

(i) Results from ACS study

**(ii) New organic trials at Swift Current
and plans for future research**

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Impact of organic management on *Fusarium* root/crown infection – ACS study at Scott

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- ✓ **common root rot** is a widespread cereal disease on the Canadian Prairies...
- ✓ main root rot pathogen: *Cochliobolus sativus*
 - ... followed by *Fusarium* spp.
 - e.g. *F. avenaceum*, *F. culmorum*

... how do current crop production practices (including organic management) affect *Fusarium* populations in roots and crowns of wheat???

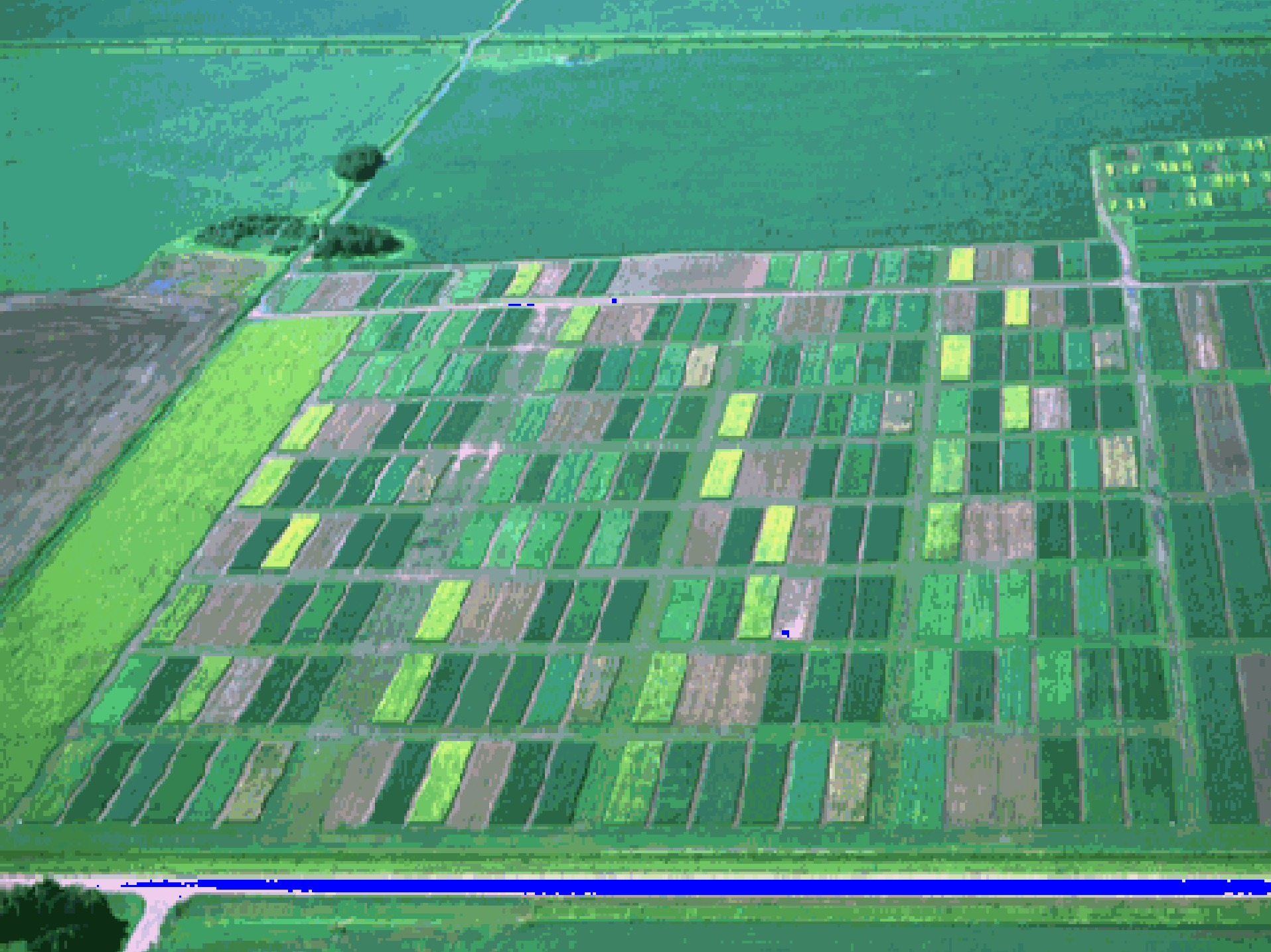
Study at Scott, SK – 2001-2006:

Main plots: 3 tillage/input levels:

- high - conventional-till
- reduced - no tillage
- organic - intensive tillage and green manure

Sub-plots: 3 crop diversity levels:

- low diversity: wheat-based rotation with high frequency of fallow/ green manure
- diversified annual grains: oilseed/cereal/pulse/ barley/oilseed/wheat
- diversified annual/perennial: oilseed/wheat/barley/ forage (3 yr)



✓ highest levels of *Cochliobolus sativus* with high tillage intensity

... a differential effect of tillage/
input system on the various
Fusarium spp. =

✓ the pathogens *F. avenaceum* and *F. culmorum*:

were associated with conventional systems involving reduced tillage...

✓ the saprophyte *F. equiseti* was favoured by organic systems...

ORG

RED

HIGH

Root rot

<i>C. sativus</i>	57.0 a	39.6 b	53.4 a
<i>F. avenaceum</i>	2.1 b	5.2 a	2.8 b
<i>F. culmorum</i>	0.2 b	3.5 a	2.3 a
<i>F. equiseti</i>	11.1 a	7.1 b	4.3 b

Crown rot

<i>C. sativus</i>	66.6 a	33.6 c	46.8 b
<i>F. avenaceum</i>	0.5 b	12.4 a	4.3 b
<i>F. culmorum</i>	0.2 b	2.1 a	2.1 a
<i>F. equiseti</i>	15.0 a	9.9 b	9.2 b

- ✓ **organic management** resulted in a reduction in populations of *F. avenaceum* and *F. culmorum* – two of the most common crown/root and Fusarium head blight pathogens in SK

Previous studies in SK:

- ✓ decrease in *C. sativus* / increase in *Fusarium* spp. with lower tillage intensity...

(Bailey et al., 2001; Fernandez et al., 2007a)

- ✓ decrease in *C. sativus* / increase in pathogenic *Fusarium* species associated with previous use of glyphosate (regardless of tillage intensity)

(Fernandez et al., 2007b, 2007c)

No previous studies in North America have compared root/crown rot in organic vs. conventional systems

- ✓ **lower levels of pathogenic *Fusaria*, such as *F. avenaceum* and *F. culmorum*, in organic than conventional fields**

(Baturu, 2007; Hannukkala and Tapio, 1990; Knudsen *et al.*, 1995; Lukanowski *et al.*, 2006)

- ✓ **higher levels of the saprophyte *F. equiseti* in organic than conventional fields**

(Elmholt, 1996; Knudsen *et al.*, 1999)

- ✓ other studies have shown strong antagonism of *F. equiseti* against pathogenic *Fusarium* spp., including *F. graminearum*, *F. culmorum*, and *F. pseudograminearum*

(Dawson et al., 2004; Luongo et al., 2005; Singh et al., 2009)

➤ lower populations of *F. avenaceum* and *F. culmorum* might cause...

... lower development of **crown/root rot**

... lower levels of **Fusarium head blight**

in succeeding cereal crops...

- ✓ lower levels of Fusarium head blight and mycotoxins in organic than conventional fields

(Birzele et al., 2002; Edwards, 2009; Meister, 2009)

Further research into the mechanisms responsible for reduced levels of pathogenic *Fusarium* species under organic management systems is warranted...

New organic research program at SPARC, Swift Current

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- ✓ needed to respond to increased interest in organic production methods in southwest SK...
- ✓ and to lack of testing of wheat breeding lines for organic production in the Brown soil zone

- ✓ four years ago, 5 acres of land were set aside at SPARC for organic research
- ✓ this land has been under green manure (field pea), with no chemical inputs for the past four years

➤ **organic wheat breeding trials - 2009**

➤ **organic agronomic trial - 2010**



Organic Wheat Breeding Trials

Collaborators:

Cereal Research Centre, AAFC, Winnipeg, MB

University of Manitoba, Winnipeg, MB

Crop Development Centre, University of Saskatchewan, Saskatoon, SK

University of Alberta, Edmonton, AB

Semiarid Prairie Agricultural Research Centre, AAFC, Swift Current, SK

Canada

Organic wheat breeding trials:

- the Swift Current location is the only Brown soil zone test site, and has joined a recently developed network of test sites across the prairies: AB (University of Alberta, Ellerslie), SK (CDC-Kernen Farm, Oxbow) and MB (Carman, Glenlea) - D. Spaner, P. Hucl, and S. Fox.
- these various sites are necessary to identify superior candidate cultivars adapted to organic production systems in various regions and that are worthy of entering into varietal registration trials.

- ✓ in 2009, growth in the organic wheat trials was very poor at some of the other locations, or Fusarium head blight infections prevented evaluation of grain yield and quality...

NEW organic agronomic trial to start in 2010:

“Impact of agronomic practices on cereal and alternative crops grown under organic management methods in the semi-arid Brown soil zone”

4 acres of organically managed land

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- ✓ little information is available to organic growers in the Brown soil zone regarding the best agronomic practices to maximize production and minimize the environmental impact of their operations.
- ✓ organic growers in this region are still relying heavily on tillage for weed control, so there is a need to investigate:
 - effectiveness of reducing tillage intensity on weed control,**
 - production, economic and soil benefits of diversified rotations under water-limited conditions.**

Objective of this new field project:

- investigate impacts of **tillage reduction** and **mixed cropping sequences** on weed control, soil fertility, and crop production under organic management methods in the Brown soil zone of SK

Tentative design:

Tillage (2 treatments):

- (i) one post-harvest tillage operation in fall plus two pre-seeding tillage operations and harrowing in spring;
- (ii) no-fall tillage and only one tillage operation and harrowing in spring.

Crop Rotations (3 treatments):

- (i) legume green manure (Indianhead lentil)-wheat;
- (ii) legume green manure-wheat-pulse (lentil or pea)-wheat;
- (iii) legume green manure-oilseed (mustard or flax)-pulse (lentil or pea)-oilseed-wheat.

- the results from this study will help organic producers in the Brown soil zone to choose cropping systems and management methods to minimize production costs, increase net farm income, reduce business risk, and enhance environmental quality

