BMPs of Winter Wheat Production in Eastern Nebraska

USDA Crop Reporting Districts

Nathan Mueller Ph.D. CCA
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Introduction

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Acct. Region: Saline, Jefferson, & Gage counties
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Best Management Practice (BMPs) of Winter Wheat Production in Eastern Nebraska

<table>
<thead>
<tr>
<th>Rank</th>
<th>Management Factor</th>
<th>Yield Difference (bu/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Variety Selection</td>
<td>10 - 20</td>
</tr>
<tr>
<td>2</td>
<td>Foliar Fungicide</td>
<td>10 - 16</td>
</tr>
<tr>
<td>3</td>
<td>Row Spacing, 15 vs 7.5”</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>Planting Date (2 wks)</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Seeding Rate</td>
<td>5</td>
</tr>
</tbody>
</table>

Yields difference not all additive due to interactions
Topics

- Winter wheat management
  - Variety Selection
  - Diseases
  - Planting dates and rates
  - Nutrient management

- Yields, economics and weather risks

- Soil health aspect
Wheat Production Regions
Native Vegetation

Hwy 14
Soil Moisture Regime – USDA-NRCS and K-State Research Analysis

97 degrees west longitude
Online Resources
Winter Wheat Cafe

Crop Tech Cafe
Know your crop, know your tech, know your bottom line...feeding you agronomic information for your farm in southeast Nebraska

Winter Wheat Cafe for East and South Central Nebraska

2020 Winter Wheat Variety Trial near Fairbury in Jefferson County

Positioning your farm to manage manure, control tough weeds, and improve soil health are just some of the advantages to growing winter wheat in east and south central Nebraska.

What’s on this page?

View at croptechcafe.org/winterwheat
Eastern Nebraska Wheat Email Group

- 194 current members
- Weekly Email Update: What’s Up This Wheat?
- Opportunity for members to email others with questions
- Opportunity to be aware of upcoming Extension events related to wheat

Sign up at croptechcafe.org/winterwheat
Variety Selection
Variety Selection is Critical

<table>
<thead>
<tr>
<th>Variety</th>
<th>3-year yield average (bu/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WB4303</td>
<td>91</td>
</tr>
<tr>
<td>Freeman</td>
<td>81</td>
</tr>
</tbody>
</table>

UNL Variety Trial Test Results  
[http://cropwatch.unl.edu/winter-wheat-variety-test-results](http://cropwatch.unl.edu/winter-wheat-variety-test-results)

Colorado Wheat Variety Database  
2021 Variety Testing Locations – East and South Central Nebraska

Average yield of top-yielding variety from 2002-2020

- **East**
  - Saunders
    - Tomek silt loam
    - Tilled after oats
  - Lancaster
    - Crete & Aksarben silty clay loam
    - Tilled after oats

- **South Central**
  - Jefferson
    - Crete silt loam
    - No-till after soybeans
  - Clay
    - Crete silt loam
    - Tilled after soybeans
  - Gosper
    - Holdrege silt loam
    - No-till after soybeans
Example: Zenda – Kansas Wheat Alliance Released 2016

Placement
• Southeast & south central NE

Highlights
• Great yield performance record in UNL 3-yr trials
• Moderate resistance to Fusarium Head Blight
• Excellent test weight

Management Suggestions
• Replacement for Everest
• Average drought tolerance

View at croptechcafe.org/winterwheat
Disease Management: FHB, Leaf and Stripe Rust
Fusarium Head Blight (Scab)

• Disease
  • Caused by fungus *Fusarium graminearum & boothii*
  • Reported in NE since 1898
  • Survives on residue, in soil
  • Rainfall/humidity during flowering
  • Vomitoxin (DON)

• Management
  • Crop rotation (C-S-A)
  • Variety selection for resistance
  • Disease risk mapping
  • Scouting
  • Foliar fungicide at early flowering
Wheat Development and Growth

**VISUAL GUIDE**

Winter Wheat

DEVELOPMENT AND GROWTH STAGING

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**Feekes scale**

for cereal growth stages

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>One shoot, first leaf through coleoptile</td>
</tr>
<tr>
<td>2</td>
<td>Tillering begins; main shoot and one tiller</td>
</tr>
<tr>
<td>3</td>
<td>Tillers formed; leaves often twisted. In some varieties, plant may be prostrate in appearance</td>
</tr>
<tr>
<td>4</td>
<td>Leaf sheaths lengthen; beginning pseudostem erection</td>
</tr>
<tr>
<td>5</td>
<td>Leaf sheaths fully elongated to form strongly erect pseudostem</td>
</tr>
<tr>
<td>6</td>
<td>First node of stem visible at base of shoot; jointing</td>
</tr>
<tr>
<td>7</td>
<td>Second node of stem formed; next-to-last leaf just visible</td>
</tr>
<tr>
<td>8</td>
<td>Flag leaf visible but still rolled up</td>
</tr>
<tr>
<td>9</td>
<td>Ligule of flag leaf just visible</td>
</tr>
<tr>
<td>10</td>
<td>Flag leaf sheath completely grown out; booting</td>
</tr>
<tr>
<td>10.1</td>
<td>First awns of head just visible</td>
</tr>
<tr>
<td>10.2</td>
<td>1/4 of heading process complete</td>
</tr>
<tr>
<td>10.3</td>
<td>1/2 of heading process complete</td>
</tr>
<tr>
<td>10.4</td>
<td>3/4 of heading process complete</td>
</tr>
<tr>
<td>10.5</td>
<td>All heads out of sheath</td>
</tr>
<tr>
<td>10.5.1</td>
<td>Beginning of flowering</td>
</tr>
<tr>
<td>10.5.2</td>
<td>Flowering complete to top of head</td>
</tr>
<tr>
<td>10.5.3</td>
<td>Flowering complete at base of head</td>
</tr>
<tr>
<td>10.5.4</td>
<td>Flowering complete; kernel watery ripe</td>
</tr>
<tr>
<td>11.1</td>
<td>Kernel milky ripe; milk stage</td>
</tr>
<tr>
<td>11.2</td>
<td>Kernel mealy ripe; soft but dry consistency; soft dough stage</td>
</tr>
<tr>
<td>11.3</td>
<td>Kernel hard; difficult to divide with thumbnail; hard dough stage</td>
</tr>
<tr>
<td>11.4</td>
<td>Kernel harvest ready; straw dead</td>
</tr>
</tbody>
</table>

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nathan.mueller@unl.edu
Fungicides for FHB

- Prosaro 421 SC (Bayer)
  - Prothioconazole (3, Triazole)
  - Tebuconazole (3)

- Caramba (BASF)
  - Metconazole (3)

- Miravis Ace (Syngenta)
  - Two modes of action
    - Propiconazole (3)
    - Pydiflumetofen (7, SDHI)
Varieties with Moderate Resistance for FHB

- Varieties in the Trials
  - WB4699 (4)
  - Overland (4)
  - Zenda (4)
  - SY Benefit (5)
  - WB4269 (5)
  - WB4401 (5)
  - KS Western Star (5)
  - LCS Valiant (6)
Leaf Rust

- **Disease**
  - Caused by fungus *Puccinia triticina*
  - Does not overwinter
  - Central and eastern Nebraska
  - Yield losses up to 14% typical

- **Management**
  - Variety selection for resistance
  - Scouting
  - Foliar fungicide
Stripe Rust

- Disease
  - Caused by fungus *Puccinia striiformis* f. sp. *Tritica*
  - Does not overwinter
  - Has become a significant disease since 2010 in Nebraska
  - Yield loss up to 40%

- Management
  - Variety selection for resistance
  - Scouting
  - Foliar fungicide
Foliar Fungicide at Flag Leaf

Lancaster County: Average across 6 varieties

Planting Date and Seeding Rate
Target Planting Date Map

400 GDD (Base 40) accumulation between planting and December 31

1980s work in southeast NE

Temperature norms – 1981-2010

New daily accumulated GDD map: https://mesonet.unl.edu/
Use Certified Seed
Seeding Rate

Lancaster County, planted Oct. 2, 2013

Bhatta et al., 2017. Seeding rate, genotype, and top-dressed nitrogen effect on yield and agronomic characteristics of winter wheat. Crop Sci. 57:951-963
Seeding Rate and Planting Date

Crop Tech Cafe Winter Wheat Seeding Rate Calculator for East Central Nebraska

<table>
<thead>
<tr>
<th>Estimated Planting Dates</th>
<th>Oct. 7 - Oct. 14</th>
<th>Select estimated planting dates from drop-down</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommended Seeding Rate (Pure Live Seeds per Acre)</td>
<td>1,350,000</td>
<td>Based on estimated planting dates selected</td>
</tr>
<tr>
<td>Germination (%)</td>
<td>95</td>
<td>Enter germination from seed tag</td>
</tr>
<tr>
<td>Purity (%)</td>
<td>99</td>
<td>Enter purity from seed tag</td>
</tr>
<tr>
<td>Seed Size (seeds/lbs)</td>
<td>15,000</td>
<td>Enter seed size from seed tag</td>
</tr>
</tbody>
</table>

Contact Nathan Mueller at nathan.mueller@unl.edu with questions

<table>
<thead>
<tr>
<th>Seeding Rate (lbs/acre)</th>
<th>96</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seeding Rate (bu/acre)</td>
<td>1.6</td>
</tr>
</tbody>
</table>

- Plant certified fungicide-treated seed to control seed-transmitted and soilborne fungal diseases
- Plant at 1.5 inches deep no-till after soybeans

Download at croptechcafe.org/winterwheat
Evaluating Winter Wheat Stands

- Better option than a tape measure
- No need to glue together, so easy storage.
- Interpretations
  - Assesses yield components
  - Risk of weed pressure

View at croptechcafe.org/winterwheat
Nutrient Management

N  P  K  S  Ca  Mg

Fe  Mn  Cu  Zn  B  Cl  Mo  Ni
Nitrogen Management

• Based on regional UNL recommendations and local grower experiences
  • 80 – 110 lbs N/acre

• Apply most or all as wheat begins to green up in February/March

• Grain protein can be improved with late N applications
  • N at Flag leaf can still improved protein/yield
Phosphorus Management

- Higher soil test phosphorus needed compared to corn and soybeans
  - Similar to alfalfa and corn-after-corn
    - 25 ppm Bray P1 or more
- Helps with early growth, tillering, and winter hardiness
Sulfur and Chloride Management in Winter Wheat


Photo by Randy Pryor
Thank You!

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Economics, Weather Risks, and Soil Health Considerations
USDA-NASS
Winter Wheat Yield Trends
Local Success Stories

- Growing 100 bushel/acre wheat not uncommon
  - Thurston County
    - Winter wheat in a 5-year rotation with corn-soybeans
  - Washington County
    - 2 winter wheat fields per year
  - Jefferson County
    - National Wheat Foundation Dryland Yield Contest Finalist in 2017 – 4th place with 119 bu/ac
Eastern Nebraska Markets

- **Grain - Strong Local Basis**
  - ADM Lincoln = +0.20
  - Hansen-Mueller = +0.30
  - Scoular-Fremont = +

- **Straw Prices**
  - December 2020
    - $80/ton
Corn Yields in w/Wheat in Rotation

Monmouth 1998-2014

<table>
<thead>
<tr>
<th>Crop Sequence</th>
<th>Tilled</th>
<th>No-till</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cont corn</td>
<td>166</td>
<td>148</td>
</tr>
<tr>
<td>Soy-corn</td>
<td>198</td>
<td>193</td>
</tr>
<tr>
<td>Soy-wheat-corn</td>
<td>210</td>
<td>202</td>
</tr>
<tr>
<td>Wheat-soy-corn</td>
<td>206</td>
<td>203</td>
</tr>
</tbody>
</table>

http://web.extension.illinois.edu/nwiardc/downloads/58547.pdf
Soybean Yields w/Wheat in Rotation

Monmouth 1998-2014

Soybean yield, bu/acre

Tilled: Cont. soy 56.3, Corn-soy 62.5, Wheat-corn-soy 66.0, Corn-wheat-soy 67.9
No-till: Cont. soy 57.3, Corn-soy 62.1, Wheat-corn-soy 65.0, Corn-wheat-soy 66.6

Rotation

http://web.extension.illinois.edu/nwiardc/downloads/58547.pdf
Winter Wheat Can Help

• Manure management flexibility

• Consider all potential profits streams
  • Value of straw
  • Double crop and forages crop options
  • Potential nitrogen credit for legume cover crop
  • Corn and soybean yield improvement in 3-yr rotation
  • EQIP and CSP opportunities

• Weed control & herbicide cost
  • Marestail, Palmer Amaranth, & Waterhemp

• Soil health and conservation
  • Soil structure, erosion control, cost-share and priority

• Workload management

• Manage weather risks
Managing Risks from Extreme Weather

Seasonal crop water use (ET) in Eastern Nebraska when water is not limiting.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Inches/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>21-24</td>
</tr>
<tr>
<td>Soybean</td>
<td>20-22</td>
</tr>
<tr>
<td>Winter Wheat</td>
<td>16-18</td>
</tr>
<tr>
<td>Alfalfa</td>
<td>31-35</td>
</tr>
</tbody>
</table>

Source: water.unl.edu

Source: Crop Water Use Curves from Colorado State University [http://extension.colostate.edu/topic-areas/agriculture/limited-irrigation-managementprinciples-and-practices-4-720/]
15-year rotation study – 0 to 8 inch depth

Water Stable Aggregates

<table>
<thead>
<tr>
<th></th>
<th>CCC</th>
<th>CS</th>
<th>CSW</th>
</tr>
</thead>
<tbody>
<tr>
<td>kg kg⁻¹</td>
<td>0.82</td>
<td>0.83</td>
<td>0.88</td>
</tr>
</tbody>
</table>

Improving Soil Health with Winter Wheat

• Aspects of soil health
  • Physical
  • Biological
  • Chemical

Current issue
Soil health (biological, physical, and chemical) has been a popular focus with emphasis on utilizing no-till and cover crops in eastern Nebraska. However, a more diverse crop rotation is often left out of the discussion as a way to improve soil health. The corn-soybean rotation is the most widely utilized cropping systems in eastern Nebraska. Despite the potential benefits adding a third or fourth crop to this rotation to improve soil health, farmers in eastern Nebraska have because of various adoption barriers.

Crop rotation benefits
The trifecta of soil health practices:
• No-till, cover crops, and diverse crop rotation

Two long-term (14 & 15 years) crop rotation studies in the Midwest have shown that including winter wheat into the corn-soybean rotation results in the following improvement in soil health:

1. Increase in water stable aggregates (most sensitive and best single indicator of soil physical health, example in Figure 1)
2. Higher total nitrogen (N), potentially mineralizable N in soil, and N use efficiency
3. Reduced N rates needed in corn for maximum economic return
4. Higher yields in corn and soybeans

These aspects of soil health were increased by adding wheat into the rotation regardless of the tillage system, conventional and no-till. The dense fibrous root system of wheat and nitrogen derived from wheat root deposits is likely the cause of these measurable differences. These long-term crop rotation studies did not include cover crops.

Overcome barriers to adding wheat
Barriers producers share:
• Economics of wheat grain yield only/inputs cost compared to corn and soybean production
• Logistics of planting and harvesting only 1 or 2 fields
• Concerns about the learning curve of growing a new crop

Overcoming these barriers:
• Improve economics by capturing good basis (Lincoln & Fremont), selling straw, growing forage crop after wheat, higher corn and soybean yield in rotation, and USDA programs payments
• Improve logistics with custom drilling and harvesting and business opportunity
• Reduce learning curve through new website, grower group email list, and future peer-learning group, and working with cropping systems extension educators

Local grower quotes
"If wheat breaks up our corn-bean rotation and it creates more organic matter, because of the root mass."
Local Farmer - Fremont Tribune

"Winter wheat gives you an additional 45 to 60 days for the cover crop to grow, which results in more material to grazes if you choose to, and more root mass to help build organic matter in the soil."
Local Farmer - Nebraska Farmer Magazine

For more Information
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