Overview

❖ 2021 Field Research Results
   • 15 studies completed and harvested
   • Discuss several today

❖ Soil Fertility & Nutrient mgmt. program
   • Results will be on website soil.msu.edu
   • Other wheat extension activities
     ❖ Field Day Location?

❖ 2022 Proposed Field Research
2021 Plot Specifics

 Görn-up Applications: March 23 (red) March 30 (white)
 Görnkes 5: April 12 (red) – April 14 (white)
 Görnkes 9: May 20 (red) – May 21 (white)
 Harvest Lansing, MI: July 14
 Harvest Richville, MI: July 14
Lansing, MI


1.80 March, 1.5 April, 1.00 May, 8.0 June, 2.1 July
Precipitation Totals Lansing, MI

- **March**: 1.8 in (2021 Data), 1.8 in (30 Year Average)
- **April**: 1.5 in (2021 Data), 2.9 in (30 Year Average)
- **May**: 1.0 in (2021 Data), 3.3 in (30 Year Average)
- **June**: 8.0 in (2021 Data), 3.5 in (30 Year Average)
- **July**: 2.1 in (2021 Data), 3.3 in (30 Year Average)
Richville, MI

8.6 in. March 1 – Aug 1

0.0 0.5 1.0 1.5 2.0

Precipitation (in.)

3/1/21 4/1/21 5/1/21 6/1/21 7/1/21

1.3 March, 0.7 April, 1.2 May, 4.5 June, 0.9 July
Precipitation Totals Richville, MI

Month | Rainfall Total (in) | 2021 Data | 30 Year Average
--- | --- | --- | ---
March | 1.3 | 1.2 | 1.2
April | 2.1 | 2.9 | 2.9
May | 0.7 | 1.2 | 1.2
June | 3.4 | 4.5 | 4.5
July | 0.9 | 3.0 | 3.0

*March April May June July*
Identify One Thing To Do in Autumn Study – SRWW and SWWW

Field-Day focused study

- Let’s get some field day interaction!!
- Provide soil test
  - Does PD impact what we do in the autumn or soil test?
- Provide 8 management practices to do in autumn
- 2021 SRWW – 8 practices and 2 planting dates
- 2021 SWWW – 8 practices and single planting date

SRWW - 2 PDs
- Sept 21 and Oct 15

SWWW – 1 PD
- Sept 24
8 Practices to Choose From

- Plant and do nothing
- 25 lbs N
- 65 lbs P2O5 and 15 N (P = Crop removal)
- 25 lbs S
- 50 lbs K2O (K = crop removal)
- Starter MESZ (30N, 100P, 25S, 2.5 Zn)
- Spring N only (No fall treatments)
- Starter S and K (87K, 25S)

- ALL 100 N at GU
Feekes 9 Early Plant
### Identify One Thing To Do in Autumn Study – SRWW – Early Plant

(ALL 100 N at GU)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Early Plant</th>
<th>Late Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant and Nothing</td>
<td>39.2 e</td>
<td>42.6 e</td>
</tr>
<tr>
<td>25 N Autumn</td>
<td>89.2 ab</td>
<td>74.3 d</td>
</tr>
<tr>
<td>65 P2O5, 15 N</td>
<td>89.1 ab</td>
<td>69.2 d</td>
</tr>
<tr>
<td>25 S</td>
<td>82.8 bc</td>
<td>69.2 d</td>
</tr>
<tr>
<td>50 K2O</td>
<td>75.0 cd</td>
<td>71.5 d</td>
</tr>
<tr>
<td>30 N, 100P, 25 S, 2.5 Zn</td>
<td>95.9 a</td>
<td>72.2 d</td>
</tr>
<tr>
<td>Spring N Only</td>
<td>87.9 b</td>
<td>67.6 d</td>
</tr>
<tr>
<td>87 K, 25 S</td>
<td>88.6 ab</td>
<td>73.7 d</td>
</tr>
<tr>
<td>P&gt;F (&lt; 0.01)</td>
<td></td>
<td>LSD (0.05) = 7.8</td>
</tr>
</tbody>
</table>
Identify One Thing To Do in Autumn
Study – SWWW

(ALL 130 N at GU)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Grain Yield (bu A(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant and Nothing</td>
<td>55.4 d</td>
</tr>
<tr>
<td>25 N Autumn</td>
<td>85.8 bc</td>
</tr>
<tr>
<td>65 P(_2)O(_5), 15 N</td>
<td>110.4 a</td>
</tr>
<tr>
<td>25 S</td>
<td>97.4 ab</td>
</tr>
<tr>
<td>50 K(_2)O</td>
<td>84.3 bc</td>
</tr>
<tr>
<td>30 N, 100P, 25 S, 2.5 Zn</td>
<td>110.4 a</td>
</tr>
<tr>
<td>Spring N Only</td>
<td>80.5 c</td>
</tr>
<tr>
<td>87 K, 25 S</td>
<td>100.6 a</td>
</tr>
<tr>
<td>P&gt;F</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>
Variety x Intensive Mgmt.

- SRWW
  - Jonah, W304, and AgriMaxx
- SWWW
  - Whitetail, Jupiter, and Dyna Gro9362W
- Base N (90 red and 130 white)
- Base N with late N (40 N F7)
- Autumn Starter with base N (250 MESZ)
- Check
Variety x Intensive Mgmt.

SRWW

No differences among varieties

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Grain Yield (bu A⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base N only</td>
<td>83.6 b</td>
</tr>
<tr>
<td>Base N with 40 N late</td>
<td>86.7 b</td>
</tr>
<tr>
<td>Autumn Starter with Base N</td>
<td>93.7 a</td>
</tr>
<tr>
<td>Check</td>
<td>48.0 c</td>
</tr>
<tr>
<td>P&gt;F</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>
Variety x Intensive Mgmt.

SWWW

No differences among varieties

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Grain Yield (bu A⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base N only</td>
<td>101.1 b</td>
</tr>
<tr>
<td>Base N with 40 N late</td>
<td>103.8 b</td>
</tr>
<tr>
<td>Autumn Starter with Base N</td>
<td>114.8 a</td>
</tr>
<tr>
<td>Check</td>
<td>53.2 c</td>
</tr>
<tr>
<td>P&gt;F</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>
Other Studies Not Presenting Today

- Results soon posted on soil.msu.edu
- Chlormequat chloride and Palisade combinations and timings on soft red wheat
- (2) Intensive nutrient management with fall and spring application
- Winter wheat N response and management
- Starter gradient study with PGR
Start Right to Finish Well: Nutrient Management for Winter Wheat Grain AND Straw Production

Lacie Thomas (M.S. student)
Study Objectives

Evaluate wheat grain and straw yield response to 12-40-0 10S 1Zn autumn starter and spring N rates

Evaluate wheat grain and straw yield response to short and tall varietal stature
  - Can starter further or better influence production than N?
  - Reduce N? Tall vs short varieties

Determine the economic optimum of autumn and spring nutrient applications for both grain and straw production
Lansing, MI
- Planted
  - September 22, 2020
- Variety
  - Flipper (Short Statured SRW)
  - Red Dragon (Tall Statured SRW)

Richville, MI
- Planted
  - September 24, 2020
- Variety
  - Jupiter (Short Statured SWW)
  - AC Mountain (Tall Statured SWW)
Measurables Collected

- Spring Tiller Counts (1ft²)
- Canopeo App: 10-14 days
- Greenseeker NDVI (F5,F7,F9)
- Flag leaf samples: nutritional concentration, 40pp
- Plant Heights: 10pp
- Head Counts: (1ft²)
- Peduncle Lengths: 10pp
- Straw Nutrient Analysis
- NIR Grain Analysis
# Grain and Straw Production in Winter Wheat as Affected by Autumn Starter and Spring Nitrogen

## Fertilizer Rates: Soft Red Winter Wheat

<table>
<thead>
<tr>
<th>Autumn Starter: 12-40-0 10S 1Zn</th>
<th>28% Nitrogen</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Starter Fertilizer</td>
<td>Low Spring N</td>
</tr>
<tr>
<td>Low Autumn Starter</td>
<td>Base Spring N</td>
</tr>
<tr>
<td>High Autumn Starter</td>
<td>High Spring N</td>
</tr>
</tbody>
</table>
# Grain and Straw Production in Winter Wheat as Affected by Autumn Starter and Spring Nitrogen

## Fertilizer Rates: Soft White Winter Wheat

<table>
<thead>
<tr>
<th>Autumn Starter: 12-40-0 10S 1Zn</th>
<th>28% Nitrogen</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Starter Fertilizer</td>
<td>0 lb/A</td>
</tr>
<tr>
<td>Low Autumn Starter</td>
<td>125 lb/A</td>
</tr>
<tr>
<td>High Autumn Starter</td>
<td>250 lb/A</td>
</tr>
</tbody>
</table>
2021 Soft Red Winter Wheat
Michigan State University Campus Farm
2021 Soft White Winter Wheat
Michigan State University
Saginaw Valley Research & Extension Center
# Spring Nitrate (NO$_3^-$) Conc. as Affected by Autumn-Applied Starter

## Treatment Results

<table>
<thead>
<tr>
<th>Treatment</th>
<th>East Lansing, MI</th>
<th>Richville, MI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>‘Flipper’</td>
<td>‘Red Dragon’</td>
</tr>
<tr>
<td>No Starter</td>
<td>1.28</td>
<td>1.38</td>
</tr>
<tr>
<td>Low Starter</td>
<td>1.24</td>
<td>1.20</td>
</tr>
<tr>
<td>High Starter</td>
<td>1.34</td>
<td>1.38</td>
</tr>
</tbody>
</table>

*Pr > F*  
NS  
NS  
NS  
NS

| Check      | 1.25 | 1.61 | 2.1  | 1.16 |

---

*NO$_3^-$ ppm*
Flipper SRWW Grain Yield as Affected by Starter Fertilizer (bu A⁻¹)

Yield (bu A⁻¹)

<table>
<thead>
<tr>
<th></th>
<th>Low N</th>
<th>Base N</th>
<th>High N</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Starter</td>
<td>90.6 ef</td>
<td>98.3 ed</td>
<td>88.6 f</td>
</tr>
<tr>
<td>Low Starter</td>
<td>106.7 bcd</td>
<td>104.0 cd</td>
<td>113.8 ab</td>
</tr>
<tr>
<td>High Starter</td>
<td>111.1 abc</td>
<td>105.6 bcd</td>
<td>118.0 a</td>
</tr>
</tbody>
</table>

P = 0.04

MESZ Rate (lb A⁻¹)  Check: 43.7
Flipper SRWW Straw Yield as Affected by Starter Fertilizer (T A⁻¹)

Yield (T A⁻¹)

<table>
<thead>
<tr>
<th></th>
<th>Low N</th>
<th>Base N</th>
<th>High N</th>
<th>Low N</th>
<th>Base N</th>
<th>High N</th>
<th>Low N</th>
<th>Base N</th>
<th>High N</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Starter</td>
<td>1.07  c</td>
<td>1.38 bc</td>
<td>1.36 bc</td>
<td>1.48 bc</td>
<td>1.66 ab</td>
<td>1.54 ab</td>
<td>1.96 a</td>
<td>1.52 b</td>
<td>2.00 a</td>
</tr>
</tbody>
</table>

P = 0.04

MESZ Rate (lb A⁻¹)

Check: 0.53
Flipper SRWW Tiller Count as Affected by Autumn Fertilizer (ft⁻²)

<table>
<thead>
<tr>
<th>Tillers (ft⁻²)</th>
<th>No Starter</th>
<th>Low Starter</th>
<th>High Starter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>162</td>
<td>165</td>
<td>171</td>
</tr>
</tbody>
</table>

MESZ Rate (lb A⁻¹)

\( P = 0.79 \)

Check: 160.8
Red Dragon SWWW Grain Yield as Affected by Autumn Fertilizer (bu A⁻¹)

MESZ Rate (lb A⁻¹)

<table>
<thead>
<tr>
<th>No Starter</th>
<th>Low Starter</th>
<th>High Starter</th>
</tr>
</thead>
<tbody>
<tr>
<td>71.4 b</td>
<td>88.6 a</td>
<td>92.3 a</td>
</tr>
</tbody>
</table>

P < 0.01

Check: 40.8
Red Dragon SWWW Grain Yield as Affected by Spring Nitrogen (bu A\(^{-1}\))

- **Low N**: 64.9 b
- **Base N**: 92.4 a
- **High N**: 94.9 a

*Check: 40.8*

\[P < 0.01\]
Red Dragon SRWW Straw Yield as Affected by Autumn Fertilizer (T A\textsuperscript{-1})

Yield (T A\textsuperscript{-1})

No Starter: 1.07 b
Low Starter: 1.41 a
High Starter: 1.53 a

MESZ Rate (lb A\textsuperscript{-1})

P < 0.01

Check: 0.58
Red Dragon SRWW Straw Yield as Affected by Spring Nitrogen (T A⁻¹)

Nitrogen Rate (lb A⁻¹)

<table>
<thead>
<tr>
<th>Nitrogen Rate</th>
<th>Yield (T A⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low N</td>
<td>1.00 b</td>
</tr>
<tr>
<td>Base N</td>
<td>1.48 a</td>
</tr>
<tr>
<td>High N</td>
<td>1.53 a</td>
</tr>
</tbody>
</table>

P < 0.01

Check: 0.58
Red Dragon SRWW Tiller Count as Affected by Autumn Fertilizer (ft⁻²)

- **No Starter**: 156 b
- **Low Starter**: 165 b
- **High Starter**: 228 a

**MESZ Rate (lb A⁻¹)**

- **P = 0.03**

**Check**: 120.5
Low Spring Nitrogen (50 lb/A)
SRWW – Red Dragon

No Autumn Starter

Low Autumn Starter (125 lb/A)

High Autumn Starter (250 lb/A)
Base Spring Nitrogen (100 lb/A)
SRWW – Red Dragon

No Autumn Starter  Low Autumn Starter (125 lb/A)  High Autumn Starter (250 lb/A)
High Spring Nitrogen (150 lb/A)  
SRWW – Red Dragon

No Autumn Starter  
Low Autumn Starter (125 lb/A)  
High Autumn Starter (250 lb/A)
Low Spring Nitrogen (60 lb/A)

SWWW – AC Mountain

No Autumn Starter

Low Autumn Starter
(125 lb/A)

High Autumn Starter
(250 lb/A)
Base Spring Nitrogen (120 lb/A)

SWWW – AC Mountain

No Autumn Starter

Low Autumn Starter
(125 lb/A)

High Autumn Starter
(250 lb/A)
High Spring Nitrogen (180 lb/A)

SWWW – AC Mountain

No Autumn Starter

Low Autumn Starter (125 lb/A)

High Autumn Starter (250 lb/A)
Jupiter SWWW Grain Yield as Affected by Autumn Fertilizer (bu A\(^{-1}\))

<table>
<thead>
<tr>
<th>MESZ Rate (lb A(^{-1}))</th>
<th>No Starter</th>
<th>Low Starter</th>
<th>High Starter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>83.9 b</td>
<td>103.7 a</td>
<td>108.2 a</td>
</tr>
</tbody>
</table>

Yield (bu A\(^{-1}\))

P < 0.01

Check: 52.3
Jupiter SWWW Grain Yield as Affected by Spring Nitrogen (bu A⁻¹)

- Low N: 89.8 c
- Base N: 101.3 b
- High N: 104.6 a

P < 0.01

Check: 52.3
Jupiter SWWW Straw Yield as Affected by Autumn Fertilizer (T A⁻¹)

- No Starter: 0.88 b
- Low Starter: 1.21 a
- High Starter: 1.22 a

MESZ Rate (lb A⁻¹)

P < 0.01

Check: 0.58
Jupiter SWWW Straw Yield as Affected by Spring Nitrogen ($T \text{ A}^{-1}$)

P < 0.01

Check: 0.58
Jupiter SWWW Tiller Count as Affected by Autumn Fertilizer (ft⁻²)

- No Starter: 106 b
- Low Starter: 148 a
- High Starter: 158 a

Mesz Rate (lb A⁻¹)

P < 0.01

Check: 98.3
AC Mountain SRWW Grain Yield as Affected by Starter Fertilizer (bu A⁻¹)

<table>
<thead>
<tr>
<th>Starter</th>
<th>Yield (bu A⁻¹)</th>
<th>MESZ Rate (lb A⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Starter</td>
<td>80.5 e</td>
<td></td>
</tr>
<tr>
<td>Low N</td>
<td>96.6 c</td>
<td></td>
</tr>
<tr>
<td>High N</td>
<td>103.6 b</td>
<td></td>
</tr>
<tr>
<td>Low N</td>
<td>88.3 d</td>
<td></td>
</tr>
<tr>
<td>Base N</td>
<td>105.3 b</td>
<td></td>
</tr>
<tr>
<td>High N</td>
<td>106.7 b</td>
<td></td>
</tr>
<tr>
<td>Low N</td>
<td>93.0 dc</td>
<td></td>
</tr>
<tr>
<td>Base N</td>
<td>113.3 a</td>
<td></td>
</tr>
<tr>
<td>High N</td>
<td>105.5 b</td>
<td></td>
</tr>
</tbody>
</table>

P = 0.06  
Check: 48.0
AC Mountain SWWW Straw Yield as Affected by Autumn Fertilizer (T A⁻¹)

<table>
<thead>
<tr>
<th>MESZ Rate (lb A⁻¹)</th>
<th>Yield (T A⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Starter</td>
<td>1.34 b</td>
</tr>
<tr>
<td>Low Starter</td>
<td>1.50 a</td>
</tr>
<tr>
<td>High Starter</td>
<td>1.61 a</td>
</tr>
</tbody>
</table>

P = 0.03

Check: 0.80
AC Mountain SWWW Straw Yield as Affected by Spring Nitrogen (T A⁻¹)

Yield (T A⁻¹)

Low N: 1.29 b
Base N: 1.57 a
High N: 1.59 a

Nitrogen Rate (lb A⁻¹)

P < 0.01

Check: 0.80
AC Mountain SWWW Tiller Count as Affected by Autumn Fertilizer (ft⁻²)

P = 0.03  
Check: 136
# Plant Height as Affected by Autumn Starter & Spring N

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Flipper</th>
<th>Treatment</th>
<th>Red Dragon</th>
<th>Jupiter</th>
<th>AC Mountain</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Starter, Low N</td>
<td>67.75 c †</td>
<td>No Starter</td>
<td>77.93 b</td>
<td>63.88 b</td>
<td>74.19 b</td>
</tr>
<tr>
<td>No Starter, Base N</td>
<td>71.60 a</td>
<td>Low Starter</td>
<td>82.55 a</td>
<td>70.26 a</td>
<td>77.12 a</td>
</tr>
<tr>
<td>No Starter, High N</td>
<td>68.80 bc</td>
<td>High Starter</td>
<td>83.74 a</td>
<td>72.14 a</td>
<td>78.93 a</td>
</tr>
<tr>
<td>Low Starter, Low N</td>
<td>73.02 a</td>
<td>Pr &gt; F</td>
<td>=0.01</td>
<td>&lt; 0.01</td>
<td>=0.03</td>
</tr>
<tr>
<td>Low Starter, Base N</td>
<td>71.50 ab</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Starter, High N</td>
<td>72.63 a</td>
<td>Low N</td>
<td>77.20 b</td>
<td>67.29 b</td>
<td>75.57 b</td>
</tr>
<tr>
<td>High Starter, Low N</td>
<td>72.45 a</td>
<td>Base N</td>
<td>83.12 a</td>
<td>69.40 a</td>
<td>77.24 a</td>
</tr>
<tr>
<td>High Starter, Base N</td>
<td>71.15 ab</td>
<td>High N</td>
<td>83.90 a</td>
<td>69.59 a</td>
<td>77.43 a</td>
</tr>
<tr>
<td>High Starter, High N</td>
<td>71.57 ab</td>
<td>Pr &gt; F</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
<td>=0.01</td>
</tr>
<tr>
<td>Check‡</td>
<td>58.20</td>
<td>Check‡</td>
<td>63.08</td>
<td>60.38</td>
<td>61.50</td>
</tr>
</tbody>
</table>

*Pr > F* = 0.04

---

*Check‡* 58.20

---

*Pr > F* = 0.01

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*Check‡* 63.08 60.38 61.50
# Straw Nutrient Removal as Affected by Autumn Starter & Spring N – ‘Flipper’ SRWW

<table>
<thead>
<tr>
<th>Treatment</th>
<th>K₂O</th>
<th>Sulfur</th>
<th>Treatment</th>
<th>P₂O₅</th>
<th>Nitrogen</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lbs T⁻¹</td>
<td></td>
<td></td>
<td>lbs T⁻¹</td>
<td></td>
</tr>
<tr>
<td>Low Starter, Base N</td>
<td>20.59 cd†</td>
<td>0.70 ed</td>
<td>Low Starter</td>
<td>2.53 c</td>
<td>8.75 b</td>
</tr>
<tr>
<td>Low Starter, High N</td>
<td>23.25 b</td>
<td>0.80 cd</td>
<td>High Starter</td>
<td>3.03 b</td>
<td>9.25 b</td>
</tr>
<tr>
<td>Low Starter, Low N</td>
<td>21.23 cbd</td>
<td>0.80 cd</td>
<td>No Starter</td>
<td>4.41 a</td>
<td>10.06 a</td>
</tr>
<tr>
<td>High Starter, Base N</td>
<td>21.85 cb</td>
<td>0.90 cb</td>
<td>Pr &gt; F</td>
<td>&lt; 0.01</td>
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## Straw Nutrient Removal as Affected by Autumn Starter & Spring N – ‘Red Dragon’ SRWW

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<tr>
<th>Treatment</th>
<th>P$_2$O$_5$</th>
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<th>K$_2$O</th>
<th>Treatment</th>
<th>Sulfur</th>
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\[ Pr > F \]

- 0.09
- 0.07
- < 0.01

- 0.80
# Straw Nutrient Removal as Affected by Autumn Starter & Spring N – ‘Jupiter’ SWWW

<table>
<thead>
<tr>
<th>Treatment</th>
<th>P$_2$O$_5$</th>
<th>Nitrogen</th>
<th>K$_2$O</th>
<th>Sulfur</th>
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<table>
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<tr>
<th>Treatment</th>
<th>P$_2$O$_5$</th>
<th>Nitrogen</th>
<th>K$_2$O</th>
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# Straw Nutrient Removal as Affected by Autumn Starter & Spring N – ‘AC Mountain’ SWWWW

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<tbody>
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<td><strong>Pr &gt; F</strong></td>
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<td>Base N</td>
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<tr>
<td>High N</td>
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<td>Low N</td>
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<td>6.20 b</td>
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<td><strong>Pr &gt; F</strong></td>
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<td>4.03</td>
<td>6.85</td>
<td>20.10</td>
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</table>
Preliminary Conclusions – ‘Flipper’ SRWW

- **Grain Yield**
  - Low starter yielded equal or better than high starter

- **Straw Yield**
  - High starter + low N > no starter high N

- **Tiller Production**
  - NS

- **Plant Height**
  - Autumn starter, spring N interacted
  - Plant height increased with addition of autumn starter

- **Head Length**
  - Addition of autumn starter & spring N increased head length

- **Head Count**
  - Increased with addition of autumn starter
Preliminary Conclusions – ‘Red Dragon’ SRWW

- Grain & Straw Yield
  - Autumn starter increased grain yield 17-21 bu A⁻¹, respectively
  - Autumn starter increased straw yield 0.34-0.46 T A⁻¹, respectively

- Tiller Production
  - High autumn starter > low autumn starter

- Plant Height
  - Plant height increased with addition of autumn starter

- Head Length
  - Spring N increased head length

- Head Count
  - Increased with addition of autumn starter
Preliminary Conclusions – ‘Jupiter’ SWWW

Grain & Straw Yield
- Autumn starter increased grain yield 20-24 bu A\(^{-1}\), respectively
- Autumn starter increased straw yield 0.34 T A\(^{-1}\), respectively

Tiller Production
- No significant difference in low vs. high starter

Plant Height
- Plant height increased with addition of autumn starter

Head Length
- Addition of autumn starter & spring N increased head length

Head Count
- Increased with addition of autumn starter
Preliminary Conclusions – ‘AC Mountain’ SWWW

 Grain & Straw Yield

 S High starter + base N > no starter + high N
 S High N rate NS across all starter rates
 S Autumn starter increased straw yield → NSD between low & high rate

 Tiller Production

 S No significant difference in low vs. high starter

 Plant Height

 S Plant height increased with addition of autumn starter

 Head Length

 S Autumn starter increased head length
 S High spring N > Base spring N > Low spring N

 Head Count

 S Increased head production with high autumn starter
Summary

Autumn practices are NOT only tied to grain yield
- Straw production also influenced
- This factors into cost of starter and profit (in progress)

High spring N did not compensate for lack of autumn starter
- Varietal (stature) differences

Plant height increased with autumn starter across all varieties
- Direct impact on variety selection for straw production

Pre-plant soil test levels crucial to determining plant response
2022 Proposed Soil Fertility Wheat Research

Fertilizer, Fungicide, and Food: Improving Wheat Yield, Straw, and Quality

Up to Three Projects/Locations

Non-irrigated soft red, irrigated soft red, non-irrigated soft white

Collaboration between Marty Chilvers (Plant Path.) and myself (Soil Fertility)

Builds on results from BOTH programs from last 4-6 years

10-37 bu/A yield increases with starter when soil nitrate < 10 ppm

Increased grain AND straw with starter helps offset cost and improves profitability

Meta-analysis (in review) found:

10.5 bu/A increase with F5-7 app and F10.5.1 app

4 bu/A increase with F5-7 alone
Meta-analysis of 93 individual studies on difference in grain yield between fungicide treated and non-treated wheat
Meta-Analysis of yield response to fungicide

<table>
<thead>
<tr>
<th>Timing</th>
<th>Yield response bu/ac ($\bar{D}_t$)</th>
<th>Among-study variance $\sigma^2$</th>
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</thead>
<tbody>
<tr>
<td>T1</td>
<td>4.01 (A)</td>
<td>8.65</td>
</tr>
<tr>
<td>T2</td>
<td>6.93 (B)</td>
<td>37.16</td>
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<td>T3</td>
<td>7.41 (B)</td>
<td>40.79</td>
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<td>T3_L</td>
<td>6.65 (B)</td>
<td>31.72</td>
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<tr>
<td>T1_T3</td>
<td>10.53 (C)</td>
<td>60.76</td>
</tr>
<tr>
<td>T2_T3</td>
<td>9.48 (CB)</td>
<td>64.14</td>
</tr>
</tbody>
</table>

- On average, all application timings provided significant yield benefit.
- T1 provided the least benefit.
- Combination treatments provided highest benefit on average, but also largest variance.
2022 Proposed Soil Fertility Wheat Research

Fertilizer, Fungicide, and Food: Improving Wheat Yield, Straw, and Quality

Treatments to include:

- 2 starter fertilizer rates (0 and 250 lb./A (12-40-0-10))
- 5 fungicide application timings
  - None
  - F5-7 and F10.5.1
  - F10.5.1 individually
  - F9 and F10.5.1
  - F5-7 plus F9 plus F10.5.1
- 2 late season applied N rates (0 and 40 lb N/A)

- 3 separate environments
2022 Proposed Soil Fertility Wheat Research

Fertilizer, Fungicide, and Food: Improving Wheat Yield, Straw, and Quality

Treatments to include:

- 2 starter fertilizer rates (0 and 250 lb./A (12-40-0-10))
- 5 fungicide application timings
  - None
  - F5-7 and F10.5.1
  - F10.5.1 individually
  - F9 and F10.5.1
  - F5-7 plus F9 plus F10.5.1
- 2 late season applied N rates (0 and 40 lb N/A)

3 separate environments
2022 Proposed Soil Fertility Wheat Research

Fertilizer, Fungicide, and Food: Improving Wheat Yield, Straw, and Quality

**Objective:** Determine whether starter fertilizer, multiple fungicide application timings, and late-applied N influence wheat grain yield, straw production, and grain quality.

**Hypothesis:** autumn-applied starter fertilizer with low soil nitrate levels will influence fungicide application timings which in turn may affect response to late-season N and affect wheat grain yield, straw production, and quality (protein, nutritive value).

The overall plant growth response may also be able to address climate variability related production issues.
2022 Proposed Soil Fertility Wheat Research

Fertilizer, Fungicide, and Food: Improving Wheat Yield, Straw, and Quality

MWP Priorities Addressed in proposal:

- Improve the efficiency and management of N fertilizer
- Identify plant nutrients limiting grain yields
- Identify difference in varietal responses to agronomic inputs
- Develop network of cooperators for on-farm research
- Identify varieties and practices advantageous to growers with marginal soils
- Evaluate the efficacy of fungicides, herbicides, and insecticides
- Develop management strategies to mitigate losses due to pests
- Evaluate the interaction of pesticides, varieties, and agronomic practices
- Develop strategies to manage FHB to ensure a quality product for end users

Matching funds match MWP request
2022 Proposed Soil Fertility Wheat Research

Other Proposed Work:

- Interactions Between Nutrient Management Strategies Across Varieties on Red and White Winter Wheat
- Identifying One Management Practice to Initiate in Autumn
- Balancing Cost and Profitability within Starter Fertilizer Programs
- On-Farm PGR Integration into Winter Wheat Management Systems
Thank you!
Michigan State University
Soil Fertility & Nutrient Management Research

For more information
soil.msu.edu