Growth Regulators for Use in Winter Wheat
1: Gibberellic Acid Enhancement of Fall Establishment

Alexander D. Pavlista, Crop Physiologist
UNL- Panhandle Research and Extension Center, Scottsbluff, NE 69361

The desired planting date for winter wheat in this area is around the middle of September if not earlier but summer crops in rotation with winter wheat are not harvested until late September or even early October. Stimulating seedling wheat growth under cooler conditions could allow wheat to be planted later and be established for winter survival. Winter wheat would be more compatible with summer crops. Gibberellic acid (GA3) is the most active gibberellin hormone and naturally causes plants to grow taller. The objective of this study was to increase seedling growth of winter wheat under cool soil conditions.

After completing growth chamber studies of several varieties grown under two temperature regimes, field studies were conducted last year to evaluate application methods. In the 2006-07 season, a detailed dose response was determined in the field at the Panhandle Research and Extension Center. Seeds of the varieties Goodstreak, a standard type, and Wesley, a semi-dwarf, were treated with GA3 at 0, 125, 250, 500, and 1000 ppm and planted on 20 Sep, 4 Oct and 16 Oct 2006. Height was measured in Nov 06 and Mar 07; mass weight was taken on samples in May, and yield was harvested in July. Goodstreak was more sensitive to GA3 than Wesley. In fall 2007, these trials were replicated to verify the results reported here.

Goodstreak (Table 1a) -- Plants treated with 125 ppm GA3 or greater and seeded on 4 Oct were as tall or taller than untreated plants seeded on 20 Sep (Table 1). With GA3 at 500 ppm, plants seeded on 4 Oct were 40% taller than untreated plants seeded 20 Sep. Plants treated with GA3 at 1000 ppm and seeded on 16 Oct were as tall as untreated plants seeded on 4 Oct. After the winter in late Mar, GA3 treated plants seeded on 4 Oct were the same height as plants seeded 20 Sep; this was also true of GA3 treated plants seeded 16 Oct compared to the untreated plants seeded 4 Oct. There was no effect of GA3 on canopy height or width at any planting date prior to harvest. Late planting did result in a lower canopy width than the other two, earlier planting dates.

Wesley (Table 1b) -- Plants were less sensitive requiring 1000 ppm GA3 seed treatment for the 4 Oct seeded plants to attain the same height as the check (untreated, seeded 20 Sep) (Table 1). This relation continued after the winter when heights were measured on 20 Mar. There was no effect on canopy height prior to harvest. Except for a decrease by 1000 ppm GA3 at the last planting date associated with a slightly reduced vigor appearance, there was no effect on canopy width prior to harvest either.

Biomass (fresh weight of plants) was determined on 2 ft by 6 ft samples within plots. There was no significant difference between GA treated plants and check for the 20 Sep and 4 Oct seeding for either cultivar. However, for both cultivars, there was a biomass reduction by 500 and 1000 ppm when seeded on 16 Oct. Plants seeded later had lower biomass than those seeded earlier. Yields were not affected by GA3 and yields from 20 Sep and 4 Oct did not differ either. Plants seeded on 16 Oct yielded less than the other two dates regardless of GA3. Germination (94%) and the amount of viable seed (PLS = 91%) were not affected by either anti-lodging agents.

Gibberellic acid will promote early growth of winter wheat when applied to the seed. It can stimulate growth sufficiently to overcome a two-week delay in planting. The GA3 dose for Goodstreak would be 125 or 250 ppm, and for Wesley, about 1000 ppm GA3 would be needed. The cost of GA3 for seed application would be less than $2/a, making it economical. The field trial reported here is being replicated this season to verify these results.

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Table 1. Plant height of winter wheat after seed treatment with GA3, 2007.

GA3 ppm	Height on 20 Nov 06			Height on 20 Mar 07		
	planting date			planting date		
	20 Sep	4 Oct	16 Oct	20 Sep	4 Oct	16 Oct
	inches					
a. cultivar Goodstreak						
0	**4.5** C	**3.2** D	1.8 E	**3.7**	**3.4** C	2.7 B
125	5.1 BC	**4.3** C	2.5 D	4	**3.7** B	3.2 A
250	5.6 AB	5.2 B	2.7 C	4.1	3.7 B	3.3 A
500	6.2 A	6.3 A	3.0 B	3.6	4.0 A	**3.4** A
1000	6.2 A	6.5 A	**3.2** E	4	4.0 A	3.5 A
b. cultivar Wesley						
0	**6.1** C	3.7 E	2.1 B	**5.2**	**3.9** C	3.6 B
125	6.6 C	4.1 D	2.4 B	5.1	3.9 C	3.7 B
250	7.1 BC	4.7 C	2.8 A	5	3.8 C	3.6 B
500	7.8 AB	5.5 B	2.8 A	5.1	4.5 B	**3.9** AB
1000	8.3 A	**6.1** A	3.1 A	4.9	**4.8** A	4.1 A

* Numbers followed by same letter are not different at 95% confidence.

Growth Regulators for Use in Winter Wheat
2: Inhibitors for Reducing Lodging

Alexander D. Pavlista, Crop Physiologist
UNL- Panhandle Research and Extension Center, Scottsbluff, NE 69361

Improving stem strength of wheat would improve production under intensive management. The objective of this study was to prevent lodging of irrigated winter wheat prior to harvest. Two anti-lodging agents were tested. Prohexadione-Ca is an inhibitor of the natural stem growth promoter, gibberellic acid (GA3). Ethephon releases ethylene which is a natural gaseous hormone that can inhibit cell growth. Five winter wheat cultivars, Alliance, Buckskin, Goodstreak, Millenium and Wesley, were planted on 29 Sep 2006 and treated on 18 May 2007 when the flag leaf's collar was visible and swelling was felt below it. Prohexadione was applied as Apogee at 14 and 28 oz/a and ethephon as Cerone at 8 and 16 oz/a, the lowest and highest label rates. Heights were taken on 2 July 07. Wheat was harvested on 12 July. Seed samples were prepared for germination determinations by the Seed Testing Lab.

All cultivar's height were reduced by these anti-lodging agents (Table 1), including Wesley, a short semi-dwarf. There was no difference between the Cerone rates except for Alliance; only in Buckskin and Goodstreak was the rate a factor with Apogee. Apogee was significantly better than Cerone; the lowest rate of Apogee reduced height greater than the highest rate of Cerone in four cultivars and overall. The yield (adjusted for 12.5% moisture and test weight) was increased by anti-lodging treatments for all five cultivars (Table 2). There was no difference between the application rates for Cerone nor was there a difference between the rates of Apogee. Apogee increased yield significantly greater than Cerone and Cerone increased yield over the untreated checks. Germination (96%) and the amount of viable seed (PLS = 93%) were not affected by either anti-lodging agents.

From this first year trial, it appeared that the use of these two growth inhibitors will reduce plant height and, by inference, reduce lodging. They will also increase yield even in the absence of lodging. An anti-gibberellic acid regulator such as the active ingredient in Apogee seemed superior to the ethylene-releasing compound found in Cerone. These winter wheat cultivars plus Jagalene were planted in Sep 2007 to verify the results of this trial.

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Table 1. Height of winter wheat after exposure to anti-lodging agents, 2007.							
Anti-Lodging Agent	Rate oz/a	Alliance	Buckskin	Goodstreak	Millenium	Wesley	mean
		---------- inches ----------					
check	0	31.0 A	37.2 A	31.3 A	31.3 A	26.4 A	31.4 A
Cerone	8	29.1 B	34.4 B	29.3 B	27.8 B	24.5 B	29.0 B
Cerone	16	26.0 C	33.3 B	28.1 B	26.7 B	23.5 B	27.5 C
Apogee	14	25.5 CD	28.2 C	24.5 C	24.3 C	21.7 C	24.8 D
Apogee	28	24.9 D	26.2 D	22.4 D	23.9 C	20.7 C	23.0 D
* Numbers followed by same letter are not different at 95% confidence.							

Table 2. Yield winter wheat after application of anti-lodging agents, 2007.							
Anti-Lodging Agent	Rate oz/a	Alliance	Buckskin	Goodstreak	Millenium	Wesley	mean
		---------- bu/a ----------					
check	0	78.5 C	56.8 C	67.4 C	61.2 D	67.3 B	66.2 C
Cerone	8	85.4 AB	65.1 B	69.8 BC	65.4 C	70.8 AB	71.3 B
Cerone	16	83.1 B	67.8 B	72.4 AB	66.7 BC	75.9 A	73.2 B
Apogee	14	88.1 A	74.5 A	74.8 A	69.5 AB	75.3 A	76.4 A
Apogee	28	86.8 AB	72.5 A	75.6 A	70.9 A	73.9 A	75.9 A
* Numbers followed by same letter are not different at 95% confidence.							