Getting Started with Wheat Agronomy

Dennis Pennington
Wheat Systems Specialist, MSU
Agenda

- Why plant wheat?
- Fall management
- Spring/summer management
- Cost of production
Why put wheat in the rotation?

- ↑ corn acres
- ↑ soybean acres
- ↓ wheat and other rotation crops

Loss of rotational diversity causes:

- ↓ soil organic matter
- ↓ aggregate stability
- ↓ soil quality

- ↑ soil erosion
- ↑ GHG emissions
- ↓ yield potential
- ↓ yield stability
Wheat Rotation Study

- Ridgetown Long Term Rotation Study
- Five crop rotations
  - C-C
  - C-S
  - C-S-W
  - S-S
  - S-W

Objective: To determine the impact of wheat in the rotation

Rotation Effect - Corn

Overall: 23% increase

- +34% (45 bu)
- +32% (48 bu)
- +5% (8 bu)
- +21% (32 bu)

Rotation Effect - Soybean

Overall: 16% increase

+20% (10 bu)

+12% (5 bu)

+15% (9 bu)

+18% (13 bu)

Rotation Effect – Soybean w/rc

No significant decrease in yield

Soybean Yield (bu/a)

<table>
<thead>
<tr>
<th></th>
<th>No-Till</th>
<th>Conventional Till</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-S</td>
<td>61</td>
<td>56</td>
</tr>
<tr>
<td>C-S</td>
<td>63</td>
<td>59</td>
</tr>
<tr>
<td>C-S-W</td>
<td>68</td>
<td>66</td>
</tr>
<tr>
<td>C-S-W/rc</td>
<td>67</td>
<td>68</td>
</tr>
</tbody>
</table>

MICHIGAN STATE UNIVERSITY Extension
Advantages for Producers to Plant Winter Wheat

Rotation
- Improve soil health & fertility
- Provides additional crop in their production mix

Spread Work Load
- Allows time to perform field improvements
- Gets away from all fall harvested crops

Cash Flow
- Generates revenue outside of fall sales

Source: Jeff Kuehnlein, MAC, MABA Winter Meeting 2016.
Fall Management
Planting Dates

- Hession Fly Free Date: September 3-23
  - [http://msue.anr.msu.edu/news/planting_the_2015_winter_wheat_crop](http://msue.anr.msu.edu/news/planting_the_2015_winter_wheat_crop)
- Hasn’t been any recent problems with BYDV, but should still use as a guide
- Target end of September/early October
Planting Dates

- **goal:** 2 to 3 tillers by winter
- **adds 1 bu per day** *(relationship hold into late Oct.)*
- **early soybean harvest?**
- **seeding rate:** 1.4-1.6 mill (early)
- **Late Oct:** 1.8-2.1 mill seeds/a
Seeding practices for uniform stand

- Consistent seed placement
  - Residue management
  - Drill operation/settings
  - Tillage?
Variety Selection

- Use Multi-Year Performance Data
  - Yield
  - Test Weight
  - Height
  - Lodging
  - Winter Hardiness
  - Disease Scoring

http://www.varietytrials.msu.edu/wheat
Seed Source

- Certified vs. Non-Certified
- % Germination
- Purity
- Free of foreign material (weed seed)
- 0% sprouting
Seed Placement

- Prepare soil with minimum tillage (single pass with field cultivator)
- Avoid highly compacted fields
- Do **NOT** plant when fields are too wet
- 1-1.5 inches deep
- Only plant deeper in dry soils
Seeding Rate

- Seeds/acre **not** Bushels/acre
- 1.6-2.1 million seeds per acre (22-29 seeds/foot for 7 inch rows)
PARENT SEED

MCIA RED DEVIL BRAND RED
MCIA
LANSING MI 48909
F 15 2810 LMS
99.70 % Net Wt. 2000/907.2 Lbs./Kg
00.28 % Germ. 90 %
00.01 % Inert
00.01 % Seed Count 14948 lb.
VARIETY NOT STATED
ORIGIN - MI (USA)

QUALITY ASSURANCE

RED WHEAT
MCIA RED DEVIL BRAND RED
METZ SEED FARM
IDA, MI 48140
F 15 2810 LMS
99.70 % Net Wt. 2000/907.2 Lbs./Kg
00.28 % Germ. 90 %
00.01 % Seed Count 15481 lb.
VARIETY NOT STATED
ORIGIN - MI (USA)

FOUNDATION SEED

SUNBURST RED WHEAT
MCIA
Lansing MI 48909
F 15 2810 LMS
99.70 % Net Wt. 2000/907.2 Lbs./Kg
00.29 % Date 8/15
00.00 % Germ. 90 %
00.01 % Seed Count 11948 lb.
PVPA94 MAY BE SOLD ONLY
CLASS OF CERTIFIED SEED

MEMBER OF ASSOCIATION OF OFFICIAL SEED CERTIFYING AGENCIES
Example

**Red Devil**
- Target: 1.8 million
- 14,996 seeds/pound
- Calibrate drill to plant:
  \[1,800,000 \div 14,996 = 120.0 \div 90\%\]
  germ= 133 lbs/a

**Sunburst**
- Target: 1.8 million
- 11,948 seeds/pound
- Calibrate drill to plant:
  \[1,800,000 \div 11,948 = 150.7 \div 90\%\]
  germ= 167 lb/a
Fall Fertility

- Soil Test
  - pH
  - P
  - K
  - Mn in some areas
- Fall fertilizer
  - up to 25 lbs of actual N
  - P and K according to soil test
  - pH amendments as indicated by test
Weed Control

- Control all annuals and perennials prior to planting
- Optimum wheat stands may mean there’s no need for chemical control
- Apply chemicals at proper time at low rates
Nitrogen Recommendation

- MSU rec’d:
  - $N = (1.33 \times \text{yield potential}) - 13$

- if use 20 lbs in fall:
  - for 80 bu., need 73 lbs N
  - for 100 bu., need 100 lbs N

- If use little or no N in Fall, 1.1 lb N / bu of YP may be reasonable
Grain yield and head number in response to fertilizer N rate*
2008-2010

* represents an average response to fertilizer N across 3 years of trials, except Coral, which was derived from only 2 yrs of
Fungicides

- Reduces leaf disease & increases yield (always)
  - extent depends on weather, yield potential, & variety
- Reduced risk of Head scab
  - using Caramba or Prosaro at anthesis (flowering)
  - maybe Tebuconazole
Fungicide response depends on fungicide(s), application timing, & disease levels

Average yield response from fungicide use across five varieties, 2008-2010

- Headline
- Prosaro
- All treatments

Yield advantage (bu/ac)

2008
- T-2
- T-3
- T-

2009
- T-2
- T-3
- T-

2010
- T-2
- T-3
- T-
Head scab management trials

Dr. Marty Chilvers
Fusarium Head Blight (Scab)

- Angle nozzles forward or use Twin jet nozzles
- Maintain lower boom height
- Use coarse spray
- Should use minimum of 10-20 gpa water

Source: http://www.agriculture.gov.sk.ca/fusarium-head-blight
Head scab management trial

4 SWWW varieties:
- Ambassador - susceptible check
- DynaGro 9242W - partially resistant check
- F1014 (line from Dr. Olsen’s program)
- E6012 (line from Dr. Olsen’s program)

6 Prosaro fungicide timing treatments:
- Non-sprayed, non-inoculated check
- Inoculated, non-sprayed check
- Fungicide at flowering (Feekes 10.5.1)
- Fungicide 2 days post flowering
- Fungicide 4 days post flowering
- Fungicide 6 days post flowering

- Planted 10/17/2014
- 90 lbs N/A applied at green up
- 31.24 g of colonized sorghum applied on both 14 & 26 May 2015

Chilvers et al. 2016
Head Scab disease index (0-100)

Disease index (0-100)

- fung., - innoc
- fung., + innoc
Flowering
+ 2 days
+ 4 days
+ 6 days

Ambassador
9242W
F1014
E6012

Chilvers et al. 2016
DON (vomitoxin) (ppm)

<table>
<thead>
<tr>
<th>DON (ppm)</th>
<th>- fung., - innoc</th>
<th>- fung., + innoc</th>
<th>Flowering</th>
<th>+ 2 days</th>
<th>+ 4 days</th>
<th>+ 6 days</th>
<th>- fung., - innoc</th>
<th>- fung., + innoc</th>
<th>Flowering</th>
<th>+ 2 days</th>
<th>+ 4 days</th>
<th>+ 6 days</th>
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<th>+ 4 days</th>
<th>+ 6 days</th>
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<th>- fung., + innoc</th>
<th>Flowering</th>
<th>+ 2 days</th>
<th>+ 4 days</th>
<th>+ 6 days</th>
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<tr>
<td>Ambassador</td>
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<td>9242W</td>
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Chilvers et al. 2016
## Flag leaf disease (%)

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<th>9242W</th>
<th>F1014</th>
<th>E6012</th>
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</thead>
<tbody>
<tr>
<td>- fung., - innoc</td>
<td>67</td>
<td>53</td>
<td>25</td>
<td>43</td>
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<tr>
<td>- fung., + innoc</td>
<td>17</td>
<td>19</td>
<td>19</td>
<td>17</td>
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<tr>
<td>Flowering</td>
<td>10</td>
<td>10</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>+ 2 days</td>
<td>13</td>
<td>3</td>
<td>15</td>
<td>17</td>
</tr>
<tr>
<td>+ 4 days</td>
<td>10</td>
<td>1</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>+ 6 days</td>
<td>11</td>
<td>2</td>
<td>8</td>
<td>13</td>
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</tbody>
</table>

Chilvers et al. 2016
Yield (bu/A)

Chilvers et al. 2016

Yield (bu/A)

- fung., - innoc
- fung., + innoc
Flowering
+ 2 days
+ 4 days
+ 6 days

Ambassador
9242W
F1014
E6012

Extension
Fungicide profitability *depends on level of response*

<table>
<thead>
<tr>
<th>Wheat Price</th>
<th>$5.00</th>
<th>$5.00</th>
<th>$5.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response (bu/a)</td>
<td>4 bu</td>
<td>7 bu</td>
<td>10 bu</td>
</tr>
<tr>
<td>Net Income</td>
<td>$20.00</td>
<td>$35.00</td>
<td>$50.00</td>
</tr>
<tr>
<td>Prosaro/Caramba</td>
<td>$15.00</td>
<td>$15.00</td>
<td>$15.00</td>
</tr>
<tr>
<td>NIS</td>
<td>$0.50</td>
<td>$0.50</td>
<td>$0.50</td>
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<tr>
<td>Application</td>
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<td>$7.00</td>
<td>$7.00</td>
</tr>
<tr>
<td>Total Cost</td>
<td>$22.50</td>
<td>$22.50</td>
<td>$22.50</td>
</tr>
<tr>
<td>Net Profit</td>
<td>-$2.50</td>
<td>$12.50</td>
<td>$27.50</td>
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</table>
Fungicide profitability depends on grain price

<table>
<thead>
<tr>
<th>Wheat Price</th>
<th>$5.00</th>
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<tbody>
<tr>
<td>Response:</td>
<td>5 bu</td>
<td>5 bu</td>
<td>5 bu</td>
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<tr>
<td>Net Income</td>
<td>$25.00</td>
<td>$30.00</td>
<td>$35.00</td>
</tr>
<tr>
<td>Prosaro/Caramba</td>
<td>$15.00</td>
<td>$15.00</td>
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<tr>
<td>Application</td>
<td>$7.00</td>
<td>$7.00</td>
<td>$7.00</td>
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<tr>
<td>Total Cost</td>
<td>$22.50</td>
<td>$22.50</td>
<td>$22.50</td>
</tr>
<tr>
<td>Net Profit</td>
<td>$2.25</td>
<td>$7.50</td>
<td>$12.50</td>
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</tbody>
</table>
Fungicide profitability **depends on traffic loss**

<table>
<thead>
<tr>
<th></th>
<th>Wheat Price</th>
<th>Response (bu/a)</th>
<th>Net Income</th>
<th>Prosaro/Caramba</th>
<th>NIS</th>
<th>Application</th>
<th>Total Cost</th>
<th>Net Profit</th>
<th>Traffic loss (1.5 bu/a)</th>
<th>Net after traffic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$5.00</td>
<td>4</td>
<td>$20.00</td>
<td>$15.00</td>
<td>$0.50</td>
<td>$7.00</td>
<td>$22.50</td>
<td>-$2.50</td>
<td>$7.50</td>
<td>-$10.00</td>
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<td>$12.50</td>
<td>$7.50</td>
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<td>10</td>
<td>$50.00</td>
<td>$15.00</td>
<td>$0.50</td>
<td>$7.00</td>
<td>$22.50</td>
<td>$27.50</td>
<td>$7.50</td>
<td>$20.00</td>
</tr>
</tbody>
</table>
## Efficacy of fungicides

- **No strobilurin** – can increase DON

<table>
<thead>
<tr>
<th>Active ingredient</th>
<th>Product</th>
<th>Rate/A (fl. oz)</th>
<th>Powdery mildew</th>
<th>Leaf/ glume blotch</th>
<th>Septoria leaf spot</th>
<th>Stripe rust</th>
<th>Leaf rust</th>
<th>Stem rust</th>
<th>Heads scab</th>
<th>Harvest Restrict.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metconazole 8.6%</td>
<td>Caramba 0.75 SL</td>
<td>10.0 - 17.0</td>
<td>VG¹</td>
<td>VG</td>
<td>VG</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>G</td>
<td>30 days</td>
</tr>
<tr>
<td>Prothioconazole 41%</td>
<td>Proline 480 SC</td>
<td>5.0 - 5.7</td>
<td>--²</td>
<td>VG</td>
<td>VG</td>
<td>VG</td>
<td>VG</td>
<td>VG</td>
<td>G</td>
<td>30 days</td>
</tr>
<tr>
<td>Tebuconazole 38.7%</td>
<td>various³</td>
<td>4.0</td>
<td>G</td>
<td>VG</td>
<td>VG</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>F</td>
<td>30 days</td>
</tr>
<tr>
<td>Prothioconazole 9% plus Tebuconazole 19%</td>
<td>Prosaro 421 SC</td>
<td>6.5 - 8.2</td>
<td>G</td>
<td>VG</td>
<td>VG</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>G</td>
<td>30 days</td>
</tr>
</tbody>
</table>

(source: North Central Region Committee NC)
2015 Trial:

Response to increasing inputs on selected wheat varieties

A trial conducted in concert with MCIA
Response to increasing inputs - Deckerville, 2015

ave of 5 varieties

- base: 101
- base + Prosaro: 108
- base + Prosaro + 45#N: 116
- base + Prosaro + 45#N + Palisade: 117
Response to increasing inputs - Deckerville, 2015

- ave of 5 varieties
- 4 to 10
- 6 to 11
- - 5 to 6

base
base + Prosaro
base + Prosaro + 45#N
base + Prosaro + 45#N + Palisade

101
108
116
117

Response to increasing inputs - Kingston, 2015

- base 110
- base + Prosaro
- base + Prosaro + 40#N
- base + Prosaro + 40#N + Palisade

107
115
123
121

Response of increasing input - Monroe, 2015

- base 130
- base + Prosaro
- base + Prosaro + 50#N
- base + Prosaro + 50#N + Palisade

76
80
85
89

Response to increasing inputs - Hillman, 2015

- base 80
- base + Prosaro
- base + Prosaro + 30#N

74
78
84
Cost of Production

- Poll 2
Cost of Production

Variable cash
- Seed, fertilizer, chemicals, trucking, drying, repairs, supplies, marketing, fuel, storage

Land Cost + Draw
- Rent, prop taxes, draw

Fixed cash
- Insurance, labor, interest

Other
- Depreciation, Return to capital & management
# Cost of Production

<table>
<thead>
<tr>
<th></th>
<th>Corn</th>
<th>Wheat</th>
<th>Soybean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield (bu/a)</td>
<td>190</td>
<td>90</td>
<td>60</td>
</tr>
<tr>
<td>Price ($/bu)</td>
<td>$3.25</td>
<td>$5.00</td>
<td>$8.50</td>
</tr>
<tr>
<td>Gov. Program ($/a)</td>
<td>$15.00</td>
<td>$15.00</td>
<td>$15.00</td>
</tr>
<tr>
<td>Income ($/a)</td>
<td>$632.50</td>
<td>$465.00</td>
<td>$525.00</td>
</tr>
<tr>
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</tr>
<tr>
<td>Var. Cash ($/a)</td>
<td>$427.32</td>
<td>$214.44</td>
<td>$240.97</td>
</tr>
<tr>
<td>Land Cost + Draw ($/a)</td>
<td>$175.00</td>
<td>$175.00</td>
<td>$175.00</td>
</tr>
<tr>
<td>Fixed Cash ($/a)</td>
<td>$40.37</td>
<td>$23.72</td>
<td>$24.30</td>
</tr>
<tr>
<td>Depr./return to mngmt</td>
<td>$47.00</td>
<td>$47.00</td>
<td>$47.00</td>
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<tr>
<td>Total Expense ($/a)</td>
<td>$689.69</td>
<td>$460.16</td>
<td>$487.27</td>
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## Cost of Production

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<td>Total Expense ($/a)</td>
<td>$689.69</td>
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<td>Return per acre</td>
<td>-$57.19</td>
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<td>207</td>
<td>89</td>
<td>56</td>
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<td>Breakeven price</td>
<td>$3.63</td>
<td>$5.11</td>
<td>$8.12</td>
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Cost of Production

- What about different management?
- Lower productivity
- Lower land rent
- Two scenarios:
  - 75 bu yield/$90 rent
  - 120 bu yield/$225 rent

- Variables changed
  - Nitrogen
  - Phosphorus
  - Potash
  - Fungicide
  - Fuel & Lube
  - Marketing
  - Trucking
  - Rent
## Cost of Production

<table>
<thead>
<tr>
<th>Item</th>
<th>Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>$42.00</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>$27.50</td>
</tr>
<tr>
<td>Potash</td>
<td>$17.00</td>
</tr>
<tr>
<td>Fungicide</td>
<td>$22.50</td>
</tr>
<tr>
<td>Fuel &amp; Lube</td>
<td>$6.06</td>
</tr>
<tr>
<td>Marketing ($0.05/bu)</td>
<td>$4.50</td>
</tr>
<tr>
<td>Trucking ($0.15/bu)</td>
<td>$11.48</td>
</tr>
<tr>
<td>Rent</td>
<td>$150.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$281.04</strong></td>
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## Cost of Production

<table>
<thead>
<tr>
<th>Item</th>
<th>Base</th>
<th>75 bu/a</th>
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<td>Nitrogen</td>
<td>$42.00</td>
<td>$31.50</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>$27.50</td>
<td>$22.50</td>
</tr>
<tr>
<td>Potash</td>
<td>$17.00</td>
<td>$15.30</td>
</tr>
<tr>
<td>Fungicide</td>
<td>$22.50</td>
<td>$22.50</td>
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<tr>
<td>Fuel &amp; Lube</td>
<td>$6.06</td>
<td>$5.03</td>
</tr>
<tr>
<td>Marketing ($0.05/bu)</td>
<td>$4.50</td>
<td>$3.75</td>
</tr>
<tr>
<td>Trucking ($0.15/bu)</td>
<td>$11.48</td>
<td>$9.56</td>
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<tr>
<td>Rent</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>$281.04</strong></td>
<td><strong>$200.14</strong></td>
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## Cost of Production

<table>
<thead>
<tr>
<th></th>
<th>Base</th>
<th>75 bu/a</th>
<th>120 bu/a</th>
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</thead>
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<tr>
<td>Nitrogen</td>
<td>$42.00</td>
<td>$31.50</td>
<td>$63.00</td>
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<tr>
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<td>$27.50</td>
<td>$22.50</td>
<td>$35.00</td>
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<tr>
<td>Potash</td>
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<td>$20.40</td>
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<td>Fuel &amp; Lube</td>
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<tr>
<td>Marketing ($0.05/bu)</td>
<td>$4.50</td>
<td>$3.75</td>
<td>$6.00</td>
</tr>
<tr>
<td>Trucking ($0.15/bu)</td>
<td>$11.48</td>
<td>$9.56</td>
<td>$15.30</td>
</tr>
<tr>
<td>Rent</td>
<td>$150.00</td>
<td>$90.00</td>
<td>$225.00</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>$281.04</strong></td>
<td><strong>$200.14</strong></td>
<td><strong>$417.75</strong></td>
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## Cost of Production

<table>
<thead>
<tr>
<th></th>
<th>Base</th>
<th>75 bu/a</th>
<th>120 bu/a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield (bu/a)</td>
<td>90</td>
<td>75</td>
<td>120</td>
</tr>
<tr>
<td>Price ($/bu)</td>
<td>$5.00</td>
<td>$4.85</td>
<td>$4.85</td>
</tr>
<tr>
<td>Gov. Program ($/a)</td>
<td>$15.00</td>
<td>$15.00</td>
<td>$15.00</td>
</tr>
<tr>
<td>Income ($/a)</td>
<td>$465.00</td>
<td>$378.75</td>
<td>$597.00</td>
</tr>
</tbody>
</table>
**Cost of Production**

<table>
<thead>
<tr>
<th></th>
<th>Base</th>
<th>75 bu/a</th>
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</tr>
<tr>
<td><strong>Income ($/a)</strong></td>
<td>$465.00</td>
<td>$378.75</td>
<td>$597.00</td>
</tr>
<tr>
<td><strong>Var. Cash ($/a)</strong></td>
<td>$214.44</td>
<td>$193.57</td>
<td>$276.18</td>
</tr>
<tr>
<td><strong>Land Cost + Draw ($/a)</strong></td>
<td>$175.00</td>
<td>$115.00</td>
<td>$250.00</td>
</tr>
<tr>
<td><strong>Fixed Cash ($/a)</strong></td>
<td>$23.72</td>
<td>$21.93</td>
<td>$26.06</td>
</tr>
<tr>
<td><strong>Depr./return to mngmt</strong></td>
<td>$47.00</td>
<td>$47.00</td>
<td>$47.00</td>
</tr>
<tr>
<td><strong>Total Expense ($/a)</strong></td>
<td>$460.16</td>
<td>$377.50</td>
<td>$599.24</td>
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# Cost of Production

<table>
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<th></th>
<th>Base</th>
<th>75 bu/a</th>
<th>120 bu/a</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Yield (bu/a)</strong></td>
<td>90</td>
<td>75</td>
<td>120</td>
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<tr>
<td><strong>Price ($/bu)</strong></td>
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<tr>
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<td>$460.16</td>
<td>$377.50</td>
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<td><strong>Return per acre</strong></td>
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<td><strong>$5.11</strong></td>
<td><strong>$5.03</strong></td>
<td><strong>$4.99</strong></td>
</tr>
</tbody>
</table>
Poll 3
Questions? Discussion?

Dennis Pennington
pennin34@msu.edu