

# **Fertilizing Wheat for High Yields**

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**Basic principles of fertility for wheat are-**

**Select optimistic and realistic yield goal.**

**Apply N preplant or at planting in a manner of high efficiency.**

**Apply P at seeding in some sort of seed zone band.**

**Supplement with N in season if environmental conditions are favorable.**

**Adequate preplant N and banded P results in expression of tillers.**

**Tillers are encouraged. Tillers and root growth are linked. If T1 and T2 tillers are not initiated, adventitious roots do not develop.**

# Comparison of with seed and broadcast P on wheat, Zubriski, NDSU

Yield increase, bu/a

Rate of P<sub>2</sub>O<sub>5</sub>

Seed-placed			Broadcast
12	24	48	48
3.8	5.0	5.5	3.3

**Effect of P application on wheat yield,  
Racz, Manitoba. mean of 6 six years.**

<b>Placement</b>	<b>Yield, bu/a</b>
<b>0</b>	<b>34.8</b>
<b>Broadcast</b>	<b>39.6</b>
<b>Seed</b>	<b>41.9</b>
<b>Deep band</b>	<b>42.6</b>

**Yields are means of 22 and 44 lb P<sub>2</sub>O<sub>5</sub>  
application rates.**

**Deep band was placed 3-4 inches deep  
in 7 inch spacing**

## **Nitrogen management-**

**Spring wheat growth is very fast.**

**Spring wheat can easily go from  
5 leaf to 7 leaf in 10 days.**

**There are practical and agronomic  
reasons to preplant N.**

**Preplant N is not easily lost  
except on the rarest of  
years.**

**Fall N application is not  
recommended on sandy soils  
or soils with a history of flooding.**

**There has been recent interest in delaying N application until after the wheat has emerged.**



**Topdress compared with preplant N applications in the Northern Plains were previously explored by researchers in North Dakota, South Dakota and Minnesota. The result of the studies was continued reliance on preplant N application.**

**Reasons for the use of topdress as a primary N application included:**

- less chance of leaching**
- lower risk of lodging**
- less early season water use**
- ability to save the N costs if the treatment were not needed.**

**Topdress application can be prevented by fields that are too wet.**



**Application of N to dry soils, and lack of rain following application can result in volatilization of urea and lack of movement of nitrogen to roots during the critical yield development period.**



# Likelihood of successful top-dress N application to spring wheat

Dickinson

Date	Days 4-6 leaf stage	Rainfall inches	Efficiency estimate %
1991	8	0.75	50
1992	12	0.0	0
1993	13	1.2	90
1994	11	0.6	20
1995	8	0.25	20
1996	11	1.0	30
1997	12	0.15	10
1998	10	0.0	0
1999	12	0.5	70
2000	12	0.4	75
2001	13	0.6	75
2002	10	3.1	20

6 years out of 12, complete bust

4 years out of 12, successful

2 years out of 12, marginal

**It might be a better plan in  
to apply enough N for  
an optimistic, but commonly  
achievable crop.**

**If the season appears favorable  
for higher yields, topdress as a  
supplement,  
but not as a primary N source.**

## **2003 Data- split N vs preplant N for wheat**

**Winter wheat, VanderVorst, Duck's unlimited**

### **N Timing**

	<b>Yield</b>	<b>Protein</b>
<b>4/1 (100 lb urea)</b>	<b>86</b>	<b>12.8</b>
<b>5/2 (45 lb N 28%)</b>	<b>80</b>	<b>12.8</b>
	<b>sig.</b>	<b>not sig.</b>

## 2003 data, Garrison, ND, McKay

S. rate	90/0/0	45/45/0	0/90/0	0/0/90
	----- yield, bu/acre-----			
1 m	66	64.5	63.6	55.9*
1.5 m	68	64.2	63.9	60.9*
LSD 5% 6.8 bu				

**No differences in protein**

## Langdon, 2003 data, Lukach

### Treatment

	Yield	Pro	Tw
135 ppi	74.1	13.6	62.1
45 /90 6L	74.5	14.0	62.8
0 /135 3L	72.0	12.4	62.1
45/ 90 3L	71.5	14.7	62.4
0/ 135 6L	64.5	12.2	62.0
LSD 5%	4.1	0.5	0.5

# Carrington, 2003, Hendrickson, dryland

<b>Post N timing</b>	<b>Rate</b>	<b>Yield</b>	<b>Pro</b>	<b>TW</b>
<b>90 lb ST + N</b>				
No post	0	45.5	11.0	63.8
3 lf	90	60.7	13.0	64.5
6 lf	90	59.7	14.2	63.8
<b>135 lb ST + N</b>				
No Post	0	56.6	12.2	64.8
3 lf	45	61.8	14.4	63.9
6 lf	45	65.4	14.3	64.5
<b>180 lb ST + N</b>				
No Post	0	63.0	14.2	64.3
<b>LSD 5%</b>		<b>8.6</b>	<b>1.2</b>	<b>NS</b>

# Carrington, 2003, Hendrickson, irrigated

<b>Post N timing</b>	<b>Rate</b>	<b>Yield</b>	<b>Pro</b>	<b>TW</b>
<b>90 lb ST + N</b>				
<b>No post</b>	<b>0</b>	<b>80.1</b>	<b>13.3</b>	<b>63.4</b>
<b>3 lf</b>	<b>90</b>	<b>87.1</b>	<b>14.6</b>	<b>63.9</b>
<b>6 lf</b>	<b>90</b>	<b>89.6</b>	<b>14.4</b>	<b>63.9</b>
<b>135 lb ST + N</b>				
<b>No Post</b>	<b>0</b>	<b>86.8</b>	<b>13.7</b>	<b>64.0</b>
<b>3 lf</b>	<b>45</b>	<b>78.2</b>	<b>15.1</b>	<b>63.4</b>
<b>6 lf</b>	<b>45</b>	<b>83.2</b>	<b>15.3</b>	<b>63.3</b>
<b>180 lb ST + N</b>				
<b>No Post</b>	<b>0</b>	<b>73.2</b>	<b>15.8</b>	<b>62.9</b>
<b>LSD 5%</b>		<b>8.8</b>	<b>0.8</b>	<b>1.0</b>

## **Summary of replicated NDSU testing in 2003-**

**Preplant N was no worse and often  
resulted in higher yield than split  
applications in dryland testing.**

**Under irrigation, split applications were  
sometimes superior to entirely preplant N.  
Under irrigation, our recommendations  
have always been to split N applications.**

**Our recommendations continue to be:**

- 1. Soil test and apply preplant N at rates appropriate for a decent crop.**
- 2. If environment favors a higher yield, topdressing may provide additional N if rainfall moves the application into the soil to be beneficial.**

## **Other nutrients?**

### **Sulfur**

**Acid rain (sulfuric acid from the reaction of sulfur dioxide with water in the atmosphere) is much reduced compared to even ten years ago due to environmental regulations.**

**Sulfur responses were documented in North Dakota on several crops, including wheat.**

**Most likely soils are sandy, but most textural classes on hilltops and slopes, especially on eroded areas can be low in sulfur.**

## **Chloride-**

**If soil test levels of chloride to 2 ft. are less than 40 lb/a, application of KCl may result in another 3-6 bu/acre.**

# Copper

**Wheat on sandy, eroded, low organic matter soils sometimes respond to copper if soil copper levels are low.**

**However, these soils usually suffer from other problems, especially lack of water, so yield potential is much less, also. Yield increases have not been consistent.**

**Wheat is very good at extracting other nutrients from our soils.**

**North Dakota soils are very able to supply wheat zinc, manganese and boron, regardless of soil test level.**

**QUESTIONS?**

[4HiProfitWMMcMull.ppt](#)