

Durum Intensive Management Study: Impact of Postemergence Nitrogen on Seed Quality

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Durum growers and the pasta industry need consistent seed yield and excellent quality for profitability. A significant production strategy of interest by durum growers is the use of postemergence-applied nitrogen (N) fertilizer to potentially increase seed yield and achieve hard amber durum milling quality.

A field study consisting of five trials was conducted during 2021-23 at NDSU Research Extension Centers in Carrington and Minot with financial support from the North Dakota Wheat Commission. The primary study objective was to examine durum seed yield and quality response, specifically seed protein and vitreous kernels (hard count), to 30 lbs per acre of supplemental N applied at tillering or post-anthesis (flowering) growth stages. Soil nitrate-N levels (125-175 lbs N per acre) present at seeding time were based on NDSU Extension recommendations. Research was conducted using the durum variety 'ND-Riveland' planted at 1.2-1.7 million pure live seeds per acre under center-pivot irrigation at Carrington and dryland at Minot.

Summary of study results:

Seed yield across five site-years, averaged 76.0 bu per acre with N applied at tillering stage, while yield was less (LSD [0.05] = 2.5 bu per acre) with post-anthesis applied N (72.2 bu per acre) and the standard management check (71.5 bu per acre).

Averaged across two site-years (Carrington 2022-23) in trials with soil N not sufficient for achieving the milling durum threshold level for vitreous kernels (85% or greater), the standard management check averaged 84% compared to 96% with application of post-anthesis N and 90% with tillering N (Table). In addition, seed protein improved to 13.6% with post-anthesis N and to 12.8% with tillering N, compared to standard management check at 11.9% (threshold for milling durum at 13%).



Durum Intensive Management trial during mid-season in 2022 at Carrington.

Table. Durum seed response to post-N application, Carrington 2022-23.

Timing of N treatment ¹	Seed			
	Vitreous (Hard count)		Protein	
	%	% improvement compared to check	%	% improvement compared to check
Standard management check	84	x	11.9	x
Tillering	90	7	12.8	8
Post-anthesis	96	14	13.6	14
LSD (0.05)	3	x	0.5	x

¹N applied at 30 lb per acre.

In summary, study data confirmed previous research where soil N levels limit yield potential, an early season postemergence N application (before the jointing stage) can increase wheat seed yield. Especially in environments with high seed yield potential and soil N levels inadequate for high quality seed, N application immediately after durum flowering will optimize the potential for a substantial increase in seed protein and hard seed count. The challenge is predicting durum seed yield, and deficient protein and hard seed count triggering market discounts, to make the decision to post-apply N to improve return on investment of N fertilizer and application costs.

NDSU Extension publications that may aid in making decisions to post-apply N in durum include:

- Ransom, J.K., et al. (2017) Field Guide to Sustainable Production of Quality Durum Wheat in North Dakota, A1825. North Dakota State University Extension Service, Fargo.
- Tools for determining need in spring wheat for immediate post-anthesis N application to enhance grain protein, <https://www.ndsu.edu/agriculture/extension/publications/site-specific-farming-active-optical-ground-based-sensor-algorithms-tools-0>.

The study also examined durum response to seeding rates and late-season application of fungicide. Plant stand targeted at 1 and 1.4 million plants per acre was investigated at Carrington in 2021, with no yield increase with the greater plant density. Foliar disease and Fusarium head blight (scab) were at minimal incidence levels in the trials causing no positive yield or quality response to fungicide application at early flower (Miravis Ace or Prosaro Pro) or sequential-application at early flower plus 4-7 days later (tebuconazole, Prosaro or Prosaro Pro).