

Seeding Rate Effects on Durum Grain Protein Concentration

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Summary

It has been observed in other wheat growing regions that stands that are thin rarely have problems with low grain protein. The purpose of this study was to determine if this is indeed the case in Arizona. A study was conducted at Maricopa where the durum varieties Duraking, Minos, and Turbo were sown at rates from 30 to 360 lbs seed/acre. Seeding rate had no effect on grain protein or yield in this study. The reported effects of thin stands on grain protein may be related to low yield rather than seeding rate per se.

Introduction

Durum grain protein is an important quality parameter. Growers will typically be docked if durum protein concentration falls below 13%. Several high yielding varieties currently grown in the state have protein contents near the 13% level. Nitrogen fertilizer has a major impact on grain protein. The influence of seeding rate is less well known. It has been observed in other regions that stands that are thin rarely have problems with low grain protein, presumably because of low yields; a constant amount of protein distributed over less dry matter in the grain will result in a higher protein concentration in the grain. The purpose of this study is to determine the influence of seeding rate on grain protein concentration.

Procedure

The effect of seeding rate was studied at the Maricopa Agricultural Center during the 1996 growing season using the durum varieties Duraking, Minos, and Turbo. These varieties are fairly similar in maturity, are high yielding, and have relatively low grain protein content. The soil type was a Trix clay loam. The field was in sudangrass the previous summer. Preplant soil nitrate was 18 ppm $\text{NO}_3\text{-N}$ and preplant soil phosphate was 17 ppm P, both of which are considered high levels. Seed was planted into dry soil on November 15 and 16, 1995, and a germination irrigation was applied on November 16. The seed was planted with a cone planter in seven rows spaced 8 inches apart. The seeding rates were 3.6, 7.3, 14.5, 21.8, 29.0, and 43.6 pure live seeds per foot of row. A seeding rate of 14.5 pure, live seeds per foot of an 8-inch row corresponds to approximately 120 pounds of seed per acre. The plots were 6 ft. x 20 ft. The experimental design was a randomized complete block design with a factorial arrangement of treatments and 4 replications, 3 varieties, and 6 seeding rates.

The plots were irrigated on November 16, January 12, February 16, March 7, March 22, April 5, and April 17. Urea ammonium nitrate solution (32-0-0) was applied in the irrigation water at a rate of 100 lbs N/A on January 12, 50 lbs N/A on February 16, 50 lbs N/A on March 7, and 30 lbs N/A on March 22 for a total of 230 lbs N/A. The plots were harvested with a small plot combine in late May. The following data was collected: grain yield, grain protein concentration, heading, flowering, physiological maturity, plant height, and lodging. Grain protein was calculated by multiplying total N (determined by the combustion technique) by a factor of 5.7.

Discussion

Seeding rate averaged across the three varieties had no effect on grain yield, grain protein, or physiological maturity, but increased seeding rate hastened heading and flowering, decreased plant height, and increased lodging (Table 1). The lack of an effect of seeding rate on grain yield is remarkable due to the wide range of seeding rates used in this study. The hastening of maturity due to increased seeding rate is due to fewer late maturing tillers forming in the high compared to low seeding rates. The decrease in plant height due to increased seeding rate is not expected since crowding of plants tends to result in increased stem elongation. The increase in lodging with increased seeding rate has been observed in the past.

The varieties responded in a similar manner to seeding rate except for Minos, which exhibited much greater delays in heading and anthesis due to low seeding rates compared to the other varieties. These results do not confirm the results from identical work conducted the previous year where low seeding rates increased grain protein concentration of Minos but not the other varieties (Ottman, 1995). In two years of research, we have not been able to confirm the hypothesis that grain protein concentration is greater in thin stands. The effect of thin stands on grain protein concentration may be more related to yield than seeding rate per se.

Literature Cited

Ottman, M. J. 1995. Seeding rate and phosphorus fertilizer effects on durum grain protein concentration. P. 43-45. Forage and Grain. Univ. Ariz. Coll. Agric. Coop. Ext. Serv. Report Series P-102, Tucson.

Table 1. Seeding rate effects on grain yield, plant height, lodging, and grain protein for three durum varieties.

Variety	Seeding rate seeds/ ft of row	Seeding rate lbs/acre	Grain yield ¹ lb/acre	Grain protein ¹	Heading	Flowering	Maturity	Plant height inches	Lodging %
Duraking	3.6	30	6292	12.4	3/13	3/20	4/30	37.4	10
	7.3	60	6663	12.3	3/13	3/24	5/1	37.7	8
	14.5	120	6809	12.3	3/11	3/21	4/30	37.4	15
	21.8	179	6899	12.0	3/11	3/18	4/30	34.7	18
	29.0	239	6629	12.4	3/11	3/18	4/30	36.9	23
	43.6	359	6224	12.2	3/11	3/19	4/29	36.2	45
Minos	3.6	32	5785	13.1	3/10	3/16	4/30	39.4	45
	7.3	63	5684	13.4	3/8	3/13	4/28	37.7	58
	14.5	126	5594	13.4	3/5	3/12	4/27	39.4	63
	21.8	189	5718	13.6	3/4	3/10	4/27	37.9	75
	29.0	253	5290	14.5	3/2	3/9	4/27	35.9	88
	43.6	379	5042	13.5	3/2	3/9	4/26	38.4	85
Turbo	3.6	30	6370	11.7	3/15	3/25	5/3	41.8	20
	7.3	60	6776	11.6	3/14	3/22	5/2	41.8	28
	14.5	120	5965	11.5	3/13	3/18	5/3	39.9	35
	21.8	181	5954	11.7	3/13	3/21	5/2	40.4	43
	29.0	241	6427	11.2	3/11	3/20	5/5	39.4	58
	43.6	361	6111	11.4	3/12	3/21	5/3	40.9	60
Least Significant Difference (5%)			690	1.0	2	4	3	2.3	26
Average	3.6	31	6149	12.4	3/13	3/20	5/1	39.5	25
	7.3	61	6374	12.4	3/12	3/19	4/30	39.0	31
	14.5	122	6123	12.4	3/10	3/17	4/30	38.9	38
	21.8	183	6190	12.4	3/9	3/16	4/29	37.7	45
	29.0	244	6115	12.7	3/8	3/16	5/1	37.4	56
	43.6	366	5793	12.4	3/8	3/16	4/29	38.5	63
Least Significant Difference (5%)			NS	NS	1	2	NS	1.3	15
<u>Effect</u>					<u>Significance of Effects</u> ²				
Seeding Rate			NS	NS	**	**	NS	*	**
Variety			**	**	**	**	**	**	**
Seeding Rate x Variety			NS	NS	**	*	NS	NS	NS

¹ Grain yield and grain protein expressed on an "as is" moisture basis.

² NS, *, ** = not significant at the 5% probability level and significant at the 5% and 1% probability levels, respectively.