

# Effect of N Source, Rate and Application Time on Spring Wheat Grain Yield and Protein Content

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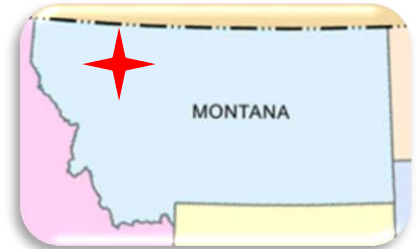
# OBJECTIVES

- To compare the efficacy of **3 liquid N fertilizers** UAN, LU, urea formaldehyde-triazone (UFT) applied to spring wheat
- To determine the **optimum N rate** of liquid fertilizers
- To compare efficiency of liquid N fertilizer application at Feekes 2-3 and Feekes 8-9 (**optimum time**)



# EXPERIMENTAL SITE

- Western Triangle Agricultural Research Center, Conrad, MT; Golden Triangle – prime wheat production area
- **Soil** – Scobey clay loam
- **Precipitation:**
  - (09/13-08/14): 12.8 in; 28 year av: 11.6 in
- **Air temperature:**
  - 40.8 °F; 28 year av: 44.5 °F
  - min winter temp: -29 °F; max summer temp: 91 °F





# GRAIN YIELD

- Grain yields ranged from 59.5 to 64.7 bu/a, which is only about 60% of the average grain yields for the experimental area of 100 bu/a.
- The **highest yield** was achieved with trt 13 (**300 lb N/a total rate; 20 lb N/a at seeding + 200 N/a at green-up as LU + 30 lb N/a as UFT**)
- The lowest yield was observed for unfertilized control (trt 1)



# TEST WEIGHT, GRAIN PROTEIN

- Test weights ranged **53.8 to 55.3 lb/bu**; test weights of at least 56 lb/bu are much more preferred - growers *are “docked”* if the test weight is lower than the acceptable range.
- Excellent grain **protein values between 14.5 and 15.5 %** were achieved in this study (Table 1).
- **Protein yield values** ranged between 51705 to 57990 lb for trts 1 and 13, respectively.



# RESULTS

<b>Parameter</b>	<b>G-Up N Rate</b>	<b>G-Up N Source</b>	<b>Flag L N Rate</b>	<b>Flag L N Source</b>
<b>Grain yield</b>	ns	*	ns	ns
<b>Test weight</b>	ns	ns	ns	ns
<b>Grain protein</b>	*	ns	ns	ns
<b>Protein yield</b>	ns	*	ns	ns
<b>NDVI</b>	ns	ns	ns	ns
<b>Biomass weight</b>	ns	ns	ns	ns
<b>Leaf length</b>	ns	ns	ns	ns
<b>Leaf total N</b>	**	ns	ns	ns



# NITROGEN RATE

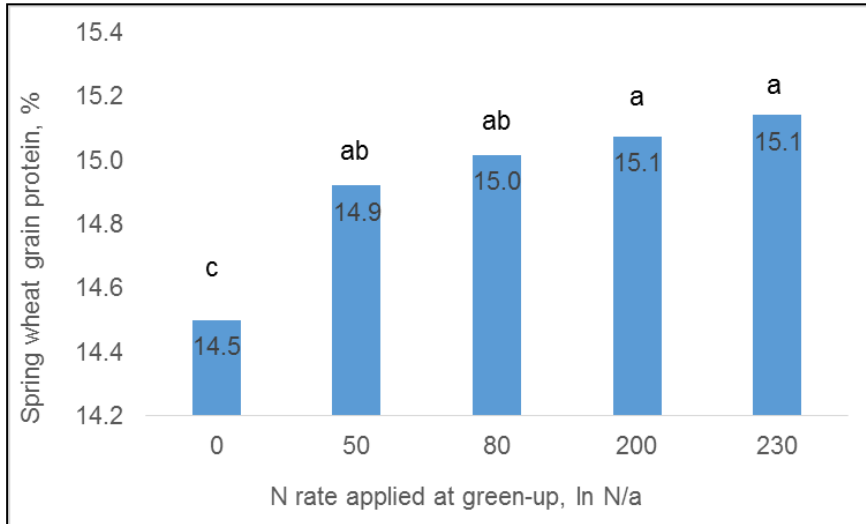
- A response to applied N was observed:
  - application of **150 lb N/a had significantly increased grain yield, test weight, grain protein, and protein yield**
  - Increasing total N rate from 150 to **300 lb N/a - no affect on yield; increased grain protein content**
- **Nitrogen rate applied at green-up (Feekes 2-3) had significantly effected grain protein content**





# N RATE AT GREEN-UP VS PROTEIN

- Nitrogen rate applied at green-up (Feekes 2-3) had **significantly effected grain protein content**



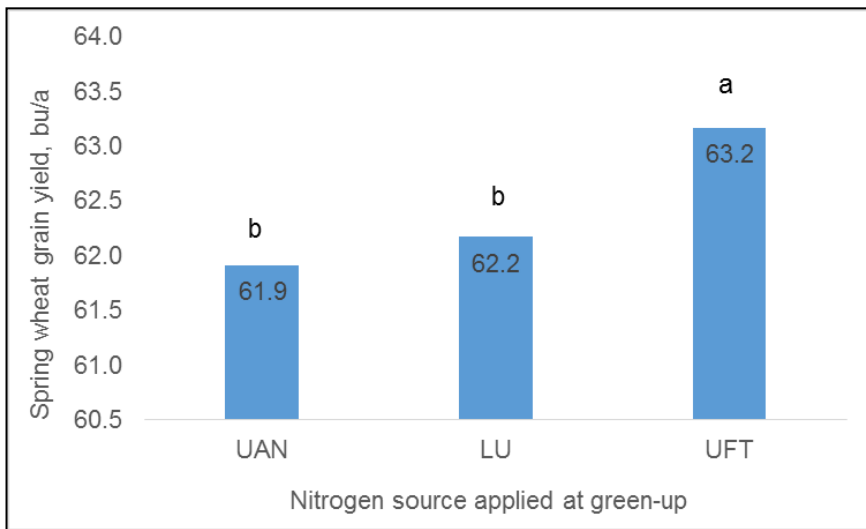
# NITROGEN SOURCE

- Nitrogen source applied **at green-up** has significantly affected spring wheat grain yield: **UFT resulted in higher yield compared to UAN and LU**
- **LU and UFT had a significant advantage** in terms of **both grain yield production and quality** – **higher protein yield** values were achieved with application of LU and UFT at green-up.



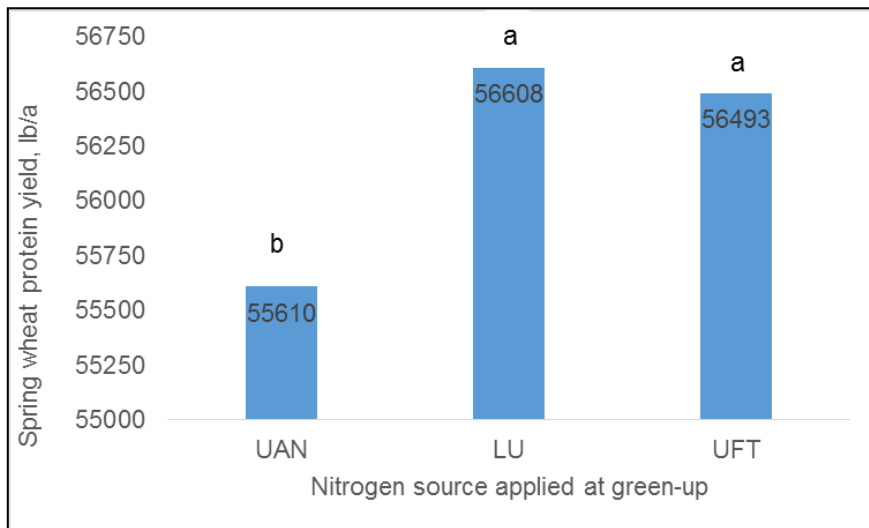
# N SOURCE AT GREEN-UP VS YIELD

- Nitrogen source applied **at green-up** has significantly affected spring wheat grain yield: **UFT resulted in higher yield compared to UAN and LU**



# N SOURCE AT GREEN-UP VS PROTEIN YIELD

- **LU and UFT had a significant advantage for grain yield and quality – higher protein yield values**



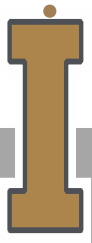
# NITROGEN AT FLAG LEAF

- Nitrogen (rate and source) applied at **flag leaf** had **no effect on any of the evaluated valuables, including grain yield and quality and biomass parameters.**
- Previous work in spring wheat had shown that N should be applied late tillering/jointing (Feekes 5-6) in order to make a difference in grain yield production.

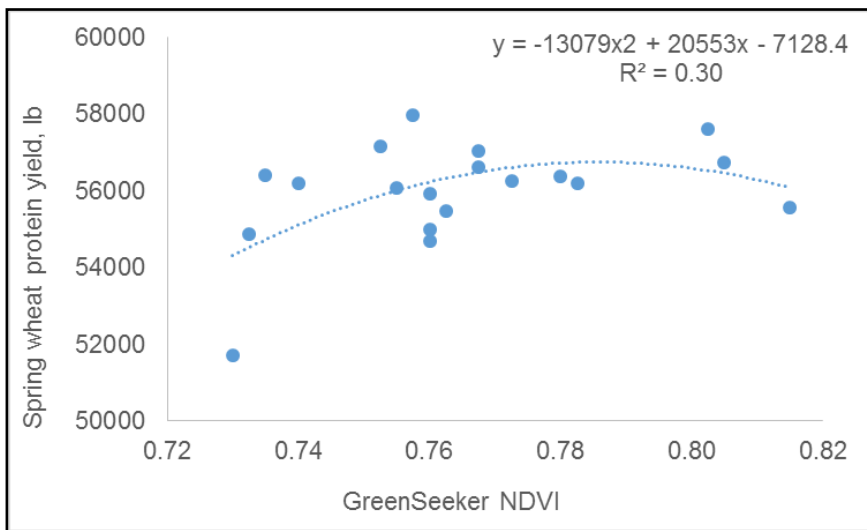


# BIOMASS, NDVI

- There was **no relationship between leaf total N concentration and grain yield**. This has been the case in several Montana studies in wheat, showing that **leaf N content is not a good predictor of grain yield**.
- **GreenSeeker NDVI had a strong relationship with test weight, grain protein, biomass weight, and leaf length.**
- **Biomass weight and leaf length were strongly correlated with grain protein content.**



# NDVI VS PROTEIN YIELD



# THANK YOU!

We thank the FFF for funding this study, and Olsen's Agricultural Laboratory for donating the cost of biomass sample analysis.

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<b>Trt</b>	<b>GY, bu/a</b>	<b>GTW, lb/bu</b>	<b>GP, %</b>	<b>PY, lb/a</b>
<b>1</b>	59.5 (b)	55.3 (a)	14.5 (e)	51705 (b)
<b>2</b>	61.7 (ab)	54.5 (bcd)	15.0 (bcd)	55485 (a)
<b>3</b>	61.9 (ab)	54.6 (bc)	15.2 (b)	56205 (a)
<b>4</b>	62.0 (ab)	54.9 (ab)	15.1 (bc)	56190 (a)
<b>5</b>	62.4 (ab)	54.6 (bc)	15.1 (bc)	56400 (a)
<b>6</b>	62.8 (ab)	54.4 (bcd)	15.0 (bcd)	56265 (a)
<b>7</b>	63.5 (ab)	54.5 (bc)	15.2 (b)	57615 (a)
<b>8</b>	61.4 (ab)	54.7 (abc)	15.0 (bcd)	54990 (ab)
<b>9</b>	62.2 (ab)	54.9 (ab)	15.0 (bcd)	55920 (a)
<b>10</b>	63.8 (a)	54.9 (ab)	14.9 (bcd)	57045 (a)
<b>11</b>	60.9 (ab)	53.8 (d)	15.5 (a)	56745 (a)
<b>12</b>	62.2 (ab)	55.1 (ab)	14.9 (bcd)	55575 (a)
<b>13</b>	64.7 (a)	54.6 (bc)	15.0 (bcd)	57990 (a)
<b>14</b>	62.5 (ab)	54.7 (abc)	15.1 (bcd)	56370 (a)
<b>15</b>	61.9 (ab)	54.9 (ab)	14.7 (de)	54690 (ab)
<b>16</b>	62.6 (ab)	54.7 (abc)	14.9 (bcd)	56085 (a)
<b>17</b>	61.4 (ab)	54.1 (cd)	15.5 (a)	57180 (a)
<b>18</b>	63.9 (a)	54.9 (ab)	14.8 (cde)	56625 (a)
<b>19</b>	62.1 (ab)	54.8 (ab)	14.7 (de)	54885 (ab)

