EFFECT OF VARIOUS TREATMENTS ON THE PERFORMANCE OF DURUM AND COMMON WHEAT

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INTRODUCTION

Durum wheat is an important crop to Saskatchewan grain producers. It is cultivated with few exceptions in dry, low rainfall areas of the world. Yields tend to be more variable than for wheat grown in more favorable climates. Even though it is a different species than bread wheat, it is treated similarly in most locations where it is grown (Danke et al., 1988; Panchuck, 1989).

Cultivars that respond differently to changes in environment may be suited to conditions of higher nitrogen or lower seeding rate, for example. Wheat cultivars have been reported to respond differently to seeding rates, and nitrogen applications. Durum did not respond differently to bread wheat the only study found in Montana (Black and Siddoway, 1977). Cutforth et al. (1988) found that semi-dwarfs outyielded standard height cultivars, and the durum cultivars slightly outyielded the bred wheats. Differences among cultivars in their ability to produce large spikes, spike bearing tillers, and numbers of kernels per spike are important in determining grain yields (Frank and Bauer, 1984).

It is evident that information about durum wheat with respect to agronomy is limited. The amount of research on pathology of durum is also small. From a literature review it could not ascertained whether durum wheat differs from bread wheat in responses to various management and environmental factors. This project was undertaken to determine if durum and bread wheat have similar growth responses to selected treatments in Saskatchewan.

MATERIALS AND METHODS

In 1988, four separate factorial experiments were conducted at four sites. Sites included Dinsmore and three locations near Saskatoon, Kernen Crop Research Farm, Zimmerman, and the Goodale Research Farm. All experiments included six varieties of spring wheat (Table 1) seeded using a small plot double disc drill. Seeding rate was 250 plants /m^2 (except seeding rate test) after adjustment for kernel size and germination percentage. Plot sizes were 2 x 4.5 m except for the seeding rate test which was 1 x 4.5 m in size. Site characteristics are presented in Table 2.

Table 1. Location, preceding crops, soil N, and moisture of 1988 test sites.

Location	Previous Crop	Total N at Seeding (kg/ha)	Seedbed Moisture
KCRF	Summerfallow	153	moist
Zimmerman	Canola	52	dry
Goodale	Spring wheat	37	dry
Dinsmore	Durum wheat	21	dry

Table 2. Characteristics of varieties used.

VARIETY	CLASS	INTRODUCED	DAYS TO MATURITY	HEIGHT (cm)
Kyle	CWAD	1984	103+	103
Medora	CWAD	1982	100	95
Sceptre	CWAD	1984	99	87
Wakooma	CWAD	1973	102	100
Katepwa	CWRS	1981	98	n/a
HY320	CPS	1984	102	n/a

From Townley-Smith et al. (1987), D. Leisle (1986), D. Knott (1986) and Hurd et al. (1973).

Four experiments, nitrogen rate, seeding rate, foliar fungicide, and seed treatment, were established at each location. Two experiments were set up in a Randomized Complete Block Design. The first of these was a Nitrogen test of three levels: field level, 30 kg/ha, and 60 kg/ha N in ammonium nitrate form, hand broadcasted at seeding. The second was a plant population test seeding at 150, 250, and 350 plants/m^2. Plant emergence, tiller number at anthesis, number of heads at maturity, yield, yield components and percentage protein were measured. Emergence was not measured in the nitrogen test.

The remaining experiments were set up in a split-plot design to simplify spraying and for isolation purposes. Foliar fungicide treatments included no treatment, Tilt (propiconozole, systemic) and Dithane (mancozeb,non-systemic) both applied at approximately Zadoks 50. Seed treatments included no treatment, Vitavax dual (carbathiin) and HWG 1608 (ethyltrianol). Leaf spot disease ratings using the Horsefall - Barrett scale were completed at the flag leaf stage on 10 leaves/plot at Dinsmore and Goodale on both tests. Plant emergence, total number of tillers/m^2, number of heads/m^2, yield, yield components, and smudge ratings were observed on the seed treatment test, but only yield, yield components, and smudge ratings on the foliar fungicide test were measured.

Only highlights of this first seasons data will be presented in this paper.

RESULTS AND DISCUSSION

All plots were harvested in 1988 except the Goodale nitrogen and seeding rate tests due to late infestations of Russian thistle. HY320 produced the highest yield of all cultivars at 1108 kg/ha (17 bu/ac) at KCRF. Durum yields were 45, 30, and 26% of the 10-year means at KCRF, Zimmerman, and Dinsmore respectively.

Plant Population

The effects of higher seeding rate on emergence was significant at Dinsmore (Table 3). Only the 350 seed/m^2 rate increased emergence. Seeding rates at 250 to 350 seeds/m^2 were not different from each other but significantly increased heads/m^2 above the lowest seeding rate. Medora, Kyle, and Wakooma yielded the highest. Medora outyielded Katepwa at this location by 27%. There was no effect of seeding rate on yield. The interaction between cultivar and seeding rate was not significant on any of the characters measured.

Table 3. Effect of cultivar and seeding rate on yield, and density of plants and heads at Dinsmore.

CULTIVAR	PLANTS/m^2	HEADS/m^2	YIELD (kg/ha)
Kyle	120b*	102cd	630c
Medora	107b	85bc	580bc
Sceptre	48a	53a	420a
Wakooma	120b	87bc	580bc
Katepwa	98b	109d	430ab
HY320	113b	77b	440ab
TREATMENT			
150 (seeds/m^2)	82a	72a	460ns
250	98a	93b	530
350	123b	92b	550
C x SR	ns	ns	ns

* means within the same factor and column followed by the same letter are not significantly different (p=0.05) according to the S-N-K test.

The effect of higher seeding rates on emergence and heads/m^2 was significant at KCRF (Table 4). Each increment of seeding rate increased the number of plants/m^2 and heads/m^2. HY320, the highest yielding, outyielded Katepwa by 14%. Higher seeding rates decreased kernel weights and the interaction between cultivar and seeding rate on kernel weight was significant (data not shown). The significant interaction between cultivar and seeding rate on heads/m^2 (fig.1) was due to Katepwa producing the most heads when seeded at 250 seeds/m^2 while the optimum for Kyle and HY320 was 350 seeds/m^2. Wakooma showed no response and Sceptre and Medora performed similarly at the two higher seeding rates.

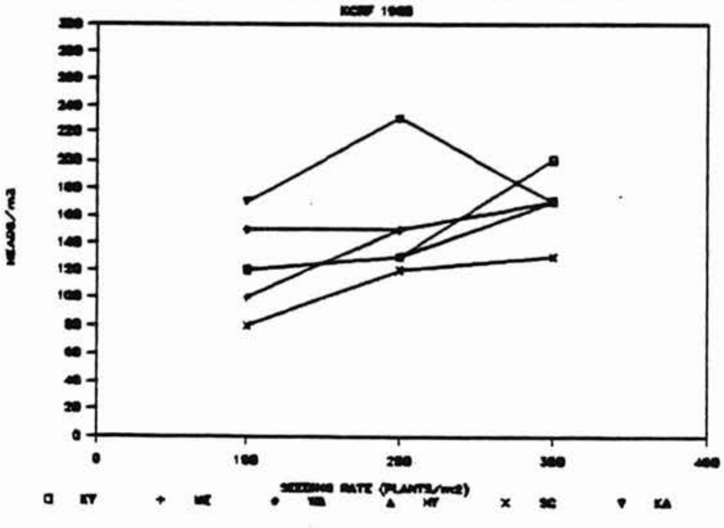
Table 4. Effect of cultivar and seeding rate on yield, and density of plants and heads at KCRF.

CULTIVAR	PLANTS/m^2	HEADS/m^2	YIELD (kg/ha)
Kyle	98b*	150b	960ab
Medora	112b	140b	1030ab
Sceptre	54a	107a	840a
Wakooma	101b	154b	970ab
Katepwa	113b	191c	970ab
HY320	79ab	140b	1110b
TREATMENT			
150 (seeds/m^2)	58a	125a	880a
250	89b	150b	1020b
350	131c	166c	1050b
C x SR	ns	*	ns

*means within the same factor and column followed by the same letter are not significantly different (p=0.05) according to the S-N-K test.

fig. 1

CULTIVAR x SEEDING RATE ON HEADS



The effect of higher seeding rate was also significant at Zimmerman (Table 5). Each increment of seeding rate increased plants and heads/m^2. The significant interaction between cultivar and seeding rate on emergence was due to the lack of response to the highest seeding rate in most cultivars (fig. 2). Only Katepwa and Kyle showed an increased number of plants at the highest seeding rate. Sceptre yielded the highest at this location, outyielding Katepwa by 34%. There was no effect of seeding rate on yield.

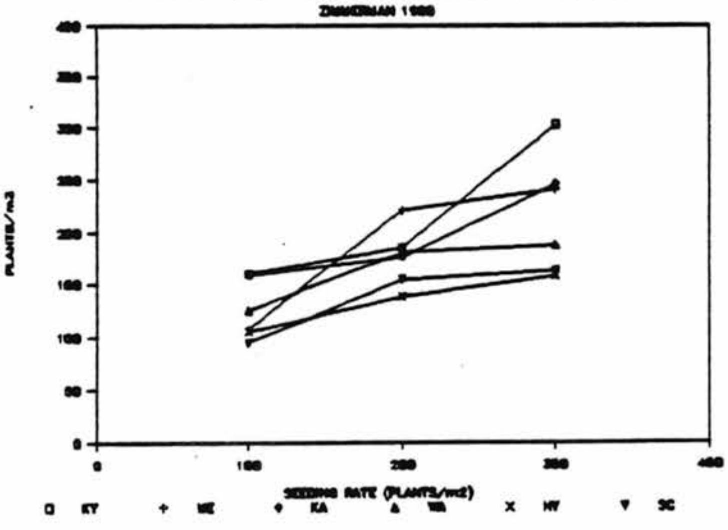
Table 5. Effect of cultivar and seeding rate on yield, and density of plants and heads at Zimmerman.

CULTIVAR	PLANTS/m^2	HEADS/m^2	YIELD (kg/ha)
Kyle	218c*	184ns	630ab
Medora	192bc	176	630ab
Sceptre	139a	163	670b
Wakooma	167ab	192	610ab
Katepwa	196bc	194	500a
HY320	136a	170	570ab
TREATMENT			
150 (seeds/m^2)	126a	155a	590ns
250	178b	183b	570
350	219c	197c	640
C x SR	**	ns	ns

* means within the same factor and column followed by the same letter are not significantly different (p=0.05) according to the S-N-K test.

fig. 2

CULTIVAR x SEEDING RATE ON PLANTS



At Goodale, the medium and high seeding rates were not different from each other but produced significantly greater stands than the lowest seeding (Table 6). An increase in seeding rate produced significantly greater number of heads. There was no significant interaction between cultivar and seeding rate at this location.

Table 6. Effect of cultivar and seeding rate on yield, and density of plants and heads at Goodale.

CULTIVAR	PLANTS/m^2	HEADS/m^2	YIELD (kg/ha)
Kyle	138ns	103ab	n/a
Medora	128	116b	
Sceptre	96	78a	
Wakooma	122	100ab	
Katepwa	147	116b	
HY320	112	97ab	
TREATMENT			
150 (seeds/m^2)	94a*	82a	n/a
250	132b	103b	
350	145b	119c	
C x SR	ns	ns	n/a

* means within the same factor and column followed by the same letter are not significantly different (p=0.05) according to the S-N-K test.

Generally, the optimum seeding rate for these locations in 1988 was 350 seeds/m^2 for all cultivars except Katepwa and Wakooma which yielded highest at 250 seeds/m^2.

Nitrogen Rate

Increased nitrogen increased tiller number only at Dinsmore where soil N was only 21 kg/ha (Table 7). Nitrogen applied at 30 kg/ha produced the same tiller number as 60 kg/ha N. There was no effect on heads/m^2. The addition of the lowest nitrogen level had a significant effect at Dinsmore, increasing yields by 30% over the field level yield. Kernel weight decreased with higher nitrogen levels at KCRF but not Dinsmore (Data not shown). There no interaction between cultivar and N on tillers, heads or yield.

Table 7. Effect of cultivar and nitrogen rate on yield, and density of tillers and heads at Dinsmore.

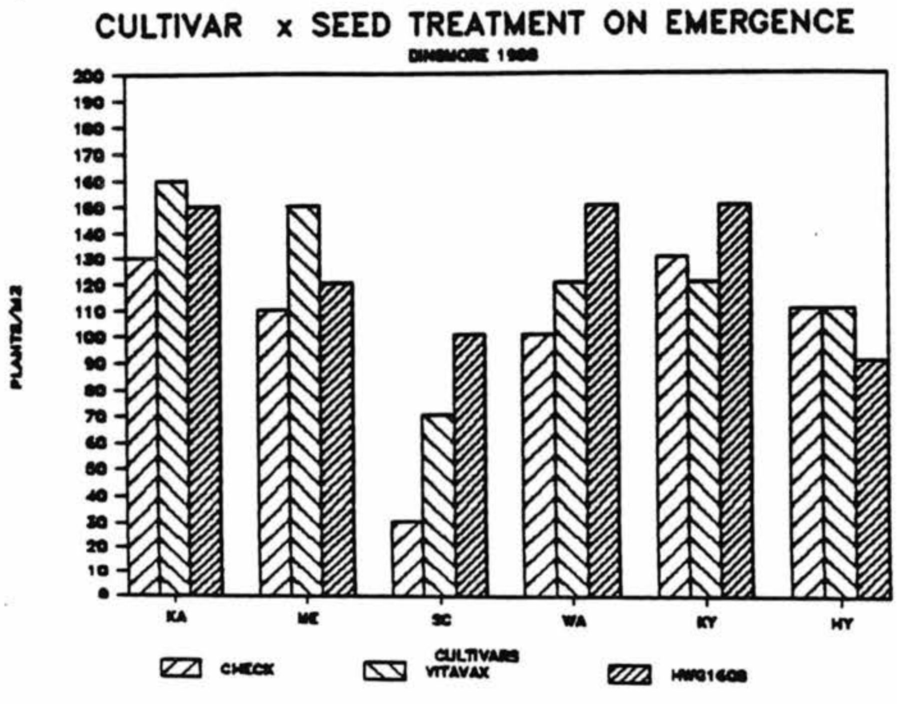
CULTIVAR	TILLERS/m^2	HEADS/m^2	YIELD (kg/ha)
Kyle	220b*	96bc	640b
Medora	185ab	85abc	650b
Sceptre	149a	68a	460a
Wakooma	186ab	85abc	460a
Katepwa	212b	102c	470a
HY320	202b	76ab	510a
TREATMENT			
0 (kg/ha)	169a	84ns	430a
30	199b	86	560b
60	209b	86	610b
C x N	ns	ns	ns

* means within the same factor and column followed by the same letter are not significantly different (p=0.05) according to the S-N-K test.

Seed Treatment

There was no main effect of seed treatment on emergence at any location. There was, however, a significant interaction between cultivar and seed treatment on emergence at Dinsmore (fig. 3). This could be attributed to the positive response to seed treatment by all cultivars except HY320 which showed no response to Vitavax and a negative response to HWG1608. The very poor germination of Sceptre may have led to emergence 2 and 3 times greater due to Vitavax and HWG 1608 respectively.

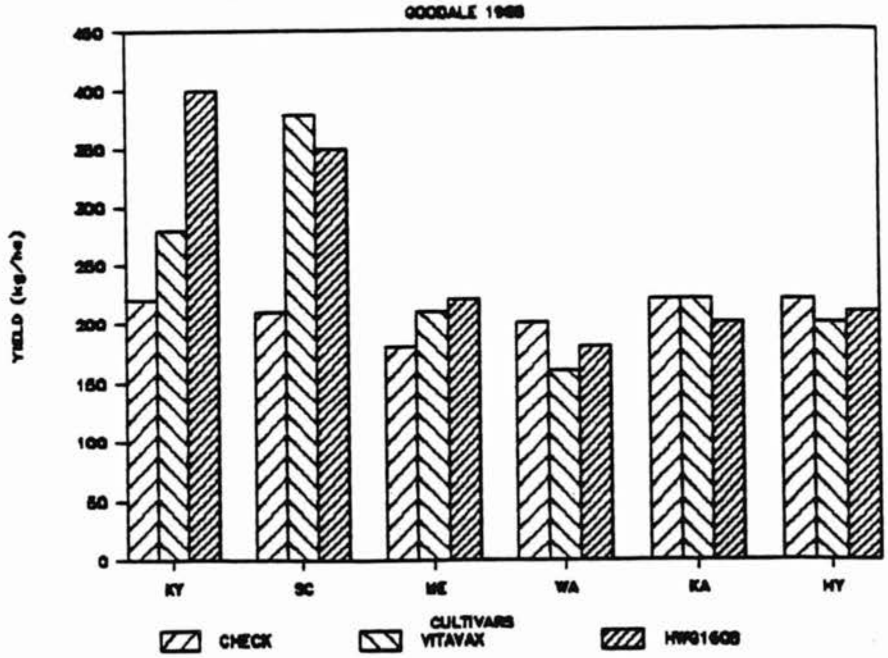
fig. 3



There was no significant yield response due to seed treatments in 1988. The interaction was significant between cultivars and seed treatments on yield at Goodale (fig. 4). The significant interaction at Goodale was due to the positive yield response of the Kyle and Sceptre to both seed treatments, the negative yield response of HY320, and little or no response of Katepwa, Medora, and Wakooma to either seed treatment.

fig. 4

CULTIVAR x SEED TREATMENT ON YIELD



The amount of leaf spot diseases was small in these tests (data not shown). After plating leaves from all sites, spotting on leaves was attributed primarily to Septoria nodorum and physiological phenomenon. There was no effect of seed treatment on the incidence of these diseases in our 1988 tests.

Foliar Fungicide

There were no significant responses in any of the cultivars to foliar fungicides in any of the characters studied.

SUMMARY

This was a trying year for conducting crop research in Saskatchewan. Variation across test sites was large causing problems in data interpretation. However, several generalities can be drawn from this information that can be used in planning next years research.

1. Classes of wheat responded differently to seeding rate with respect to emergence and heads/m^2. The effect on emergence was not expected because seeding rates were adjusted for kernel size and germination percentage. Cultivars of durum responded differently from each other in these variables also.

2. The effect of Nitrogen was significant only at Dinsmore where soil N was the lowest and no interactions between cultivar and N were significant at any location. This was due to the low rainfall in 1988 limiting yields and lowering the uptake of nitrogen.

3. The effect of seed treatment on yield of Kyle and Sceptre showed the differential response of seed treatment on wheat cultivars. The performance to the experimental fungicide HWG 1608 was as good as or better than Vitavax in these tests in 1988.

4. The dry growing season limited development of foliar diseases and resulted in no responses to foliar fungicides in 1988.

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