

## Organic Dry Bean Production Systems and Cultivar Choices

Thomas Michaels, Craig Sheaffer, Hannah Swegarden,  
Claire Flavin, University of Minnesota

November 12, 2013

[http://www.extension.org/organic\\_production](http://www.extension.org/organic_production)



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Thomas Michaels



Craig Sheaffer



Claire Flavin



Hannah Swegarden

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### Organic Dry Bean Production Systems and Cultivar Choices

Dr. Craig Sheaffer, Dr. Thomas Michaels,  
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University of Minnesota-Twin Cities- Department of Agronomy and Plant Genetics

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## Overall Objectives

- Promote diversification of organic cropping systems with grain legumes
- Develop agronomic strategies to promote efficient production and high yields of dry beans while sustaining soil quality
- Identify dry bean varieties suited to organic systems
- Improve market availability of locally produced dry beans to consumers

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## Overview

Bean Basics

Minnesota Research

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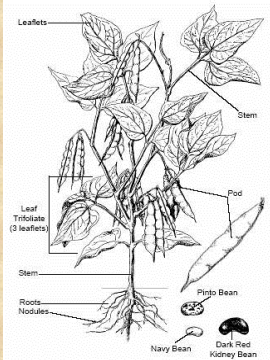
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## Organic Dry Edible Beans

- *Phaseolus vulgaris* L.
- Members of legume family
- Nitrogen fixation – particularly important in organic systems
- In contrast to snap beans, seeds are harvested dry



The illustration shows a trifoliate leaf with three leaflets, a central stem, and a root system with nodules. To the right, a pod is shown with a single bean inside. Below the plant, three types of beans are depicted: a Pinto Bean, a Navy Bean, and a Dark Red Kidney Bean.

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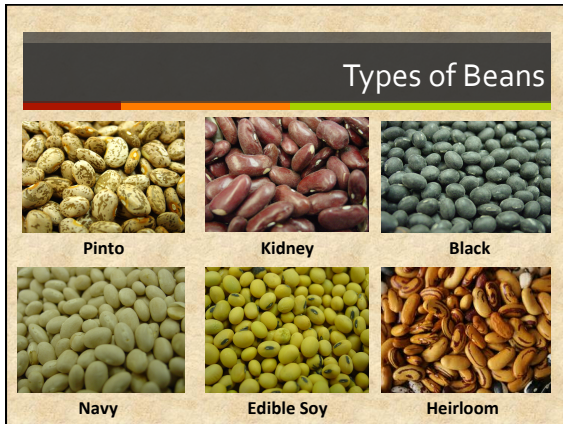
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**Background Information**

- Navy, dark red kidney, and pinto are the top three dry beans produced in Minnesota
- Largest County Producers: Polk, Otter Tail, Marshall (*NW or W Central*)
- Acreage and Average Yields:
  - 2010 – 185,000 acres with an average of 1,750 lbs/A
  - 2011 – 140,000 acres with an average of 1,690 lbs/A
- Planting Date: May 25-June 15<sup>th</sup>
- Harvest Dates: September 5<sup>th</sup> – October 5<sup>th</sup>

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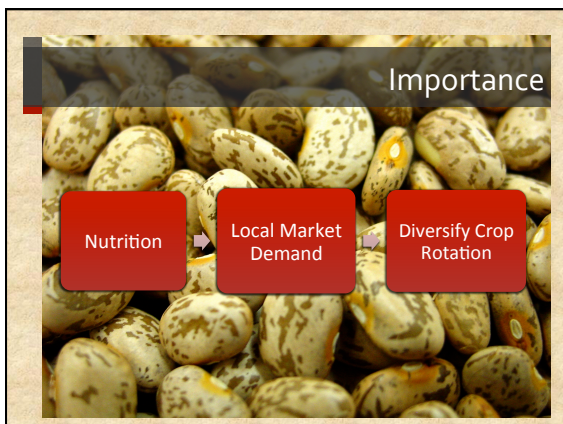
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### Nutrition

	Calories	Protein	Carbs	Fiber	Fatty Acids	Sugars
grams per 100 g						
Kidney Bean	333	24	60	25	1	2
Soybean	446	37	30	9	20	7
Corn	365	9	74	7	5	1

Dry beans are high in protein/fiber, but also low in fat/cholesterol

Featured as a MN Farm-to-School food (1/2 cup per week)

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### Locally Grown for Local Nutrition




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### Diversification of Crop Rotation



**What is a rotation?**

- Yearly sequence of crops on land

**Advantages of rotation:**

- Disease, weed, and insect control
- Reducing risk
- Biologically fixed N

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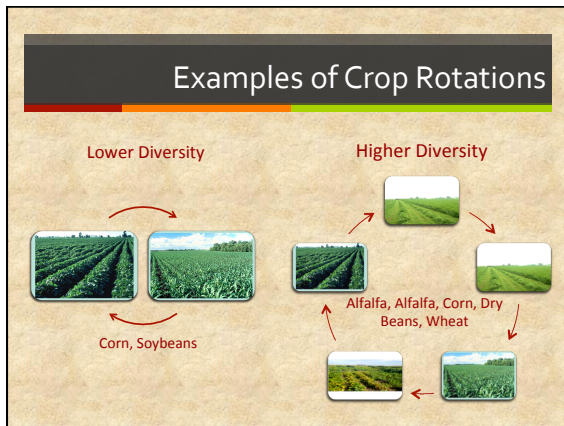
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### Biological Nitrogen Fixation

Rhizobia nodules

- Main source of N for organic systems, besides manure
- Symbiotic relationship with Rhizobia bacteria
- Improve yields of dry beans and possibly that of other crops in rotation
- Dry beans as alternative to soy in rotation

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**Bean Basics**

**Minnesota Research**

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## Dry Beans in Organic Systems

➤ Breeding for organic systems needs to be conducted specifically under organic conditions



More diverse  
crop rotations

More  
mechanical  
weed control

Use of organic  
fertilizers

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## Edible Bean Research in Organic Systems

Weed Control	Rotation Benefits	Variety Evaluation	Heirloom Breeding	Market Analysis
Tillage Method	3 Year Rotation: Alfalfa or Corn, Dry Beans, Wheat	Yield & Quality of 24 Market Class Varieties	Evaluation & Selection within Cultivars	CSA
Row Spacing				Co-op
				Distributor

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## Mechanical Weed Control

Field Cultivator



Tine Weeder



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### Weed Management Experiment

**3 Treatments**

- Tine Weeding 15" Rows
- Cultivation & Tine Weeding 30" Rows
- Cultivation 30" Rows

**Preliminary Data Suggests:**

- Weed biomass was significantly affected by tillage, variety, and the interaction between the two
- Tine weeding of plots with 15" rows had greatest effect on weeds

➤ Breeding for adaption to narrow rows and mechanical weed control

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### Three-Year Rotation Experiment

➤ Determine the rotation benefits (including fertilizer N equivalency) of edible beans and soybeans under organic management

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graph TD
    Treatments[Treatments] --> Crop1[1st year crop-- corn or alfalfa]
    Treatments --> Crop2[Bean varieties as second year crop]
    Treatments --> Crop3[Nitrogen and bean effect on wheat]
  
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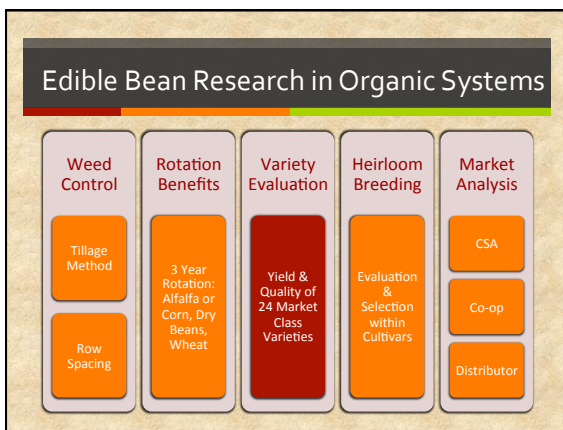
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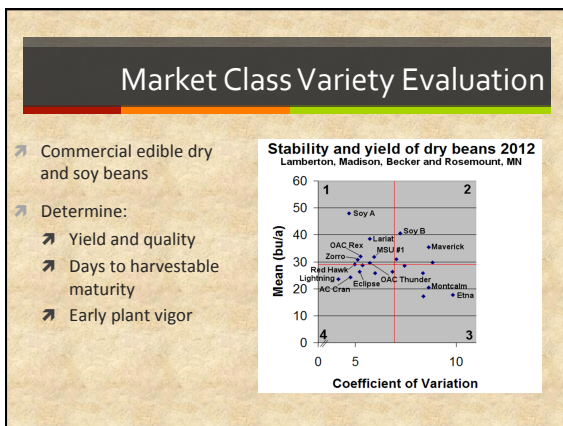
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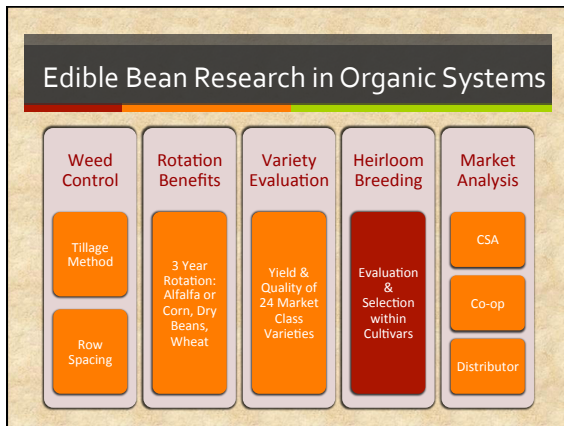
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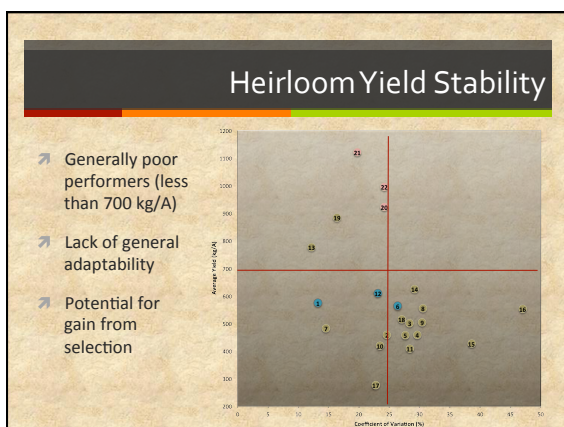
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### Selection Within Heirlooms



➤ Maintain high degree of variation

➤ Perform replicated evaluation trials to establish gain from selection

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### Local Market Demand

➤ Market analysis was coordinated between the University of Minnesota School of Agronomy and the Regional Sustainable Development Partnerships

➤ Surveyed regional co-ops, distributors, and CSAs

➤ Objective: To evaluate avenues for incorporating dry beans into the local food system

➤ Key personnel:

- Kathy Draeger
- Greg Schweser




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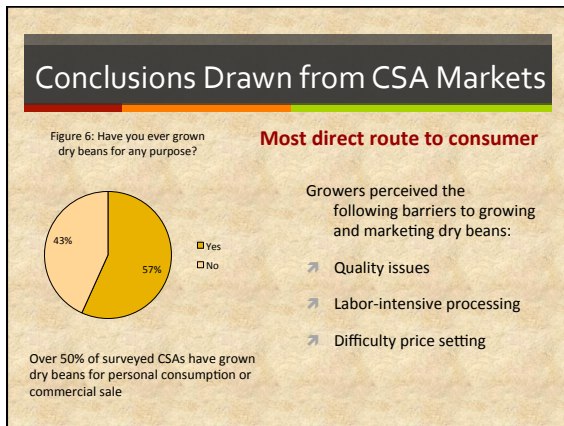
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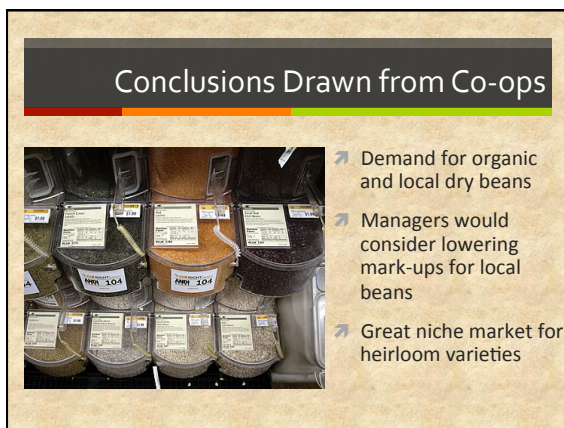
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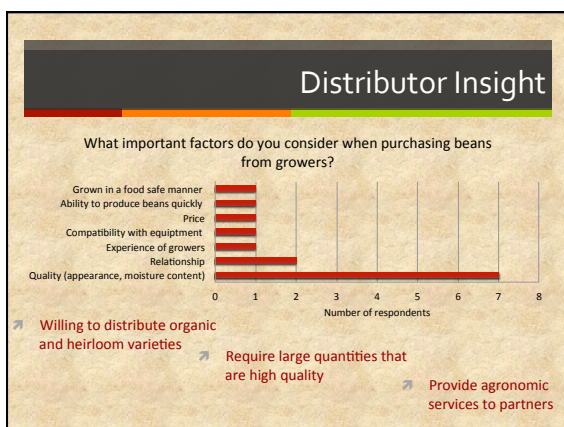
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### Future Work

- Local Market Analysis
- Molecular Diversity
- Nutritional Composition
- Culinary Taste Tests




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### Funding Provided By:



THE CERES TRUST



NORTH CENTRAL  
**SARE**  
Sustainable Agriculture  
Research & Education



USDA NIFA  
United States Department of Agriculture  
National Institute of Food and Agriculture



UNIVERSITY OF MINNESOTA  
Driven to Discover

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