Wheat: an Alternative?

Jochum Wiersma
FBM Data

- **What the data tells us:**
  - It appears that HRSW is economically viable across MN, but probably as volatile as corn.

- **What the data doesn’t tell us:**
  - Sample size/sampling error.
  - Rotational effects/considerations
  - Future
Pressures

- **Price:**
  - World stocks continue to be low (drought)
  - Strong export demand (weak $)
  - Winter wheat deteriorating (drought)
  - Fight for acres

- **Inputs:**
  - Fertilizer up sharply
  - Seed up sharply
  - Land rents up sharply
Crop Budgets

- Absolutely essential:
  - Too many things are changing too quickly

- Keep an eye out for FBM data and NDSU’s crop budgets.

- Margin risk and compression will bring us back to reality in a heartbeat
‘Vell, isn’t corn and soybeans a crop rotation, then?’
<table>
<thead>
<tr>
<th>Previous Crop</th>
<th>Conventional Tillage Wheat Yield</th>
<th>No-Till Wheat Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wheat Yield (bu/A)</td>
<td>Wheat on Previous Crop (%)</td>
</tr>
<tr>
<td>Wheat</td>
<td>33.8</td>
<td>100</td>
</tr>
<tr>
<td>Soybean</td>
<td>45.3</td>
<td>134</td>
</tr>
<tr>
<td>Sugar beet</td>
<td>40.8</td>
<td>121</td>
</tr>
<tr>
<td>Sunflower</td>
<td>39.3</td>
<td>116</td>
</tr>
<tr>
<td>Corn</td>
<td>38.6</td>
<td>114</td>
</tr>
<tr>
<td>Flax</td>
<td>38.0</td>
<td>112</td>
</tr>
<tr>
<td>Barley</td>
<td>37.0</td>
<td>109</td>
</tr>
</tbody>
</table>

Source: NDSU
The Lancaster Rotation Experiment
A Long-Term Cropping System Study

- A multiple crop rotation experiment established in 1966
- Objective: To compare the benefits of growing corn continuously and in rotation using commercial nitrogen fertilizer.
- RCB in a split-plot arrangement with two replications.
  - Main-plots= 21 rotations
  - Split-plots= four N levels in corn
A one year break using soybean reduces the rotation effect in the second phase.

**Corn Yield Response to Crop Rotation**

1998 to 2000
Control treatments averaged across tillage treatments at Arlington, WI.

<table>
<thead>
<tr>
<th>Cropping Sequence</th>
<th>Grain Yield (bushels/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS</td>
<td>215</td>
</tr>
<tr>
<td>CCCS-1C</td>
<td>218</td>
</tr>
<tr>
<td>CCCS-2C</td>
<td>200</td>
</tr>
<tr>
<td>CCCS-3C</td>
<td>192</td>
</tr>
<tr>
<td>CCS-1C</td>
<td>214</td>
</tr>
<tr>
<td>CCS-2C</td>
<td>201</td>
</tr>
<tr>
<td>Cont.</td>
<td>192</td>
</tr>
</tbody>
</table>

Source: Lauer, unpublished

**Cropping Sequence**
C= Corn, S= Soybean, Number = consecutive year of corn

Lauer © 1994-2007
University of Wisconsin - Agronomy

http://corn.agronomy.wisc.edu
At least two break years are needed to measure a response in the second crop phase.

Corn Yield Response to Crop Rotation

Grain Yield (bushels/acre)

<table>
<thead>
<tr>
<th>Cropping Sequence</th>
<th>1990-2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD</td>
<td>161</td>
</tr>
<tr>
<td>AB</td>
<td>170</td>
</tr>
<tr>
<td>BC</td>
<td>164</td>
</tr>
<tr>
<td>D</td>
<td>156</td>
</tr>
<tr>
<td>DE</td>
<td>153</td>
</tr>
<tr>
<td>A</td>
<td>173</td>
</tr>
<tr>
<td>CD</td>
<td>157</td>
</tr>
<tr>
<td>AB</td>
<td>169</td>
</tr>
<tr>
<td>CD</td>
<td>160</td>
</tr>
<tr>
<td>E</td>
<td>146</td>
</tr>
</tbody>
</table>

Source: Stanger and Lauer, 2008

A = Alfalfa, C = Corn, O = Oat, S = Soybean, W = Wheat
Adding a third crop does not increase corn grain yield, but does improve soybean grain yield ...

![Graph showing corn and soybean yield response to crop rotation](image)

**Source:** Lauer, unpublished

C = Corn, S = Soybean, W = Wheat

2004-2006: Values averaged across seed fungicide treatments at Arlington, WI.

http://corn.agronomy.wisc.edu

Lauer © 1994-2007
University of Wisconsin - Agronomy
Rotational Studies

- **What the data tells us:**
  - Crop rotations work - there are advantages to include SGs in rotations, even in a CS or CC world

- **What the data doesn’t tell us:**
  - No comprehensive enterprise/systems analysis:
    - Economies of scale
    - Labor film
    - Input cost differentials
Rotational Considerations

- Do not plant small grains after corn.
  - Q: Why?

- Do plant small grains after soybeans.

- Possible rotations:
  - Winter wheat - Corn - Soybean
  - Spring wheat - Corn - Soybean
  - Small Grain - Corn-Soybean - Alfalfa
Advantages of Soybean

- Non-host crop for major diseases in wheat:
  - Residue born leaf diseases
    - Maximum benefit if rotation is wider than 2 years.
  - Common root rot
    - Maximum benefit if rotation is wider than 3 to 4 years.
  - Fusarium head blight
    - Maximum benefit if rotation is wider than 2 years.

- Weed control flexibility:
  - This is especially true with RR-soybeans
Fertility Management

‘Manure alone might be the shits’
Grain Yield vs Protein

Sims and Rehm, 2003
Grain Yield versus NUE

- Protein: 14.4% @ 90 lbs N; 15.2% @ 120 lbs N

Sims and Rehm, 2003
Grain Protein versus NUE

Sims and Rehm, 2003
Fertility Management

- Soil test.
  - To get a reference point

- Apply according to recommendation:
  - Refer to Small Grains Field Guide
    - Eastern MN and OM% >3.0: 70 lb N/A
    - Western MN: \( N_{rec} = (YG \times 2.5) - STN - NPC \) (=40 lb N/A for soybean)

- Split applications:
  - Be aware that N can not be rate limiting at 5 leaf stage
  - Splits only recommended for very sandy soils.
Seeding Operations

‘This is not your grandfather’s drill’
Population

SDR = \[
\frac{(\text{Desired Stand in Plants/Acre})}{(1 - \text{Expected Stand Loss})}
\]
\[
\times \frac{(\text{Seeds/Pound}) \times (\text{Percentage Germination})}{(\text{Plants per acre}) (\text{times 1 million})}
\]

Initial Stands:

<table>
<thead>
<tr>
<th>Crop</th>
<th>Plants per acre (times 1 million)</th>
<th>Plants per sq. ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter wheat</td>
<td>1.0</td>
<td>23</td>
</tr>
<tr>
<td>Spring wheat</td>
<td>1.30 – 1.35</td>
<td>30 – 32</td>
</tr>
<tr>
<td>Barley</td>
<td>1.25 – 1.30</td>
<td>28 – 30</td>
</tr>
<tr>
<td>Oats</td>
<td>1.25 – 1.30</td>
<td>28 – 30</td>
</tr>
</tbody>
</table>
Depth

- Depth control critical component:
  - You can not afford a delay in emergence.
  - Increases problems with root rots.

- Ideal seeding depth is 1” - 1.5”
Crop Physiology
Temperature

Minimum, optimum, and maximum growth temperatures for small grains.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Minimum</th>
<th>Optimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>37-39</td>
<td>75-77</td>
<td>86-90</td>
</tr>
<tr>
<td>Barley</td>
<td>37-39</td>
<td>68-70</td>
<td>82-86</td>
</tr>
<tr>
<td>Oat</td>
<td>37-39</td>
<td>68-70</td>
<td>82-86</td>
</tr>
</tbody>
</table>

Q: What is the correct order to plant small grains?
Management Stages
Different crop staging models in use.

Feekes and Zadoks most widely used.

Remember to:
- Only count the main stem
- To include dead leaves or if unsure the axillary tillers.
Figure 1. Timetable with approximate days after emergence and growing degree days (base 40°F) required to attain various growth stages. Data are for an intermediate maturing variety grown in St. Paul, Minnesota. For simplicity, tillers are not shown after "advanced tillering."

- Emergence (10)
- Two-leaf (12)
- Tiller length begins (13, 21)
- Advanced tillering (15, 23)
- Jointing (16, 31)
- Flag leaf emerging (38)
- Flag leaf fully emerged (39)
- Boot (45)
- Head emergence (58)
- Maturity (89)

Days after emergence: 12, 15, 23, 28, 34, 39, 41, 45, 85
Growing degree days: 170, 230, 430, 500, 690, 810, 885, 990, 2260
Optimizing Scouting Time

- **In HRSW:**
  - Fifteen distinct crop growth stages.
  - Five of these are critical in HRSW:
    - 2 leaf stage - stand count, weed ID)
    - 4 to 5 leaf stage - weed ID, insects, and fungi
    - flag leaf emergence - insects, and fungi
    - heading to flowering - insects, and fungi
    - physiological maturity - pre-harvest management
## Scouting Activities

<table>
<thead>
<tr>
<th>Timing Stage</th>
<th>Growth Stage (Zodaks)</th>
<th>Scouting Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Agronomic</td>
</tr>
<tr>
<td>2–Leaf Stage</td>
<td>12</td>
<td>Stand count</td>
</tr>
<tr>
<td>4 – 5 Leaf Stage</td>
<td>14-15</td>
<td>Estimate yield (if jointing has started)</td>
</tr>
<tr>
<td>Flag Leaf Emergence</td>
<td>37</td>
<td>-</td>
</tr>
<tr>
<td>Anthesis</td>
<td>60</td>
<td>Estimate yield</td>
</tr>
<tr>
<td>Physiological Maturity</td>
<td>90</td>
<td>-</td>
</tr>
</tbody>
</table>
Fungal Diseases

- **Early season:**
  - Tan spot
  - Powdery mildew

- **Mid season**
  - Tan spot
  - Septoria leaf blotch
  - Leaf rust

- **Heading**
  - Fusarium Head Blight
  - All of the above
Powdery Mildew

Tan Spot & Leaf Rust

FHB & Ergot


Fungal Diseases

**Decisions:**

- HRSW - use decision guides and risk maps ([http://mawg.cropdisease.com/](http://mawg.cropdisease.com/)) and understand risk of leaf rust and FHB.

- Understand the disease ratings for the different varieties
Disease Forecasting

FHB

Tan Spot
State Yield Trials

- **Yield responses to fungicides:**
  - 2004 - across locations and varieties 8 bu/A
  - 2005 - across locations and varieties 6 bu/A
  - 2006 - across locations and varieties 3.5 bu/A
  - 2007 - across locations and varieties 10 bu/A

- **Rank correlation for grain yield:**
  - In 2004 and 2005, 4 out 5 environments showed no rank correlation
  - Use of fungicides results in rank changes
FHB Fungicide Update

- **Prosaro**
  - Will not receive full label in 2008

- **Proline + Folicur (3+3)**
  - Will depend on Section 18 submission for Folicur
In Summary

- Do not expect miracles - small grains are cool season annuals.
- Winter wheat will likely have higher yield potential.
- Do not plant after corn and do plant after soybeans.
- Winter wheat after soybeans is feasible.
- Pay attention to diseases:
  - Winter wheat: early leaf spotting diseases and leaf rust
  - Spring wheat: leaf rust
- Pay attention to insects:
  - Aphids
  - OWBM
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