

## EVALUATED FACTORS

### Fertilizer Timing: Preplant vs Topdress PREPLANT

- ✓ Supplies N (nitrogen) to establish crop stand
- ✓ Better soil/weather conditions for fertilization
- ✓ Higher risk of N loss (immobilization, volatilization)

### TOPDRESS

- ✓ Supplies N at maximum plant uptake – higher N use efficiency
- ✓ N fertilization after Feekes 5 – wheat can catch up without decrease in yield
- ✓ Enables fertilization based on crop need for fertilizer N and crop's yield potential

### Fertilizer Sources: Granular vs Liquid

#### GRANULAR N (UREA)

- ✓ Up to 30% N loss as ammonia for broadcasted urea
- ✓ Urea applied with the seed may damage seeds, may cause drying out of seed bed – affects germination

#### LIQUID N (UREA AMMONIUM NITRATE = UAN)

- ✓ Plants absorb water and nutrients through leaves
- ✓ Efficiency of foliar fertilizers may be higher
- ✓ Crop injury/leaf burn is of concern

## OBJECTIVE, MATERIALS and METHODS

### OBJECTIVE:

- ✓ To determine the most efficient nitrogen (N) fertilizer source, N rate, and N fertilizer application time combination for optimizing Montana spring wheat yield while maximizing grain protein



Applying topdress fertilizer N to spring wheat plots as UAN (LEFT) and as urea (RIGHT)

- ✓ 3 dryland experimental sites: Western Triangle Research Center (WTARC), Conrad, MT, and 2 on-farm studies (Jack Patton, Knees, Chouteau County, MT and Lindsey Martin, Pendroy, Teton County, MT)
- ✓ Choteau spring wheat variety
- ✓ Treatment structure is reported in Table 1.

Table 1. Treatment structure for all site years.

Treatment	Preplant N rate, kg N ha <sup>-1</sup>	Topdress N rate, kg N ha <sup>-1</sup>	Topdress N source	Topdress N time
1	0	0	n/a	n/a
2	90	0	n/a	n/a
3	135	0	n/a	n/a
4	45	45	urea	Before flowering
5	45	45	urea	After flowering
6	45	90	urea	Before flowering
7	45	90	urea	After flowering
8	45	45	UAN	Before flowering
9	45	45	UAN	After flowering
10	45	90	UAN	Before flowering
11	45	90	UAN	After flowering

## RESULTS and DISCUSSION

- ✓ Grain yield data is reported here; grain samples are currently being analyzed for protein content. Spring wheat grain yields varied greatly between site-years (Figure 1). At all site-years, strong linear relationship between soil nitrate-N and spring wheat grain yields were observed (Figure 2).
- ✓ Analysis of data from 5 site-years indicated that there were no statistically significant differences in mean grain yields of spring wheat associated with topdress N source, topdress N rate, and topdress N fertilizer application time (Table 2).
- ✓ In 3 of 5 site-years, the rate of preplant N fertilizer rate significantly affected spring wheat grain yields. Specifically, at WTARC in 2011 and 2012, and at Martin in 2012, preplant application of 90 kg N ha<sup>-1</sup> resulted in significantly higher grain yields. Increasing preplant N fertilizer rate to 135 kg N ha<sup>-1</sup> did not further increase grain yields.
- ✓ Due to comparable prices of urea and UAN at the time of topdress application (urea cost of \$0.34 per kg of N vs UAN cost of \$0.36 per kg of N), and taking into an account the lack of response to topdress N fertilizer source, either source could be recommended based on this data set.
- ✓ Further data analysis is necessary to access the effect of topdress N source, rate and application time on spring wheat grain protein content.

Table 2. The effects of preplant N rate, topdress N source, topdress N rate and topdress time on spring wheat grain yields

Effects	Mean grain yield, kg ha <sup>-1</sup>				
	2011		2012		
	WTARC	PATTON	WTARC	PATTON	MARTIN
<b>Preplant N rate, kg N ha<sup>-1</sup></b>					
0	736(a)	1478(a)	5783(a)	4550(a)	2971(a)
90	1843(b)	1582(a)	7476(b)	4830(a)	3754(b)
135	1833(b)	1548(a)	7448(b)	4918(a)	3844(b)
<b>Topdress N source</b>					
Urea	1275(a)	1578(a)	7483(a)	4976(a)	3617(a)
UAN	1432(a)	1540(a)	7350(a)	4814(a)	3631(a)
<b>Topdress N rate, kg N ha<sup>-1</sup></b>					
0	1471(a)	1536(a)	6902(a)	4766(a)	3523(a)
45	1330(a)	1547(a)	7292(a)	4775(ab)	3645(a)
90	1376(a)	1571(a)	7541(a)	5014(b)	3603(a)
<b>Topdress N time</b>					
Before flowering	1432(a)	1540(a)	7277(a)	4972(a)	3643(a)
After flowering	1274(a)	1578(a)	7556(a)	4818(a)	3605(a)

\*\*\*\* Means in the same column, followed by the same letters are not significantly different (t-test, p<0.05).

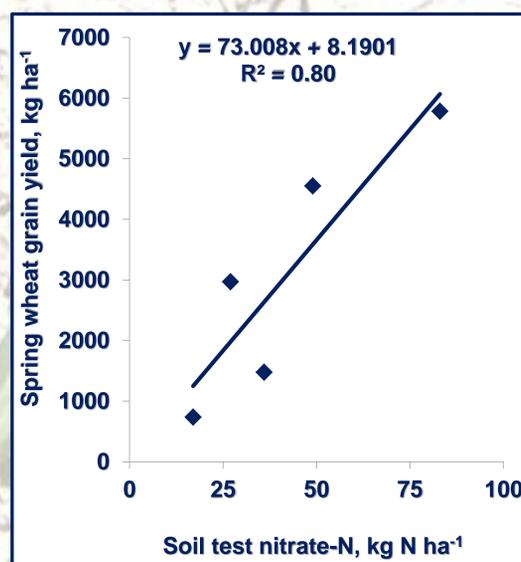


Figure 2. Relationship between soil nitrate-N and mean grain yield of unfertilized check plots.

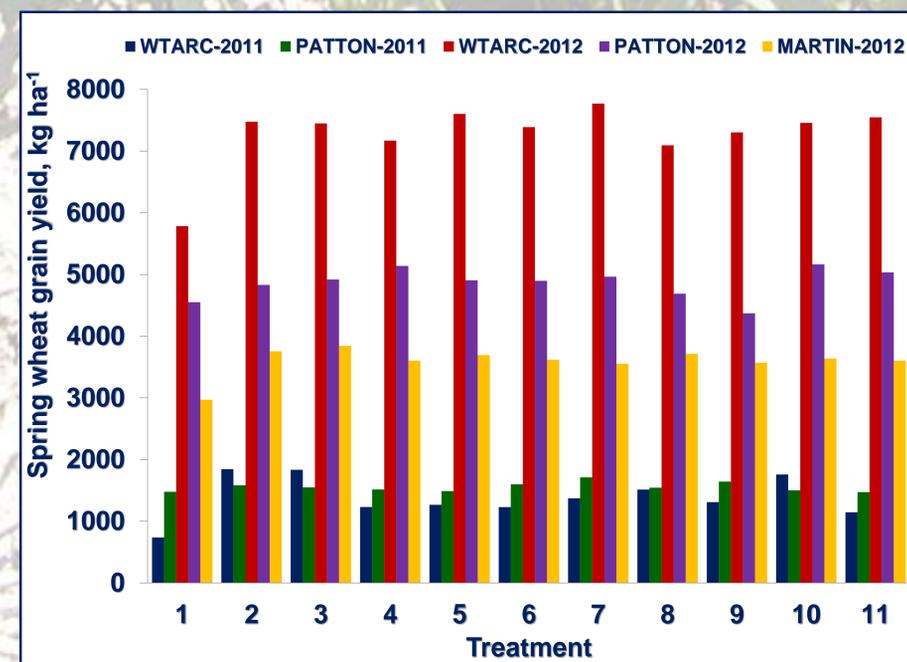


Figure 1. Spring wheat mean grain yields for all 5 site-years.