

Final Report

Arizona Grain Research and Promotion Council

August, 2017

Late season N application method effect on grain protein

Mike Ottman
University of Arizona

Late Season N Application Method Effect on Grain Protein, 2017

M. J. Ottman

Summary

Nitrogen fertilizer is normally applied later in the season around flowering time to boost grain protein content. The purpose of this study is to determine if the grain protein boost provided by late N application is affected by method of application. A trial testing late season N application methods was conducted at the Maricopa Ag Center in the 2017 growing season. The crop was grown with 209 lb N/acre in split applications until flowering when 35 lb N/acre was applied either as 1) low biuret urea in a foliar application or 2) as urea granules and both application methods were compared to no N application at all at flowering. In this study, we were not able to detect a difference in grain protein or any other variable measured due to the late N application method or compared to the control with no late N fertilizer applied at all.

Introduction

Nitrogen fertilizer is normally applied later in the season around flowering time to boost grain protein content, and these late season N applications are not expected to affect grain yield. The fertilizer is usually applied as UAN32 in the irrigation water. However, the fertilizer can also be applied as a foliar or granule. The advantage of foliar N application is that it is not tied to irrigation water application. Granular N is a cheaper, however, and is usually distributed more uniformly than liquid forms applied in the irrigation water. Some evidence exists that foliar N gets into the plant more efficiently than granular forms of N in the case of barley (Bulman and Smith, 1993). The purpose of this study is to determine if the grain protein boost provided by late N application is affected by method of application.

Procedure

A trial testing late season N application methods was established at the Maricopa Ag Center. The field was fallow the previous year and the soil texture is a sandy loam. Soil chemical properties from a sample taken before planting are listed in Table 1. The seed was planted with a grain drill in plots 13.33 ft wide and 40 ft long. The seeding rate was approximately 150 lbs/acre. Growing conditions are listed in Table 2.

The experimental design was a randomized complete block with 3 varieties (Orita, Platinum, and Tiburon), 3 late season N application methods (foliar, granular, and none) and 4 replications. Fertilizer application was similar until flowering when nitrogen fertilizer was applied using various methods. Foliar N application was with low biuret urea and granular was with urea (46-0-0).

The following data was collected: grain yield, test weight, seed weight, plant height, lodging, grain protein, and HVAC. Grain was harvested with a small plot combine and yields are expressed on an “as is” moisture basis. Test weight was calculated from the weight of 1 pint of grain. Seed weight was determined from 200 seed. HVAC was determined from 10 g of seed. Grain protein was determined from total N multiplied by 5.7 and expressed on a 12% moisture basis.

Discussion

Late N application method effects on yield and other plant characteristics of three durum varieties are presented in Table 3. Late N application had no effect on grain yield, grain test weight, seed weight, plant height, lodging, heading, flowering, maturity, or HVAC (hard vitreous amber count). Differences among varieties were detected, but it was not the intent of this study to compare variety differences. We were interested in variety x late N application method interaction, but this interaction was not significant for all variables measured. Grain protein was not affected by late season N application no matter what the method presumably since the protein contents were so high (15.9% on average) that late season N could not increase the protein content further. In this study, we were not able to detect a difference in grain protein or any other variable measured due to the late N application methods of foliar or granular applications, or compared to the control with no late season N fertilizer applied at all.

References

Bulman, P., and D. L. Smith. 1993. Grain protein response of spring barley to high rates and post-anthesis application of fertilizer nitrogen. *Agron. J.* 85:1109-1113.

Acknowledgments

Financial support for this project was received from the Arizona Grain Research and Promotion Council. The technical assistance of Mary Comeau is greatly appreciated.

Table 1. Soil chemical analysis from a sample collected preplant from the surface 6 inches for a late season N application method trial at the Maricopa Ag Center, 2017.

Chemical measurement	Unit	Value	Unit	Value
Total Exchange Capacity	(meq/100 g)	20.62	---	---
pH	(pH)	8.4	---	---
Organic Matter	(%)	0.92	---	---
Estimated Nitrogen Release	(lb N/acre)	37	---	---
NO ₃ -N	(ppm)	37.7	---	---
NH ₄ -N	(ppm)	24.3	---	---
S	(mg/kg)	30	---	---
P	(mg/kg)	4	---	---
Ca	(mg/kg)	3237	(%)	78.49
Mg	(mg/kg)	221	(%)	8.93
K	(mg/kg)	332	(%)	4.13
Na	(mg/kg)	259	(%)	5.46
Fe	(mg/kg)	3	---	---
Mn	(mg/kg)	6	---	---
Cu	(mg/kg)	1.28	---	---
Zn	(mg/kg)	0.73	---	---

Table 2. Cultural practices for a late season N application method trial at the Maricopa Ag Center, 2017

Cultural information	Maricopa																				
Previous crop	Fallow																				
Soil texture	Sandy loam																				
Planting date	12/07/2016																				
Irrigation dates and amounts	<table> <thead> <tr> <th><u>Date</u></th> <th><u>Inches</u></th> </tr> </thead> <tbody> <tr> <td>12/07</td> <td>3.50</td> </tr> <tr> <td>1/09</td> <td>3.42</td> </tr> <tr> <td>1/31</td> <td>3.80</td> </tr> <tr> <td>2/27</td> <td>4.16</td> </tr> <tr> <td>3/16</td> <td>4.09</td> </tr> <tr> <td>3/30</td> <td>4.00</td> </tr> <tr> <td>4/13</td> <td>4.07</td> </tr> <tr> <td><u>4/26</u></td> <td><u>3.80</u></td> </tr> <tr> <td>Sum</td> <td>30.84</td> </tr> </tbody> </table>	<u>Date</u>	<u>Inches</u>	12/07	3.50	1/09	3.42	1/31	3.80	2/27	4.16	3/16	4.09	3/30	4.00	4/13	4.07	<u>4/26</u>	<u>3.80</u>	Sum	30.84
<u>Date</u>	<u>Inches</u>																				
12/07	3.50																				
1/09	3.42																				
1/31	3.80																				
2/27	4.16																				
3/16	4.09																				
3/30	4.00																				
4/13	4.07																				
<u>4/26</u>	<u>3.80</u>																				
Sum	30.84																				
Nitrogen dates and rate (of urea)	<table> <thead> <tr> <th><u>Date</u></th> <th><u>lbs N/A</u></th> </tr> </thead> <tbody> <tr> <td>1/30</td> <td>102</td> </tr> <tr> <td>2/24</td> <td>51</td> </tr> <tr> <td>3/15</td> <td>56</td> </tr> <tr> <td><u>3/30</u></td> <td><u>35</u></td> </tr> <tr> <td>Sum</td> <td>244</td> </tr> </tbody> </table>	<u>Date</u>	<u>lbs N/A</u>	1/30	102	2/24	51	3/15	56	<u>3/30</u>	<u>35</u>	Sum	244								
<u>Date</u>	<u>lbs N/A</u>																				
1/30	102																				
2/24	51																				
3/15	56																				
<u>3/30</u>	<u>35</u>																				
Sum	244																				
Phosphorus (date, lbs P ₂ O ₅ /A, fertilizer)	None																				
Herbicide	Bromoxynil at 1.02 pts/acre on 2/24																				
Plant growth regulator	Palisade EC at 14.2 oz/acre on 2/14																				
Harvest date	5/24/2017																				

Table 3. Late N application method effects on yield and other plant characteristics of three durum varieties for a test at the Maricopa Ag Center, 2017.

Variety	Late N method	Yield	Test weight	Seed weight	Plant height	HVAC	Grain protein
		lb/a	lb/bu	mg	inches	%	%
Orita	Control	6058	59.3	44.5	34	99	16.5
	Foliar	6638	60.2	45.5	35	99	15.5
	Granular	6402	58.6	42.9	34	100	16.1
Platinum	Control	5967	64.1	47.6	31	100	15.2
	Foliar	6131	64.2	47.5	32	100	15.3
	Granular	6264	64.3	48.3	32	100	14.9
Tiburón	Control	6310	62.9	59.9	34	100	16.8
	Foliar	6379	62.8	59.7	35	99	17.1
	Granular	6207	62.8	59.9	34	99	16.0
Avg	Control	6112	62.1	50.7	33	100	16.1
	Foliar	6383	62.4	50.9	34	100	16.0
	Granular	6291	61.9	50.4	33	99	15.7
Avg	Avg	6262	62.1	50.6	33	99	15.9
N method		ns	ns	ns	ns	ns	ns
N x Variety		ns	ns	ns	ns	ns	ns
LSD _{.05}		ns	ns	ns	ns	ns	ns
CV (%)		7.29	1.2	4.8	2.89	8.75	0.6