Management of Fresh Wheat Residue for Irrigated Winter Canola Production

Bill Schillinger and Tim Paulitz
WSU and USDA-ARS
Cropping System

1. Under irrigated circles, potato are the dominant cash crop.
2. Good rotations are needed to maintain productivity
3. A common rotation is potato/winter wheat/winter canola
Problem

1. Difficult to establish winter canola in heavy winter wheat residue
2. Growers currently burn residue and then moldboard plow.
3. Losing valuable organic matter, C, N.
4. Environmental problems with burning
Goal

1. Test other residue management methods
   - straw removal
   - straw chopping
   - Disking vs plowing
   - Direct seeding with and without row cleaners

2. Understand why it is difficult to establish winter canola in winter wheat stubble— is it a biological (pathogen), physical or environmental cause?
Objectives

1. Determine how six different WW residue management practices affect WC health and yield.

2. Determine cause(s) for decline in WC vigor and yield as affected by WW residue management.

3. Test methods to retain WW residue without adversely affecting WC.

4. Disseminate results of research through field days, grower meetings, an extension bulletin, and a scientific journal article.
Theories

1. Straw produces toxic compounds.

All of this work is done in greenhouse or artificial conditions.

Compounds like water-soluble organic acids can be leached from straw that may inhibit seedlings, but they are very short-lived in the soil (microbes quickly use them).

No evidence for allelopathy in situ under field conditions.
Theories

2. Decomposing straw immobilizes nitrogen.

This may occur over the season, but may not be important in the first 2-3 weeks of seedling establishment.

Can be overcome with adequate fertilizer
Theories


Problem of getting good seed-to-soil contact, straw tucking, clogging openers, etc.
Theories

4. Excess straw keeps soils too wet and cool.
5. Straw shades WC seedlings and interferes with photosynthesis.

4- may be important in spring, but not fall plantings

5- Australians have evidence for this- seedlings have to elongate out of residue, slows establishment
Theories

6. Straw serves as a food base for soil-borne pathogens, increasing disease, especially for *Pythium* and *Rhizoctonia*.

10 years of evidence for this- *Rhizoctonia solani* AG 2-1
Irrigated Winter Canola Experiment at Lind

Treatments (established on fresh irrigated winter wheat stubble)

1. Burn + disk – present practice
2. Mechanical straw removal + disk
3. Chop stubble + moldboard plow
4. Burn + direct seed
5. Direct seed into standing residue
6. Direct seed into standing residue with row cleaners
Stubble chop & moldboard

Standing stubble

Mechanical removal & disk
Horned Lark - *Eremophila alpestris*
Despite bird netting, horned larks ate almost every WC seedling before emergence.

We then broadcast more seed, spread garlic powder, added 2” irrigation water, and then spread more garlic. Horned larks again ate almost every WC seedling. Also tried cannons, dummy owls, etc.

Field experiment to be moved to the Jeff Schibel farm in 2012.
Measurements in Winter Canola

1. Soil water dynamics and water use efficiency
2. Plant stand establishment
3. Rhizoctonia levels in the soil
4. Rhizoctonia AG-8 and AG 2-1 on roots
5. Soil temperature
6. Weed pressure
7. Grain yield
8. Oil content
Bioassay of Field Soil from Fall, 2010 Planting of Winter Canola, sampled in Spring 2011

1) burn-disk; 2) straw removed, disk 2X, 3) straw chopped and plowed in; 4) direct-seeded and 5) Burned-directed seeded
Bioassay of Field Soil from Fall, 2010 Planting of Winter Canola, sampled in Spring 2011

% post-emergence damping-off

Day 10

Day 20

1) burn-disk; 2) straw removed, disk 2X, 3) straw chopped and plowed in; 4) direct-seeded and 5) Burned-directed seeded
Bioassay of Field Soil from Fall, 2011 Planting of Winter Canola

1) burn-disk; 2) straw removed, disk 2X, 3) straw chopped and plowed in; 4) direct-seeded and 5) Burned-directed seeded, 6) direct-seed with row openers
Bioassay of Field Soil from Fall, 2011 Planting of Winter Canola

1) burn-disk; 2) straw removed, disk 2X, 3) straw chopped and plowed in; 4) direct-seeded and 5) Burned-directed seeded, 6) direct-seed with row openers
Conclusions

• The treatment with chopped straw added to the soil (3) showed the most post-emergence damping-off from *R. solani* AG 2-1. This suggests that straw is providing a food base for this pathogen.

• Noticed better performance of the surviving seedlings in the two burned treatments. Is this due to stimulation by nutrients in the ash? Reduction of pathogen?
Laboratory Pot Experiment

• Take Lind soil to the greenhouse.
• Pasteurize half the soil to remove pathogens, leave the other half untreated.
• Four residue treatments: (i) no WW residue, (ii) fresh WW residue mixed with soil, (iii) fresh WW residue on surface only, (iv) straw burned on top of pot
• Then plant WC in $\frac{1}{2}$ gallon pots.
• Pot experimental design is a 2 X 4 factorial with five replications.
Hypothesis to be Tested

• If we do not see a WC growth reduction in the pasteurized soil but see a growth reduction in the normal soil, this will prove that soil pathogens or other microbes are responsible for the phenomenon.

• If we see a WC growth reduction in the absence of straw, this will show that straw is not responsible for the problem.

• With normal soil, if there is WC growth reduction with WW residue, then planting methods to remove fresh residue from the seed row will be evaluated.
Questions?