THE EFFECTS OF PRE-VERNALIZATION N-FORM ON WINTER WHEAT

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Abstract

The form of nitrogen fertilization (N-source) can affect early development and subsequent flowering and yield in spring wheat, although the response is cultivar-dependent. The effects of N-form on growth and development of winter wheat is less understood. Previous work with spring wheat indicated that N-source supplied during early development contributed markedly to effects on growth and yield. The purpose of this study was to determine the effects of pre-vernalization N-form on the growth and development of winter wheats, a club wheat, and a triticale. These field studies complemented growth chamber/greenhouse studies conducted with the same cultivars in Corvallis. Field results for the first year of the study (1991-1992 growing season) suggested that the yield of the club wheat Hyak may have been enhanced by ammonium nitrogen while the remainder of plants were relatively unaffected by N-form. Seed weight and grain protein content were relatively insensitive to pre-vernalization N-nutrition. Because of the variability in these studies, the trials are being conducted a second year at the COARC.

Introduction

Previous studies in corn, barley, and spring wheat have indicated that nitrogen nutrition during early plant development can have marked effects on subsequent growth and yield of the plants. In particular, mixed nitrogen nutrition (use of both nitrate and ammonium) has increased yields in each of these crops. There is less information available regarding the effect of N-source on vernalization-requiring crops. The purpose of this study, and a parallel growth chamber study, was to determine whether pre-vernalization N-source would affect subsequent yield of four wheats or a triticale. Plants received nitrogen fertilizers that contained either nitrate, ammonium, or both forms after emergence, but prior to vernalization. Yield and soil data were taken during the subsequent harvest season.

Materials and Methods

Seeds were planted at a density of 3,000 seeds per 100 ft^2 (5x20 ft) plot on 18 Oct. 1991. Sixteen plots of each variety were planted and the plots were distributed randomly. Field irrigation began within one day after planting. On 21 Nov. 1991, fertilizers were applied by hand to the plots. Four plots of each variety, determined randomly, received either urea, $Ca(NO_3)_2$, $(NH_4)_2SO_4$, or NH_4NO_3. Based upon the results of soil tests take at a 4-8 inch depth and performed by Oregon State University Soils Lab, sufficient fertilizer was added to provide the equivalent of 200 lbs of N per acre for each plot.

Soil samples were collected from each plot on 3 June 1992 for nitrogen and pH determinations, and the plots harvested in July, 1992. Yield per 100 ft^2 plot, weight per 1,000 seeds, and grain protein percentage were determined. Standard wet lab techniques were used for protein determination.

Results and Discussion

By June 1992, soil nitrogen levels were very low and soil pH values ranged from 6.98 - 7.50 (data not shown). Little differences in yield, weight per 1,000 seeds, or grain protein were noted between treatments of the triticale (Celia) or the wheats, with the exception of the club wheat, Hyak (Table 1). Yields in the ammonium sulfate plots appeared to be higher compared to the other nitrogen treatments.

There was considerable variability in the yield data and no conclusion can be based upon a single year's results. These field data are similar to that collected in growth chamber studies, which also indicated little difference in the response of these varieties to pre-vernalization N-form. Field plots have been planted to collect second year information on the effects of N-form on yield of these five varieties.

Table 1. The effect of pre-vernalization N-source on four winter wheats and a triticale, Madras, OR, 1992.

Cultivar	N-Source	Yield	Wt/1000 seeds	Protein
		--kg/ha--	-g--	-%-
Hyak	urea	4814 +/- 117'	34.99 +/- 1.17	11.53 +/- 0.99
Hyak	Ca(NO3)2	4518 +/- 260	35.58 +/- 1.47	11.07 +/- 1.66
Hyak	(NH4)2SO4	5475 +/- 42	36.96 +/- 0.49	11.92 +/- 0.28
Hyak	NH4NO3	4815 +/- 231	34.18 +/- 0.97	10.77 +/- 1.37
Celia	urea	5937 +/- 188	39.25 +/- 1.58	9.91 +/- 0.41
Celia	Ca(NO3)2	5945 +/- 146	41.22 +/- 2.82	10.49 +/- 0.19
Celia	(NH4)2SO4	6000 +/- 306	37.28 +/- 2.07	9.89 +/- 1.87
Celia	NH4NO3	5403 +/- 115	39.05 +1- 0.74	10.15 +/- 0.92
Malcolm	urea	5883 +/- 362	45.97 +/- 0.86	11.32 +/- 1.01
Malcolm	CaNO3)2	5103 +/- 85	44.54 +/- 5.13	11.40 +/- 0.68
Malcolm	(N144)2SO4	5822 +/- 261	44.25 +/- 1.71	10.04 +/- 1.43
Malcolm	NH4NO3	5419 +/- 329	44.21 +/- 1.52	9.91 +/- 1.04
Stephens	urea	5849 +/- 155	50.16 +/- 1.13	11.57 +/- 0.37
Stephens	Ca(NO3)2	6285 +/- 170	48.17 +/- 1.96	12.30 +/- 1.23
Stephens	(NH4)2SO4	6429+/- 77	46.58 +/- 3.77	11.60 +/- 0.53
Stephens	NH4NO3	5717 +/- 296	49.23 +/- 1.13	11.08 +/- 1.00
Yamhill	urea	5331 +/- 124	41.65 +/- 2.27	11.07 +/- 0.57
Yamhill	Ca(NO3)2	4849 +/- 20	42.52 +/- 1.27	11.52 +/- 0.17
Yamhill	(NH4)2SO4	4548 +/- 169	40.71 +/- 4.01	11.05 +/- 0.79
Yamhill	NH4NO3	5073 +/- 166	41.22 +/- 3.01	11.78 +/- 0.99

' Values are presented as means +/- one standard error.