

State/Province Report: Ontario, Canada

The increase in interest in cover crops continues to grow. While general interest has been high, a lack of forage due to the early spring, insects and dry hot summer weather prompted increased cover crop seeding for emergency forages after wheat harvest.

Request for cover crop talks by growers and ag industry personnel has also been high. More than 50 extension, scientific and policy presentations on cover crops have been made by Ministry of Agriculture and Food staff and associated researchers.

In 2012- 2013 cover crops were profiled at a number of venues including:

- Outdoor Farm Show – cover crop garden featuring species, rates, dates – (show attendance 40,000)
- Cover Crop Open House/plot tour – University of Guelph, Ridgetown Campus (attendance 60)
- Southwest Agricultural Conference - University of Guelph, Ridgetown (attendance 1600)
- FarmSmart Conference – University of Guelph (attendance 1000)
- Sound Advice – Radio report/podcast, part of CFCO Farm show (listeners – 13,000) 5 separate reports

University of Guelph Cover Crop Research

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Eastern Canada cover crop selection tool for vegetable production. Initiated 2012. Cover crop use has increased in the past few years. Soil, climate and production system greatly influences how well a cover crop will grow. There are approximately 30 different cover crops to choose from and growers are selecting cover crops for many reasons. Providing decision makers (growers and crop consultants) with more and accurate information on cover crops would be beneficial. The objective of this project is to develop and validate a Cover Crop Selector tool suitable as a web-based resource that provides informed recommendations about appropriate cover crops possessing specific beneficial (pest, soil and crop management) attributes, which can be integrated into the cultivation, farm operation and climatic conditions of vegetable farms in eastern provinces of Canada, i.e. ON, QC, NB, NS, and PEI. The Eastern Canada cover crop selection tool is based on the framework of the Midwest Cover Crop Council (MCCC) decision tool. The on-line decision tool will be available online March 2014. Principal Researcher: Laura L. Van Eerd. Collaborators: New Brunswick-Claude Bertheleme, Gavin Graham; Nova Scotia- Viliam Zvalo; Prince Edward Island-Aaron Mills, Shauna Mellish; Quebec-Stephanie Sanchez, Danielle Bernier; Ontario-Anne Verhallen, Kristen Callow. Funding Source: AAFC-Pest Management Centre.

Undersown cover crops in seed corn: capturing sunshine and nitrogen. Initiated 2012. Cover crops are a significant component of OMAFRA's nutrient management plans and best management practices. Even with red clover where there is substantial research, it is difficult to predict the N credit from leguminous cover crops in the following year. This is mainly because cover crop stands and growth are variable. This often leads to over (sometimes under) application of N fertilizer, which costs money and increases the risk for N loss. Due to the open canopy of seed corn, it was possible to

establish and grow a good cover crop (ie biomass 2000 lb/ac and N content of 100 lb/ac). As opposed to previous trials which evaluated hand-seeding at one alfalfa seeding rate, the proposed project focuses on evaluating grower seeding equipment to evaluate stand establishment and cover crop growth and N content. We evaluated cover crop biomass at 3+ grower fields, which were planted using 2 different types of seeders. As well, we established 2 research small plot trials. By the end of the project, we will develop a tool growers can use to easily estimate cover crop growth and N content and then select an appropriate N credit for their field. Right now, we know if we have a 'good stand' of red clover, but what does this mean for N content. The proposed tool, we can put a number on the amount of biomass and N content, based on this, growers can better estimate the N credit they want to apply to the next crop. *Principal Researcher:* Laura L. Van Eerd. *Funding Source:* Seed Corn Growers of Ontario, Agricultural Adaptation Council- Canadian Agricultural Adaptation Program (CAAP).

Evaluating the role of cover crops in low crop residue production systems.

Initiated 2011. Maintaining healthy, productive soil is critical to enhancing the longterm profitability of agriculture. The anticipated demand for crop residue (corn stocks/cobs or wheat straw) may have a negative effect on soil and crop productivity. For instance, previous research has shown that removing winter wheat straw lowered tomato yields the following year but no yield reductions were observed when cover crops were in the rotation (Van Eerd et al. 2009. *ASA-CSSA-SSSA. Pittsburgh, PA*). Thus, cover crops may play a significant role maintaining soil and crop productivity, especially in production systems where crop residues are low or removed. The goal of the proposed research is evaluate the role of cover crops in maintaining soil and crop productivity within two low crop residue production systems 1) vegetable crop production systems and 2) field corn crop residue removal for the anticipated bioeconomy. The proposed project builds on two already existing rotational trials, initiated in 2007 and 2008 with four and six cover crop types and a no cover crop control treatment. The effect of cover crops in low crop residue production systems will be evaluated in terms of crop yield and quality, soil health and quality, insect and disease pressure and economics. *Principal Researcher:* Laura L. Van Eerd. *Collaborators:* Richard Heck, Cheryl Trueman, Richard Vyn. *Funding Source:* OMAFRA-UoG –Environmental Sustainability Program.

Cover crop decision-making tools. *Initiated 2011.* Greater use of cover crops supports a thriving agricultural system and healthy environment through improved soil management and reduced movement of contaminants. The ideal species and management practices for cover crops are highly specific to many factors including soil, climate and production system. This Knowledge Translation and Transfer (KTT) project seeks to address the information gap through the development and validation of an Ontario module of the on-line cover crop decision tool developed through the Midwest Cover Crop Council (MCCC). The MCCC decision tool allows growers to input their specific soil, drainage, and crop information as well as goals (i.e. minimizing erosion, forage for livestock, adding organic matter) to obtain custom-made cover crop recommendations. The proposed project will effectively translate knowledge via traditional and innovative means by a provincial cover crop workshop and Cover Crop Innovator profiles, respectively. Overall, the project will help to speed the adoption and integration of cover crops into a greater portion of the Ontario landscape because the information is relevant to all parts of the province, a variety of farming systems and backed or validated by research and grower experience. *Principal Researcher:* Laura L. Van Eerd. *Collaborator:* Anne Verhallen. *Funding Source:* OMAFRA-UoG –KTT.

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Drought tolerance as a mechanism for red clover non-uniformity

Several projects underway to confirm drought tolerance as the primary mechanisms. Funded by Grain Farmers of Ontario, Loblaws, and the UofG/OMAFRA Plants Program. With Dr. Ralph Martin, University of Guelph

Project with Steve Bowley/Hugh Earl to screen for drought tolerant red clover genotypes. Funded by UofG/OMAFRA Plants Program.

Red clover contribution to sustainability

A study looking at cover crops in corn/soybean rotations with Dr. Dave Hooker, University of Guelph, Ridgetown campus. We have a 5 year data set (still needs to be published) that demonstrates limited potential for cover crops in CS rotations under an Ontario environment. The long term trials at Elora and Ridgetown are funded by OMAFRA/UofG Plants program. Data demonstrates that the benefit of wheat alone is substantial. Further inclusion of red clover offers additional benefits (Dave and I hope to summarize this data and submit for publication this year). We are working with Mike Cowborough to put in a extension format.

Amélie C. M. Gaudin, Sabrina Westra, Cora E. S. Loucks, Ken Janovicek, Ralph C. Martin and William Deen. 2013. Improving Resilience of Northern Field Crop Systems Using Inter-Seeded Red Clover: A Review. *Agronomy*. 3:148-180.

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Effect of Residual Herbicides on Establishment and Performance of Cover

Two trials were established in 2011 completed in 2012, and two additional studies were established in 2012 to meet these objectives. Soil water holding capacity and nutrient data are currently still being collected, though our first years' results indicate the ability of buckwheat and sorghum-sudangrass to prevent nitrates from leaching through the soil is reduced by as much as 25% when planted 12 months after an application of Pursuit or Broadstrike RC. Furthermore, the ability of these cover crops to compete with weeds for light is reduced significantly, which allowed for weeds to establish and set seed. Callisto+Primextra and Integrity have thus far negatively affected the ability of fall rye to improve soil aggregate stability and therefore may negatively influence water holding capacity.

Establishment of sorghum-sudangrass and buckwheat have been reduced by 10 and 50%, respectively, where Broadstrike RC was applied 12 months prior to planting. Pursuit reduced establishment of sorghum-sudangrass and buckwheat by 20 and 60%, respectively. Establishment of these cover crops was not reduced by Coverge Flexx or Callisto+Primextra. Sorghum-sudangrass was able to recover from the injury, so we did

not see a reduction in total plant biomass from these treatments, however both above and belowground biomass of buckwheat was decreased by the Pursuit treatments.

None of the herbicides applied (Integrity, Broadstrike RC, Converge, Callisto+Primextra, Pursuit) have reduced establishment of spring wheat. Thus far, the ability of this cover crop to scavenge nitrogen and improve soil aggregate stability has not been negatively affected by residues of any of these herbicides applied 12 months prior to planting.

Greenhouse studies have been established to determine herbicide residues at the time of planting. Initial estimates indicate that less than 1 ppm of imazethapyr (Pursuit) were enough to negatively impact establishment and growth of buckwheat. Additional studies are being established through the winter to confirm these results.

- 1) 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.
- 2) Determine how residual herbicides affect cover crop establishment and biomass of leguminous species.

These experiments are still underway, and will be monitored until October of this year. One trial was established in 2011 and a second study was established in 2012 to meet these objectives. Soil water holding capacity and organic matter data are still being collected. First year data indicate that Callisto+Primextra and Pursuit can reduce ability of red clover to improve soil aggregate stability, and reduce establishment by 20% when applied one year prior to planting.

Other Projects	Lead
Evaluating Cover Crop Options After Winter Wheat (St. Clair Region Soil and Crop Improvement Association project) – looking at cover crop mixtures oats/OSR and oats/OSR/crimson clover Interim report - http://www.ontariosoilcrop.org/docs/v9crpadv_gen2_evaluating_cover_crop_options_after_winter_wheat_and_into_standing_corn_interim_report_scscia.pdf	Adam Hayes, MAF adam.hayes@ontario.ca
Cover crops in a field crop rotation – side by side cover crop trial	Anne Verhallen, MAF anne.verhallen@ontario.ca

Proposed 3 year study on quinoa organic weed management trial with rye and crimson clover cover crops	Kristen Callow, MAF kristen.callow@ontario.ca Dr. Rob Nurse, AAFC
Fall Cover Crops for Sequestering Manure Nitrogen (Georgian Region Soil and Crop Improvement Association project) – looking at oats/OSR and rye/OSR	Brian Hall and Dr. Bonnie Ball, MAF brian.hall@ontario.ca
Cover Crops as Emergency Forage Interim report - http://www.ontariosoilcrop.org/docs/v9crpadv_for3-2012_cover_crops_for_emergency_forages_interim_report.pdf	Peter Johnson, MAF peter.johnson@ontario.ca

MCCC Executive Committee member – Ontario

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