Production Management of Durum Wheat

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Introduction

The agronomy of hexaploid (bread) wheat production has been researched extensively. The effect of row spacing and seeding rate has been variable but in high moisture environments yields have often been increased by narrow row spacings (Holiday 1963). Brandt et al (1990) found that yields of HY320 and Neepawa wheats were greater when planted in narrow rows, at several sites in Central and Northern Saskatchewan. Lafond (1994) found that durum wheat had significantly higher yields at 30 cm vs 10 cm row spacings seeding rate did not alter the row spacing effect. At seeding rates greater than 67 kg/ha (~ 150 seeds/m*) there was a small increase in yield. Since durum wheat and hexaploid wheat are thought to share some common parentage their agronomy has been assumed to be similar. The effects of seeding rate, seeding date or row spacing on the performance of durum wheat under irrigation at high latitudes have not been determined.

Materials and Methods

Seeding date

Several grain cultivars were grown in plots 4.2 m by 9.1 m in a 4 replicate randomized complete block. Seeding dates were: May 5-10 (early) and May 25-28 (late). This trial was conducted from 1989-92, however the early seeding date in 1991 was not planted due to excess soil moisture. Nitrogen was broadcast at 112 kg/ha in addition to the soil test nitrogen levels (approximately 55 kg/ha). P_2O_5 was applied at seeding as 105 kg/ha of 11-52-o with a sidebanding hoe opener. All trials were planted on cereal grain stubble.

Seeding rate and row spacing at 2 nitrogen levels

The design of the trial was a 6 replicate split plot with seeding rates and seeding equipment arranged in a factorial within the main plots. Main plots were 112 and 150 kg/ha of fertilizer nitrogen applied prior to planting a 6 replicate split plot design. Sceptre durum wheat was planted at 215, 320 and 430 seed/m^2 with each of 4 seeding systems, within nitrogen blocks. These seeding rates are approximately 1.4, 2.0 and 2.8 bu/ac. The seeding systems were Amazone (hoedrill) 8 cm, Amazone (hoedrill) 16 cm, ConservaPak openers on 20 cm centres, normal airseeder with openers on 20 cm centres and a seed spread of about 15 cm. Nitrogen was preplant banded with 55 kg/ha P_2O_5 on 20 cm centres. Subplots were 4 x 21 m with 2 m from the centre of the plot harvested for grain.

The percent of the area lodging and the degree of lodging (0.2 erect, 9 flat) were rated. The percentage of the plot area lodged was coded into 5 groups with increments of 20% ie 1 =0-

20%, 5 =80-100%. The degree of lodging*the area lodged (l-5) gave the relative lodging rating. Weed control was obtained using various herbicides applied at recommended times and rates. This trial was conducted on a high nitrogen tine sandy loam (> 80 kg/ha) and a low nitrogen clay loam soil from 1990 to 1992.

It was not possible to run a combined analysis of variance over years for the seeding date trial or the seeding method*rate trial since the variances were not homogeneous.

Results and Discussion

Seeding date

Seeding date in this trial is treated as a fixed effect in that early May and late May seeding dates differ significantly in daylength and temperature during the spikelet development phase of the crop. However, since every growing season has a unique combination of solar radiation and temperature, crop development will differ between seasons. Lodging is an extremely variable trait and thus a significant interaction between seeding date and cultivar was identified only in 1989 (Table 1). The semidwarf cultivars Biggar CPS wheat and Duke barley were consistently more resistant to lodging.

Table 1. Effect of seeding date on yield and lodging of cereal grains

Cultivar	seed date	Lodging l-9			Yield kg/ha		
		1989	1990	1992	1989	1990	1992
Arcola	Early	2.8	3.5	5.2	5624	5073	5961
Medora	Edrly	2.0	3.5	4.3	5555	5166	6512
Sceptre	Early	1.8	2.3	2.3	6222	5628	6995
Katepwa	Early	3.5	1.5	3.0	5455	5249	5003
Roblin	Early	1.3	0.7	1.0	5416	5012	5374
Duke	Early	1.5	1.0	2.5	6255	6946	6255
	Mean	2.0	1.9	2.9	5879	5597	5944
Arcola	Late	8.0	8.5	6.5	4550	4049	4843
Medora	Late	5.6	9.0	5.6	4252	4052	5060
Sceptre	Late	7.0	7.6	4.1	4424	4387	4538
Katepwa	Late	5.5	6.5	5.5	4202	4946	4301
Roblin	Late	4.2	2.2	4.3	4401	4718	473 I
Duke	Late	2.8	4.5	1.8	5964	7112	6124
	Mean	5.3	6.0	4.2	4681	4853	4963
Pr>0.5	LSD	NS	NS	NS	588	842	903

Early (May 5-10), Late (May 25-28)

Yields of Duke barley decreased less than other cultivars in all seasons (Table 1). The durum cultivars reacted similarly to each other. Durum yields declined between 23 and 41% % due to the delay in planting. While there will be seasons where yields do not decline, early seeding appears to be a low cost method of maintaining high yields.

Seeding rate and row spacing

Increasing nitrogen rate from 112 kg/ha to 150 kg/ha decreased yields in 1 of 6 seasons and had no significant effect in the remaining 5 site years. This would indicate that soil test recommendations are adequate to ensure high yields and that increased nitrogen may actually reduce yields unless cultivars with greater lodging tolerance are used.

Increasing seeding rate from 215 to 430 seeds/m^2 increased the number of heads in 3 of 6 trials but this increase was less than 10% (Table 2). In each case where the number of heads increased lodging also increased and therefore yields were significantly lower. In 4 of 6 trials, including all three seasons at the high nitrogen site, yields were lower at high seeding rates. While higher seeding rates reduced yields by less than 5% the increased lodging that occurred at 3 of the 4 sites would hinder harvesting and can not be recommended for Sceptre durum. Genetic material with superior lodging tolerance is being developed, this should allow an increase in nitrogen application rates.

Yields were not improved when seed was distributed more uniformly, 8 cm or "solid seeding", at any seeding rate (Table 3). Stapper and Fischer (1990) report similar responses under irrigated conditions with bread wheat. In Saskatchewan Lafond found no effect of row spacing in bread wheat and higher yields of durum at 30 vs 10 cm, while Brandt el al (1990) found higher yields in bread wheats at narrow row spacings. Narrow row spacings did not improve yields in these trials and did not improve yields even with the semidwarf genotypes used by Stapper and Fischer (1990). This may be due to the fact that most genetic material has been selected at row spacings between 20 and 30 cm. Under irrigated conditions many tillers die without producing heads and while head numbers were increased competition appeared to reduce the other yield components such that yield did not increase. This implies that although a greater leaf area may be formed earlier in the season the extra light intercepted early in the season is not used to increase grain yield.

Lodging increased with seeding rate at both sites in 1990 and 1991 while in 1992 very little lodging occurred at either site. This was despite that fact that high yields were produced in 1992. Lodging is the result of light, temperature and storm conditions and in some seasons reducing seeding rate will have a small effect on lodging. Although there were significant effects on spacing on lodging at both sites in 1990 and 1991 the impact was small and the spacing differed between years.

Table 2. Effect of seeding rate on agronomic traits of durum wheat

Site	plants/n?			heads/m*			lodging (0.2-9)			grain (kg/ha)		
seeds/m*	215	320	430	215	320	430	215	320	430	215	320	430
HighN90	105	157	162	372	389	402	1.2	2.9	4.5	6350	6028	5747
HighN9 1	152	199	226	296	309	304	2.3	3.8	5.1	3659	3441	3141
HighN92	to4	131	160	300	312	313	0.8	0.6	0.9	6284	5989	5606
LowN90	108	134	153	359	365	381	0.6	1.2	1.8	5365	5399	5142
LowN91				281	287	295	0.2	0.6	0.8	4732	4146	4487
LowN92	99	121	148	285	288	298	0.2	0.2	0.2	4870	4881	5084

Shaded area under a column headmg indicatesignificantdifferences between the means

Table 3. Effect of seeding equipment on head number and yield of durum wheat

	Head/m'				Yield (kg/ha)			
	solid seed	Amazone 8 cm	Amazone 16 cm	Hoedrill @20 cm	solid seed	Amazone 8 cm	Amazone 16 cm	Hoedrill @20 cm
HighN90	392	391	387	379	5908	5877	6289	6114
HighN91	343	316	261	299	3445	3263	3534	3414
HighN92	312	309	304	307	5789	6063	6058	6035
LowN90	367	382	355	369	5480	5416	4904	5351
LowN91	330	296	255	271	4475	4769	4892	4511
LowN92	301	268	289	304	4896	4954	4587	5343

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