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## Contacts

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## Research

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### Tim Harrigan: Research

- **Nutrient-Enriched Micro-Site Cover Crop Seeding and Feeding of Organically Grown Corn and Small Grains:** Project Team: Tim Harrigan, Dale Mutch, Dan Rossman and Vicki Morrone Project Funding: Michigan Project Green Project Duration: April 2007 to June 30 2009 Project Summary: There are currently more than 20,000 acres of organically grown corn and small grains in Michigan. Corn yields are typically depressed 20% and small grains 35% compared to conventional cropping methods because of difficulties in matching available N from natural sources with crop demand. This work will use on-farm and on-campus replicated trials to: **1)** research and develop a new and resource efficient seeding and crop feeding method-- *slurry enriched micro-site seeding*--for establishing cover crops and banking N in organically grown cropping systems, **2)** quantify the effects of slurry seeding on cover crop plant population and biomass yield, **3)** evaluate N losses as ammonia emission following slurry seeding, **4)** evaluate the yields of subsequent grain crops following slurry seeding of cover crops, and **5)** develop guidelines for nutrient management with slurry seeding in organic cropping systems.
- **Reclaiming Beet Ground Soil Quality and Productivity with Low-Intensity Tillage, Biosuppressive Covers and Organic Inputs:** Project Team: Tim Harrigan, Dale R. Mutch, Sieglinde Snapp, Steve Poindexter Project Funding: Michigan Sugar Company and Saginaw Bay Watershed Initiative Project Duration: April 2006 to June 30, 2009 Introduction: Many beet growers have seen yields stagnate or decline in recent years. The specific cause is often difficult to identify and in some cases the problem seems to arise from multiple sources which include diseases, insects and nematodes. Economic pressures have led to shorter rotations with more frequent planting of beets. Intense tillage and trafficking have damaged soil structure. Managing cropping systems for soil quality can improve stand establishment and crop growth, improve water infiltration, drainage and aeration, maintain a balance of pests and pathogens, and create a low-stress environment for the crop. This project will develop a soil quality management approach designed to reclaim the natural productivity of currently unproductive beet ground. The fundamental efforts will include a reduction in tillage intensity when practical; the use of biosuppressive cover crops for disease, insect and nematode control; and the use of organic inputs such as livestock manure to enhance microbial activity and add soil carbon and structure. We will establish on-farm, replicated strip trials comparing no-till and manure slurry seeding of oil seed radish and oriental mustard after wheat and before beets in the crop rotation. Key indicators will be cover crop plant population and biomass production, sugar beet plant emergence and stand, sugar production, disease and nematode pressure identified in scouting activities, and standard measures of soil quality and plant health.
- **Crosscutting:** We have and are continuing to gather cover crop biomass production and nutrient cycling information in these studies. The new process under evaluation in each study, *manure slurry-enriched seeding of cover crops*, has been in development for about four years and is proving to be a very effective integration of manure and cover crops establishment under the right conditions. Within the next few years I would like to see slurry seeding of cover crops included in the NRCS cover crops standard. In order to facilitate the process, I would like to organize and seek funding for a coordinated, multi-state evaluation of this new cover crop seeding method. Many questions need additional work including effects on nutrient uptake and release; cover crop emergence and growth; windows of opportunity for establishment in existing rotations; equipment evaluation; barriers to adoption, etc.




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Research

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**Sieglinde S. Snapp: Research**

- **Long-term evaluation of cover crops in row crop systems with and without compost additions:** We are currently using Mammoth red clover and cereal rye in three crop rotations (corn-soybean-wheat) where red clover is frost seeded into wheat; (corn-soybean) where cereal rye is planted after harvest for both crops; and (continuous corn) where cereal rye is planted after harvest each year. We are focusing on overall productivity, N fertility, and soil organic matter. We are considering adding a treatment comparing corn stover removal with stover retention. In addition, we hope to evaluate red clover varieties and N fixation rates across fertility gradients.
- **Perennial wheat evaluation:** We are currently assessing genotypes for productivity and suitability in MI.
- **Incorporated hairy vetch into a corn-soybean rotation:** We are evaluating the feasibility of establishing vetch in the predominant cropping system in MI.
- **Cereal rye as a fall seeded winter cover crop:** In a corn-corn-soybean rotation with cereal rye planted after harvest, we evaluated crop productivity and N uptake with variable N rates of 0, 34, 68, 101, 134, 168, 202 kg/ha.
- **Short rotation alfalfa in organic systems:** We are investigating productivity in a novel organic rotation of corn-soybean-wheat/alfalfa-alfalfa.
- **Additional Information:** We are interested in evaluating local varieties of cover crops for parameters such as biomass production and winter hardiness. We are looking for locations for satellite trials with perennial wheat.

**Dale R. Mutch: Research**

- **Red clover into rye and wheat:** Comparison of red clover seeded winter wheat and rye: at planting, frost seeded, early April, and after wheat harvest for the following year's corn crop.
- **Pumpkins with rye cover crop:** Comparison of weed control strategies for no-till organically and conventionally grown pumpkins using rolled/cripped rye as a weed suppression crop for pumpkin quality, pumpkin yield, and weed suppression. (Southwest Michigan Research and Extension Center (SWMREC) and W.K. Kellogg Biological Station)
- **Cover crops as N source for organic field corn:** Comparison between red clover, hairy vetch, and no cover crop in organic corn for corn yields.
- **Rye varieties for no-till soybeans:** Comparison of five varieties of rye for an organic no-till soybean system for rye growth, rye maturity, weeds suppression, and soybean yield.
- **Organic tillage trial:** Comparison between fall and spring moldboard plowing and chisel plowing red clover frost seeded into wheat for number of tillage operations, weed pressure, and corn yields.
- **Organic N sources for organic tomatoes:** An evaluation of organic tomato production for quality and yield, using five sources of nitrogen following a cover crop of rye or hairy vetch. (SWMREC)
- **On farm no-till rye:** Comparison of four on farm experiments with rye crimped and soybeans no-tilled into organic and conventional systems for weed control, timeliness, and soybean yields.
- **Organic soybeans:** Comparison between no-till soybeans into crimped rye and a traditional rowed organic system. (Clarksville Horticultural Experiment Station)

**Mathieu Ngouajio: Research**

- **Evaluation of cover crops and compost for organic fresh market cucumber production in Michigan:** Summary: This study was initiated in 2006 at the Michigan State University Horticulture Teaching and Research Center. The study is comparing rye and rye plus hairy vetch cover crops used alone or in combination with diary compost. Data collected included soil biological, physical and chemical properties as well as cucumber and tomato growth, yield and quality. Funding: USDA Integrated Organic Program (until 2009) Duration: Long term study
- **Evaluation of biofumigants cover crops as potential alternatives to methyl bromide for eggplant and melon production:** Summary: This study is comparing efficacy various brassica cover crops used as biofumigants on the incidence of soil borne diseases (mainly Verticillium wilt of eggplant) and melon and eggplant yield. The study includes a positive control (Methyl bromide fumigation) and a negative control (bare ground). Funding: USDA Methyl bromide transition (until 2009) Duration: 2007-2009
- **Cover crop strategies for management of Phytophthora in vegetable systems:** Summary: The goal of this study is to test the suitability of various covers as host of Phytophthora. We are also testing the incidence of the disease in the field following various cover crops. This research will help design rotation systems that minimize the impact of the disease in vegetable production. Funding: USDA Special grant Duration: Long-term




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Research

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**Christy Sprague: Research**

- **Cover Crops and Tillage Combinations in Roundup Ready Sugar Beet Production:** The 2008 growing season will be the first wide-spread commercialization of glyphosate-resistant (Roundup Ready) sugar beets. The acceptance of this technology should simplify weed management in Michigan sugar beet fields. However, the development of glyphosate-resistant weeds is a major concern with the increased use of glyphosate for weed control in a grower's complete crop rotation. Incorporating other strategies including the use of cover crops to suppress initial weed emergence and growth may reduce the need for the over-reliance on glyphosate for weed control in sugar beet. In current production systems glyphosate will need to be applied 3 to 4 times to control weeds and maximize sugar beet yield. Incorporating cover crops into this production system may help alleviate the use of glyphosate for weed control. In 2008, a project will begin at the Saginaw Valley Bean and Beet Research Farm to assess the potential for using oilseed radish, wheat, oriental mustard, oat, and no cover crop in combination with two tillage treatments (i.e. strip tillage and no-till) for improved stand establishment, weed control, and improved quality and yield in Roundup Ready sugar beets.

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Extension/Education

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**A. Davis, K. Renner, C. Sprague, L. Dyer, and D. Mutch. 2005: Integrated Weed Management "One year's seeding..." Michigan State University Extension Bulletin E-2931**

- To fulfill the lack of information available on sustainable weed management the extension bulletin "Integrated Weed Management 'One Year's Seeding...'" (IWM) was released in February 2005 as the result of a collaborative effort of researchers, extension educators, and producers. Since then over 2,000 copies have been sold, several workshops in Michigan and the surrounding states have been held to present the information to North Central Region farmers, and fifteen on-farm trials have been conducted to test some of the weed management methods published. One of the chapters in the bulletin is dedicated to soil organic amendments, including cover crops. Additionally, four of the on-farm trials looked at the use of cover crops for weed management. The trials were titled as follows:
  - Intercropping for weed control in corn (Alma, MI, 2 years)
  - Cover crops for Canada thistle suppression (Maple Park, IL)
  - Intercropping with buckwheat and oats in open-pollinated corn (North Branch, MI)
- **Coming soon...a NEW supplemental bulleting to Integrated Weed Management "One year's seeding...":** Grower evaluations of the IWM bulletin indicated that there are still several areas where they thought it could be expanded, suggesting a 'Supplement' to the IWM bulletin, to complement what they currently are using as a reference. In 2007 we obtained funding through the Integrated Organic Program and Project GREEN to produce a supplemental bulletin, which will be available in hard copy and on the New Agriculture Network and MSUweeds.com. One of the chapters in this new bulletin will be dedicated to cover crops, covering areas such as...
  - Positive and negative attributes on weed management
  - Cost/benefit analysis
  - Potential options for no-till production
  - Nitrogen availability for crops and weeds
  - Suggestions for implementation into various crop rotations

The information in this chapter will be a collaborative effort among several researchers across the North Central region. We are still working on these collaborations and would welcome any additional input from people doing research on these topics.

**Sieglinde S. Snapp: Extension/Education Activities**

- Research planning and steering meeting with famers, Extension Educators, and researchers
- Annual field day at the field site
- Presentations for farmers at Extension Educator meetings
- Presentations at professional meetings such as Organic Farming Conference and ASA
- Publish in NewAgNetwork (on-line extension newsletter)
- On-farm participatory research
- Publications in peer reviewed journals
- Data available on our website (linked through LTER website)




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**Extension/Education**

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**Tim Harrigan: Extension/Education Activities**

- We have PP presentations highlighting the slurry seeding process, how it is done, what conditions are most likely to be successful, and the range of cover crops that we have evaluated.

**Dale R. Mutch: Extension/Education Activities**

- Guest Extension speaker for three out-state meetings in IN, IA and IL.
- Roller/crimper DVD produced with Rodale Institute and MSU Agricultural Experiment Station.
- Three field days touring research plots.
- *Building a Sustainable Future: Ecologically Based Farming Systems*, MSU Extension Bulletin E-2983.

**Mark Seamon: Extension/Education Activities**

- In 2007 I conducted an on-farm demonstration trial to evaluate the Nitrogen utilization of corn from a previous clover cover crop. This trial was conducted in a field that was winter wheat in 2006 and frost seeded with red clover. The clover was fall plowed and corn grown in 2007. Six sidedress nitrogen rates were used to determine the optimum nitrogen rate following clover. This trial showed that the 60 pound/acre N rate was the optimum for both yield and net income. Stalk nitrate analysis and soil nitrate analysis were not effective in evaluating the nitrogen rate. These results were published in state wide and local MSUE publications as well as presented at six local grower meetings in December 2007. When asked about the overall topic of maximizing profitability when applying N to corn 89% of the respondents claimed that they gained some new or significant new knowledge on the topic while 77% planned to make a significant or moderate change to their farming operation based on this information. About 260 people attended these programs.
- This information can be used in other areas to show the general Nitrogen benefit to the following crop from clover cover crops. I am glad to share it with whoever is interested.
- Multiple sites and years of this data will build confidence in these findings and increase adoption if shown to be consistent.
- Cooperative effort could help to plan trials that would be similar enough to combine results when completed.

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**Strategic Communication**

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**K. Renner, C. Sprague, E. Taylor: Strategic Communication**

- We plan to share our research findings (past and present) via extension meetings and publications, scientific meetings and publications, and our web site (MSUweeds.com) with growers, researchers, and educators. Though our focus is Michigan and the North Central region, our publications and web site information can be utilized across the nation.
- Regional collaboration through the use of a networking web site targeted at cover crops in production systems could be useful to everyone involved. It would be a way to see what is going on at other universities, both to prevent overlapping research and to encourage the building of research ideas.
- Specific messages we would like to get across include:
  - How cover crops have been used for weed control in organic and conventional field cropping systems.
  - Successes and failures using cover crops in Michigan.

**Sieglinde S. Snapp: Strategic Communication**

- Open dialogue with the State Agronomist at NRCS
- Interaction with Extension Educators
- Interaction with area farmers
- We continue to rely on information from these stakeholders for guidance of our research objectives. We believe building relationships with farmers who are willing to conduct research is critical to adoption. Adoption may gain greater traction from a bottom-up approach where farmers teach other farmers.

**Tim Harrigan: Strategic Communication**

- The benefits of cover crops are widely recognized, but practical constraints limit their use. Most farmers are too busy with other activities during times when cover crops should be seeded. Slurry seeding can relax that constraint in livestock-based cropping systems because seeding and manure application are combined in one efficient operation. There is a need to raise awareness of this new process, particularly among farmers and custom applicators that already have aeration tillage and manure application equipment.

**Dale R. Mutch: Strategic Communication**

- Interaction with Extension Educators and area farmers
- New Ag Network, [www.new-ag.msu.edu](http://www.new-ag.msu.edu), a resource for organic farmers throughout the upper Midwest.