Nitrogen Fertilization of Durum Based on Stem Nitrate, Buckeye, 1996

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Introduction

Best management practices for small grains as well as many other crops are based on preplant soil testing and in-season plant tissue testing. The lower part of the stem is sampled in the case of small grains, and analyzed for nitrate content. The nitrogen status of the plant at the time of sampling is defined as deficient, adequate, or excessive depending on the nitrate content of the tissue and the plant growth stage. Nitrogen fertilizer recommendations are provided based on the results of the tissue test.

The stem nitrate test for small grains has been the subject of extensive research for 20 years. A survey of Arizona wheat growers in 1996 showed that 30% normally use tissue testing as a guide for fertilization. The wheat tissue test has received more attention lately due to increased cost of nitrogen fertilizer, the demand for high protein grain, and the strong wheat market. The purpose of this test is to compare stem nitrate testing and standard farm practice in terms of the amount of nitrogen fertilizer applied, yield, and grain protein.

Procedure

A field trial was established at H-4 farms in Buckeye, AZ during the 1995-96 crop season on a sandy loam soil. The previous crop was cotton. The seedbed was prepared by cutting the stalks, disking, ripping, disking, blading, and forming the border ridges. A total of 54 pounds of nitrogen and 67 pounds of phosphate per acre were applied preplant as 16-20-0. The durum cultivar Duraking was planted at a rate of 175 pounds of seed per acre on 20 December 95. A total of 34.68 inches of irrigation water was applied in 10 irrigations using the border flood method on the following dates: 20 Dec (2.68 inches), 1 Jan (2.84 inches), 11 Feb (2.84 inches), 25 Feb (3.94 inches), 8 Mar (3.52 inches), 23 Mar (3.52 inches), 1 Apr (3.52 inches), 9 Apr (3.66 inches), 20 Apr (3.66 inches), 29 Apr (4.50 inches). On 14 Mar, 1 inch of rain was recorded.

The field was divided into eight plots 2.71 acres in size (1192 ft. x 99 ft.) consisting of three borders each at the first stem tissue sampling date on 1 Feb. Stem tissue was sampled and analyzed for nitrate a total of six times before each irrigation between 1 Feb and 4 Apr (Table 1). Four of the plots were controls or grower standard practice, and the other four in alternating strips were the stem nitrate treatment. The experimental design was a complete block with two treatments and four replications. The standard farm practice received 50 pounds of nitrogen per acre as UN32 in the irrigation water on 11 Feb, 25 Feb, and 1 Apr. The stem nitrate treatment received 50 pounds of nitrogen per acre as UN32 in the irrigation water on 11 Feb and 30 pounds of nitrogen per acre on 1 Apr. Thus, total nitrogen fertilizer including the preplant application was 204 pounds of nitrogen per acre for the standard farm practice and 134 pounds of nitrogen per acre for the stem nitrate treatment.

The plots were harvested on 23-24 May 96 with a commercial combine. The grain from the combine was augered into trucks which were weighed on truck scales and yield calculated based on the area. A sample of grain was saved and analyzed for test weight, kernel weight, hard vitreous amber count (HVAC), and protein. Test weight was determined using a 1 quart container and kernel weight and HVAC were determined from 10 grams of hand picked kernels. Protein was determined using a NIR whole grain analyzer and expressed on a 12% moisture basis.

Discussion

Grain yield and kernel characteristics are presented in Table 1. We were not able to detect any differences in yield, kernel characteristics, or grain protein due to nitrogen application. The stem nitrate test appears to be a good guideline for nitrogen fertilizer application. Nitrogen fertilizer application was cut by 70 pounds of nitrogen per acre, from 204 to 134 pounds of nitrogen per acre, without any change in yield or grain protein. The cost for a single stem nitrate tissue analysis is about $10, and if four samples are taken per 40 acres six times in the year, the cost is $240 per 40 acres, or $6 per acre. In this trial, we spent $6 per acre to save about $21 per acre of fertilizer.

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Table 1. Stem nitrate values obtained at various sampling dates for nitrogen fertilizer application based on standard farm practice or guided by stem nitrate testing. Stem nitrate guidelines are provided at the bottom of the table.

Nitrogen fertilizer treatment	Stem nitrate					
	1 Feb (3-4 leaf)	21 Feb (Early tillering)	5 Mar (Late tillering)	20 Mar (Joint)	29 Mar (Early boot)	4 Apr (Late boot)
	ppm					
Standard farm practice	4594	10,750	5063	1619	1625	875
Stem nitrate testing	5062	10,625	5438	3231	1600	1356
Stem nitrate guidelines						
Excess	5000	5000	5000	3000	3000	3000
Desired	2000-5000	2000-5000	2000-5000	1000-3000	1000-3000	1000-3000
Deficient	2000	2000	2000	1000	1000	1000

Table 2. Grain yield and kernel characteristics as influenced by nitrogen fertilizer application based on standard farm practice or guided by stem nitrate testing.

Nitrogen fertilizer treatment	Grain yield	Test weight	1000 kernel weight	Hard vitreous amber count	Grain protein
	lbs/acre	lbs/bu	grams	%	%
Standard farm practice	5698	63.0	49.9	100	12.9
Stem nitrate testing	5751	63.0	50.2	100	12.9
Statistical difference (5%)	No	No	No	No	No