Profitable Wheat Production

Modern technology, fluctuating export markets, farm policies, and environmental regulations all contribute to wheat producers' need for careful planning and management to ensure good production and profitability. Fluctuating weather and stored soil moisture levels also make it important for wheat producers to make careful decisions about the type of tillage, seedbed preparation, rotations, and pest management practices.

**Spring Wheat and Durum Calendar**

This guide will help you make timely management decisions. However, extensive details on any one production area are not given. More detailed and complete discussions of soil fertility, weed, disease and insect control and control of stored grain insects are available in sources such as Extension circulars and bulletins and the Crop Production Guide.

The pesticide use suggestions in this guide are based on federal label clearances and on research information from the North Dakota Agricultural Experiment Station. All pesticides listed had a federal or state label at the time of publication.

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Fertilizing Hard Red Spring and Durum Wheat

Fertilizer recommendations for hard red spring and durum wheat are given in the following table. These recommendations are based on soil test results from soil samples collected from the field during the fall or spring before seeding. Samples for nitrates should be taken to a depth of 24 inches. Broadcast applications of fertilizer can be made prior to seeding. Many producers with fertilizer banding or air-seeding equipment can economize on phosphorus and potassium costs with band applications. Rates of P and K can be reduced by 1/3 from the chart recommendations for low and very low P and K levels with banding. Recommendations for P and K at medium or higher soil test levels should not be decreased with banding or soil test levels may decrease over time. No reduction in nitrogen is recommended, whether the N is banded or not.

**Set Realistic Yield Goals**

Fertilizer recommendations are based on soil test levels of plant nutrients and the probability of an economic response to nutrients at a given soil test level and yield goal. Once soil test levels are known, yield goals should be thoughtfully estimated to increase the efficiency of the fertilizers used. Unrealistic yield goals can either limit yield potential or waste valuable nutrients and farm operating capital. Information which helps define yield goals include:

- Yield history (disregarding unusual years).
- Knowledge of general soil productivity of the farm.
- Knowledge of soil water status prior to planting.
- Management intensity of the producer.
- Ability of the producer to understand and assume risks.

<table>
<thead>
<tr>
<th>Yield Goal</th>
<th>Soil N plus Fertilizer N Required</th>
<th>Bray-I Olsen</th>
<th>Soil Test Phosphorus, ppm</th>
<th>Soil Test Potassium, ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>bu/a</td>
<td>lb/acre-2³</td>
<td>-</td>
<td>lb P2O5/acre</td>
<td>lb K2O/acre</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0-5</td>
<td>6-10</td>
<td>11-15</td>
</tr>
<tr>
<td>20</td>
<td>50</td>
<td>20</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>40</td>
<td>100</td>
<td>40</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>60</td>
<td>150</td>
<td>60</td>
<td>40</td>
<td>25</td>
</tr>
<tr>
<td>80</td>
<td>200</td>
<td>80</td>
<td>55</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0-40</td>
<td>41-80</td>
<td>81-120</td>
</tr>
<tr>
<td>20</td>
<td>50</td>
<td>50</td>
<td>35</td>
<td>20</td>
</tr>
<tr>
<td>40</td>
<td>100</td>
<td>95</td>
<td>70</td>
<td>40</td>
</tr>
<tr>
<td>60</td>
<td>150</td>
<td>140</td>
<td>100</td>
<td>60</td>
</tr>
<tr>
<td>80</td>
<td>200</td>
<td>190</td>
<td>135</td>
<td>80</td>
</tr>
</tbody>
</table>

Nitrogen recommendation = 2.5 YG-STN-SDA-PCC
Bray-I P recommendation = (1.071-0.054 STP)YG
Olsen P recommendation = (1.071_0.067 STP)YG
Potassium recommendation = (2.710_0.017 STK)YG

STP = soil test phosphorus
STN = soil test nitrogen
YG = yield goal
STK = soil test potassium
SDA = sampling date adjustment
PCC = previous crop credit
Soil Sampling

Phosphorus (P), potassium (K), zinc, copper, soil pH and organic matter is analyzed on a 0-6 inch soil core. Nitrate, sulfur and chloride recommendations are based on analytical results from the 0-24 inch soil depth. When other depth increments are submitted for analysis the depth collected should be indicated on the sample information sheet. For example, a no-till producer with a history of broadcast P application might want to submit a 0-2 inch core depth separately to determine the degree of surface stratification of P compared to the 2-6 inch depth. These unusual depths should be indicated on the soil sample information sheet at the time the sample is submitted to the soil laboratory. More accurate recommendations can be made from any known sampling depth if the depth is known. Increasing numbers of producers sample to 4 feet to gain information on stored water and the status of deep nitrogen.

Guidelines for Management Decision Estimates

- Wheat in the Northern Plains will require about 2.5 lbs of nitrogen/bushel of grain.
- About 20 lbs/A of added P_2O_5 is required to increase Olsen P test levels one ppm (part per million).
- Low potassium levels are not common in North Dakota but occasionally occur in leached sandy soils on higher landscapes. Potassium needs attention when soil test levels are below 150 lbs/A.
- Chloride test levels below 30 lbs/A may need management attention, especially if sensitive varieties are to be grown.
- Low soil sulfur levels are sometimes present in some areas of North Dakota. Sulfur additions are recommended with 0-24 inch depth soil sulfur levels below 15 lbs/A. Responses would be more likely where organic matter levels are low and soil textures are sandy or gravelly on upslope positions. Sulfate sources are usually more quickly effective than the elemental form.

Nutrient Deficiency Symptoms – Wheat

Nitrogen, phosphorus, sulfur and chloride are the nutrient deficiencies commonly found in North Dakota. Potassium and zinc deficiencies are rare in North Dakota wheat fields. Nutrient deficiency symptoms are difficult to determine absolutely in the field. Suspected deficiencies should be followed up by laboratory plant or leaf analysis.

<table>
<thead>
<tr>
<th>Deficiency</th>
<th>Field View</th>
<th>Individual Plants</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nitrogen–</strong></td>
<td>Conspicuous early season yellowing not associated with wet ground or chemical application patterns.</td>
<td>Older leaves yellow. Emerging leaves green. Reduced tillering.</td>
</tr>
<tr>
<td>Severe (visible early)</td>
<td>Yellowing in patches at boot stage not associated with drought or wet spots.</td>
<td>Compared with the flag-leaf other leaves are yellow. Tiller die back. Older leaves die early.</td>
</tr>
<tr>
<td>Moderate (crop may look normal until mid-season)</td>
<td>No obvious problems. Crop matured early. Crop appears to suffer drought stress by early heading.</td>
<td>Small mainstem head. Tiller heads didn’t fill.</td>
</tr>
<tr>
<td>Low (disappointing yields)</td>
<td>Slow growth in a stand with conspicuous thin spots.</td>
<td>Stunted slow growing plants with reduced tillering.</td>
</tr>
<tr>
<td><strong>Phosphorus–</strong></td>
<td>Crop may appear drought stressed by early heading.</td>
<td>Excessive tiller die back at heading.</td>
</tr>
<tr>
<td>Severe (early season, after weather warms)</td>
<td>No visible symptoms. Heads didn’t fill.</td>
<td>Small mainstem head. Tiller heads didn’t fill.</td>
</tr>
<tr>
<td>Moderate (crop looks good at mid-season)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low (disappointing</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Yields

<table>
<thead>
<tr>
<th>Sulfur–</th>
<th>Moderate</th>
<th>Upper leaves yellow.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe</td>
<td>Early season yellowing patches that disappears with crop growth and root extension.</td>
<td>Reduced tillering.</td>
</tr>
<tr>
<td>(early season)</td>
<td>No visible symptoms. On sandy ground, plants appear to suffer drought stress by early heading.</td>
<td>Tillers fail to fill.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chloride–</th>
<th>Moderate</th>
<th>No visible symptoms. Leaf disease may be more prevalent. Yield response to other nutrient applications disappointing.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Early season yellowing patches that disappears with crop growth and root extension.</td>
<td>No visible symptoms. Leaf and root disease may be more prevalent. In severe cases a leaf spotting not related to obvious leaf diseases is evident.</td>
</tr>
</tbody>
</table>

Rotations

Sound rotations should be an integral part of every farming operation. Operations with rotational plans that consider disease, insect, and weed pest pressures will be the most productive. Long-term studies show that wheat does best when following soybean, sugarbeet, sunflower, corn, flax and barley, in that order. It is not a good practice to grow continuous wheat. Pest problems escalate in continuous wheat, increasing costs for that year and following years. The best way to manage disease pressure in wheat is rotation to a crop that is not a common host to prevalent wheat diseases. Other factors which influence rotation decisions are herbicide residues from previous crops, crop insurance, and commodity pricing.

The organic matter levels of many soils in North Dakota have decreased to around half of what they were when first cropped. Fallow was adopted early in this century as much to take advantage of extra nitrogen breakdown from this organic matter as from water accumulation. In many areas of western North Dakota, there is little advantage to fallow either for water retention or nitrate accumulation. By managing recrop and rotational crops instead of fallow, a producer can take advantage of good rainfall years without overextending himself in low rainfall years. Using soil testing and modifying yield expectations on continuous crop to conservatively optimistic levels will efficiently predict fertilizer input needs.

NDSU Extension Bulletin 48, Crop Rotations For North Dakota provides in depth discussion of rotational benefits and contains suggested rotations for different regions of the state.

Tillage

Many tillage systems are used by North Dakota wheat producers. No single practice is the best, and under certain sets of conditions they all will work satisfactorily. No matter what tillage system is used, a good seed bed is required. This means the seed should be placed in moist soil as shallow as possible and the moist soil firmed around the seed. This will allow rapid absorption of water and, if temperatures are adequate, rapid germination. The tillage system you use will depend on available equipment, rotation sequence, residue management and, to some degree, soil type. All of these factors also affect
how planting into a good seed bed is achieved. Generally, reduced and no-till production increases surface residues for soil conservation, increases organic matter levels over time, increases water infiltration and retention, and tends to increase the level of certain residue-borne diseases to subsequent wheat crops. Tillage increases the erodibility of soil, decreases surface residues, decreases the amount of organic matter over time, and decreases the inoculum of certain residue-borne diseases. There are advantages and disadvantages associated with most tillage systems.