Research funded by USDA - OREI grants on four UNL research farms across three ecoregions in Nebraska

Developed a network of organically, certified areas across Nebraska

Agriculture Research Development Center (ARDC) at Mead, NOP certified organic farm ground - 45 acres protected by mature shelterbelts and 7 acres are part of an Ecological Study experimenting with cover crop mixtures in a crop rotation of corn, soybean, winter wheat.

ARDC Crop rotation: corn, soybeans, winter wheat with clovers and cattle manure as plow-down. Average rainfall 26 inches/year
The average rainfall is 24 inches/year.

South Central Agricultural Laboratory (SCAL) - Clay Center 21.7 acres are certified NOP organic farm ground. The laterally irrigated field strips are set-up in a four year rotation: soybeans, corn/popcorn, winter wheat, alfalfa. (3.1 acre wheat strips are in randomized blocks with tiller radish and compost variables) Alfalfa is in the rotation for three years, mowed periodically, then disked under for a green manure follow with corn. The average rainfall is 25 inches/year.

High Plains Agricultural Laboratory (HPAL) - Sidney, 76 acres NOP certified organic farm ground. Two three-year crop rotations stacked on top of each other = six-year rotation. The rotation is winter wheat-proso millet-green manure-fallow-winter wheat-sunflower-fallow with composted manure. Fallow every third year, although every other fallow is only a partial fallow using field peas as a green manure for a portion of the fallow period, April through June. The average rainfall is 16.5 inches.
Extend results to farmers, stakeholders, life-long learners, and institutionalize organic farming principles in resident instruction.

- Integrate results from on-station and on-farm organic research into classroom teaching programs, and enhance classroom education programs.
- Teach principles and practical knowledge to students and help them envision future agricultural systems.
- Summarize and demonstrate results in the field through producer participation.
- Provide guidance to Extension and their statewide offices, programs, and publications.
- Student-Run Organic Demonstration Farm on the UNL Campus.

NebGuide

Transitioning to Organic Farming, NebGuide 2145, University of Nebraska Extension.

Developing an Individual Farm Organic System Plan, NebGuide 2146, University of Nebraska Extension.

Certification Process for Organic Production, NebGuide 2163, University of Nebraska Extension.

UNL Organic Farming Research, NebGuide 2120, University of Nebraska Extension.

http://cropwatch.unl.edu/web/organic/organic-nebguides

Service Manuals & Training Guides

All are available for download or for order at the Propane MaRC.

Propane-Fueled Flame Weeding in Corn, Soybean, and Sunflower

This manual is designed to help agricultural producers select and configure the propane-fueled flame weeding equipment that is best for their operation. It provides information on the basics of flame weeding, including its benefits as a weed control method, how it works, and the components and configuration of flame weeding systems. It also recommends the propane dosage, growth stage for different weeds, and growth stages at which corn, soybean, and sunflower should be treated to increase weed control effectiveness while minimizing crop damage. Download an electronic version or to order a printed copy visit the Propane MaRC.

Stevan Knezevic, Avnish Dutta, Chris Bruening, and George Gogos.
On-Farmer Research for Organic Production

Involves organic farmers to identify topics and conduct well-designed trials on their fields to obtain reliable information.

Technical support from UNL Extension faculty to help set-up the experimental design and collection of data.

Some of the projects farmers are investigating:

- Forage Teff grass as a cover crop to improve soil tilth;
- Biological control of leafy spurge;
- Use of Neem oil and varietal resistance in soybean aphid management;
- Mob grazing pasture;
- Bio-char as a soil amendment;
- Use of a Rodale Roller/Crimper to roll rye and plant soybeans (organic no-till system)

Charles Wortmann, Associate Professor lwortmann2@unl.edu
Liz Sarno, Extension lsarno2@unl.edu

Winter Wheat Studies

Winter Wheat Studies

Cover Crop Research Plots

Haskell Ag Lab (HAL) - Concord

Charles Shapiro cshapiro@unl.edu
Stevan Knezevic sknezevic2@unl.edu

Nutrient Management Research in Organic Systems
Two Main Projects

• Create a cropping system that includes winter wheat in the rotation in eastern Nebraska

• Develop an understanding of the nutrient weed interactions in organic row crop systems

Winter wheat/row crop system

• Establish and manage cover crops after small grain harvest
• Synchronize and manage Nitrogen management for yield and protein
Goals:

Exp 1. Determine the effect of previous crop, manure rate and timing and foliar N application on Winter Wheat yield and protein.
Exp 2. Determine the effect of cover crop management on subsequent row crop yield.

Cover Crop Management Objectives:

Determine how over-winter CC species and CC termination method affect subsequent annual row crop yield in field conditions of eastern Nebraska.

Quantify cover crop termination method on row crop yield.
Effect of cover crop management on corn population and yield (2009, 2010)

- **Yield (bu/ac)**
- **Population (pfts/ac)**

Exp 1. Nitrogen timing and previous crop
- Spring Yr 1
- Fall Yr 1
- Fall/Winter Yr 1
- Spring Yr 2
- Summer Yr 2

Exp 2. Determine the effect of cover crop management on subsequent row crop yield.

Goals:
- Exp 1. Determine the effect of previous crop, manure rate and timing and foliar N application on Winter Wheat yield and protein.
- Exp 2. Determine the effect of cover crop management on subsequent row crop yield.

CC Kill
- Method

July 27, 2008
Exp 1. Nitrogen timing and previous crop
Exp 2. Cover crop and management

First cycle (2009):
Did not kill alfalfa completely
Spring manure damaged wheat

Best treatments:
Corn-Fall Manure
20 ton/acre
No Foliar N: 66 vs 54 bu/acre

Alfalfa- Fall Manure
40 ton 60 vs 54 bu/acre

Grain protein was all high > 13%

Alfalfa/Corn, 2008
Fall 2008:
  manure
  winter wheat
Spring 2009:
  manure
  joint stage N app
Repeat 2010-11
**Second cycle (2011):**
- Alfalfa killed completely
- Dry fall, poor stands early
- Spring manure damaged wheat

**Best treatments:**
- Corn-Fall Manure
  - 20 ton/acre
  - No Foliar N: 62 vs 50 bu/acre
- Alfalfa- Fall Manure
  - 20 ton
  - 65 vs 58 bu/acre

Grain protein was all high = 13%

---

**Summary**

- Cover crop growth varied by rainfall in August and spring
- Crimping alone was not sufficient to smoother weeds and reduced corn yields 68% and soybeans yields 36%
- Influencing winter wheat yield and protein was difficult due to high native fertility, but alfalfa was mostly adequate without manure, spring manure caused more damage than benefit, foliar N late in the season was not effective in influencing protein levels, but the controls were high
Promising Wheat Lines for Organic Production and Markets

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<th>Cultivar</th>
<th>Male sterile</th>
<th>Height (in.)</th>
<th>Earliness (rd)</th>
<th>Grain Protein (%)</th>
<th>Test Weight (lbs)</th>
<th>Plant Height (in.)</th>
<th>Earliness (rd)</th>
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Breeding Hard Winter Wheat for Organic Markets and Production Systems

Richard Little, University of Nebraska at Lincoln

United States Department of Agriculture
National Institute of Food and Agriculture

Heartland Mill

CERES-TRUST
Winter Wheat Production Area and UNL Germplasm
With Hard Winter Wheat in yellow-brown

Organic Wheat Breeding Challenges
• Whole grain flour and nutrient density
  • Bran
  • Vomitoxin
  • Ash
  • Sourdough
  • Phytate
  • Fenolic Acid
  • Functionality—have been selecting for stronger gluten

Winter Wheat 2011
Harvested Acres by County
for Selected States

U.S. Department of Agriculture, ... -  9,999
10,000 - 24,999
25,000 - 49,999
50,000 - 99,999
100,000 +
200 Organic Farms (2008)

Key Challenge to the Organic Wheat Industry:
Vulnerability resulting from low production volume and limited genetics.

Wheat Breeding Trial Sites
and Annual Water Balance

Semi-Arid Subhumid

Sustainability 2011, 3, 1190-1205

Organic Wheat Breeding Challenges

- Whole grain flour
- Bran and vomitoxin
- Coleoptile Length
Organic Wheat Breeding Challenges

- Whole grain flour
- Bran and vomitoxin
- Coleoptile Length
- Test Weight
- Diseases
  - Fusarium Head Blight
  - Black Tip
  - Common bunt

Organic Wheat Breeding Challenges

- Whole grain flour
- Bran and vomitoxin
- Coleoptile Length
- Test Weight
- Diseases
  - Fusarium Head Blight
  - Lyman, Expedition
  - Overland, Goodstreak

Dilemmas with Yield and Quality

- Yield vs. protein
  - McGill
    - Short on expectations for bread quality
    - Positive response to N top-dressing

- Yield vs. antioxidants
  - Overland and McGill
  - Buckskin
  - Protein content vs. protein quality
Summary

Very few selections have:

- Adequate resistance to seed-borne diseases and FHB
- Very long coleoptiles
- Both high yield and excellent bread quality.

See Nebguide for table details.

Conclusion

A focus on selecting for yield in organic environments:

- resulted in several promising lines for organic production that overlap with recommended lines for conventional production;
- but did little to improve the chances of obtaining lines with the optimal combination of traits.

Recommendations

- Before testing in replicated organic yield trials, selected lines:
  - should be grown in a low-nitrogen environment and screened with a micro-quality test designed to predict whole-wheat bread quality;
  - For sub-humid ecozones should have resistance to seed-borne diseases and FHB;
  - For semi-arid ecozones should have long coleoptiles.

http://agronomy.unl.edu/web/agronomy/breedingorgsys
Organic Crops Grown in Nebraska: Phenolic Based Antioxidants.

Vicki Schlegel, Ph.D.
Associate Professor,
Department of Food Science and Technology
University of Nebraska – Lincoln
Lincoln, NE 68583-0919

Outline

- What are Phenolic Compounds.
- Goal / Outcomes
- Example of Research
- Data and Results from One Study
- Other On-going studies.
- Final Impacts

The Phenols -- Plant Based Antioxidants

General Information:

- Phytochemicals that are widely distributed throughout nature.
- Present in small amounts.
- Chemically diverse.
- Consumption by humans have been linked to lower risks for
  -- Cancer
  -- Heart disease
  -- Arthritis
  -- Alzheimer’s
  -- Diabetes
  -- Parkinson’s
The Phenols

Phenolic Acids (Monoterpenes)
- Salicylic Acid
- Ferulic Acid
- Gallic Acid
- Umbelliferone
- Coumarin Derivative
- Psoralen

Stilbenoids
- Resveratrol

Flavonoids
- Ellagic Acid
- Isoflavones
- Genistein
- Daidzein
- Flavonol
- Quercetin
- Rhamnazin
- Flavan-3-ol

Flavonoids, Antioxidants

Secondary metabolites synthesized by different plants in response to stress
- wounding
- stage of growth
- weed / insect pressure
- drought
- UV radiation
- soil nutrient content
- location
- infection
- infection
- cultivar

Goal: To determine the phenol/flavonoid levels of organically grown crops in response to different effectors.

Outcome: To provide information on the optimal crops, cultivars and/or organic farming practices to implement in different areas throughout Nebraska that promotes “healthy crops”.
Example:

- Nineteen different wheat lines were grown
  - Grown under organic conditions
  - Grown in 4 locations throughout Nebraska
  - Monitored for their total phenol / flavonoid Composition.
  - Monitored for antioxidative capacity.
  - Peroximates (in progress).
  - Long-term related back to yield and other Quality characteristics.

Example: Total Phenols
Example: Total Flavonoids

Average Antioxidant:
- Haskel Ag Lab: 4088 μmol/100g
- Ag Research Development Center (Mead): 9524 μmol/100g
- South Central Ag Lab (Clay Center): 4940 μmol/100g

Antioxidants -- Experimental Design:

Organically grown crops are being evaluated for phenolic compounds and health promoting properties across:

- Crops Type
- Cultivars
- Locations
- Nutrient Treatments
- Years
- Disease stressors
- Weed / Insect Pressures
- Conventional Crops

Final Long-Term Impact:

To produce “healthy” crops.

Thank You.
Biodiversity and Organic Agriculture

James R. Brandle, UNL
John E. Quinn, Furnam Univ.
R.J. Johnson, Clemson Univ.

Biodiversity crisis
What role can sustainable practices play and can organic systems contribute more to biodiversity?
If so how do we measure our impacts and help organic farmers spend their money wisely?

Benefits of organic for biodiversity
In SE Nebraska bird abundance and richness 2x greater in organic then non-organic farm systems

Beecher et al. 2002

Organic
Nonorganic

50
40
30
20
10
0

Birds / 10 ha

p = 0.015
p = 0.0005

p = 0.030
Within organic

Grassland Birds

Quinn et al. 2012

Within organic

Shrubland birds

Quinn et al. in prep

Biodiversity and Ecosystem Services

Nicholls and Altieri 2004
Avian Foraging Sites

For More Information Contact
- John Quinn
  - Furman University
  - john.quinn@furman.edu
- On the web - http://hfi.unl.edu
- Video of Bell's Vireo at the nest - http://www.youtube.com/watch?v=N5Kndb7Lmo
- Key papers

Importance of Developing Partnerships

OCIA Research and Education (OCIA R&E) their mission is to support farmer driven research, on farm and at research institutions. OCIA R&E helped with the certification costs and our research appears in their workshops and publications: http://www.ocia.org/RE/Board.aspx

Nebraska Sustainable Ag Society (NSAS) cooperator - provides updates on our projects and research results to farmers through the NSAS newsletter and at the Rural Advantage/Healthy Farms Conference http://www.nebsusag.org/

Organic Farmer Advisor Committee provide guidance on research ideas and review projects to assure organic farmers' production needs are being addressed.
Vision Statement
Developed by Organic State Advisory Committee:

“The University of Nebraska-Lincoln Organic Working Group will develop strategies for transition from conventional agriculture to organic whole farming systems and work with established organic farms so that they are ecologically self-renewing, socially responsible and profitable, and that will provide nutrient-dense foods, ecosystem services and education to current and future generations.”