active (Halauxifen-methyl): Recrop Intervals for Pulse Crops and Potato in Western Canada	Juras, Len
56	Arylex™ Active (Halauxifen-methyl) plus Pyroxsulam for Broadleaf and Grass Control in Western Canada Cereal Crops	Smith, Laura
57	Ethalfluralin Efficacy in Minimal Disturbance Fields in the Black Soil Zone of Western Canada	MacRae, Andrew

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#	**Title**	**Speaker**
58	Does tolerance to preemergence fomesafen tank mixes vary among cucurbit crops?	Robinson, Darren
59	Seed bank characteristics, seedling recruitment, and management of fescues (*Festuca* spp.) in wild blueberry.	White, Scott

Posters		
#	**Title**	**Speaker**
60	Effect of late herbicide applications on growth and reproductive ability of glyphosate-resistant common ragweed (*Ambrosia artemisiifolia* L.)	Bae, Jichul * Nurse, Robert E Simard, Marie-Josee Page, Eric R
61	Emergence nature of *Galium* spp. populations from W. Canada	De Roo, Andrea C * Willenborg, Christian J
62	First report: spotted knapweed *(Centaurea maculosa L.)* resistance to auxinic herbicides	Mangin, Amy R * Hall, Linda
63	Garlic mustard spreads to Alberta: Urban invasive species in undergraduate research initiatives	Hills, Melissa *
64	Residual Weed Populations in Saskatchewan – 1976 to 2015	Leeson, Julia *
65	Weed population response to rotation and conservation practices in a 12-year study	Blackshaw, Robert E *
66	Biologically effective dose of glyphosate as influenced by weed size in corn	Soltani, Nader * Nurse, Robert E Sikkema, Peter
67	Control of field horsetail (*Equisetum arvense* L.) in corn	Soltani, Nader * McNaughton, Kris Sikkema, Peter
68	Influence of plant growth regulator application and nitrogen fertilization on oat yield and stand-ability	Aidoo, Joseph P * Hall, Linda Strydhorst, Sheri May, William
69	Genetic transformation of Canadian pea (*Pisum sativum* L.) for drought tolerance using DREB2a and PR10a genes	Kahlon, Jagroop G * Negawo, Alemayehu Teressa

		Hassan, Fathi Jacobsen, Hans-Joerg Hall, Linda
70	Pre- or post-emergence management of glyphosate-resistant canola in glyphosate-resistant soybean crops.	Tozzi, Eric * Willenborg, Christian J
71	Development of a Bioherbicide for the control of Conzya spp. in Brazil	de Fatima Fernandes, Alessandra de Fatima Fernandes Boyetchko, Sue *
72	Control of Volunteer Enlist Corn in Enlist Soybean	Ashigh, Jamshid * MacRae, Andrew Smith, Laura
73	A New Target Site Mutation Conferring Broad Spectrum Resistance to ALS-Inhibiting Herbicides	Laforest, Martin *
74	Sensitivity of canola and soybean to dicamba in a replacement series experiment	Gulden, Robert H *

ABSTRACTS

1

GLYPHOSATE-RESISTANT COMMON RAGWEED: TWO-PASS HERBICIDE PROGRAMS IN ROUNDUP READY AND ROUNDUP READY XTEND SOYBEAN.
Holly Byker*[1], Peter Sikkema[2], Darren Robinson[1], François J. Tardif[2], Martin Laforest[3], Mark Lawton[4]; [1]University of Guelph, Ridgetown, ON, [2]University of Guelph, Guelph, ON, [3]Agriculture and AgriFood Canada, Saint-Jean-sur-Richelieu, QC, [4]Monsanto, Guelph, ON

ABSTRACT

Glyphosate-resistant common ragweed in Ontario was first confirmed in 2011. Initial experiments have shown 2,4-D ester, linuron, metribuzin, and saflufenacil as effective, though inconsistent pre-emergent herbicides. Fomesafen applied post-emergence also provided moderate to excellent control, but due to high weed population and early season weed competition was insufficient when applied alone. It was found that due to the prolonged emergence period of common ragweed, a two-pass weed control system would likely be the best management option. Therefore, experiments in Roundup Ready soybean were completed in the 2014/2015 growing seasons to investigate whether full season weed control could be obtained using a two-pass weed control approach with the above identified herbicides. An additional experiment was completed in Roundup Ready Xtend soybean to investigate single and sequential applications of dicamba for control of glyphosate-resistant common ragweed. These two-pass herbicide systems provide excellent alternative herbicide options for managing glyphosate- resistant common ragweed in soybean, while increasing the number of herbicide modes of action used throughout the growing season.

2

EVALUATING A TWO-PASS HERBICIDE SYSTEM FOR MANAGING GLYPHOSATE-RESISTANT CANOLA IN GLYPHOSATE-RESISTANT SOYBEAN CROPS.
Ally Mierau*; Chris Willenborg, Rob Gulden, Bill May, Jessica Weber, Eric Johnson, University of Saskatchewan, Saskatoon, SK

ABSTRACT

In recent years, soybean acreage has increased significantly in western Canada. One of the challenges associated with growing soybeans in western Canada is the control of volunteer glyphosate resistant (GR) canola since the majority of soybean cultivars are glyphosate resistant. Volunteer GR canola has the potential to cause significant yield losses in soybean crops if left uncontrolled. Currently there are very few herbicides registered in western Canada for control of GR canola in GR soybeans and there are no published studies in the scientific literature that address this issue. An experiment was conducted in 2014 and 2015 at four different sites in Saskatchewan and Manitoba to assess efficacy and crop phytotoxicity of different PRE- and POST- herbicide combinations. Treatments consisted of three different PRE- herbicide treatments (2,4-D, tribenuron and saflufenacil) and five different POST- treatments (bentazon, imazamox+bentazon, cloransulam, thifensulfuron and fomesafen), as well as a glyphosate-alone check. Data collection included visual ratings, canola and soybean

	biomass and soybean seed yield. Efficacy among PRE- products was highest with saflufenacil 7-10 DAT. Efficacy among POST- products varied with rating timing, but was highest at 7-10 DAT with the contact herbicides fomesafen, bentazon and imazamox+bentazon, and highest at 56 DAT with cloransulam and imazamox+bentazon. Crop injury ratings were highest in treatments containing thifensulfuron, and PRE- 2,4-D damage was also observed at some locations. Crop biomass and yield did not differ significantly among imazamox+bentazon, cloransulam, bentazon, and fomesafen treatments, but were significantly lower in thifensulfuron and glyphosate-alone treatments. Canola biomass exhibited an oppsite trend with glyphoste > thifensulfuron > imazamox + bentazon = cloransulam = bentazon = fomesafen. Based on combined site-year results, the best herbicide combination for growers to manage GR volunteer canola in GR soybean crops is saflufenacil PRE- and imazamox+bentazon or cloransulam POST.
3	VOLUNTEER CANOLA IN SOYBEAN: SHIFTING THE COMPETITIVE BALANCE. Charles Geddes*and Robert H. Gulden, University of Manitoba, Winnipeg, MB **ABSTRACT** Canola is the most abundant oilseed crop grown in Canada. Volunteer canola, mainly derived from canola harvest losses, can be problematic throughout the Canadian prairies and other canola growing regions. This weed can be especially problematic in soybean, a crop currently increasing in seeded acreage in Manitoba. Like some canola varieties, soybean is genetically-engineered (GE) to be resistant to the herbicide glyphosate. Certified seedlot contamination with unwanted herbicide resistance (HR) traits, pod drop and silique shatter (before and at harvest), secondary dormancy, seed return from unmanaged volunteers in subsequent crops, and short crop rotations all contribute to seedbank persistence of volunteer canola (averaging 3-4 years). This study focused on the evaluation of weed management tools that may be used in combination with herbicides to manage volunteer canola in soybean production, with specific focus on their ability to reduce volunteer canola seed return. In 2013 and 2014, a field research study conducted at four sites in Manitoba, Canada, explored how soybean row spacing, seeding rate, nitrogen supply, inter-row tillage, and living or dead inter-row mulches affect the competitive balance of volunteer canola and soybean. Increasing soybean seeding rate (from 432,400 to 648,700 target plants ha^{-1}) resulted in an approximate 23% increase in soybean yield under volunteer canola/soybean interference. Additionally, supplementation of 26 kg N ha^{-1} at seeding increased volunteer canola seed return by about 14,500 seeds m^{-2} compared to unsupplemented soil. Overall, the management tools evaluated herein had a greater effect on soybean yield than volunteer canola seed return, highlighting the plasticity of volunteer canola to overcome individual management techniques. Nevertheless, these data show potential for the inclusion of several weed management tools in a comprehensive integrated volunteer canola management strategy. The effect of soil nitrogen on volunteer canola seed return, and other seed characteristics related to seedbank persistence, is being investigated further.
4	INTERACTION BETWEEN XTENDIMAX™ AND GROUP 1 HERBICIDES FOR THE CONTROL OF VOLUNTEER CORN IN SOYBEAN. Matthew G. Underwood[1], P. Sikkema[1], D. Hooker[1], D. Robinson[1], C. Swanton[2], J. Vink[3]. [1]Dept. of Plant Agriculture, University of Guelph-Ridgetown, Ridgetown, ON, N0P 2C0, [2]Dept. of Plant Agriculture, University of Guelph, Guelph, ON, N1G 2W1, [3]Monsanto Canada, Winnipeg, MB, R3T 6E3

ABSTRACT

Weed control is an ongoing challenge for farmers. Since the introduction of glyphosate resistant crops in 1996, several weeds have developed resistance to glyphosate, the most used herbicide worldwide, further increasing the difficulty of achieving acceptable weed control. A transgenic soybean cultivar has been developed with resistance to both glyphosate and dicamba (RR Xtend Soybean). Applying glyphosate plus dicamba reduces soybean yield losses caused by glyphosate resistant weeds. However, there is a risk of herbicide antagonism reducing control of monocot weeds when Group 1 herbicides are co-applied with dicamba. Six field experiments were conducted over two years at three sites in south-western Ontario to determine the effect of tank-mixes of dicamba with Group 1 herbicides for controlling volunteer corn. Two rates of dicamba (300 and 600 g ha^{-1}), using the Xtendimax™ herbicide formulation, were co-applied with quizalofop-p-ethyl (24, 30, and 36 g ha^{-1}) and clethodim (30, 37.5, or 45 g ha^{-1}), when volunteer corn reached the V4 growth stage. Weed control and crop yield were evaluated. Reduced volunteer corn control and yield were greatest in tank-mixes containing the high rate of dicamba and low rate of the Group 1 herbicide. The high rate of dicamba and low rate of quizalofop-p-ethyl resulted in yield losses above 1.25 Mg ha^{-1}. The addition of dicamba to quizalofop-p-ethyl resulted in greater antagonism than when co-applied with clethodim. This research indicates that farmers wishing to control volunteer corn and glyphosate resistant weeds, may need to increase their Group 1 herbicide rate or apply the two herbicides sequentially.

5 **HALOSULFURON TANK MIXES APPLIED PPI AND PRE IN WHITE BEAN**.
Zhenyi Li*[1], Peter Sikkema[1], Rene Van Acker[1], Darren Robinson[2], Nader Soltani[2];
[1]University of Guelph, Guelph, ON, [2]University of Guelph, Ridgetown, ON

ABSTRACT

Twelve field experiments were conducted over a two-year period (2013, 2014) to evaluate the tolerance of white bean and spectrum of weeds controlled with halosulfuron applied alone in combination with trifluralin, pendimethalin, EPTC, dimethenamid-p or s-metolachlor applied preplant incorporated (PPI) and pendimethalin, dimethenamid-p or s-metolachlor applied preemergence (PRE). Halosulfuron applied alone or in combination with trifluralin, pendimethalin, EPTC, dimethenamid-p or s-metolachlor caused 3% or less visible injury 1 and 4 weeks after emergence (WAE) in PPI and PRE. Halosulfuron applied both PPI and PRE provided greater than 90% control of lamb's-quarters, wild mustard, redroot pigweed and common ragweed and less than 60% control of green foxtail evaluated 4 and 8 WAE. Weed biomass and density followed a similar pattern. White bean yield with halosulfuron applied in combination with trifluralin, pendimethalin, EPTC, dimethenamid-p or s-metolachlor was equivalent to the weed-free control.

Abbreviations: halosulfuron, preplant incorporated (PPI), preemergence (PRE), weeks after emergence (WAE).

6 **SULFENTRAZONE TANK-MIX PARTNERS FOR GRASS CONTROL IN ONTARIO DRY BEANS (*PHASEOLUS VULGARIS* L.)**. Allison Taziar*; University of Guelph, Ridgetown, ON; Advisors: Peter Sikkema, Plant Agriculture, University of Guelph Ridgetown Campus, ON N0P 2C0 and Darren Robinson, Plant Agriculture, University of

	Guelph Ridgetown Campus, ON N0P 2C0 **ABSTRACT** Soil applied herbicides for dry bean (*Phaseolus vulgaris*) crops in Ontario are limited. Sulfentrazone is an effective broadleaf herbicide with some grass activity, currently used in some pulse crops in Western Canada. If registered in Ontario, sulfentrazone will provide dry bean growers with another mode of action for broadleaf weed control. Twenty-six field studies were conducted over a two-year period (2014, 2015) to determine the tolerance of dry beans to sulfentrazone and to develop weed management programs in white beans with sulfentrazone. Sulfentrazone at 140 and 210 g ai ha^{-1} was mixed with pendimethalin, dimethenamid-p, s-metolachlor or pyroxasulfone. Crop injury was visually assessed at 2 and 4 weeks after emergence (WAE). Weed control was evaluated at 4 and 8 weeks after herbicide application (WAA). Weed stand counts and dry weights were taken at 8 WAA and yields were determined at maturity. All the tankmixes evaluated provided good control of large crabgrass (*Digitaria sanguinalis* L.), barnyard grass (*Echinocloa crusgalli* L.), green foxtail (*Setaria viridis* L.) and green pigweed (*Amaranthus powelli* L.), but only sulfentrazone+pendimethalin had an adequate margin of crop safety. Based on this study, although sulfentrazone combined with a grass herbicide provides acceptable control of some grass and broadleaf weed species, further research is required to determine if there is an adequate margin of crop safety for its use for weed management in Ontario dry beans
7	HOW TO IMPROVE THE CONSISTENCY OF GLYPHOSATE-RESISTANT CANADA FLEABANE (CONYZA CANADENSIS L. CRONQ.) CONTROL WITH SAFLUFENACIL: AN INVESTIGATION OF TANK MIX PARTNERS AND OPTIMAL TIME OF DAY APPLICATION. Christopher Budd*[1], Peter Sikkema[2], Darren Robinson[1]; [1]University of Guelph, Ridgetown, ON, [2]University of Guelph, Guelph, ON **ABSTRACT** Glyphosate plus saflufenacil, applied preplant, previously provided excellent control of glyphosate-resistant (GR) Canada fleabane in soybean, however, variable control has been observed in recent research and growers' fields. To improve consistency of GR Canada fleabane control, the effect of three-way herbicide tankmixes with glyphosate plus saflufenacil, the time of day (TOD) at application, as well as a biologically effective rate of metribuzin with glyphosate plus saflufenacil, were investigated in a two-year study conducted on three farms in Ontario. These sites were previously confirmed with GR Canada fleabane. The TOD treatments were applied at three hour intervals starting at 06hr to 24hr and GR Canada fleabane control ratings were completed at 1, 2, 3, 4 and 8 weeks after application for all trials. The 09hr TOD treatment provided the greatest control with 88%. The best tank mix partners with glyphosate plus saflufenacil were dicamba (300 and 600 g a.i. ha-1), amitrole (2000 g a.i. ha-1) and metribuzin (400 g a.i. ha-1) which provided 95, 97, 97 and 96% Canada fleabane control, respectively. The addition of 50 and 400 (g a.i. ha-1) of metribuzin was required with glyphosate plus saflufenacil to provide 90 and 95% control, respectively. The TOD appears to have an effect on the control of GR Canada fleabane with glyphosate plus saflufenacil. Metribuzin is an effective tank mix partner to improve the consistency of GR Canada fleabane control. Investigation of variable control with glyphosate plus saflufenacil and ways to improve consistency will provide Ontario growers with a

	reliable control option.
8	SINGLET OXYGEN SIGNALS RESPONSE OF SOYBEAN SEEDLINGS TO NEIGHBOURING WEEDS. Andrew G. McKenzie-Gopsill*, Sasan Amirsadeghi, Hugh Earl, Lewis Lukens, Elizabeth Lee, Clarence Swanton; University of Guelph, Guelph, ON **ABSTRACT** Far-red light reflected by neighbouring weeds compromises early development of soybean which may influence yield potential. To gain insight into the physiological events during early development of soybean grown under far-red-enriched (FR-E) light reflected by neighbouring weeds, the antioxidant, photosynthetic and carbon partitioning responses of soybean at the unifoliate stage were investigated. FR-E light decreased superoxide dismutase (SOD) activity in unifoliate leaves, while *in situ* staining did not reveal an increase in relative steady-state level of superoxide. This was accompanied by increases in hydrogen peroxide (H_2O_2) and oxidised ascorbate levels suggesting an increase in singlet oxygen ($^1O_2$) level and its conversion to H_2O_2 via ascorbate. This was further supported by enhanced sensitivity to cell death induced by a $^1O_2$-generating compound and an increase in carotenoid content and activity of the $^1O_2$-responsive glutathione peroxidase. FR-E light also caused significant decreases in activity of a thiol-modulated Calvin cycle enzyme and photosynthesis as well as changes in biomass allocation and carbohydrate levels. We propose that one primary and fundamental impact of FR-E light reflected by early emerging weeds is increased production of $^1O_2$, which acts to regulate H_2O_2 level by decreasing SOD activity and signals a cascade of physiological events that directly impacts photosynthesis and carbon partitioning.
9	UNIQUE SUBCELLULAR DISCOVERIES IN GLYPHOSATE RESISTANT GIANT RAGWEED, A ROLE FOR PROGRAMMED CELL DEATH? Mackenzie A. Lesperance*[1], Mihai Costea[2], J. Chris Hall[1], Sang Bog Kim[3], Peter Sikkema[1], François J. Tardif[1]; [1]University of Guelph, Guelph, ON, [2]Wilfrid Laurier University, Waterloo, ON, [3]Canadian Nuclear Laboratories, Deep River, ON **ABSTRACT** Mechanisms of resistance to the herbicide glyphosate in Canadian biotypes of giant ragweed are currently unknown. In Ontario, a resistant (R) biotype shows a distinct phenotypic response in the mature leaves characterized by a light-dependent, hydrogen peroxide induced, rapid-necrosing reaction to glyphosate, leaving meristems intact. To gain insight into the subcellular events leading to damage in the mature leaves, transmission electron microscopy was used to compare cellular morphology between R and susceptible (S) biotypes. Morphological evidence of different programmed cell deaths (PCD) were observed between R and S biotypes and a rapid increase in starch accumulation was observed in the R biotype. This evidence was accompanied by a time lapse quantification of [14C]-glyphosate through biological oxidation and liquid scintillation when application was specific to the apical meristem of R and S plants. At 24 hours after application, [14C]-glyphosate was shown to increase in the mature leaves and decrease in the apical meristem of R plants in comparison to S plants ($P < 0.10$). We propose that translocation impairment of glyphosate in the R biotype could be due to the combination of two distinct cellular events, PCD and the

	impairment of an active glyphosate transport system.
10	BELOW GROUND ACTIVITIES AS INFLUENCED BY CROPS AND WEEDS: THE CASE OF EXTRACELLULAR DNA (EDNA). Leila Kamino*[1], Robert H. Gulden[2]; [1]University of Manitoba, Winnipeg, MB, [2]Univ. of Manitoba, Winnipeg, MB **ABSTRACT** The introduction and successful adoption of genetically modified (GM) crops fueled interest in the persistence of extracellular DNA (eDNA) in the environment. This quest has been highly motivated by concerns over the release of transgenes from GM crops into the environment where they may become accessible for DNA-uptake by competent bacteria. As plants are the primary providers of specific carbon and energy sources readily available to soil microbes, they have profound influence on soil microbial community structure and function. DNases released by soil microbes are thought to be the key mechanism by which eDNA is broken down and thus can be viewed as one measure or component of soil function. However, there is a dearth of information on how crop rotations and weed communities influence soil microbial functions such as DNase activity. The objectives of this study were to determine how different crops grown in rotation and weediness levels influence soil microbial DNase activity, total culturable bacteria and total DNase producing bacteria of over time. Research was initiated in a long-term fully-phased field study at the Ian N. Morrison Research Farm located in Carman, Manitoba. The study consists of an annual and a perennial crop rotation, with three different weed management intensities arranged as a RCBD with three replicates. Crop species consistently affected DNase activity, total culturable DNase producing bacteria and total culturable bacterial populations of the soil, while weed densities affected these response variables only occasionally. Soils sampled from alfalfa and oats had the highest DNase activities, while wheat supported the lowest DNAse activity, and culturable total and DNAse producing bacteria. Soils from flax and oats contained higher proportions of DNase producing and total culturable bacteria. The results demonstrate that plant species greatly influence composition and functions of soil microbial communities.
11	UNLOCKING THE POTENTIAL OF SPECTROSCOPY IN HERBICIDE RESEARCH. Vladimir Pajic*; University of Saskatchewan, Saskatoon, SK **ABSTRACT** Spectroscopy is able to provide high-throughput and high-precision in herbicide research. Terms high-throughput and high-precision have become dogmas of modern agriculture research. Multiple spectroscopy-based techniques, that are being used in the research of tolerance to PPO inhibitors in lentils could easily be transferred in other herbicide research. Lentil association mapping panel was used to determine genetic factors that influence tolerance to PPO inhibitors among lentil germplasm. Instead of destructive methods, GreenSeeker® was used to obtain NDVI (normalized difference vegetation index) values at different time points. Multispectral imaging via an unmanned aerial vehicle (UAV) was also employed. The application of hyperspectral imaging and its possible role in assessing damage of PPO inhibitors to individual lentil plants was tested. Use of these tools allowed

detection and quantification of minute differences in response to PPO inhibitors. Results show that spectroscopy-based nondestructive methods could and should be used in weed science research in much larger capacity.

12 **THE ROLE OF OLFACTION IN BRASSICACEOUS WEED SEED PREDATION**.

Sharavari S. Kulkarni*[1], John R. Spence[2], Christian J. Willenborg[3]; [1]University of Alberta, Edmonton, AB, [2]Professor, Edmonton, AB, [3]Assistant Professor, Saskatoon, SK

ABSTRACT

Ground beetles are postdispersal weed seed-predators that play important role in weed seed consumption in agro-ecosystem. We investigated seed preferences of three omnivorous ground beetle species, *Amara littoralis* Mannerheim, *Harpalus affinis* (Schrank) and *Pterostichus melanarius* (Illiger) (Coleoptera: Carabidae) on three brassicaceous weeds, *Brassica napus* (volunteer canola), *Sinapsis arvenisis* (wild mustard) and *Thlapsi arvense* (field pennycress) and possible role of olfaction for these preferences. All carabid species preferred seeds of *B. napus* most and those of *T. arvense* least, and showed intermediate preferences for *S. arvensis* seeds. Beetles highly preferred imbibed seeds of all three weed species. We further conducted olfactometer experiments to investigate if carabid beetles use olfactory stimuli to detect seed dispersed on the ground. A four choice olfactory bioassay was used to test whether carabid species show any olfactory response to dry or imbibed seeds of these weed species. Only *A. littoralis* showed a response to dry seeds of *B. napus*. Imbibition of seeds influenced behaviour as all three species exhibited a greater response to *B. napus* seeds compared to *S. arvensis* and *T.arvense*. A two choice bioassay confirmed the preference for imbibed *B. napus* seeds, as all three carabid species responded in greater proportions to odours from imbibed seeds than dry seeds. Our results indicate that olfactory cues associated with weed seeds contribute to weed seed foraging by seed predatory carabids. Imbibed seeds of weed species such as *B. napus* tend to be most preferred by carabid seed predators.

Keywords: carabid beetle, olfaction, volunteer canola, wild mustard, field pennycress

13 LINKING SEED BANK COMPOSITION AND SPATIAL VARIATION IN VEGETATION TO PIPELINE DISTURBANCE IN MIXED-GRASS PRAIRIE.

Lysandra A. Pyle*; University of Alberta, Edmonton, AB

ABSTRACT

Disturbances such as pipelines, roads and well sites can function as corridors for seed dispersal and allow invasive species to establish. Over-time introduced or ruderal species may saturate the seed bank near the disturbance and eventually migrate into adjacent native grassland. Invasive species of potential concern in the mixedgrass prairie include cool-season grasses (Agropyron cristatum, Poa pratensis), noxious weeds (e.g. Sonchus arvensis) and escaped agronomics (Melilotus spp.). All these species can be highly competitive and alter their microenvironment, thereby facilitating further invasion and displacement of native plant species. We hypothesized that the presence and abundance of invasive plants, both above-ground and in the seed bank, will increase as a function of spatial distance from disturbance

	and time since pipeline construction. Pipelines were visually identified and sampled along transects oriented perpendicular to the pipeline at 15 varying distances. Spatial sampling intensity was high adjacent to the pipeline and decreased out to a distance of 55 m. Within each distance, 16 soil cores (3.25 cm wide x 6 cm deep) were removed and bulked, then placed in a greenhouse where emergent seedlings were identified and counted. In addition, cover of above-ground vegetation was assessed at every third transect. By comparing seed bank and vegetation composition we will identify the degree of similarity between the seed bank and current plant community, and evaluate how this relationship changes with distance from pipeline and age of the disturbance. Records of pipeline installation and reclamation may also identify practices that promote the conservation of native vegetation and minimize invasive species.
14	**EXPLOITING WEAKNESSES IN WEEDS LIFE CYCLES IN ORDER TO OPTIMISE HERBICIDE RESISTANCE PREVENTION STRATEGIES**. Tasha Valente*[1], François J. Tardif[l], Michael Cowbrough[2]; [1]University of Guelph, Guelph, ON, [2]OMAFRA, Guelph, ON **ABSTRACT** The increasing number of herbicide resistant weeds in agriculture negatively impacts the number of management options available to producers. The concept of integrated weed management (IWM) was developed as a branch of integrated pest management as a comprehensive approach to weed management targeting multiple stages in the plant life cycle. Seed production of annual weeds is a major contributing factor to the persistence of herbicide resistant weeds through contribution to the weed seed bank. Field studies were conducted in 2014 and 2015 to determine the effects of pre-plant nitrogen application, seeding rate, and cultivar selection on weed populations and the timing of canopy closure in glyphosate resistant soybeans. The trials were conducted at the Elora Research station (ERS) Elora, ON and Woodstock Research station (WRS) Woodstock, ON in 2014 and 2015. Canopy closure occurred 1 week later at the ERS site in relation to the WRS in 2015. Fewer weeds emerged throughout the season when pre-emerge herbicide was applied compared to unsprayed plots. Nitrogen, seeding rate, and cultivar selected had little effect on weed emergence and weed biomass. The end of season weed biomass was greater in plots that did not receive herbicide compared to the unsprayed plots. The findings of this research could provide an alternative approach to weed control and reduce the effects of herbicide resistance on soybean production.
15	EVALUATING SEED SHATTER OF ECONOMICALLY IMPORTANT PRAIRIE WEED SPECIES. Nikki R. Burton*; University of Saskatchewan, Saskatoon, SK **ABSTRACT** The rapid evolution of herbicide-resistant (HR) weed species and limited herbicide options for producer's cereal, oilseed, and pulse crops have created a need for increased development of non-chemical weed management strategies and tactics. Research on weed seed retention in Australia has helped their producers manage HR weeds through the development of harvest

	weed seed control (HWSC) systems. For these systems to be effective, weed seeds must be retained at crop harvest and produced above harvest cutting height. Wild oat (Avena fatua), wild mustard (Sinapsis arvensis), green foxtail (Setaria viridis), and cleavers (Galium spp.) were grown in both early (field pea) and late (spring wheat) season maturity crops to evaluate weed seed retention and shatter in small-plot field experiments and producer fields throughout central Saskatchewan. Seed shatter was assessed using shatter trays collected once a week and seed retention determined at two crop harvest stages (swathing, direct harvest). Results showed that 31, 3, 0.5, and 5% of wild oat, wild mustard, green foxtail, and cleaver seeds, respectively, shattered at wheat direct harvest stage. The field pea trial showed similar results as the spring wheat trial, with 36, 1, 0.2, and 11% of wild oat, wild mustard, green foxtail, and cleaver seeds, respectively, shattered at direct harvest. Regression analysis indicated that seed shatter of wild oat occurred sooner and at a greater amount during the growing season compared with the other three weed species in both trials. Seed viability testing showed that the viability of both the shattered and retained seeds was relatively high for all species. Analysis from the 2014 field season at Scott, SK show that wild mustard, green foxtail, and cleavers may be suitable candidates for control by HWSC systems. Due to the amount and timing of seed shatter exhibited by wild oat, this weed may not be effectively controlled by these systems.
16	POTENTIAL EFFECTS OF HARVEST WEED SEED CONTROL ON WILD OAT (*AVENA FATUA*) POPULATIONS BASED ON DEMOGRAPHIC MODELLING. Breanne Tidemann*[1], Linda Hall[2], K. Neil Harker[3], Brendan C. Alexander[2], Kristina Polziehn[4]; [1]University of Alberta, Lacombe, AB, [2]University of Alberta, Edmonton, AB, [3]Agriculture and Agri-Food Canada, Lacombe, AB, [4]Axiom Agronomy Ltd., Edmonton, AB **ABSTRACT** Wild oat is a globally problematic weed species that requires new management techniques to manage herbicide resistance; Harvest Weed Seed Control (HWSC) may be an option. Data collected in rotational field studies in Alberta under management regime extremes (no IPM, no herbicide to high IPM, full herbicide) was used to parameterize a periodic matrix model. Elasticity analysis was conducted in addition to an analysis where the model equation was rearranged, population growth rate (λ) was designated and the equation solved for survival of newly shed seed (s_{new}). All populations had λ>1, or growing populations. Elasticity analyses indicated that population growth rate is most highly elastic to the over-winter seed-bank (E_{sw}= 1), followed by seedling survival, fecundity, and survival of newly shed seed (0.63-0.86 across treatments). The latter may be the most accessible life-cycle transition for management. However, decreasing the proportion of newly shed seeds that survives was the most effective and available control strategy only until reduced to 0.1-0.3. Further reductions are less impactful; the seed-bank during the growing season becomes more critical. When averaged across treatments, >80% of newly shed seed must be eliminated to stop the population from growing, resulting in a stable population, but not a decline. Due to pre-harvest seed shattering, causing wild oat populations to decline by using HWSC alone to impact the survival of newly shed seeds will likely not be effective; new management techniques to use in combination with HWSC and IWM strategies are needed.

17 WILD OAT *(AVENA FATUA L.)* POPULATIONS RESISTANT TO TRIALLATE MAY ALSO BE RESISTANT TO PYROXASULFONE AND SULFENTRAZONE. Amy R. Mangin*; University of Alberta, Edmonton, AB

ABSTRACT

Wild oat is the most economically detrimental weed species in the Canadian Prairies and effective herbicidal control options are limited due to widespread resistance to ACCase-inhibitors (Gr. 1), ALS-inhibitors (Gr. 2) and lipid biosynthesis inhibitors (Gr. 8). Evaluation of herbicides with different modes of action, such as pyroxasulfone (Gr. 15) and sulfentrazone (Gr. 14), to control current wild oat populations is critical to understand potential of new products in Western Canada. Two grower submitted wild oat populations (HR08-210 and HR11-151) with suspected resistance to triallate were first subjected to a discriminating dose screening to characterize resistance to group 1 and 2 herbicides in comparison with a susceptible population (S1988). Dose response experiments with triallate, pyroxasulfone and sulfentrazone were also conducted to evaluate potential cross-resistance. Screening indicated both HR populations where resistant to group 1 and 2 herbicides, most likely due to enhanced metabolism. HR populations were both resistance to triallate with resistance ratios of 2.53 and 3.39 for HR08-210 and HR11-151, respectively, but cross-resistance to pyroxasulfone (2.78) and sulfentrazone (2.0) was only observed in HR11-151. A high degree of variation was observed between individuals within a population when treated with pyroxasulfone and sulfentrazone suggesting that further selection would be rapid. These results indicate that previously selected for resistance to Gr. 1 and 2 (enhanced metabolism) or Gr. 8 (enhance endogenous gibberellins) could potentially limit the use of new herbicide modes of action for control of wild oat populations.

18 **Evaluation of new herbicide options for control of foxtail barley (*Hordeum jubatum*) in spring wheat .** Vercaigne, M.P. Department of Agriculture, Food and Nutritional Science, University of Alberta, Edmonton, Alberta.

ABSTRACT

Foxtail barley (*Hordeum jubatum*) is a perennial grass increasing in prevalence in western Canadian cereal fields. Seedling, over wintering juvenile and mature stages makes herbicide timing and choice more difficult. We compared pre-seeding applications of short residual ALS1 at 7.5 or 10 g ai ha^{-1}, pyroxasulfone at 150 g ai $ha^{-1}$and flucarbazone-sodium/tribenuron at 21.79 g ai ha^{-1} in combination with pre-seeding glyphosate applied at 450 or 900 g ai ha^{-1}in field trials in Scott, Saskatchewan; and Lethbridge and Olds, Alberta. In-crop applications of ALS2 at 4.9 g ai ha^{-1} were combined with pre-seeding ALS1, flucarbazone-sodium/tribenuron or pyroxasulfone with a base treatment of 900 g ai ha^{-1} of glyphosate being applied to all treatments. Control, biomass of mature and juveniles foxtail barley, wheat biomass and wheat grain yield were quantified. Seedling emergence was also monitored throughout the growing season. Scott had the highest mature foxtail barley population of 76 mature plants m^{-2}, while Lethbridge and Olds site had 44 and 28 mature plants m^{-2}, respectively. None of the pre-seeding herbicides applied controlled foxtail barley

	in the absence of glyphosate, but applied in combination with the low rate of glyphosate, control increased to 57.5%, 61.7% and 56.3% with ALS1 at the low and high rate and flucarbazone-sodium/tribenuron, respectively. Glyphosate applied pre-seeding at the high rate provided greater than 70% control, except at Scott, but the addition of other pre-seeding herbicides did not increase control. Foxtail barley biomass was reduced by glyphosate at 450 gai ha^{-1} pre-seeding from 84.3 to 3.4 g m^{-2} at Lethbridge, at Olds from 90.8 to 27.3 g m^{-2} and at Scott from 124.9 to 88.1 g m^{-2}. The addition of pre-seeding herbicides to the low rate of glyphosate did not decrease foxtail barley biomass. Glyphosate at 900 g ai ha^{-1} pre-seeding decreased biomass at Lethbridge to 0, Olds to 47.7 g m^{-2} and Scott to 69.1 g m^{-2}. The addition of ALS1, flucarbazone-sodium/tribenuron and pyroxasulfone to 900 g ai ha^{-1} of glyphosate did not decrease foxtail barley biomass further. An in-crop application of ALS 2 applied in conjunction with 900 g ai ha^{-1} of glyphosate pre-seeding appears to reduce foxtail barley biomass more than glyphosate applied alone. Seedling emergence was observed over an extended period in spring and post-harvest, suggesting that both pre-seeding and in-crop control timings along with a multiyear strategy may be required to reduce future foxtail barley populations.
19	COMPARISION OF ARTIFICIAL NEURAL NETWORK (ANN) AND LOGISTIC REGRESSION AS POTENTIAL MODELS FOR PREDICTING WEED POPULATIONS IN DRYLAND WINTER WHEAT FIELDS IN KURDISTAN PROVINCE, IRAN. Sahar Mansourian*[1], Ebrahim Izadi Darbandi[2], Mohammad Hassan Rashed Mohassel[2], Mehdi Rastgoo[2], Homayoun Kanouni[3]; [1]University of Guelph, Guelph, ON, [2]Ferdowsi University of Mashhad, Mashhad, Iran, [3]Research Plant Protection Institute of Kurdistan Province, Sanandaj, Iran **ABSTRACT** Artificial Neural Networks (ANN) are models inspired by biological neural networks which can accurately predict complex and non-linear processes at a desirable level. A survey was conducted in 2014 to compare the potential of ANN and a logistic regression equation (LR) to predict weed presence in 33 dryland winter wheat fields in the province of Kurdistan in Iran. In both models, climatic and soil properties were defined as independent variables and weed abundance as the dependent variable. Field bindweed (*Convolvulus arvensis* L.) and salsify (*Tragopogon graminifolius* DC.) were the dominant weeds. Predictions based on the LR model failed to predict accurately the abundance of field bindweed (R^2= 0.25) and salsify (R^2=0.39) whereas ANN resulted in the best predictions. R^2 values ranged from 0.62 to 0.96 for salsify and field bindweed, respectively. Sensitivity analysis revealed that altitude and rainfall were the most significant parameters for modelling weed abundance under dry land cropping conditions. This study demonstrates the potential for ANN as a new tool for the study of weed population dynamics.
20	IMPROVING WEED MANAGEMENT IN FLAX WITH INTEGRATED WEED MANAGEMENT. Moria Petruic*[1], Christian J. Willenborg[2], Eric N. Johnson[3], Eric Tozzi[4]; [1]University of Saskatchewan, Saskatoon, SK, [2]Assistant Professor, Saskatoon, SK, [3]Univ. of Saskatchewan, Saskatoon, SK, [4]University Of Saskatchewan, Saskatoon, SK

ABSTRACT

The ability to withstand late season frosts and produce high profits makes flax a desirable crop option for growers. However, flax is a poor competitor with weeds, especially wild oat, and this can deter growers from planting the crop. Moreover, there are few in-crop herbicides registered for use in flax to successfully manage herbicide-resistant wild oat. Thus, integrated weed management techniques that provide good weed control are important to the successful production of flax crops. It is not known, however, which combinations of techniques can be used to provide the greatest level of weed management. This study investigates the effect of seeding date (early vs. late), seeding rate (400 vs 800 seeds m-2), crop height (tall – CDC Sorrel vs. short – Prairie Grande), and in-crop herbicide applications (1x vs. 0x) on wild oat control in flax. This trial was conducted at four different sites across Manitoba (Carmen and Morden), Saskatchewan (Saskatoon) and Alberta (Edmonton) in 2014 and 2015. Results indicate that seeding early at high rates (800 seeds m-2), with the use of an in-crop herbicide resulted in significantly higher yields at three of the four research sites, regardless of the cultivar used. When comparing cultivar performance, CDC Sorrel produced 26% more yield than Prairie Grande. In addition, CDC Sorrell had greater TKW than Prairie Grande at three of the four sites. Based on these results, we are optimistic that by adopting various integrated weed management techniques, growers can improve flax yield and seed weight, thus improving profitability.

21 DETERMINING OPTIMUM PLANT POPULATIONS IN DIFFERENT LENTIL CLASSES. Kali Kasper*; University of Saskatchewan, Saskatoon, SK

ABSTRACT

Lentils (*Lens culinaris* Medik.) are one of the most uncompetitive crops grown on the prairies and therefore integrated weed management (IWM) is an important part of lentil production due to a minimal amount of herbicides for post emergence control of broadleaved weeds. Reliance on herbicides as the sole form of weed control is not an effective means of IWM attributable to group 2 herbicide weed resistance. Group 2 resistance leaves limited options available for weed control in lentil if those herbicides continue to lose efficacy. Target plant populations should be increased in Canadian lentil production if the field microclimate is suitable, to minimize weed pressure and to maximize yield. The objective of this study is to highlight interactions between the seeding rate and plant populations among different seed size classes of lentil. Factors including crop emergence, crop biomass, disease ratings and yield were taken into consideration. A field experiment was conducted in 2015 at a location near Osler, SK and another location near Saskatoon, SK. Treatments included seed rates from 60 to 320 seeds m-2 throughout extra small red, small red, large red, small green, medium green and large green lentil classes with different fungicides applied to red lentils as well. Seed yield increased with seed rates up to approximately 150 seeds m-2. Small red lentils yielded the highest across all classes at both locations and the optimal seed rate relative to yield was higher than current recommended lentil seed rates on the prairies. Higher seed rate recommendations are likely going to show yield increase and improved lentil competitiveness in the future, with more research and analysis.

22 INTER-ROW CULTIVATION IN ORGANIC PULSE PRODUCTION. Katherine Stanley*[1], Steven J. Shirtliffe[2]; [1]University of Saskatchewan, Saskatoon, SK, [2]Univ. of Saskatchewan, Saskatoon, AB

ABSTRACT

Field pea (*Pisum sativum*) and lentil (*Lens culinaris L.*) are important crops in the Canadian Prairies due to their desirable agronomic characteristics, high economic return and significant role in the global export market. Weed control remains to be a significant yield limiting factor in these crops due to their inability to compete in the presence of weeds. Initial research in inter-row cultivation has shown potential in cereal crops however few studies have examined the level of crop tolerance and weed control independently. The objective of this experiment was to determine the efficacy of inter-row cultivation in organic pulse production. To determine this, two replicated field experiments were conducted in Saskatchewan, Canada. The first experiment, conducted at two locations in 2014 and 2015, examined the tolerance of field pea and lentil to cultivation at different growth stages. Weekly cultivation began at the 4 node stage, continuing for six weeks. Multiple cultivation timings and an uncultivated control were also included. The second experiment conducted in 2015, observed the level of weed control achieved using the inter-row cultivator at different growth stages. Treatments were similar to the first experiment and had a weed-free control. Results of the first experiment found that field pea and lentil had a significant ($P<0.05$) linear decline in yield when cultivation occurred at later growth stages. In the weed control experiment, inter-row cultivation resulted in no significant ($P>0.05$) yield increase or reduction in weed biomass in any treatment. This response may be attributed to below-average rainfall in 2015. In conclusion, lentil and field pea were tolerant to inter-row cultivation at early growth stages, however yield losses increased with cultivation at later growth stages. Future studies are recommended to determine the efficacy of inter-row cultivation for weed control.

23 **MANUKA OIL: A POTENTIAL HERBICIDE FOR ORGANIC VEGETABLE PRODUCTION**. Sierra Harris*, Rene Van Acker; University of Guelph, Guelph, ON

ABSTRACT

Manuka oil (MO) is an essential oil derived from *Leptospermum scoparium,* a member of the Myrtaceae family. The active compound in MO is leptospermone a beta-triketone that exhibits both pre (PRE) and post-emergent (POST) herbicidal activity. The mode of action for leptospermone is similar to the synthetic triketones-based herbicide mesotrione (trade name Callisto®), which is classified as a group 27 herbicide that works by inhibiting HPPD (*p*-hydroxyphenylpyruvate dioxygenase) and other photosynthetic enzymes causing plant bleaching and death. Current research has shown that tank mix solutions can increase the efficacy of MO between 20-40% and can give total weed suppression of 80-95%. The objective of this project is to explore the PRE and POST efficacy of MO and to investigate ways of enhancing its efficacy via tank mixes with adjuvants and/or other organic certified herbicides. Growth chamber experiments will be conducted on *Digitaria sanguinalis* L. and *Amaranthus powellii* S. Wats. to isolate the source of the tank mix effects. Tank mixes were

	chosen on the basis of Canadian organic certification, product availability and past research. MO efficacy as affected by tank mixes will also be investigated in field experiments on two morphologically different crops (*Solanum lycopersicum* and *Zea mays var. saccharata)* at two different locations (Simcoe and Ridgetown). Efficacy will be measured on the basis of visual injury ratings and weed and crop yield biomass. This research could be a solution for the increasing demand for new organic herbicide products by providing new tank mix options for MO.
24	**WEEDS IN ORGANIC VS. CONVENTIONAL CROPPING SYSTEMS:WHAT WE HAVE LEARNED AFTER 18 YEARS OF RESEARCH**. Dilshan I. Benaragama*; University of Saskatchewan, Saskatoon, SK **Weeds in organic vs. conventional cropping systems:What we have learned after 18 years of research** D. Benaragama, S.J Shirtliffe, E.N Johnson, J.Leeson, S.A. Brandt, R. Lemke, R.P. Zentner, O. Olfert , B.Gossen, A.Moulin, C. Steevenson Differences in cropping systems including tillage, inputs and crop rotations are the driving factors affecting weed dynamics which can ultimately effect crop yields. Several experiments were carried out using a long-term (18 year) cropping systems study in Scott, Saskatchewan, Canada to asses the impact of long-term organic and conventional crop rotations on weed abundance, community composition, crop yield and yield loss. The long-term study consisted of three input systems, such as high (conventional tillage), reduced (no-till conventional) and organic and three crop rotations (low diversity, diversified annual grains and diversified annual-perennials). A statistical analysis of the 18 year data revealed that the organic rotations have seven and four times higher weed density, 32% and 35% lower overall crop yields and 15% and 18% lower wheat yields than the reduced and the high systems respectively. Weed community composition was consistently different in organic rotations than the two conventional rotations throughout the years. All cropping systems showed an increase in weed biomass, weed density, and crop yields over time. Annual-perennial rotation was not benificial in managing weeds or increasing crop yields but reduced the overall crop productivity. A two year micro-plot experiment with four additional treatments (no weed management, weed-free, standard weed management and a model weed treatment) in the wheat phase revealed that the wheat yields were lower in the organic rotations even in the absence of weeds. This suggests that the lower crop yields in the organic system was due to soil fertility related factors. In a greenhouse pot experiment with external supply of mineral N and P fertilizers to both organic and reduced rotations revealed that wheat yields were still lower in organic than reduced systems. Under both field and greenhouse conditions there were no differences in yield loss due to weed competition among cropping systems. Overall, despite differences in weed dynamics its impact on crop yields were similar in organic that to conventional systems. **Keywords**- conventional, crop diversity, long-term, organic, weeds, yield loss

25 EFFECT OF HERBICIDE RESIDUES ON COVER CROP PERFORMANCE AND FUNCTION. Darren Robinson*[1], Peter Sikkema[2], Kris McNaughton[3]; [1]University of Guelph, Ridgetown, ON, [2]University of Guelph, Guelph, ON, [3]University of Guelph Ridgetown Campus, Ridgetown, ON

ABSTRACT

Cover crops offer many potential benefits to vegetable products systems, including managing for erosion, sequestering soil nitrogen, soil improvement and pest management. One aspect that can significantly impact cover crop establishment, but has received little attention is the effect of residual herbicides on subsequent cover crop establishment and function. Three trials were established in 2011 and again in 2012 to examine effect of residues of flumetsulam, saflufenacil/dimethenamid-p, mesotrione+s-metolachlor/atrazine isoxaflutole+atrazine and imazethapyr on establishment and function of 12 cover crops, including spring- and fall-seeded grass and broadleaf cover crops, and four legume cover crops. The first objective of this work was to determine how soil water holding capacity and nutrient uptake of non-leguminous species (ie. annual (cereal) rye, wheat, oat, (annual) ryegrass, sorghum-sudangrass, buckwheat, oilseed radish) are affected by residual herbicides applied in the previous year. Soil water holding capacity and nutrient uptake of non-leguminous species (ie. annual ryegrass, wheat, oat, fall rye, sorghum sudangrass, buckwheat, oilseed radish) were affected differently by residual herbicides applied the previous year. Specifically, flumetsulam and imazethapyr reduced ability of oilseed radish, fall oats, and buckwheat, and sorghum sudangrass to improve soil water holding capacity and scavenge nitrogen. Mesotrione+s-metolachlor/atrazine reduced ability of annual ryegrass and buckwheat to improve soil water holding capacity and scavenge nitrogen. Despite the visible injury, saflufenacil/dimethenamid-p and isoxaflutole+atrazine caused to annual ryegrass, they did not reduce the ability of this cover crop to improve soil water holding capacity and scavenge nitrogen – this is likely because the cover crop stand, and root and shoot biomass were not negatively impacted by either herbicide treatment. The second objective of this study was to determine the relationship between soil water holding capacity and organic matter production of crimson clover, hairy vetch, red clover and sweet clover, and application of residual herbicides in the previous year. Crimson clover, red clover and sweet clover were not negatively affected by herbicide residues of flumetsulam, saflufenacil/dimethenamid-p, isoxaflutole+atrazine and imazethapyr. As a result, their ability to improve soil water holding capacity and organic matter were not affected by any herbicide residues. This is important, as it shows the compatibility of the different clover species with many commonly used corn and soybean herbicides. Research has shown that mesotrione+s-metolachlor/atrazine will carry over onto red clover and reduce its ability to improve soil water holding capacity and soil organic matter.

26 GLYPHOSATE-RESISTANT GIANT RAGWEED CONTROL IN CORN AND WHEAT. Peter Sikkema*[1], Kris J. Mahoney[2], Kris McNaughton[3], Nader Soltani[2]; [1]University of Guelph, Guelph, ON, [2]University of Guelph, Ridgetown, ON, [3]University of Guelph Ridgetown Campus, Ridgetown, ON

ABSTRACT

Eight field trials [four with preplant (PP) and four with postemergence (POST) herbicides] in corn and four field trials in winter wheat were conducted from 2012 to 2014 on various Ontario farms infested with GR giant ragweed to determine the efficacy of PP and POST tank-mixes in corn and POST herbicides in winter wheat. In corn, glyphosate tank-mixed with atrazine, dicamba, dicamba/atrazine, mesotrione plus atrazine, flumetsulam, isoxaflutole plus atrazine, saflufenacil/dimethenamid-P, S-metolachlor/atrazine and rimsulfuron applied PP provided up to 54%, 95%, 93%, 95%, 40%, 89%, 91%, 50% and 93% control of GR giant ragweed and reduced dry weight 69%, 100%, 99%, 100%, 30%, 92%, 98%, 66% and 99%, respectively. POST application of glyphosate alone and tank-mixed with 2,4-D ester, atrazine, dicamba, dicamba/diflufenzopyr, dicamba/atrazine, bromoxynil plus atrazine, prosulfuron plus dicamba, mesotrione plus atrazine, topramezone plus atrazine, tembotrione/thiencarbazone-methyl and glufosinate provided up to 31%, 84%, 39%, 94%, 89%, 86%, 83%, 78%, 72%, 43%, 63% and 58% GR giant ragweed and reduced dry weight 55%, 99%, 72%, 99%, 99%, 98%, 96%, 96%, 93%, 89%, 91% and 95%, respectively. In winter wheat, the herbicide evaluated provided 54 to 90% and 51 to 97% control of GR giant ragweed at 4 and 8 weeks after treatment, respectively. Reductions in GR giant ragweed population density and dry weight were 62 to 100% and 83 to 100%, respectively and generally reflected the level of control.

27 SEED TREATMENTS AND THE ENHANCEMENT OF STRESS TOLERANCE. Clarence Swanton*; University of Guelph, Guelph, ON

ABSTRACT

Traditionally, seed treatments are viewed within the discipline of crop protection. The ability to apply both fungicides and insecticides to seeds has played an important role in reducing the risk to successful crop establishment. Recent advancements in seed treatment technology, notably the neonicotinoids, have been reported to protect the seed against pest invasion as well as enhancing crop stress tolerance to abiotic and biotic variables. This presentation will highlight the ability of selected seed treatments to trigger genes that enhance crop stress tolerance. The ability to apply new chemistry to seed which is able to specifically activate selected genes, opens up new possibilities for seed technology. This new role for seed treatments may prove to be an important component in the pursuit of improved crop stress tolerance.

28 FIGHT THE LIGHT: REDUCING HERBICIDE DEPENDENCE WITH AGRONOMY IN A CORN-SOYBEAN-WHEAT ROTATION. François J. Tardif*[1], Michael Cowbrough[2]; [1]University of Guelph, Guelph, ON, [2]OMAFRA, Guelph, ON

29 HOW TO COMPLY WITH NEW DRIFT LABEL STATEMENTS FOR DICAMBA AND 2,4-D CHOLINE. Tom Wolf (Agrimetrix Research & Training, Saskatoon, SK) *; and Jason Deveau

ABSTRACT

The introduction of dicamba and 2,4-D tolerance traits in corn and soybeans will be accompanied by product label statements that emphasize spray drift control to a greater degree than previous products. Labels will make prominent reference to the appropriate "spray quality", a term referring to an internationally standardized droplet size classification (ASABE S572.1). In this standard, the droplet size spectrum produced by a nozzle is communicated using terms such as "Medium", "Coarse", "Very Coarse" etc., and used to describe the potential for spray coverage and spray drift. Spray qualities are voluntarily published by most nozzle manufacturers. Stakeholders will need to become familiar with accessing this information to ensure that applications comply with new label requirements. This presentation will describe how to locate and interpret this information, drawing on a variety of tools that include manufacturer catalogues, websites, and mobile apps.

30 CONTROL OF VOLUNTEER POTATO. Gavin L. Graham*; NBDAAF, Fredericton, NB

ABSTRACT

Volunteer potato (*Solanum tuberosum*) remains a difficult problem within a potato rotation within New Brunswick. If tubers are not removed during the harvest procedure, they may survive the winter and compete with the following crop, provide a host for other potato pests and create new daughter tubers to continue the weed cycle. As with all volunteer weeds, control begins at harvest to prevent loss of tubers and field management to reduce tuber survival over the winter. Previous research to evaluate herbicide control options within a cereal crop provided inconsistent results. A trial was conducted in 2015 near Hartland, NB in a commercially managed planting of Russet Burbank potatoes. Herbicides were applied to control the plants soon after emergence following hilling. The grower standard treatment of MCPA amine slightly suppressed potato growth early after application, but had minimal effects on final tuber yield. Fluroxypyr/MCPA ester and halauxifen/fluroxypyr/MCPA ester improved suppression but only had minimal decreases on tuber yield. Pyrasulfotole/bromoxynil, thiefensulfuron/tribenuron and thiefensulfuron/tribenuron/MCPA amine suppressed plants early and reduced tuber yield by 40%. Mesotrione treated plants developed symptoms slowly, but offered control within the middle evaluations followed by late regrowth. Tuber yield was reduced by 80%. The most effective treatment, both for growth suppression and tuber yield, was glyphosate. Applying the herbicides in a true volunteer control situation with crop competition could improve the effectiveness pf herbicide treatments. Potato varieties may differ in their response to herbicides and this could be evaluated further. Volunteer potato control in cereal production is difficult, especially when the crop is underseeded with legumes.

33 **PUNCTUREVINE *(Tribulus terrestris)* CONTROL IN THE SOUTH OKANAGAN,** Ken L. Sapsford[1]*, Lisa K. Scott[2]; [1] K & J Agro Inc., Kaleden, BC., [2]Okanagan and Similkameen Invasive Species Society, Summerland, BC.

ABSTRACT

Puncturevine *(Tribulus terrestris)* was first recorded in Canada in the 1970's. In British Columbia it only occurs in the Okanagan and Similkameen Valleys, with the majority of the

	population in the South Okanagan near Osoyoos and Oliver but has been recorded as far north as Vernon. It is classified as a noxious weed for the Regional District of Okanagan-Similkameen. Puncturevine prefers dry, sandy or gravely soils and requires less water than most plants. The most distinguishing feature is its spiny seedpods that can damage the feet of humans, the mouths of grazing wildlife and domestic animals and they can also puncture bicycle tires. There is no herbicide registered for control of puncturevine at this time in Canada. Trials were established in the Osoyoos area in 2015 to evaluate a number of pre-emergent and post-emergent herbicides for puncturevine control. None of the post-emergent treatments provided residual control of the puncturevine. Pre-emerge products: Napropamide at 4500 gai/ha, glyphosate at 900 gai/ha and sulfentrazone at 140 gai/ha did not provide any residual control of puncturevine. Indaziflam at 75 gai/ha, rimsulfuron at 15 gai/ha, flumioxazin at 140 gai/ha and halosulfuron at 67.5 gai/ha suppressed or controlled puncturevine through part or all of the growing season and should be investigated further
34	**IMPACT OF POST-ANTHESIS GLYPHOSATE ON WOOLLY CUPGRASS SEED PRODUCTION, SEED WEIGHT AND SEED VIABILITY**. Robert E. Nurse*[1], Stephen Darbyshire[2], Marie-Josee Simard[3]; [1]Agriculture Canada, Harrow, ON, [2]AAFC, Ottawa, ON, [3]AAFC, St. Jean, QC **ABSTRACT** Herbicides are generally applied at early stages of crop and weed growth to protect crop yield. Few studies have evaluated the effect of late (post-anthesis) applications of glyphosate as a management option to limit the seed production of weed escapes, such as woolly cupgrass (*Eriochloa villosa*). We propagated woolly cupgrass under greenhouse conditions and then applied three glyphosate treatments post-anthesis including: (1) an untreated control; (2) 900 g a.e. ha^{-1}; and (3) 1800 g a.e. ha^{-1}. Terminal inflorescences were collected 21 d after glyphosate application, and seed production, seed weight and embryo viability were assessed. Post-anthesis glyphosate applications did not influence seed production, but reduced seed weight and viability by 50 and 96%, respectively. Therefore, glyphosate applied just before the woolly cupgrass inflorescence begins to emerge from the leaf sheath (as late as the R1 stage in soybeans) is an effective strategy to manage woolly cupgrass reproduction and stop viable seeds from entering the soil seed bank or other dispersal pathways.
36	**SMARTPHONE APPLICATION FOR INVASIVE PLANT IDENTIFICATION AND REPORTING IN ALBERTA**. Elinam Hini*; Athabasca University, Edmonton, AB **ABSTRACT** **Smartphone application for invasive plant identification and reporting in Alberta.** Hini E.R.,[1] Laubhann D.[2], Graf S.[1] [1]Athabasca University, Edmonton, AB; [2]City of Edmonton, Edmonton, AB. Invasive alien plant species (IAPS) in Alberta present two crucial challenges to their control and management, namely the lack of public awareness and the lack of knowledge about weed distribution. To effectively get information on weed distribution for the entire province, citizens need to be involved in reporting weed locations. However, most people lack the

	awareness of IAPS and how to identify them, thus resulting in limited infestation reports. The primary educational material for identifying IAPS in Alberta is a print format booklet known as the Alberta Invasive Plant Identification Guide. The booklet allows for weed identification only by flower colour and does not directly support notifying weed managers about an infestation. Currently, the weed management authorities rely on citizens to report weed infestations by telephone or email. Given the ubiquity of mobile devices, the Alberta WeedSpotter smartphone app was developed as an alternative, more advanced but still easy-to-use identification tool that would also allow for reporting weed locations, all in one place. Providing a digital tool would also allow to reach a wider population. The app features an interactive workflow that utilizes touch gestures and interactive graphics to aid the identification process. It also provides a comparison feature for similar weeds. Capitalizing on sensors and connectivity technologies found in modern smartphones, the app utilizes the touch sensors on the screen for input, GPS for tagging the location of weed sightings, camera to provide visual confirmation of weed sightings, and Internet connectivity to send a weed location report. Reports are sent to a weed management database for verification and control. Over 6000 downloads of the app and over 500 reported weed infestation in 2015 suggests a strong support for this app and provided information on previously unknown weed locations.
37	**GENE FLOW IN KOCHIA (*KOCHIA SCOPARIA* L. SCHRAD.)**. Hugh J. Beckie*; Agriculture and Agri-Food Canada, Saskatoon, SK **ABSTRACT** In 2014 and 2015, a glyphosate-resistant (GR) kochia pollen flow field experiment, arranged in a radial design on fallow (eight directions, 96 m long), was conducted at Saskatoon, SK. Additionally, field experiments were conducted at Scott, SK and Lethbridge, AB using recently-collected tumbleweeds (ALS-R but not GR) tagged with mini-GPS collars. When wind speeds were sufficiently high (> 20 km hr-1), four tumbleweeds spaced 50 m apart were released and allowed to move across a chem-fallow area to the distance limit of each site (maximum 1000 m). The experiment was repeated twice. Percentage seed dropped from each tumbleweed was calculated by destructively harvesting plants and determining seed mass and number, as well as by calculating the harvest index of 10 randomly-sampled tumbleweeds not used in the experiment. Data from 2014 are presented. Pollen-mediated gene flow declined exponentially with distance, with 7.5% outcrossing at 0 m to 0.5% outcrossing at 96 m distance. At Scott, there was a highly significant ($P<0.01$) relationship between percentage seed dropped and the speed of tumbleweed movement. At a top speed approaching 25 cm s-1, nearly 50% of seeds or over 40,000 seeds per plant had dropped over a distance of ca. 300 m. At Lethbridge, a significant relationship was found between percentage seed dropped and distance. Thus, up to 90% of seeds per plant had dropped over a distance of ca. 1000 m. Speed of tumbleweed movement did not significantly affect the amount of seed dropped, which averaged 87,600 seeds per plant. These preliminary results from this study highlight the magnitude and challenge of herbicide resistance gene movement in this weed via seed dispersal, and to a lesser extent, pollen flow.
38	**USING THE ORGANIC WEED PULLER TO REMOVE TALL WEEDS IN SOYBEAN: LESSONS LEARNED FROM THE FIRST TRIAL**. Marie-Josee Simard*[1], Rob E. Nurse[2], Eric R. Page[2]; [1]AAFC, St. Jean, QC, [2]Agriculture and Agri-Food Canada,

Harrow, ON

ABSTRACT

Herbicide-resistant weeds can seriously threaten profitability in crops where few alternative herbicides will control them. In soybean, ragweed (Ambrosia spp.) and other broadleaved weeds, resistant to one or multiple herbicides are an increasing concern. When these weeds reach a certain size, few options other than hand weeding will limit the production and dispersal of thousands of weed seeds carrying resistance genes. The objective of this project was to evaluate the efficacy of the Bourquin organic weed puller ® (rotating series of wheels that grab and pull) at removing tall weeds before they shed seeds in soybean. The trial was located at the AAFC research farm in Saint-Jean-sur-Richelieu on a loamy soil. The experimental design initially included two soybean cultivars of different potential heights (40 and 77 cm), two weed species (common ragweed: A. artemisiifolia and lamb's-quarters: Chenopodium album) and two pulling dates (8 and 24 August). The set-up also included weedy and herbicide-treated control plots. Weeds overtopping the soybean canopy by at least 10 cm were tagged and characterised (height, stem diameter, stage, location across rows). Damage from the weed puller was rated as 1-pulled (desired effect), 2-cut, 3-folded, 4-peeled and 5-intact. The seed production of damaged and intact weeds was also noted. Results from this first trial indicate tall weeds (>35 cm height above canopy) were more likely to be pulled. Both soybean cultivars grew taller than expected (>80 cm height) so that common ragweed plants did not overtop the soybean canopy as much as anticipated and were also less likely to be pulled (<20% both dates) compared to lamb's-quarters (43%). Ragweed plants pulled on the first date did not produce viable seed but lamb's-quarters did. Further evaluations are needed as observations suggest modifications in tractor and pulling (roller) speed could increase efficacy.

39 **PERSISTENCE AND INVASIVENESS OF GENETICALLY MODIFIED CANOLA IN CANADA: A DEMOGRAPHIC COMPARISON OF OPEN POLLINATED AND HYBRID CANOLA**. Linda Hall*[1], Brendan C. Alexander[1], Hugh J. Beckie[2], David Clements[3], Rob E. Nurse[4], Marie-Josee Simard[5]; [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]AAFC, St. Jean, QC

New traits beyond herbicide and insect resistance will challenge our ability to measure and predict invasiveness of novel crops and their hybrid offspring. As part of a larger demographic study using 4 annual species conducted in five Canadian locations over 3 years in high (agricultural) and medium (ruderal) and low disturbances, we compared the population growth rate of hybrid and open pollinated canola *(Brassica napus).* Population growth rate (l) of hybrid and OP canola was highest in the high disturbance regime but highly variable between years. In the absence of control, populations were growing. Overwinter survival and subsequent spring recruitment (s_w = 0.04 -0.07) was relatively low but seedling survival to maturity was high (s_{sdl} = 0.42 - 0.90) as was fecundity (f = 15-4157). In medium and low disturbance sites population growth rates were always less than replacement (l < 1), ostensibly due to enhanced competition reducing $s_{sdl.}$ Prospective analysis was used to examine the elasticity of l to survival and fecundity parameters. In the high disturbance regime l was highly elastic to changes in $s_{w,}$ and s_{sdl}/f, but not to seed survival in the seedbank

	from spring to fall (s_B). However, in the medium and low disturbance regimes l was most often highly elastic to s_B rather than s_w and s_{sdl}/f, sometimes even showing negative elasticities for s_w. Because s_w conflates overwinter survival and spring recruitment a negative elasticity suggests that increasing spring recruitment would cause a decrease in l. Retrospective analysis using life table response experiments (LTRE) was used to decompose differences in l's into the contributions from s_w, s_{sdl} and f. In 2011 and 2012 we observed little difference in l between the two canola cultivars, however the LTRE analysis indicates that there is a tradeoff between s_w and s_{sdl}/f. Although s_w, s_{sdl} and f were not statistically different between the two cultivars we did observe some trends. Hybrid canola always had lower s_w but higher s_{sdl}/f, which resulted in similar l's despite dissimilar survival and fecundity. Demographic analysis is an appropriate tool for quantification of fitness and identification of potential invasiveness.
40	**GIS ASSESSMENT OF THE RISK OF GENE FLOW FROM *BRASSICA NAPUS* TO ITS WILD RELATIVES IN CHINA**. Wei Wei*; BC **ABSTRACT** Risk of gene flow from Brassica napus to species of wild relatives was used as an example to evaluate the risk of gene flow of transgenic crops. Large cultivated areas of B. napus and wide occurrence of its wild relatives occur in China, thus, it is important to assess the potential risk of gene flow from B. napus to its wild relatives. Data on canola cultivation and the distribution of its wild relatives in China were collected and analyzed using a Geographic Information System (GIS). B. juncea and B. rapa were the most common weedy Brassica species in China, which were both compatible with canola. Based on biological and phenological evidence, our results showed that gene flow risk exists in most parts of the country, especially in places with higher richness of wild Brassica species. However, risk in dominant canola cultivation regions is relatively low owing to the reduced distribution density of wild species in these regions. Western China has been assumed to be the original center of B. juncea, and gene flow may lead to negative effects on the conservation of biodiversity of local species. In agricultural settings, gene flow may introduce selectively advantageous traits to weedy relatives, e.g., B. juncea, and result in difficulty in weed control after the commercial release of transgenic canola.
41	**PARASITISM OF WEEDS AND NATIVE SPECIES BY A POTENTIAL WEED, THE INTRODUCED EXOTIC, *THESIUM RAMOSUM***. Mary Ann McLean*; St. Mary's University College, Calgary, AB **ABSTRACT** Thesium ramosum Hayne, an alien invasive hemi-parasite which has the potential to become a serious weed, is a species of concern for staff at Fish Creek Provincial Park (FCPP) in Calgary. It first appeared in the park in 2001, and has since been found in many parts of the park and up to 1.6 km south of the park. Initial studies on its biology show that individual plants produce an average of 30 stems, each 20-50 cm in length; flowering continues from late May to frost; and seeds are produced abundantly (500-1500 per plant) from late July to frost. The range of host species was investigated since this may influence management

	strategies. Root washing showed haustoria on the roots of 42 species of plants (grasses, shrubs, trees and forbs) common in FCPP. Degree of parasitism as defined by number of haustoria/g dry root varied significantly between grass species (Poa pratensis 227, Nassela viridula 122, Bromus inermis 61) while shrubs tended to be less parasitized (<25) and the only legume tested was highly parasitized (Medicago lupulina 550). Associations between T. ramosum and other species will be discussed.
42	**WEED LEGISLATION HAS CHALLENGES**. Nicole Kimmel*; Government of Alberta, Edmonton, AB **ABSTRACT** Weed Legislation is often thought to be the final stake in any weed coffin. But weed legislation has many challenges. I will highlight some of the many complexities in weed legislation that has occurred in Alberta since the legislation revision in 2010. My hope is by presenting the short comings of our current weed legislation other jurisdictions can learn from our mistakes and strengthen their own weed legislation. I will highlight how Flowering Rush is driving governments to loosen legislative restraints. What happens when Jimsonweed shows up in Alberta, with no provincial legislation, and federal legislation only covers the seed. I will also highlight the challenges in trying to address ornamentals through weed legislation.
43	**LINKING RESEARCH WITH LAND MANAGERS &NDASH;A REGIONAL PERSPECTIVE**. Todd Larson*; BC **ABSTRACT** It is important to make weed science research accessible to industry, land managers, and the general public. There are currently some gaps between practical on-the-ground knowledge and available or required scientific information –we need to work together to overcome this division. Specifically with invasive plant management, there is a vast network of various government and non-profit organizations working at a variety of landscape levels. The East Kootenay Invasive Plant Council (EKIPC) works within the Southeast portion of British Columbia to support land managers in meeting their land use objectives regarding invasives. It is critical for EKIPC to prioritize which species pose the greatest risk to these goals, and determine how to effectively and efficiently mitigate their spread. Local weed management contractors require the proper tools and knowledge to perform their duties in a successful and sustainable manner. Researchers and chemical companies need to provide this information to prevent herbicide resistance, promote effective chemistries, and encourage innovative techniques. Conversely, land managers must determine which problems require a solution so that academics can respond with science-based evidence. While both of these groups are working towards a more cohesive association, more can be done. There is a great opportunity for weed science researchers to collaborate with invasive species councils. Some organizations have access to alternate funds for research trials, summer students, and public outreach. Building on these partnerships will allow for better knowledge transfer, future funding prospects, and more strategic invasive plant management.

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THE MECHANISM BY WHICH AMINO ACID BIOSYNTHESIS INHIBITING HERBICIDES CONTROL BROOMRAPES (*OROBANCHE* AND *PHELIPANCHE* SPP.). *Hershenhorn J.*[1], *Dor E.*[1], *Galili S.*[2], *Amir R.*[3],*Smirnov E.*[1], and Hacham y.[3]
[1]Department of Phytopathology and Weed Research, Newe Ya'ar Research Center, Institute of Plant Protection, Agricultural Research Organization (ARO), Ramat Yishay, Israel; [2]Institute of Plant Sciences, Agricultural Research Organization (ARO), the Volcani Center, Bet Daga, Israel; [3]Galilee Technology Center (Migal), Kiryat Shmona Israel.

ABSTRACT

Effective broomrape control without causing damage to the crop can be achieved only with amino acid biosynthesis inhibiting herbicides. Two chemical groups of herbicides inhibit amino acid biosynthesis: a) glyphosate inhibiting the enzyme Enolpyruvilshikimate phosphate synthase (EPSPS) catalyzing key step in the formation of the aromatic amino acids phenylalanine, tyrosine and tryptophan b) aceto lactate synthase (ALS) inhibiting herbicides that block the formation of the branched chain amino acids leucine, isoleucine and valin by inhibiting the key enzyme aceto lactate synthase. The ALS inhibiting herbicides include 5 chemical groups but only two are used for broomrape control: sulfonylurea and imidazolinones. The mode of action of the amino acid biosynthesis inhibiting herbicides is well known but it is not clear why they successfully control broomrapes. As obligate parasites they suck from the host all their nutritional requirements and therefore inhibition of amino acid biosynthesis within the parasite should not be lethal. The mode of action of glyphosate and imazapic (imidazolinone) against *Phelipanche aegyptiaca* (Pers.) Pomel. were studied. Both herbicides inhibited callus growth and changed the content of free amino acids. It is the first report on the presence of active EPSPS and ALS enzymes in broomrape callus and flowering shoots. Inhibition of EPSPS by glyphosate and ALS by imazapic was shown. Blasting *A. thaliana* EPSPS and ALS cDNAs against the genomic DNA identified a single DNA fragment of both ALS (*P. aegyptiaca* putative ALS gene) and EPSPS (*P. aegyptiaca* putative EPSPS gene) with about 78% and 75% identity to *A. thaliana* ALS and EPSPS proteins, respectively. It was concluded that broomrapes have their own machinery for the production of branched chain and aromatic amino acids. Glyphosate and imazapic block EPSPS and ALS activity that lead to shortage of those amino acids and finally to the death of the parasite.

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BIODIVERSITY AND ETHNOBOTANICAL ASPECTS OF WEEDS: CASE STUDY IN AN SMALL AREA OF COLOMBIA, SOUTH AMERICA. Camilo Lastra and Juan Carlos Granados. *; Colombia

ABSTRACT

This paper documents richness, floristic composition, diversity and traditional knowledge associated with weed plants from Garagoa's municipality crops (Boyacá, Colombia). Given the lack of ethnobotanical studies on Colombian weed plants and using data from countries such as Bolivia, Argentina and mainly Mexico, the following hypotheses were established: 1). Species richness and diversity of weeds of Garagoa are greater or equal than those reported in similar studies in peasant economy areas in Mexico. 2). More than 50% of the

	Garagoa weeds are used by farmers, being the main uses: forage, food and medicine. 3). Useful weeds are subject to one or more traditional management practices (tolerated, encouraged or induced, protected, cultivated or transplanted). 4). Older farmers are who have more knowledge about weeds. Richness and structure of weed flora were evaluated in 80 farms and 66 semi-structured interviews were conducted with peasants between 14 and 91 years. Between 11 and 48 weed species were found in fields (x Ì… = 25; σ=7) with Shannon index between 0,977 and 3,150 (x Ì… = 2,364; σ=0,411), indicating a greater diversity compared with San Rafael (México). 219 weed plants belonging to 63 families were found, those represent between 71 and 89% from weed species estimated for Garagoa´s crops. An 87% of the species have at least one use, being the main uses forage, food, medical, device manufacturing and fun elements. The 60% of the plants have at least one common name and 14.6% have some level of traditional management. Traditional knowledge associated with weeds increases with age up to 54-55 years when it begin to decrease following the quadratic model Y = -0.0139 x2 + 1.51 x - 4 6314 (with r2 = 0.6803). All hypotheses except fourth were corroborated and further exploration of taxonomic and ethnobotanical weed plants in Colombia it is strongly recommended.
46	A QUANTITATIVE COMPARISON OF RISK MANAGEMENT SYSTEMS FOR FORESTRY AERIAL APPLICATION IN AB AND ON. Milo Mihajlovich*; Mihajlovich Enterprises Ltd., Edmonton, AB ABSTRACT The presentation examines two approaches to using the Ag-Disp spray cloud dispersal model to develop risk management protocols for aerial application of herbicides in forest management. In both cases changes in forest harvesting practices have greatly increased nozzle-to-target distance with an attendant increase in risk of off-target movement. This has necessitated changes in application technology and risk management practice. The Ag-Disp model was used to integrate these changes into a coherent, user accessible package that provides reliable environmental protection whilst maintaining operational effectiveness. Differences in risk management protocols are largely dependent on differences in approach to regulatory protection of aquatic systems. Empirical validation of outcomes is provided.
47	**FOREST VEGETATION MANAGEMENT IN BOREAL STANDS: LONG-TERM IMPACTS OF SILVICULTURE INTENSITY ON STAND PRODUCTIVITY, STRUCTURE AND DIVERSITY** . Nelson Thiffault[1,2,*], Morgane Urli[1,3], Louis Bélanger[2], Alain Leduc[3] and Daniel Chalifour[4]; [1]Direction de la recherche forestière, Nelson, 2700 Einstein, Québec, QC, G1P 3W8, [2]Centre d'étude de la forêt, Faculté de foresterie, de géographie et de géomatique, Université Laval, Québec, QC, G1V 0A6; [3]Centre d'étude de la forêt, Université du Québec à Montréal, Case postale 8888, succursale Centre-ville, Montréal, QC, H3C 3P8; and[4]Société de protection des forêts contre le feu, **Base de Maniwaki,** 176 route 105, Messines, QC, J0X 2J0 **ABSTRACT** Vegetation management is crucial to meeting the objectives of forest management, especially those associated to plantations. However, vegetation management treatments are among the silvicultural tools that show the greatest potential for the artificialization of natural forests. In

	Quebec, a new forest regime centered on ecosystem management has been adopted to reduce gaps between managed and natural forests, while promoting the intensification of timber production to ensure a timber supply that meets public expectations regarding sustainable forest management. In this context, there is a need to assess operational vegetation management scenarios in terms of their naturalness along a gradient of intensity, and balance their potential impacts on biodiversity with the benefits they can produce regarding timber productivity. Here we report on a long term study assessing the impacts of forest vegetation management of increasing intensity on boreal stand diversity, productivity and structure. Using 20-y data from an experimental design comparing *i*) careful logging around advance growth (CLAAG); *ii*) CLAAG followed by pre-commercial thinning; *iii*) plantation followed by mechanical release; and *iv*) plantation followed by chemical release, we calculated diversity indices and examined plant community composition and structure along the intensity gradient. We also assessed timber productivity by comparing treatments in terms of conifer and broadleaf dominance and dimensions. Data obtained from stands originating from a spruce budworm outbreak, the most common natural disturbance in the study region, were used as a baseline to understand treatment impacts on stand attributes. Results will be discussed in regards of the intermediate disturbance hypothesis, which predicts that the best trade-off between stand diversity and productivity should be found in the middle of a silviculture intensity gradient between harvesting only and plantation silviculture including site preparation and chemical vegetation release.
48	**ENVIRONMENTAL FATE OF AMINOCYCLOPYRACHLOR AND THE IMPACT ON NON-TARGET VEGETATION WHEN USING AMINOCYCLOPYRACHLOR (NAVIUS VM AND TRUVIST) IN INDUSTRIAL VEGETATION MANAGEMENT (IVM)**. Darrell Chambers*; Bayer CropScience Inc. Canada, Calgary, AB **ABSTRACT** Aminocyclopyrachlor (ACP) is a new unique active ingredient registered for use in Canada in 2014 for the IVM marketplace. Currently there are two products sold in Canada containing ACP. The products are Navius VM and Truvist herbicides for brush and weed control. During this presentation the facts on mobility, non-target vegetation injury and the environmental fate of ACP will be discussed
49	IMPACTS OF SINGLE AND REPEATED GLYPHOSATE HERBICIDE APPLICATIONS ON PLANT COMMUNITY DIVERSITY AND SPRUCE GROWTH IN AN ALBERTA SPRUCE PLANTATION. Phil Comeau[1], Erin Fraser[2] and Susan Humphries[1] ,[1] Department of Renewable Resources, University of Alberta, Edmonton, Canada; [2] Alberta Environment and Sustainable Resource Development, Edmonton, Canada; Phil Comeau*; University of Alberta, Edmonton, AB **ABSTRACT** Impacts of single and repeated glyphosate herbicide applications on plant community diversity and spruce growth in an Alberta spruce plantation.

	Herbicide treatments, using glyphosate, are widely used to control major competitors, bluejoint reedgrass (*Calamagrostis canadensis)* and trembling aspen (*Populus tremuloides*) in regenerating spruce plantations in Alberta, Canada. Short-term negative impacts on vegetation cover and plant community diversity are evident, while literature from other parts of Canada and observations in Alberta suggest that a single application of glyphosate in boreal spruce plantations can result in increased plant community diversity due to reducing abundance of these two dominant species. In some cases, two treatments, timed 2 or 3 years apart, are used on this sites to provide additional control of bluejoint reedgrass. There is no published information relating to the potential impacts of application of two treatments on these sites. In 2004 we initiated a study was to examine effects of aerial herbicide application on plant community development and tree growth following harvesting and planting of a mixedwood site near Calling Lake, Alberta. This study used a randomized complete block design with one replicate of each of the four treatments replicated across five blocks. The four treatments are: a) untreated (control); b) aerial application of glyphosate at 2.1 kg ai/ha in the first growing season after harvesting; c) aerial application of glyphosate herbicide at 2.1 kg ai/ha in the third growing season after harvesting; and d) aerial application of glyphosate herbicide at 2.1 kg ai/ha in the second AND fourth growing seasons after harvesting (two treatments). In this presentation we will examine and discuss herbicide treatment effects on plant community diversity, spruce survival, and spruce growth at age 10. In addition, we will discuss future dynamics and stand structures resulting from these treatments based on simulations by the Mixedwood Growth Model.
50	CULTURAL TECHNIQUES FOR INTEGRATED WILD OAT MANAGEMENT. Kenneth N. Harker*[1], John T. O'Donovan[1], Robert E. Blackshaw[2], Eric N. Johnson[3], Denis Pageau[4], Steven J. Shirtliffe[5], Robert H. Gulden[6], John Rowsell[7], Linda Hall[8], Christian J. Willenborg[9]; [1]Agriculture & Agri-Food Canada, Lacombe, AB, [2]Agriculture & Agri-Food Canada, Lethbridge, AB, [3]Univ. of Saskatchewan, Saskatoon, SK, [4]Agriculture & Agri-Food Canada, Normandin, QC, [5]Univ. of Saskatchewan, Saskatoon, AB, [6]Univ. of Manitoba, Winnipeg, MB, [7]Univ. of Guelph, Guelph, ON, [8]University of Alberta, Edmonton, AB, [9]Assistant Professor, Saskatoon, SK **ABSTRACT** In western Canada, where summer-annual crops are the dominant crop life cycle, summer-annual weeds thrive. There, wild oat control leads to more herbicide applications than any other weed species. Consequently, wild oat resistance to herbicides is Western Canada's most wide-spread resistance issue. Truly integrated weed management strategies are required to slow weed resistance evolution and to preserve herbicide efficacy. A direct-seeded (no-till) field experiment was conducted from 2010 to 2014 at eight Canadian sites to determine crop life cycle, crop species, crop seeding rate, crop usage and herbicide rate combination effects on wild oat management and canola yield. Forgoing wild oat herbicides in only two of five years in exclusively summer-annual crop rotations resulted in higher wild oat density, above-ground biomass and seed banks than a repeated canola-wheat rotation under a full wild oat herbicide rate regime. Conversely, combining 2x seeding rates of early-cut barley silage with 2x seeding rates of winter cereals and excluding wild oat herbicides for three of five years

	(2011 to 2013) often led to similar wild oat density, biomass, seed density in the soil and canola yield as a repeated canola-wheat rotation under a full wild oat herbicide rate regime. Wild oat was similarly well-managed after three years of perennial alfalfa without wild oat herbicides. Integrated weed management systems that effectively combine diverse and optimal cultural practices against weeds, and limit herbicide use, reduce selection pressure for weed resistance to herbicides and prolong the utility of threatened herbicide tools.
51	THE EFFECT OF MECHANICAL WEEDING AND COVER CROP ON WEED CONTROL AND SEED YIELD IN ORGANIC FLAX (*LINUM USITATISSIMUM* L.). Hema Duddu*; University of Saskatchewan, Saskatoon, SK **ABSTRACT** Ground beetles are postdispersal weed seed-predators that play important role in weed seed consumption in agro-ecosystem. We investigated seed preferences of three omnivorous ground beetle species, *Amara littoralis* Mannerheim, *Harpalus affinis* (Schrank) and *Pterostichus melanarius* (Illiger) (Coleoptera: Carabidae) on three brassicaceous weeds, *Brassica napus* (volunteer canola), *Sinapsis arvenisis* (wild mustard) and *Thlapsi arvense* (field pennycress) and possible role of olfaction for these preferences. All carabid species preferred seeds of *B. napus* most and those of *T. arvense* least, and showed intermediate preferences for *S. arvensis* seeds. Beetles highly preferred imbibed seeds of all three weed species. We further conducted olfactometer experiments to investigate if carabid beetles use olfactory stimuli to detect seed dispersed on the ground. A four choice olfactory bioassay was used to test whether carabid species show any olfactory response to dry or imbibed seeds of these weed species. Only *A. littoralis* showed a response to dry seeds of *B. napus*. Imbibition of seeds influenced behaviour as all three species exhibited a greater response to *B. napus* seeds compared to *S. arvensis* and *T.arvense*. A two choice bioassay confirmed the preference for imbibed *B. napus* seeds, as all three carabid species responded in greater proportions to odours from imbibed seeds than dry seeds. Our results indicate that olfactory cues associated with weed seeds contribute to weed seed foraging by seed predatory carabids. Imbibed seeds of weed species such as *B. napus* tend to be most preferred by carabid seed predators. **Keywords:** carabid beetle, olfaction, volunteer canola, wild mustard, field pennycress
52	FACTORS AFFECTING SPRAY DEPOSITION IN MATURE CANOPIES. Tom Wolf, Brian Caldwell, Randy Kutcher, and Bruce Gossen **ABSTRACT** Late season pesticide sprays for disease control, pre-harvest weed control, or crop desiccation are increasingly common. Spray penetration through dense canopies is challenging, and the factors governing the process must be better understood. A series of spray deposition studies were conducted to evaluate the effect of application volume, travel speed, boom height, spray quality, and nozzle angling on spray interception at the top, middle, and bottom third of various mature crop canopies. Spray containing fluorescent tracer dye was applied in a track room containing simulated of cereal and broadleaf crop canopies. Deposits were captured on artificial collectors placed within these canopies at three heights and quantified using

	fluorescence spectrophotometry. Results showed that the benefit of twin fan nozzles, or forward- angled single sprays, were significant but appeared to be greatest with lower boom heights. Approximately 30% more spray was retained by the vertical samplers (simulating wheat heads) when the boom was 20" above the target compared to 30" above the target. The benefit of forward-angled sprays appeared to be limited to vertical targets in the upper part of a cereal canopy. Lower in the canopy, or in a broadleaf canopy, the benefit of angled sprays was less pronounced. Backward angled single sprays, while not as effective in the upper canopy, showed slightly improved coverage the mid canopy of a cereal crop. Twin-fan nozzles that offered the greatest spray capture by vertical targets in the upper cereal canopy usually also had the lowest spray deposition lower in the canopy. Greater water volumes appeared to increase canopy penetration into a broadleaf canopy, but the benefit of more water was less pronounced in the comparatively open cereal canopy. Higher spray operating pressures had no impact on spray penetration into a broadleaf canopy. Faster travel speeds (comparing 8 and 16 km/h) had relatively minor effects on canopy penetration. These results underscore the difficult nature of increasing canopy penetration of sprays. Application methods may need to be specifically tailored to the canopy type and the target location within the canopy for deposition amounts to be optimal.
53	**CONTROL OF VOLUNTEER CANOLA IN SUNFLOWER WITH SULFENTRAZONE AND IMAZAMETHABENZ** . William May*; Agriculture and Agri-Food Canada, Indian Head, SK **ABSTRACT** Volunteer canola is a major weed in sunflowers that growers need to be able to control to successfully grow sunflowers when canola is also grown in the crop rotation. Imazamethabenz will control volunteer canola at the rate recommended for application on barley and spring wheat; however at the reduced rate of imazamethabenz recommended on sunflowers volunteer canola is not controlled. Sulfentrazone is not labelled for control of volunteer canola ; however some a reduction in canola density and growth has been observed at high rates. The objective of this study is to determine if a combination of sulfentrazone applied pre-emergent and imazamethabenz applied post-emergent could be used to control volunteer canola in sunflowers. Sulfentazone was applied with a pre-emergent application at five rates, 0, 140, 210, 280 and 420 g a.i. ha^{-1} and imazamethabenz was applied at two rates, 0 and 255 g a.i. ha^{-1} in a factorial design with 4 replicates. The use of both herbicides increased the consistency in the control of the volunteer canola. As the rate of sulfentrazone increased the control of the volunteer canola tended to increase. The combination of sulfentrazone applied pre-emergent and imazamethabenz suppressed volunteer canola in sunflowers.
54	MANAGING SEED PRODUCTION OF HERBICIDE RESISTANT WEEDS IN LENTIL WITH PRE-HARVEST HERBICIDE APPLICATION. Angelena D. Syrovy[1], Steven J. Shirtliffe[2], Eric N. Johnson*[3], Christian J. Willenborg[4]; [1]University of Saskatchewan, Saskatoon, SK, [2]Univ. of Saskatchewan, Saskatoon, AB, [3]Univ. of Saskatchewan, Saskatoon, SK, [4]Assistant Professor, Saskatoon, SK

ABSTRACT

Lentil growers in the Canadian prairies are currently facing large challenges with weed control of herbicide resistant species. There is a need for strategies to reduce weed seed production in order to reduce populations of herbicide resistant weeds in the long term. To address this issue two trials were initiated at the University of Saskatchewan in 2015 that evaluated weed wiping and crop topping with herbicides as methods of reducing weed seed production in lentil. The weed wiping trial tested six herbicides (aminopyralid, 2,4-D, dicamba, fluoroxypyr, glyphosate, mecoprop) selectively applied at four timings during weed inflorescence with a rope wick. The crop topping trial tested five herbicides (bromoxynil, diquat, fluoroxypyr, glufosinate, saflufenacil) sprayed on the crop as a weed desiccant at four timings near lentil maturity. Both studies used a RCBD with four replications, included an untreated control, and used wild mustard as the weed. The earliest timing of weed wiping, which occurred at 80% inflorescence emergence of the weed, was the most effective at controlling wild mustard. At this timing all herbicides reduced weed seed production by at least 60% compared with the control, however aminopyralid and dicamba also caused crop yield and seed quality loss. No herbicides reduced wild mustard seed production when used for crop topping, regardless of application timing. Crop yield increased as crop topping was delayed, illustrating that lentil yield is sacrificed by desiccating early to control weeds. Weed wiping with 2,4-D, glyphosate, fluoroxypyr and mecoprop during weed inflorescence emergence can lower seed production of herbicide resistant wild mustard in lentil. Seed viability studies will determine whether crop topping can be an effective strategy to lower wild mustard populations.

55 ARYLEX™ ACTIVE (HALAUXIFEN-METHYL): RECROP INTERVALS FOR PULSE CROPS AND POTATO IN WESTERN CANADA. Len Juras*[1], Rory Degenhardt[2], Laura Smith[3], Andrew MacRae[4]; [1]Dow AgroSciences Canada Inc, Saskatoon, SK, [2]Dow AgroSciences Canada Inc, Edmonton, AB, [3]Dow AgroSciences Canada Inc, Winnipeg, MB, [4]Dow AgroSciences Canada Inc, Calgary, AB

ABSTRACT

Arylex™ active (Halauxifen-methyl): Recrop Intervals for Pulse Crops and Potato in Western Canada. L.T. Juras, R.F. Degenhardt, L. Smith, A.W. MacRae. Dow AgroSciences Canada Inc., Calgary, AB, Canada. Arylex™ (halauxifen-methyl) active is a new herbicide developed by Dow AgroSciences for post-emergence broadleaf weed control in Western Canadian cereal crops. Arylex is a Group 4 mode of action herbicide from the new arylpicolinate chemical family. Arylex degrades rapidly in the soil to halauxifen-acid, which then degrades rapidly to non-active compounds. Dissipation of Arylex occurs primarily through microbial degradation in the soil and photolysis in water. Small plot field research trials were conducted in Western Canada between 2009 and 2015 to evaluate recrop intervals for chickpeas (Cicer arietinum), dry beans (Phaseolus vulgaris), fababeans (Vicia faba) and potatoes (Solanum tuberosum). In the year of application, Arylex was applied to cereal crops or bare ground. In both application scenarios, plots were kept weed-free with the appropriate use of non-residual herbicides. The bare ground trials were designed to simulate a worst case scenario, with the maximum proportion of applied Arylex reaches the soil surface and no

crop interception occurs. Straw from treated cereal crops was returned to plots prior to planting rotational crops. No significant injury to fababeans (Vicia faba), dry bean (Phaseolus vulgaris) or potatoes (Solanum tuberosum) was observed when these crops were sown into plots treated with up to 10 g ae/ha (2X commercial rate) Arylex 10 months earlier. However, crop injury to chickpeas was observed in some trials within this recrop interval. The research data supports a 10 month recrop interval for fababeans, dry beans and potatoes; however, a longer recrop interval may be required for chickpeas following an Arylex application.

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56 **ARYLEX™ ACTIVE (HALAUXIFEN-METHYL) PLUS PYROXSULAM FOR BROADLEAF AND GRASS CONTROL IN WESTERN CANADA CEREAL CROPS** .

Laura Smith*[1], Andrew MacRae[2], Rory Degenhardt[3], Len Juras[4]; [1]Dow AgroSciences Canada Inc, Winnipeg, MB, [2]Dow AgroSciences Canada Inc, Calgary, AB, [3]Dow AgroSciences Canada Inc, Edmonton, AB, [4]Dow AgroSciences Canada Inc, Saskatoon, SK

ABSTRACT

Dow AgroSciences has developed a pre-formulated herbicide mixture containing Arylex™ active (halauxifen-methyl) and pyroxsulam, that provides a convenient one pass solution to control broadleaf and grass weed species in western Canada cereal crops. Small plot field research trials were conducted in 2014 and 2015 in cereal crops to evaluate efficacy and crop safety of this pre-formulated mixture. Arylex plus pyroxsulam applied at 5 + 15 g ae/ha, respectively, was safe to spring wheat, durum wheat and winter wheat. This combination provided control of many hard-to-kill broadleaf weeds at advanced growth stages, including up to eight-leaf stage wild buckwheat (*Polygonum convolvulus*) and hemp-nettle (*Galeopsis tetrahit)*, up to nine-whorl stage cleavers (*Galium spurium)*, and up to two-tiller stage wild oats (*Avena fatua*). This mixture is compatible with other broadleaf weed herbicides for expanded weed spectrum, and is an excellent choice for management of many broadleaf weeds with confirmed Group 2 herbicide resistance, including chickweed, cleavers, and hemp-nettle. Overall, the Arylex plus pyroxsulam pre-formulated mixture offers a very robust weed control tool for western Canada wheat producers.

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57 ETHALFLURALIN EFFICACY IN MINIMAL DISTURBANCE FIELDS IN THE BLACK SOIL ZONE OF WESTERN CANADA. Andrew W. MacRae*[1], Laura Smith[2], Rory Degenhardt[3], Len Juras[4], Jamshid Ashigh[5]; [1]Dow Agrosciences Canada Inc., Winnipeg, MB, [2]Dow AgroSciences Canada Inc, Winnipeg, MB, [3]Dow AgroSciences Canada Inc, Edmonton, AB, [4]Dow AgroSciences Canada Inc, Saskatoon, SK, [5]Dow AgroSciences Canada Inc., London, ON

ABSTRACT

Ethalfluralin granular formulation was registered in Canada in 1997 for weed control in oilseed and pulse crops grown under conventional tillage practices. In the late 1990s there was a shift toward minimal tillage with direct seeding cropping systems. In this practice the

	crop is seeded directly into the previous crop's stubble without the use of tillage. In minimal tillage, some straw management or fertilizer placement may be required resulting in minimal soil disturbance of 30% or less. Direct cropping systems have many benefits including increased water filtration and retention, increased biological activity arising from higher soil organic content, and equipment and fuel savings because of fewer passes over the field. Research was initiated in the 1990s to determine if granular ethalfluralin could be used in direct seeded cropping systems without conventional cultivation. Weed seed germination in direct seeded cropping systems generally occurs in the top 2.5 cm of the soil, requiring ethalfluralin to be placed in this surface layer to provide effective weed control. Research trials compared fall versus spring application and minimal cultivation (rotary or tine harrow for stubble management) versus no cultivation on the efficacy of ethalfluralin. When surface-applied in the fall, granular ethalfluralin at 1.4 kg/ha without any cultivation provided control of several annual grasses (wild oat, green foxtail, volunteer wheat) and broad-leaved weeds (common lambsquarters, cleavers, wild buckwheat, common chickweed). When applied in the spring at 1.1 kg/ha without any cultivation, the same species were controlled with the exception of common chickweed. Granular application of ethalfluralin in minimal tillage systems provides effective weed control and does not require cultivation unless required for management of heavy crop stubble residue to increase ethalfluralin contact with soil.
58	DOES TOLERANCE TO PREEMERGENCE FOMESAFEN TANK MIXES VARY AMONG CUCURBIT CROPS? Darren Robinson*, David Bilyea; University of Guelph, Ridgetown, ON **ABSTRACT** The objective of this research was to determine the effect of tank mix partner on the efficacy of preemergence applications of fomesafen and the tolerance of three different vine crop species. Experiments were conducted from 2013 to 2015 on three distinct soil types. Each experiment was arranged in a split-split-plot design with four replications; cucurbit species (*Cucumis sativa*, *Cucurbita moschata* and *C. pepo*) was the main plot, herbicide treatment (fomesafen, s-metolachlor, clomazone and halosulfuron each alone and in two-way combinations) was the sub-plot and hand-weeding versus no hand-weeding was the sub-sub-plot. Visible injury and yield reductions were greater in *C. sativa* than the other two species. Of all the tank mix combinations, clomazone plus halosulfuron caused little to no visiable injury and did not reduce yield of any species. Control of weeds commonly found in the areas where these crops are grown was not improved by the addition of fomesafen. The results of this study indicate that fomesafen provided little benefit to weed control, and have the potential to cause injury in vine crops.
59	SEED BANK CHARACTERISTICS, SEEDLING RECRUITMENT, AND MANAGEMENT OF FESCUES (*FESTUCA* SPP.) IN WILD BLUEBERRY. Scott N. White*, Shanthanu K. Kumar; Dalhousie University Faculty of Agriculture, Truro, NS **ABSTRACT** Fescues (*Festuca ovina* and *F. filiformis*) are common grass weeds in wild blueberry fields

	that impede harvest and reduce yields. Experiments were initiated in fall 2014 to investigate 1) the presence and depth of fescue seed banks in wild blueberry fields, 2) the dormancy status of fresh fescue seeds, 3) the temporal patterns of seedling recruitment in established fescue populations, and 4) the effects of various herbicide combinations on fescue tuft density, suppression of inflorescence growth, and reduction of fescue seed banks in wild blueberry fields. Fescues formed seed banks in wild blueberry fields and comprised 10 ± 8 to 46 ± 8% of the germinable seed bank at two field sites. Seed density exceeded 30,000 seeds m^{-2} at each site, with the majority of seeds (>90%) located on the soil surface. Fresh fescue seeds lacked dormancy, with germination rates of 97 ± 1 and 53 ± 2% in light and dark conditions, respectively. Seedling recruitment occurred in both spring and fall, indicating a biphasic seedling recruitment pattern in established fescue populations in wild blueberry fields. Preemergence applications of propyzamide and terbacil were the only herbicide treatments that significantly reduced vegetative and flowering fescue tuft density. Glufosinate ammonium application rate had a significant effect on foramsulfuron efficacy on fescues, with burndown glufosinate ammonium application rates of 750 and 1005 g a.i. ha^{-1} significantly improving foramsulfuron suppression of fescues when compared to foramsulfuron applications alone under field and greenhouse conditions. Results provide new information on the basic biology of fescue grasses in wild blueberry fields and provide insight into the potential use of herbicides to manage established populations.
60	EFFECT OF LATE HERBICIDE APPLICATIONS ON GROWTH AND REPRODUCTIVE ABILITY OF GLYPHOSATE-RESISTANT COMMON RAGWEED (*AMBROSIA ARTEMISIIFOLIA* L.). Jichul Bae*[1], Robert E. Nurse[2], Marie-Josee Simard[3], Eric R. Page[1]; [1]Agriculture and Agri-Food Canada, Harrow, ON, [2]Agriculture Canada, Harrow, ON, [3]AAFC, St. Jean, QC **ABSTRACT** High fecundity and complex germination behavior contribute significantly to the success of common ragweed (*Ambrosia artemisiifolia* L.), which help ensure replenishment of seed reserves. Seed production by glyphosate-resistance (GR) common ragweed escapes can provide seed-bank replenishment and eventually cause the subsequent spread of GR biotype. This study aims to evaluate the effects of late applications of glyphosate-phenoxy tank-mixes on growth and reproductive ability of GR common ragweed. This growth-chamber experiment used a split-block treatment design with three replicates. The main plot treatments consisted of six herbicide treatments: untreated control (H_2O); glyphosate (900 g ha^{-1}); 2,4-D (733 g ha^{-1}); dicamba (384 g ha^{-1}); 2,4-D (733 g ha^{-1}) + glyphosate (900 g ha^{-1}); and dicamba (384 g ha^{-1}) + glyphosate(900 g ha^{-1}). The subunit treatments included two spray timings: at the appearance of anther cones and pollen tubes. Growth and reproductive parameters were dry biomass, seed number, 1000-seed-weight and seed viability. When applied at the appearance of anther cones, 2,4-D, dicamba and the tank-mixes resulted in more than 70 % biomass reduction. The tank-mixes sprayed at the appearance of anther cones reduced seed number and seed weight by more than 85 and 70 %, respectively. Dicamba and 2,4-D + glyphosate tank-mix resulted in 80 and 76 % decrease in seed viability, respectively, when applied at the appearance of pollen tubes. Dicamba application at the appearance of pollen tubes will make GR common ragweed seeds largely non-viable. The tank-mixes inhibited both seed number (when applied at the appearance of anther cones) and seed viability (when applied at the appearance of pollen tubes). In conclusion, late season

	application of glyphosate-phenoxy tank-mixes could prevent seed-bank replenishment and subsequent spread of GR common ragweed biotype.
61	EMERGENCE NATURE OF *GALIUM* SPP. POPULATIONS FROM W. CANADA. Andrea C. De Roo*[1], Christian J. Willenborg[2]; [1]University of Saskatchewan, Saskatoon, SK, [2]Assistant Professor, Saskatoon, SK **ABSTRACT** False cleavers (*Galium spurium* L.) and catchweed bedstraw (*Galium aparine* L.), collectively known as cleavers, have become an increasing problem in canola fields across the Canadian prairies. The latest Prairie Weed Survey listed cleavers 6th among weeds in 2012, which is up from 31 in the 1970's. Although there are many herbicide options available, the development of resistance in cleavers to Group 2 (ALS inhibitors) and Group 4 (quinclorac) herbicides has complicated management. Understanding germination and emergence characteristics can provide a better understanding of how populations of *Galium* species are behaving in western Canada, and whether emergence timing of these populations are preventing adequate weed control. The objectives of this experiment are to 1) To determine the emergence timing of each population 2) To measure differences in emergence percentages in spring and fall between populations. Emergence timing and percentage were examined in 6 representative samples of cleavers obtained from various locations across the prairies. Approximately 400 seeds of each population was scattered on the soil surface of 1- x 2-m plots and covered with a shallow layer of soil. To determine if populations are acting as winter or summer annuals, two sowing dates (May and August) were utilized. Emergence patterns suggests that the populations start to emerge at approximately the same timing, but median emergence time and the rate of emergence differed between populations. Time to 50% emergence was 274-468 GDD in spring and 249-743 GDD in the fall. Temperature and moisture during the emergence period also affected cleavers populations differently. Fall emergence tended to be very low in comparison to spring emergence across all populations.
62	**First report: spotted knapweed *(Centaurea maculosa L.)* resistance to auxinic herbicides**. Mangin, A.R., and Hall, L. M. Agricultural, Food and Nutritional Sciences, University of Alberta, Edmonton, Alberta, Canada, T6G 2E1; **ABSTRACT** Spotted knapweed (*Centaurea maculosa L.*) is a prohibited noxious, invasive species currently replacing native rangeland in the Pacific Northwestern United States, British Columbia and Alberta. Primarily, control of spotted knapweed has been achieved by auxinic herbicides. A population collected from an extensively managed land-base near Fernie, BC appeared to be highly resistant to both clopyralid and picloram with resistance ratios of >25,600 and 28, respectively. This is the first report of resistance in spotted knapweed and the highest resistance to clopyralid reported in any species. Further research is required to investigate mechanism(s) and the genetics of resistance in this population.
63	GARLIC MUSTARD SPREADS TO ALBERTA: URBAN INVASIVE SPECIES IN UNDERGRADUATE RESEARCH INITIATIVES. Melissa Hills*; MacEwan University, Edmonton, AB

ABSTRACT

Urban invasive species are well suited to supporting a diversity of small-scale undergraduate research projects. Students have played leadership roles in experimental design, data collection and analysis in this research on the forest invader garlic mustard (*Alliaria petiolata*). This species has steadily spread across North America. First identified in Alberta in 2010, it is found in two urban ravines in Edmonton and one in St. Albert. A stratified random transect survey with adaptive cluster sampling was conducted in 2013 and 2015 to detect and map satellite patches of infestation using ArcGIS to support municipal control efforts. First and second year survival were assessed in 2014 and 2015. Preliminary data suggest low mortality in first year and variable mortality in second year plants. Fecundity analysis assessing plant position within a patch (edge vs. interior) indicates edge plants may have significantly higher fecundity than those at the centre. DNA was extracted from plants representing all 3 populations to use in a molecular phylogeographic analysis which may provide insight into whether these populations arise from a single introduction or multiple introductions. Additional projects in 2016 will replicate survival and fecundity analyses and a new project looking at the impact of garlic mustard on soil invertebrate abundance and diversity will be initiated. Research opportunities provide students with critical research skills and experience that supports their future academic and career goals.

64 RESIDUAL WEED POPULATIONS IN SASKATCHEWAN &NDASH; 1976 TO 2015.
Julia Leeson*; AAFC, Saskatoon, SK

ABSTRACT

The comparison of the relative abundance of weeds in Saskatchewan in 2014 and 2015 with results from previous provincial surveys enables the identification of recent shifts in species ranks, life form density and relative abundance. In 2014 and 2015, a total of 2243 fields of spring wheat, barley, durum, oat, canola, flax, mustard, lentil and pea were surveyed. The Parkland area was primarily surveyed in 2014, and the Grasslands in 2015. These fields were selected using a stratified random sampling procedure based on ecodistricts. In each field, weeds were counted in 20 quadrats (50 by 50 cm) in late summer. Weed data are summarized using a relative abundance index based on frequency, field uniformity and density. Green foxtail (Setaria viridis (L.) P. Beauv.) was the most abundant weed, wild oats (Avena fatua L.) ranked second, wild buckwheat (Polygonum convolvulus L.) third and canola (Brassica napus L.) fourth. The results from the 2014-2015 survey are compared to results from surveys of 2046 fields in 2003, 1178 fields in 1995, 1149 fields in 1986 and 4423 fields in 1976-1979. Eight species have been ranked amongst the top 20 most abundant species in each survey. Thirteen species are declining. Seven of these species had previously been identified as declining: rose (Rosa spp.), prostrate pigweed (Polygonum aviculare L.), night-flowering catchfly (Silene noctiflora L.), cow cockle (Vaccaria hispanica (Mill.) Rauschert), bluebur (Lappula squarrosa (Retz.) Dumort.), pale smartweed (Polygonum lapathifolium L.), flixweed (Descurainia sophia (L.) Webb ex Prantl). Six species are newly identified as declining: Persian darnel (Lolium persicum Boiss. & Hohen. ex Boiss.), Russian thistle (Salsola tragus L.), redroot pigweed (Amaranthus retroflexus L.), wild mustard (Sinapis arvensis L.) quack grass (Elytrigia repens (L.) Desv. ex B.D. Jacks), and field horsetail (Equisetum arvense L.). Since the 1970's five species have steadily

	increased: spiny annual sow-thistle (Sonchus asper (L.) Hill), cleavers (Galium aparine L.), barnyard grass (Echinochloa crusgalli (L.) P. Beauv.), round-leaved mallow (Malva pusilla Sm.), canola (Brassica napus L.) and wheat (Triticum aestivum L.). Since the 1980's three species have consistently increased: foxtail barley (Hordeum jubatum L.), dandelion (Taraxacum officinale Weber in F.H. Wigg.) and narrow-leaved hawk's-beard (Crepis tectorum L.). Cudweed (Gnaphalium spp.), broad-leaved plantain (Plantago major L.) and willowherb (Epilobium spp.), appeared in the top 25 in the most recent survey, likely attributable to the wet weather in 2014. Relative abundance of annual grass has decreased since the 1970s, while relative abundance of perennials and facultative winter annuals have increased since 2003. The densities of all life forms were higher 2014/2015 than in 2003, likely due to the wet conditions in 2014.
65	**WEED POPULATION RESPONSE TO ROTATION AND CONSERVATION PRACTICES IN A 12-YEAR STUDY**. Blackshaw, R.E., Larney, F.J., and Lupwayi, N.Z. Agriculture and Agri-Food Canada, Lethbridge, AB. ABSTRACT Potato, dry bean, and sugar beet production have increased markedly in recent years on irrigated cropland in southern Alberta. Concerns exist about declining soil quality and increased soil erosion when these low residue crops are grown in sequence in short duration rotations. A 12-year study was conducted at Vauxhall, Alberta to determine the merits of adopting various soil conservation practices (reduced tillage, cover crops, composted manure) and longer duration rotations to develop a more sustainable production system for these row crops. Weed density and weed seedbank data were collected as a component of this study. Weed densities recorded prior to applying postemergence herbicides indicated that conservation compared with conventional management treatments had greater weed densities in 30 to 45% of the cases in 3-, 4- and 5-year rotations. In contrast, a 6-year conservation rotation that included two years of timothy forage resulted in similar or lower weed densities than rotations with conventional management practices. Residual weed densities recorded 4 weeks after applying postemergence herbicides were only greater in conservation than conventional rotations in 2 of 12 years regardless of rotation length. Weed seedbank densities at the conclusion of the 12-year study were similar for 3- to 6-yr rotations under either conservation or conventional management. These findings indicate that implementing a suite of soil conservation practices pose little risk of increased weed populations in the long term. This knowledge will facilitate grower adoption of more sustainable agronomic practices for irrigated row crops in this region.
66	**BIOLOGICALLY EFFECTIVE DOSE OF GLYPHOSATE AS INFLUENCED BY WEED SIZE IN CORN**. Nader Soltani*[1], Robert E. Nurse[2], Peter Sikkema[3]; [1]University of Guelph, Ridgetown, ON, [2]Agriculture Canada, Harrow, ON, [3]University of Guelph, Guelph, ON **ABSTRACT** There is limited information on the effect of weed size at the time of application on glyphosate efficacy in Ontario. Eleven field trials were conducted over a three-year period

	(2010, 2011 and 2012) in Ontario to determine the biologically effective dose of glyphosate applied postemergence (POST) at doses of 112.5 to 1350 g a.e. ha^{-1} for the control of various grass and broadleaved weed species applied when the weeds were 10-, 20- or 30-cm in height. The doses of glyphosate to reduce redroot pigweed, common ragweed, lamb's-quarters, barnyardgrass and green foxtail dry weight by 50% were 118, 192, 182, 254 and 31 g a.e. ha^{-1} when applied at 10-cm weed height, 78, 13, 302, 289 and 101 g a.e. ha^{-1} when applied at 20-cm weed height and 264, 131, 123, 304 and 225 g a.e. ha^{-1} when applied at 30-cm weed height, respectively. The doses of glyphosate to reduce redroot pigweed, common ragweed, common lamb's-quarters, barnyardgrass and green foxtail dry weight by 90% were 353, 630, 621, 763 and 93 g a.e. ha^{-1} when applied at 10-cm weed height, 235, 201, 906, 868 and 296 g a.e. ha^{-1} when applied at 20-cm weed height and 792, 3267, 1739, 912 and 675 g a.e. ha^{-1} when applied at 30-cm weed height, respectively. Corn yields were maximized when glyphosate was applied to weeds that were up to 10-cm in height but was reduced with later glyphosate application timings which reinforces the importance of early POST weed control in corn.
67	**CONTROL OF FIELD HORSETAIL (*EQUISETUM ARVENSE* L.) IN CORN**. Nader Soltani*[1], Kris McNaughton[2], Peter Sikkema[3]; [1]University of Guelph, Ridgetown, ON, [2]University of Guelph Ridgetown Campus, Ridgetown, ON, [3]University of Guelph, Guelph, ON **ABSTRACT** Six field trials were conducted during 2013 and 2014 on various Ontario farms with heavy field horsetail infestations to determine the effectiveness of various postemergence (POST) herbicides for the control of field horsetail in corn. There was minimal and transient corn injury (3% or less) with nicosulfuron/rimsulfuron, flumetsulam or nicosulfuron/rimsulfuron + flumetsulam. In contrast, MCPA amine, nicosulfuron/rimsulfuron + MCPA amine, flumetsulam + MCPA amine, and nicosulfuron/rimsulfuron + flumetsulam + MCPA amine caused as much as 6% injury in corn. Nicosulfuron/rimsulfuron, flumetsulam, MCPA amine, nicosulfuron/rimsulfuron + flumetsulam and nicosulfuron/rimsulfuron + MCPA amine applied POST controlled field horsetail 22-68% and reduced density 27-64% and biomass 38-77%. Flumetsulam + MCPA amine and nicosulfuron/rimsulfuron + flumetsulam + MCPA amine controlled field horsetail 69-83% and reduced density and biomass as much as 87%. Based on these results, flumetsulam + MCPA amine and nicosulfuron/rimsulfuron + flumetsulam + MCPA amine provide the best and most consistent control of field horsetail in corn among POST herbicides evaluated.
68	**INFLUENCE OF PLANT GROWTH REGULATOR APPLICATION AND NITROGEN FERTILIZATION ON OAT YIELD AND STAND-ABILITY**. Joseph P. Aidoo*[1], Linda Hall[2], Sheri Strydhorst[3], William May[4]; [1]University of Alberta, edmonton, AB, [2]University of Alberta, Edmonton, AB, [3]University of Alberta, Barrhead, AB, [4]Agriculture and Agri-Food Canada, Indian Head, SK **ABSTRACT** High nitrogen fertilization in oat (*Avena sativa* L.) increases susceptibility to lodging.

	Lodging can reduce oat yield by reducing grain size and amount of harvestable crop. Plant growth regulators (PGRs) reduce stem elongation and may reduce lodging and increase yield. The objective of this research is to determine the interaction of PGRs and nitrogen fertilization on Stride oat to improve yield and harvestability. In 2014 a two factor randomized complete block experiment with 4 replicates was initiated on Stride oat with side-banded urea, applied at 5, 50, 100, or 150 kg ha^{-1}, and PGRs, applied at 0, 70, 100, 130 g ai ha^{-1} at three sites, St. Albert, and Barrhead, AB and Indian Head, SK. Plant lodging (1-5 scale), height at maturity and seed yield were collected. Average across all sites, nitrogen fertilizer increased oat yield by 36%. PGR application did not have a significant effect on yield and the interaction with nitrogen fertilizer was not significant. Both PGR and nitrogen fertilizer had a significant effect on plant height. Nitrogen fertilizer generally increased height, averaging 10 cm at the highest nitrogen rate. Height was significantly reduced by PGR applications across all three sites, averaging 7 cm at the highest PGR rate. PGR significantly reduced the rate of lodging at Indian Head but insufficient lodging was observed at Barrhead and St. Albert to determine if differences were significant. PGRs can be a valuable cereal management tool for oat growers with high nitrogen fertilizer regimes in areas of high precipitation. However the decision to use PGRs should be based on cultivar, application timing, plant growth stage and environmental conditions. **Keywords**: Plant growth regulator, lodging, *Avena sativa.*
69	GENETIC TRANSFORMATION OF CANADIAN PEA (*PISUM SATIVUM* L.) FOR DROUGHT TOLERANCE USING DREB2A AND PR10A GENES. Jagroop G. Kahlon*[1], Alemayehu Teressa Negawo[2], Fathi Hassan[3], Hans-Joerg Jacobsen[3], Linda Hall[1]; [1]University of Alberta, Edmonton, AB, [2]Leibniz University of Hanover, Hannover, Germany, [3]Leibniz University of Hanover, Hanover, Germany **ABSTRACT** Keywords: Pea, drought, drought tolerance, transgenic, *PR10*, *DREB*, *Agrobacterium*-mediated transformation, *Pisum sativum* L., genetic engineering Canada is world's largest producer and exporter of field pea. However, crop productivity can be greatly reduced by abiotic stresses including drought, salinity and freezing. Modern plant biotechnology tools provide hope for creating crops with enhanced drought tolerance expressing variety of genes induced by stress. In the present study, we report development of drought tolerant transgenic pea from line MP1862 co-expressing *PR10a* from potato (*Solanum tuberosum* L.) and transcription factor *DREB2a* from rice (*Oryza sativa* L.) using dicistronic vector through *Agrobacterium*-mediated gene transformation. Based on the PCR positive transgenic shoots, 25 transgenic shoots were obtained from a total of 684 transformed explants giving a transformation efficiency of 3.65 %. The genomic integration and inheritance of the introduced genes were validated by molecular and functional analyses (PCR, leaf paint assay).Gene expression using RT-PCR was conducted on the PCR positive transgenic plants. The expected PCR product was detected in the cDNA of the transgenic plants while no amplification was observed in negative and water controls. A preliminary drought bioassay (three weeks water withholding) under laboratory conditions showed greater drought tolerance of the developed transgenic lines compared to non-transgenic lines.

	T3 generation of the same have been obtained and imported to Canada. Further testing for efficacy of the traits is required. This research provides an opportunity for transfer of genetically engineered drought tolerant pea technology to Canadian germplasm which may open an avenue for drought resistant pea development.
70	PRE- OR POST-EMERGENCE MANAGEMENT OF GLYPHOSATE-RESISTANT CANOLA IN GLYPHOSATE-RESISTANT SOYBEAN CROPS. Eric Tozzi*[1], Christian J. Willenborg[2]; [1]University Of Saskatchewan, Saskatoon, SK, [2]Assistant Professor, Saskatoon, SK

ABSTRACT

A trial was established at the Kernen Research Farm, Saskatoon, SK, Scott Research Farm, Scott, SK, Indian Head, MB and Carman, MB during the 2014 and 2015 growing seasons to determine RR canola control in RR soybean using pre- and post-emergence treatments. Plots were arranged as a randomized complete block design with four replications and ten experimental treatments. A variety of herbicides were used to assess herbicide efficacy. Plots were established on existing RR canola stubble, with volunteer canola established by cross seeding canola at 40 plants m^{-2} to ensure the existence of a volunteer canola stand before seeding soybean. Soybean was seeded 3-5 days after herbicide application at a rate to meet the target population size of 180,000 plants ac^{-1}.

Soybean and canola plant counts were conducted two weeks after their respective emergence. Visual ratings based on the Canadian Weed Science Society (CWSS) scale were taken at 7 to 10, and 21 to 28 days after application. Canola biomass was collected at the end of canola flowering, while soybean biomass was collected before yield data was recorded at physiological maturity.

Plots with pre-emergence applications of Roundup Weathermax with First Rate showed the largest soybean yield (kg/ha). Plots with applications of Roundup Weathermax with First Rate and Roundup Weathermax with First Rate + Authority showed a significant soybean yield increase that ranged between 300% to 350% of the untreated control, respectively between all sites. Plots with pre-emergence applications of Roundup Weathermax with First Rate + Authority (-99.6%), Roundup Weathermax with First Rate (-96.1%), and Roundup Weathermax + Florasulam (-97.8%) displayed significantly lower canola seed yield at the Kernen Research Farm.

Plots receiving post-emergence applications of Roundup Weathermax (+218%) and Roundup Weathermax + First Rate (+185%) exhibited the highest average soybean yields between sites. Likewise, plots with post-emergence applications of Roundup Weathermax with First Rate (+530%) exhibited the highest soybean yields compared to the untreated control at the Kernen Research Farm. Plots with post-emergence applications of Roundup Weathermax with First Rate (-82.1%), Roundup Weathermax + Odyssey (-85.1%) and Roundup Weathermax + Reflex (-83.5%) exhibited the lowest volunteer canola seed yield compared to the untreated control.

In general, pre- and post-emergence applications of Roundup Weathermax combined with

	First Rate and/or Authority produced the highest soybean seed yields and biomass and lowest canola seed yields and biomass. Pre-emergence applications of Roundup Weathermax combined with First Rate or Authority had similar efficacy at reducing canola dockage. Post-emergence treatments of Roundup Weathermax + Odyssey exhibited the lowest canola dockage. The action of First Rate in both pre-emergence and post-emergence situations along with some level of residual control suggests that Roundup with First Rate may provide the best method of RR canola in RR soybean if only a PRE or a POST herbicide can be used.
71	ARE THERE FITNESS CONSEQUENCES OF EPSPS GENEAMPLIFICATION IN *KOCHIA SCOPARIA*? THE RESULTS OF A COMPETITIVE,SEGREGATING F2 GREENHOUSE EXPERIMENT. Leshawn Benedict[1], Connie A. Sauder[1], Tracey James[1], Leandro Olivera deCosta[2], Linda Hall[3], Hugh J. Beckie[4], Sara L. Martin*[1]; [1]Agriculture and Agri-Food Canada, Ottawa, ON, [2]University of Passo Fundo, Passo Fundo, Brazil, [3]University of Alberta, Edmonton, AB, [4]Agriculture and Agri-Food Canada, Saskatoon, SK **ABSTRACT** Glyphosate resistant (GR) weeds represent a significant threat to agricultural production. In 2011, GR *Kochia scoparia* L. Schrad. (kochia; Chenopodiaceae) was first found in Canada. Effective management strategies for GR kochia depend on the fitness cost of GR, as this will determine whether or not the frequency of GR will decline in kochia populations in the absence of glyphosate selection.Glyphosate targets an enzyme that is a part of the shikimate pathway, 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS) and, in kochia, amplification and increased expression of the EPSPS gene has conferred resistance. Here we have completed a competitive fitness experiment in the glasshouse using 344 plants from six segregating F2 populations to evaluate GR costs.Seed collected from GR kochia populations was grown in the greenhouse and EPSPS gene copy number was determined using quantitative PCR. Individuals with low and high EPSPS copy number were selected from each population and manually, reciprocally crossed, a single progeny from each of these crosses was bagged and allowed to self-pollinate and this seed was used for the fitness experiment. Here we present the results of this work.
71	FERMENTATION AND FORMULATION OF A FUNGUS ISOLATE FOR THE BIOLOGICAL CONTROL OF *CONZYA* SPP. Alessandra de Fatima Fernandes de Fatima Fernandes[1], Sue Boyetchko*[2]; [1]Univ. Federal de Viçosa, Viçosa, Brazil, [2]Agriculture and Agri-Food Canada, Saskatoon, SK **ABSTRACT** Horseweed (*Conyza canadensis* [L.] Conquist) is an economically important invasive weed in the tropics, especially in soybean (*Glycine max* [L.] Merr.) production. There are reported incidents of herbicide-resistant biotypes of the weed, thus prompting the development of alternative methods for horseweed control. A fungal isolate was discovered in the field causing necrosis of horseweed which is being evaluated as a biocontrol agent. Dose response studies, along with investigations towards the development of viable fermentation and formulation technologies were conducted. The fungus was grown in three liquid fermentation

	media (potato dextrose broth [PDB], barley flour beet molasses [BFBM], and modified casein hydolysate dextrose [MCHD] and survival and efficacy of mycelial fragments were determined. The greatest amount of fungal biomass was reached by growing the fungus in MCHD and 100% control of horseweed was obtained at an application rate of 10^6 cfu/g using a TeeJet nozzle. Unfortunately, this fermentation media is too expensive for use in industry fermentation. Nevertheless, BFBM provided statistically similar horseweed control efficacy (85% control) and adequate titre (biomass) of mycelial fragments was generated. The addition of two sugars (sucrose and maltose) as chemical protectants and their effect on mycelial survival and efficacy were determined. Addition of sucrose at a concentration of 20% led to better survival and superior horseweed control efficacy (96% weed control) as compared with sucrose at 10% concentration or maltose at 10 or 20% concentration. Finally a preliminary wettable powder containing mycelial fragments as an active ingredient in corn starch or tapioca starch at concentrations of 5, 10, and 15% (w/v) was prepared and stored at either 4°C or 22°C. After 3 months, the best mycelial fragment survival was in 15% corn starch kept at 4°C. Corn starch is a suitable carrier for a wettable powder because it is easily available and inexpensive, as compared to tapioca starch. In addition, the adjuvants, carboxymethyl cellulose and Silwet L-77 were used as amendments in the formulation and any improvement in survival of the fungal was determined. The survival of the fungus was not improved with the addition of either carboxymethyl cellulose of Silwet L-77. A protocol involving growing the fungus in BFBM, formulating mycelium in 10% corn starch amended with 20% sucrose leads to survival of the fungus for 2 months and serves as a starting point for further improvements that may allow the practical use of this isolate as a management tool for horseweed.
72	CONTROL OF VOLUNTEER ENLIST CORN IN ENLIST SOYBEAN. Jamshid Ashigh*[1], Andrew MacRae[2], Laura Smith[3]; [1]Dow AgroSciences Canada Inc., London, ON, [2]Dow AgroSciences Canada Inc, Calgary, AB, [3]Dow AgroSciences Canada Inc, Winnipeg, MB Enlist™ crops have robust tolerance to both glyphosate and 2,4-D herbicides. In Enlist corn, the AAD-1 enzyme that confers 2,4-D tolerance, also provides tolerance to the aryloxyphenoxypropionate family of grass-active herbicides. To effectively control volunteer Enlist corn in Enlist soybean, it would be desirable to combine Enlist Duo™ herbicide with cyclohexanedione herbicides such as clethodim and sethoxydim. The objective of this study was to determine the dosages of clethodim and sethoxydim that provide acceptable control of volunteer Enlist corn when applied in tank-mix with Enlist Duo herbicide. Results of four field trials conducted in Ontario and Manitoba indicated that clethodim and sethoxydim can be mixed with the field rate of Enlist Duo (1720 g ae/ha) at dosages as low as 45 g ai/ha and 150 g ai/ha, respectively, for acceptable control of volunteer Enlist corn in Enlist soybeans. ™Trademark of the Dow Chemical Company ("Dow") or an affiliated company of Dow.
73	**A NEW TARGET SITE MUTATION CONFERRING BROAD SPECTRUM RESISTANCE TO ALS-INHIBITING HERBICIDES**. J.T. Brosnan, J.J. Vargas, G.K. Breeden, L. Grier, S. Tresch, R.A. Aponte, and M. Laforest *; Agriculture et Agroalimentaire Canada | Agriculture and Agri-Food Canada, St-Jean-sur-Richelieu, QC

ABSTRACT

- Annual bluegrass (*Poa annua* L.) is a problematic weed of crop and non-cropping systems globally.
- In turfgrass, there are more reports of herbicide resistance in annual bluegrass than any other weed species with resistance to inhibitors of acetolactate synthase (ALS), photosystem II (PSII), cellular mitosis, and enolpyruvylshikimate-3-phosphate (EPSP) synthase all documented. However, there are limited reports of multiple-coexisting resistances in annual bluegrass.
- A biotype of annual bluegrass on a golf course (POAAN-R3; Memphis, Tennessee USA) evolved resistance to applications of simazine and trifloxysulfuron. Under greenhouse conditions, treatment with these herbicides at 8x labeled rates controlled plants ≤ 40%.
- We hypothesized that POAAN-R3 would contain multiple target site mutations conferring resistance to ALS and PSII inhibiting herbicides.

74 SENSITIVITY OF CANOLA AND SOYBEAN TO DICAMBA IN A REPLACEMENT SERIES EXPERIMENT. Brent Murphy, Jon D. Rosset, and Robert H. Gulden*; Univ. of Manitoba, Winnipeg, MB

ABSTRACT

Many factors affect the performance of herbicides, but their influence on herbicide performance is not understood equally well. While the importance of some abiotic factors such as formulation and/or the environment are relatively well understood, the contribution of plant interference on herbicide performance is less well understood. Using a replacement series experimental design we examined the sensitivity of soybean (*Glycine max* [L] Merr.) and canola (*Brassica napus* L.*)* grown alone and in various mixtures to dicamba in a greenhouse experiment. Doses of dicamba ranging from 0 to 555 g ai ha^{-1} were applied at the first trifoliate and 2-3 leaf stages to dicamba-sensitive genotypes of soybean and canola, respectively, and plant biomass was determined 21 days after herbicide application. From the biomass data, dose response curves were generated. The shape of the dose response curve to dicamba for soybean and in particular for canola depended on the ratio of these two species. This experiment showed that plant interference and herbicide dose interact in response to applications of this auxinic herbicide.

PRESENTERS

Title	Presenting Author	Type	Assigned Section
Influence of plant growth regulator application and nitrogen fertilization on oat yield and stand-ability	Aidoo, Joseph P.	Poster	Cereals, Oilseeds and Pulses
Control of Volunteer Enlist Corn in Enlist Soybean	Ashigh, Jamshid	Poster	Soybean, Corn, and Edible Beans
Effect of late herbicide applications on growth and reproductive ability of glyphosate-resistant common ragweed (*Ambrosia artemisiifolia* L.)	Bae, Jichul	Poster	Weed Biology and Ecology / Invasive and Noxious Weeds
Gene flow in kochia (*Kochia scoparia* L. Schrad.)	Beckie, Hugh J.	Oral	Weed Biology and Ecology / Invasive and Noxious Weeds
Weeds in organic vs. conventional cropping systems:What we have learned after 18 years of research	Benaragama, Dilshan I.	Oral	Graduate Student Presentation
Weed population response to rotation and conservation practices in a 12-year study	Blackshaw, Robert E.	Poster	Weed Biology and Ecology / Invasive and Noxious Weeds
Fermentation and formulation of a fungus isolate for the biological control of *Conyza* spp.	Boyetchko, Sue	Poster	Soybean, Corn, and Edible Beans
How to improve the consistency of glyphosate-resistant Canada fleabane (Conyza canadensis L. Cronq.) control with saflufenacil: an investigation of tank mix partners and optimal time of day application	Budd, Christopher	Oral	Graduate Student Presentation
Evaluating Seed Shatter of Economically Important Prairie Weed Species	Burton, Nikki R.	Oral	Graduate Student Presentation
Glyphosate-resistant common ragweed: two-pass herbicide programs in Roundup Ready and Roundup Ready Xtend Soybean	Byker, Holly	Oral	Graduate Student Presentation
Environmental Fate of Aminocyclopyrachlor and the impact on non-target vegetation when using Aminocyclopyrachlor (Navius VM and Truvist) in Industrial Vegetation Management (IVM)	Chambers, Darrell	Oral	Industrial Vegetation and Rangeland
Impacts of single and repeated glyphosate herbicide applications on plant community diversity and spruce growth in an Alberta spruce plantation.	Comeau, Phil	Oral	Industrial Vegetation and Rangeland
Emergence nature of *Galium* spp. populations from W. Canada	De Roo, Andrea C.	Poster	Weed Biology and Ecology / Invasive and Noxious Weeds
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