

SEED WEIGHT OF DIPLOID AND TETRAPLOID CRESTED WHEATGRASS CULTIVARS GROWN IN SOLID STANDS

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ABSTRACT

Much of the seed production of crested wheatgrass [*Agropyron cristatum* (L.) Gaertn. sensu lato] in the northern Great Plains occurs in solid stands. Variability in seed weight between and within diploid and tetraploid cultivars grown in solid stands has not been quantified. Tetraploid cultivars produced larger ($P < 0.01$) seed (242.3 mg/100 seeds) than diploid cultivars (143.2 mg/100 seeds) over up to 4 years in 2 separate experiments at Highmore, SD. Consistent differences were not detected among cultivars within ploidy levels. Mean 100-seed weights were higher ($P < 0.01$) for the first than second, third, or fourth production years. In this study seed weight of crested wheatgrass grown in solid stands was more strongly influenced by environment and ploidy than cultivar type within ploidy groups.

INTRODUCTION

Seed weight has been shown to be positively correlated with ability of crested wheatgrass [*Agropyron cristatum* (L.) Gaertn. sensu lato] seedlings to emerge from increasing planting depths (Rogler, 1954). Clonal nursery studies (Schaaf et al., 1962) indicated high heritability of seed weight in tetraploid crested wheatgrass. Rogler (1954) concluded that the most direct approach for increasing seedling vigor was selection of heavy-seeded types.

Tetraploid crested wheatgrass plants produce larger seeds than diploid plants (Schaaf et al., 1962), but little is known about seed weight variability among and within ploidy groups grown in solid stands in dryland environments. Since much of the crested wheatgrass seed production in the northern Great Plains occurs on dryland in solid-seeded stands, it would be useful to know if seed weight differences occur among cultivars under those conditions. Large-seeded cultivars should have superior seedling vigor and could serve

as base populations for selection for increased seed weight. This study was conducted to quantify seed weight differences between and within diploid and tetraploid crested wheatgrass cultivar groups grown in solid stands under dryland conditions in the northern Great Plains.

METHODS

Three diploid (Fairway, Parkway, and Ruff) and three tetraploid (Summit, Nordan, and HyCrest) crested wheatgrass cultivars and one diploid experimental population (SD 701) were planted at 8.5 kg pure live seed/ha in randomized complete block designs with 2 replications at Highmore, SD, during September 1984 and 1986. Nordan was not included in the 1986 planting. Individual plots consisted of 4 rows 7.5 m long with 30-cm spacing. Soil types were Plankington-Hoven silt loam (Typic Agriallbolls, fine, montmorillonitic, mesic and Typic Natraquolls, fine montmorillonitic, mesic) and Stickney silt loam (Glossic Natrustolls, fine, montmorillonitic, mesic) for the 1984 and 1986 experiments, respectively. Both sites were fallow for a year prior to planting. Fertilizer was not applied before or during the study.

During August 1985 and 1986 for the 1984 planting and August 1987, 1989, and 1990 for the 1986 planting, spikelets were stripped by hand from randomly selected mature spikes in the field. Empty florets were removed by air-column separation. Three 100-seed (fertile floret) samples obtained from each plot were weighed using an analytical balance. Plot means were subjected to analyses of variance in which cultivars and years were considered fixed and replications were considered random.

RESULTS AND DISCUSSION

Highly significant ($P < .01$) differences for seed weight were found among cultivars and among years in both experiments, but the cultivar x year interaction was highly significant ($P < 0.01$) for the 1984 experiment and significant ($P < 0.05$) for the 1986 experiment. Mean 100-seed weights were approximately 70% greater for tetraploid than diploid cultivars and were similar among cultivars within ploidy groups. Fluctuations in cultivar rank between years for seed weight occurred only within ploidy levels (Table 1).

Wide annual fluctuations related to environmental stresses (Wheeler and Hill, 1957) occur in crested wheatgrass seed yields. The magnitude of annual fluctuations in seed weight associated with the same environmental factors have not been well documented. This study quantified seed weight differences between diploid and tetraploid cultivars grown in solid stands under semiarid conditions. It also revealed large differences between production years for seed weight in cultivars of both ploidy levels. Percent reductions in seed weight in the second, third, and fourth production years were similar

for diploid and tetraploid cultivars, indicating no difference between ploidy levels for seed weight consistency across years. Schaaf et al. (1962) found only small decreases in seed weight of tetraploid crested wheatgrass in second and third harvest years at Mandan, ND. Their study differed from the present in that row spacing was 80 cm, and 40 kg/ha of nitrogen was applied annually.

As consistent differences were not detected among cultivars within ploidy groups, it is unlikely that any of the cultivars tested would be superior for seed weight stability in similarly managed dryland seed production fields in the northern Great Plains.

According to Rogler (1954) the most direct approach for increasing seedling vigor in crested wheatgrass is selection for heavy-seeded types. His work demonstrated that diploid cultivars produce much less vigorous seedlings than tetraploid cultivars and that seedling vigor within ploidy levels is strongly correlated with seed weight. Selection for increased seed weight in crested wheatgrass could be made more efficient if superior cultivars could be identified to serve as base populations. Data obtained from this study suggest that since seed weights of cultivars within ploidy levels were similar, initial selection at the cultivar level would not be beneficial if genetic variability for seed weight is similar for all cultivars.

Table 1. Mean 100-seed weights (in milligrams) for six cultivars and one experimental population of crested wheatgrass evaluated in solid stands at Highmore, SD.

Cultivar	Year planted				
	1984		1986		
	Year harvested				
	1985	1986	1987	1989	1990
Tetraploid					
HyCrest	278.3	235.2	267.0	231.9	246.6
Nordan	250.3	198.0			
Summit	249.7	232.6	272.4	228.3	207.9
Diploid					
SD 701	154.6	152.1	176.0	134.8	140.2
Ruff	158.5	133.3	155.1	131.2	133.4
Fairway	157.9	124.5	166.7	122.9	129.7
Parkway	140.6	130.0	156.8	125.2	146.9
Fisher's Protected					
L.S.D. (0.05)	14.9		18.8		

Nordan was not included in the 1986 planting.

LITERATURE CITED

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