IMPACT OF N FERTILIZER SOURCE ON GRAIN YIELD

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ABSTRACT

Nitrogen (N) is one of the most important and critical nutrient elements in agricultural systems, and its effect directly affects crop productivity and nutrient content.

Our field studies were related to the wheat Crop. They were conducted in four locations to evaluate the effect of various Nitrogen sources (SuperU, Urea, UAN and UAN+Anvol) applied at three different times (pre, greenup and jointing). The experimental design of the four locations was randomized complete with 4 repetitions on each one we have 13 Treatments.

This study was focused on the effect of these variables on the wheat grain yield and also the Protein content and based on the statistics data that we collect, we found that N sources, time of applying and the locations affect the wheat yield, Concerning the protein content, the only significant relation that we found was with the locations.

Also, the objective of this study is to optimize the use of N fertilizers by choosing the best source and time to apply it so we can reduce N losses (economically and in yield) and increase the nutrient quality in the grain and the productivity.

INTRODUCTION

Wheat is the most important crop in Oklahoma, also it's one of the top states that produce it in the region,

Oklahoma farmers sow each year 4 million acres approximately of winter wheat and that's make it the largest cash crop, what's make it play a major role in the US cattle industry. At a larger scale, several studies concerning the food production have shown that our productivity need to be increase so we can to meet the needs of rising population and diet shifts (Bruinsma, 2009; Tilman et al., 2011; OECD and Food and Agriculture Organization of the United Nations, 2012).

Our mean objective is to increase the yield and at the same time the nutrient content in wheat, that's why fertilization will play a major role to achieve this goal.

In this study, we will be focused on the effect of nitrogen. As we know nitrogen is one of the essential nutrients, and it's correlated directly to yield, it must be widely available during several growth steps of the wheat crop like formation of the foliage, the growth of the tubers…, also it ensures an optimal production of sugars in the leaves via chlorophyll and the enzymes of photosynthesis.

On the other hand, Nitrogen fertilizer requirements that's we must apply depend on many factors like yield to achieve, soil type and environmental factors. also, there is several sources of nitrogen that we can use, and the applying time of each one can affect directly on the target yield.

Keeping all these points in view, several trials was implanted on the field with the purpose to evaluate the effect of different nitrogen sources applied on different times on grain yield and protein content at Oklahoma state.

MATERIALS AND METHODS

Our field experiments were conducted in four different locations at Oklahoma state on 2020/2021: Lake Carl Blackwell research farm (LCB), Caldwell, ALVA and Chickasha. The experimental design of the four locations was randomized complete with four repetitions on each one we have 13 Treatments (plots). The experiment comprised 4 different sources of nitrogen applied on 3 dates (pre, January, and march) with an unfertilized check.

Concerning the nitrogen, the sources that we used are Urea, it's a low-cost fertilizer form, after field application it transformed to ammonium bicarbonate. SuperU is stabilized urea-based fertilizer. UAN (Urea Ammonium Nitrate) is fluid fertilizer containing between 28 and 32 percent of nitrogen (N). And finally, we have UAN+Anvol is Urea Ammonium Nitrate plus Anvol is a nitrogen stabilizer that Improve nitrogen use efficiency in the soil. The plots were sown in October and received Nitrogen fertilizers in (pre, greenup and jointing).

At grain maturity, the plots were harvested, and the data that we collected are grain yield, percent moisture content and grain protein that was determined in post-harvest.

Also, an average of the daily temperature and accumulated rain (7 days after each N application) were retrieved from the Mesonet (www.mesonet.org) so we can compart and see how the climate influence on the grain yield.

Concerning the data analysis, we used Microsoft Excel 2019 AND SPSS Statistics 20 to see if there is any significant relation between N sources, time of applying and the locations on crop production factors, such as grain yield and protein. Data was differentiated using ANOVA methods and Dunnett's to separate the means at $p = 0.05$. Controls utilized on the test were the check

RESULTS AND DISCUSSION

Effect of N source, locations and applied day on grain yield:

Based on figures bellow we can see that the yield increases varied depending on the nitrogen source and other subject effects like locations, applied time and climate factors (Temperature and rain).

Figures 1 to 3 of the yield trend for winter wheat shows a significant difference on the yield what that mean is the location affects directly on the yield. also, Statistical analysis (ANOVA) of the data showed a significant difference in yield from 29.34 (19.16 for check) to 56.57 bushel/acre.

Table1: ANOVA test result of between-Subjects Effects (Locations, Time, N source) on Grain yield

Source		P-value Sig.
Intercept	Hypothesis	.000
	Error	
LOCATION	Hypothesis	**.000**
	Error	
TIME	Hypothesis	**.001**
	Error	
NSOURCE	Hypothesis	**.000**
	Error	
BLOC	Hypothesis	.090
	Error	
LOCATION * TIME	Hypothesis	.774
	Error	
LOCATION * NSOURCE	Hypothesis	**.001**
	Error	
NSOURCE * TIME	Hypothesis	.076
	Error	
LOCATION * NSOURCE * TIME	Hypothesis	.602
	Error	

Table1 contain the results of the ANOVA test, we can see that P-value of Locations, time, N source and also the interaction between location and N source on yield ≤ 0,05, that's mean that these subjects have a statistically significant effect on the grain yield.

However, BLOC and some other interactions between these factors did not show any effect.

Regarding the locations, the highest yield was achieved at Caldwell – TANA using Urea as a nitrogen source in March, it was specifically 61,73 bushel/acre (Figure 1). On the contrary, the lowest yield was Lake Carl Blackwell (LCB, only 29.34 bushel/acre (Figure 3) using UAN + Anvol as a nitrogen source in March. The yield difference between these 2 locations was 32,39 bushel/acre.

Furthermore, based on the climate data that we collect 7 days after each Nitrogen application (Figure5), we have:

- The biggest grain yield was in TANA location, with a height rainfall cumulative of 1,39in divided as follows 0,52in in November, 0,84in in March and 0,02 in April. The difference between the first 2 applying time and N sources wasn't significant, except in April we get the lowest grain yield in this location and coincided also with the lowest rainfall cumulative and highest Temperature 59,6 F.
- The Second average grain yield was in LCB Location using SuperU and Urea applied in March as a N source, with a height rainfall cumulative of 0.67in in March.
- In ALVA Location, the highest grain yield was obtained by using SuperU and Urea as a N source applied in November or March.

For the Chickasha location, it was eliminated it from this study because of the climatic conditions which affected it (Low Temperature), which is directly reflected on the data that we collected (Figure4).

Figure 1: Winter wheat grain yield and protein response to the application of 4 N sources affected by the timing of application at Caldwell, Oklahoma

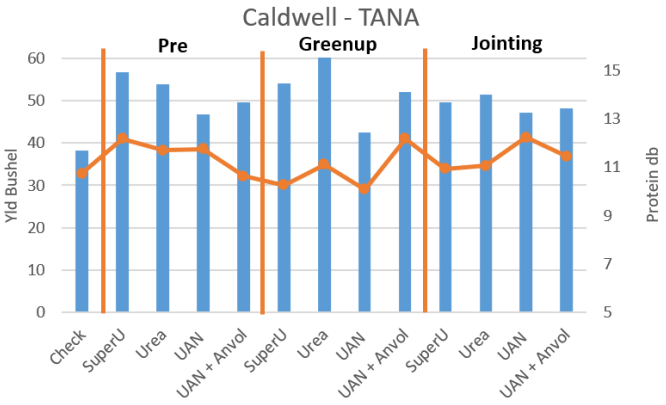


Figure 2: Winter wheat grain yield and protein response to the application of 4 N sources affected by the timing of application at ALVA, Oklahoma

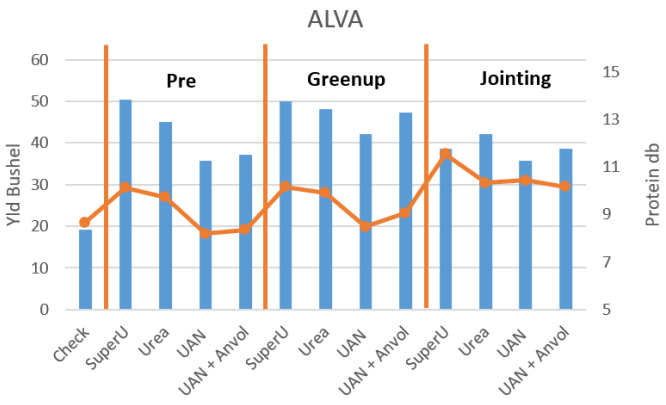


Figure 3: Winter wheat grain yield and protein response to the application of 4 N sources affected by the timing of application at Lake Carl Blackwell (LCB), Oklahoma

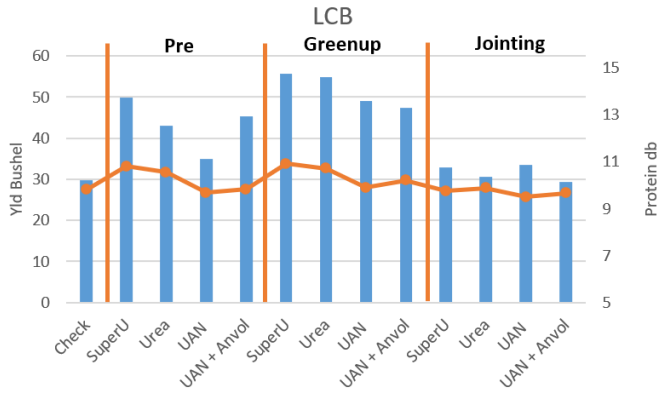


Figure 4: Winter wheat grain yield and protein response to the application of 4 N sources affected by the timing of application at Chickasha, Oklahoma

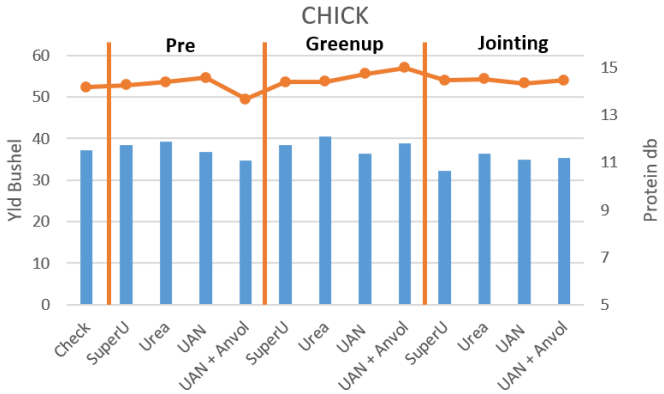
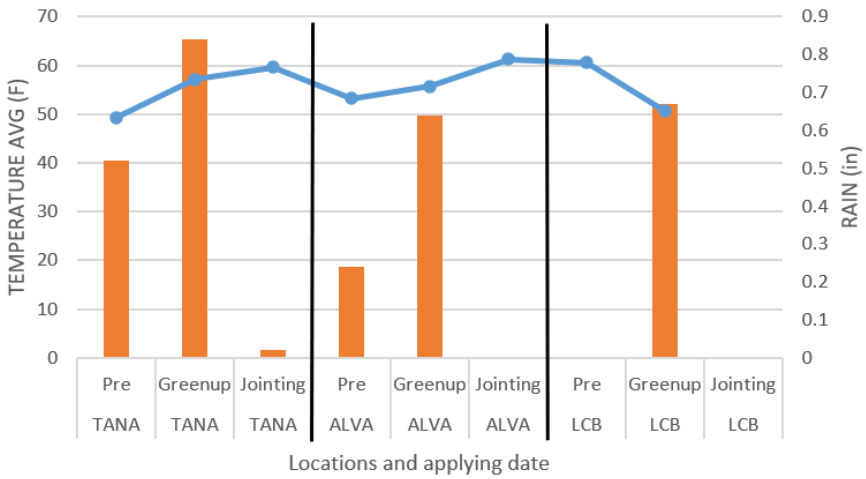


Figure 5: Temperature average and cumulated rain after 7 days of Nitrogen application at 3 locations (TANA, ALVA and LCB), Oklahoma



Effect of N source, locations and applied day on Protein content:

Table2: ANOVA test result of between-Subjects Effects (Locations, Time, N source) on Protein content

Source		Sig.
Intercept	Hypothesis	.000
	Error	
LOCATION	Hypothesis	**.000**
	Error	
NSOURCE	Hypothesis	.101
	Error	
TIME	Hypothesis	.378
	Error	
BLOC	Hypothesis	.109
	Error	
LOCATION * NSOURCE	Hypothesis	.144
	Error	
NSOURCE * TIME	Hypothesis	.101
	Error	
LOCATION * TIME	Hypothesis	**.002**
	Error	

Table2 shows the results of the statistical analysis, based on ANOVA test result between Subjects Effects (Locations, Time, N source) on Protein content, we can see that the location has a significant effect on the protein content also the interaction between location and time.

However, N source, time, bloc, and the rest interactions between these factors did not show any effect.

Based on the locations, the highest protein content was Caldwell – TANA (Figure 1). and the lowest protein content was between LCB and ALVA, what can be related to the climate factors (figure 5),

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