Research Report

Late Season N Application Method Effect on Grain Protein, 2016

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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 2016 growing season. The crop was grown 211 lb N/acre in split applications until flowering when 35 lb N/acre was applied as UAN32 in the irrigation water (fertigation), as low biuret urea in a foliar application, or as urea granules 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. We did measure a 0.4% increase in grain protein regardless of late season N application method compared to the control with no late N applied.

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 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. Mono-ammonium phosphate (11-52-0) was applied preplant at a rate of 100 lb fertilizer/acre providing 11 lb N/acre and 52 lb P_2O_5/acre. The seed was planted in 40 ft x 800 ft strips separated by a 6.67 ft borders in benches 4-7 of Field 31. The seed was planted with a Great Plains grain drill with 7.5 inch spacing between rows. The seeding rate was approximately 150 lbs/acre. The experimental design was a randomized complete block with 3 varieties (Orita, Platinum, and Tiburon), 4 late season N application methods (fertigate, foliar, granular, and none) and 4 replications. Irrigation and fertilization dates are provided in Table 2. Fertilizer application was similar until flowering when nitrogen fertilizer was applied using various methods. Fertigation was with UAN32, foliar with low biuret urea, and granular with urea. The following data was collected: grain yield, test weight, seed weight, plant height, lodging, heading, physiological maturity, grain protein, and HVAC. Grain was harvested with a commercial combine on June 17 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 6.25 for barley and 5.7 for durum and expressed on a 12% moisture basis. Physiological maturity is defined as when the glumes turn brown.

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 reduced by about 0.4% if late season N was not applied regardless of the method of application. 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 fertigation, foliar, or granular applications.

Acknowledgments

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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.

Table 1. Soil chemical analysis preplant for a late N application method test at the Maricopa Ag Center, 2016.

Chemical measurement	Unit	Value	Unit	Value
Total Exchange Capacity	(meq/100 g)	30.64	---	---
pH	(pH)	8	---	---
Organic Matter	(%)	1.1	---	---
Estimated Nitrogen Release	(lb N/acre)	42	---	---
NO_3-N	(ppm)	134.6	---	---
NH_4-N	(ppm)	8.5	---	---
S	(mg/kg)	107	---	---
P	(mg/kg)	4	---	---
Ca	(mg/kg)	4448	(%)	72.58
Mg	(mg/kg)	365	(%)	9.93
K	(mg/kg)	905	(%)	7.57
Na	(mg/kg)	458	(%)	6.5
Fe	(mg/kg)	4	---	---
Mn	(mg/kg)	10	---	---
Cu	(mg/kg)	2.82	---	---
Zn	(mg/kg)	30.64	---	---

Table 2. Irrigation and fertilizer schedule for a late N application method test at the Maricopa Ag Center, 2016.

Date[1]	Irrigation amount	Fertilizer source[2]	Fertilizer amount[3]
	inches		lb N/A
12/08	4.35	MAP (11-52-0)	11
2/03	4.22	Urea (46-0-0)	100
2/25	4.40	Urea (46-0-0)	50
3/11	3.95	Urea (46-0-0)	50
3/23	5.00		
4/05	4.03	Various	0-35
4/07	4.24		
4/14	3.42		
Total	33.61		211-246

[1]Urea was applied 1 day before irrigation.

[2]Various sources of fertilizer at the 4/05 application date included UAN32, low biuret urea, and granular urea depending on the N application method.

[3]An unfertilized control was included in the late N application method treatments applied on 4/05.

Table 3. Late N application method effects on yield and other plant characteristics of three durum varieties for a late N application method test at the Maricopa Ag Center, 2016. Variety x late N application method interaction was not detected.

Variety	Late N method	Yield	Test weight	Seed weight	Plant height	Lodging	Heading	Flower	Maturity	HVAC	Grain protein
		lb/a	lb/bu	mg	inches	%				%	%
Orita	Fertigate	7705	61.3	53.4	40	3	3/26	4/02	5/12	100	13.8
	Foliar	7602	60.8	52.0	38	3	3/26	4/02	5/12	100	13.7
	Granular	7688	60.8	53.4	39	5	3/26	4/02	5/12	100	13.7
	None	7979	61.0	52.0	39	3	3/26	4/02	5/12	100	13.4
Platinum	Fertigate	7363	61.1	40.9	36	10	4/01	4/08	5/12	100	12.9
	Foliar	7037	61.3	41.6	34	13	4/01	4/08	5/12	99	12.7
	Granular	7534	60.6	41.1	35	15	4/01	4/08	5/12	100	12.8
	None	7500	60.9	40.5	34	5	4/01	4/08	5/12	100	12.4
Tiburon	Fertigate	7688	60.5	53.3	37	10	3/26	4/02	5/12	100	12.9
	Foliar	7534	60.6	52.7	37	8	3/26	4/02	5/12	100	13.0
	Granular	7465	60.5	52.2	38	8	3/26	4/02	5/12	100	13.2
	None	7448	60.7	53.5	37	5	3/26	4/02	5/12	100	12.7
Avg	Fertigate	7585	60.9	49.2	38	8	3/28	4/04	5/12	100	13.2
	Foliar	7391	60.9	48.8	36	8	3/28	4/04	5/12	100	13.1
	Granular	7563	60.6	48.9	37	9	3/28	4/04	5/12	100	13.2
	None	7642	60.9	48.6	37	4	3/28	4/04	5/12	100	12.8
Avg	Avg	7545	60.8	48.9	37	7	3/28	4/04	5/12	100	13.1
CV (%)		6.1	1.6	4.1	---	101	---	---	---	1	2.5
$LSD_{.05}$		ns	ns	ns	---	ns	---	---	---	ns	0.3