

# Plant Growth Regulator Effects on Winter Durum Wheat in the Mid-Atlantic USA



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## Abstract

Management practices that produce high yield and good grain quality in mid-Atlantic-grown winter durum wheat (*Triticum turgidum* L. var durum) can also increase lodging. This research examined response of two winter durum genotypes to plant growth regulator (PGR) application. Etephon was applied at the boot stage (GS 45) at rates of 0.14, 0.21, and 0.28 kg a.i. ha<sup>-1</sup>. Trinexapac-ethyl was applied at rates of 0.12 and 0.12 kg a.i. ha<sup>-1</sup> at GS 32. An untreated control of each line was included for comparison. Overall, application of ethephon and trinexapac-ethyl reduced plant height in 2010 and lodging in most instances. Grain yields were significantly higher than the check when ethephon was applied at the highest rate to Snowglenn at Blacksburg and to VA05WD-42 at Harrisonburg in 2009. Grain test weight was decreased with ethephon application at Blacksburg in 2009 and with application of either chemical at Harrisonburg in 2010. PGR application should be limited to cultivars with known lodging problems and when environmental conditions will result in the least damage, such as when plants have received adequate moisture.

## Objectives

The development of winter durum wheat cultivars adapted to the mid-Atlantic region is a relatively new undertaking. Much still remains unknown about appropriate management for high yields and how durum lines will respond to our current management recommendations. The objectives of this research were to evaluate two durum wheat genotypes for differential response to label rates of ethephon and trinexapac-ethyl plant growth regulators and to develop recommendations for appropriate rates of PGR application to new winter durum wheat cultivars.

## Materials and Methods

Research trials were conducted near Blacksburg and Harrisonburg, Va., in the 2008-09 and 2009-2010 growing seasons. All trials employed a randomized complete block design with three replications and plot size of 1.52 by 2.74 m. Two winter durum wheat genotypes, Snowglenn and VA05WD-42, selected from the Virginia Tech breeding program exhibiting good agronomic and grain quality characteristics were treated with ethephon at the boot stage (GS 45) at rates of 0, 0.14, 0.21, and 0.28 kg a.i. ha<sup>-1</sup>. Trinexapac-ethyl was similarly applied at rates of 0.10 and 0.12 kg a.i. ha<sup>-1</sup> at GS 32. An untreated control was included for comparison. Growth regulator products were applied with a CO<sub>2</sub> sprayer and hand boom in 23 l ha<sup>-1</sup> water. The cultivar Snowglenn was released in 2008 and is described as a full season, medium height, winter durum wheat having good winter hardiness, high grain volume weight, and moderate resistance to Fusarium head blight. VA05WD-42 is an experimental winter durum wheat line that is high-yielding, has similar maturity to Snowglenn, but is taller and more susceptible to most foliar diseases.

## Materials and Methods (cont.)

Plots were planted with a Hege 1000 plot drill at a rate of 538 seeds m<sup>-2</sup> in 18 cm rows. Other management practices employed were appropriate for intensive wheat production in Virginia.

Crop Year	Location	Planting Date	Harvest Date	Total Fertilizer Applied		
				N	P	K
2008-09	Blacksburg	24-Sep	24-Jun	150	45	90
		13-Oct	13-Jun	157	24	46
	Harrisonburg	23-Sep	18-Jun	157	90	112
		6-Oct	22-Jun	146	24	46

Plant height was measured from the base of the plant to the base of the spike at three places in each plot and averaged to calculate plant height at GS 92 prior to harvest. Plots were rated for lodging, considering only the plot center, each year prior to harvest on a scale of 0 to 9 where 0 was no lodging and 9 was completely flat.

Grain harvest was performed using a Massey Ferguson 8XP plot combine and plot weights measured using a Graingage™ system (Juniper Systems, Logan, UT). Grain yields are reported on a 135 g kg<sup>-1</sup> moisture basis. A subsample was taken from each plot upon which test weight and moisture were determined using a Dickey-John GAC2000 grain sampler (DICKEY-john, Auburn, IL).

## Analysis

Statistical analysis was performed using the GLM procedure available from SAS (SAS Inst. Cary, NC). Due to significant interaction among years, locations, and treatments, the effect of PGR application on individual genotypes was analyzed using the LSD as a mean separation technique, when analysis of variance indicated significant differences.



## Results

### Plant Height

Line	PGR Treatment	Rate	Plant Height			
			2009		2010	
SNOWGLENN	Check	0.00	94.0	na	99.1	75.4
	Trinexapac-ethyl	0.10	94.8	na	88.9	77.0
	Trinexapac-ethyl	0.12	94.0	na	87.2	75.4
	Etephon	0.21	96.5	na	88.1	68.6
	Etephon	0.28	94.8	na	82.1	63.5
VA05WD-42	Check	0.00	95.7	na	98.2	75.4
	Trinexapac-ethyl	0.10	97.4	na	93.1	77.0
	Trinexapac-ethyl	0.12	93.1	na	88.1	78.7
	Etephon	0.21	94.8	na	87.2	70.3
	Etephon	0.28	94.0	na	82.1	61.8
LSD (0.05)			3.3	na	5.5	6.1

## Results

### Lodging

Line	PGR Treatment	Rate	Lodging Score			
			2009		2010	
SNOWGLENN	Check	0.00	3.3	5.0	3.7	4.0
	Trinexapac-ethyl	0.10	0.7	0.7	1.3	1.7
	Trinexapac-ethyl	0.12	2.0	1.3	1.7	0.3
	Etephon	0.21	0.3	1.3	1.0	1.3
	Etephon	0.28	1.0	0.3	1.0	0.3
VA05WD-42	Check	0.00	1.3	5.3	4.3	2.3
	Trinexapac-ethyl	0.10	0.0	0.0	3.3	0.7
	Trinexapac-ethyl	0.12	0.7	1.0	1.0	1.0
	Etephon	0.21	1.0	0.7	2.3	0.7
	Etephon	0.28	0.7	0.3	0.3	1.3
LSD (0.05)			2.6	1.3	1.7	2.2

### Grain Yield

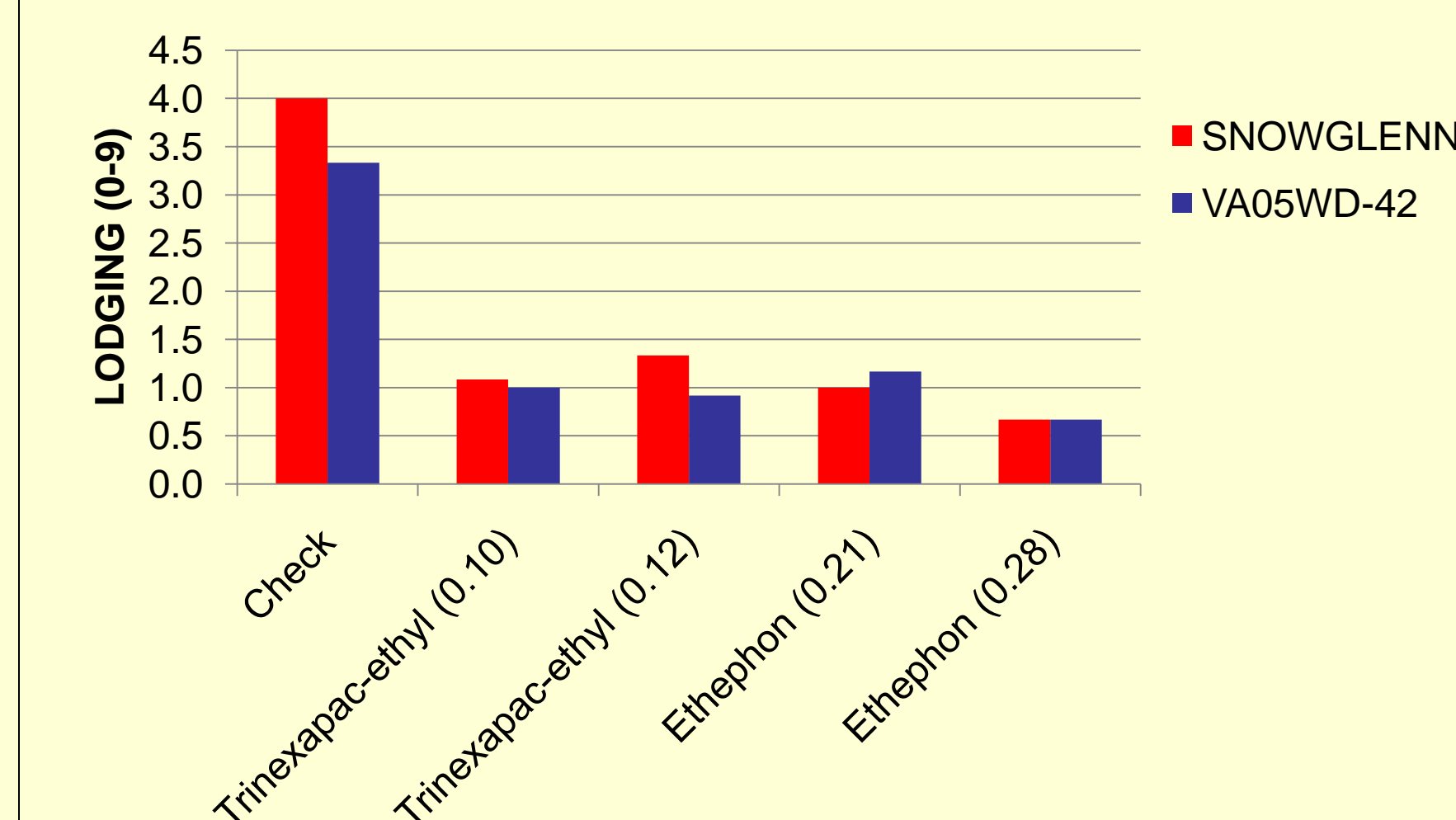
Line	PGR Treatment	Rate	Grain Yield			
			2009		2010	
SNOWGLENN	Check	0.00	3548	1448	5039	4227
	Trinexapac-ethyl	0.10	3689	1752	4828	4198
	Trinexapac-ethyl	0.12	3310	1848	4575	4202
	Etephon	0.21	3565	1549	4795	4236
	Etephon	0.28	3823	1149	4811	4193
VA05WD-42	Check	0.00	3409	1570	4845	4099
	Trinexapac-ethyl	0.10	3507	1585	5097	4144
	Trinexapac-ethyl	0.12	3750	1801	4961	4115
	Etephon	0.21	3323	1742	5035	4030
	Etephon	0.28	3462	2057	5114	4005
LSD (0.05)			235	531	249	ns

### Grain Test Weight

Line	PGR Treatment	Rate	Test Weight			
			2009		2010	
SNOWGLENN	Check	0.00	751	622	824	810
	Trinexapac-ethyl	0.10	773	575	812	804
	Trinexapac-ethyl	0.12	749	607	822	805
	Etephon	0.21	752	634	803	811
	Etephon	0.28	751	645	823	803
VA05WD-42	Check	0.00	729	599	803	785
	Trinexapac-ethyl	0.10	737	589	821	794
	Trinexapac-ethyl	0.12	736	629	821	788
	Etephon	0.21	730	571	807	772
	Etephon	0.28	725	656	811	767
LSD (0.05)			16	58	32	11



## Results



## Conclusions

- PGR application had limited effect on plant height at the one location where this factor was measured in 2009.
- Both winter durum wheat lines were significantly shorter at both locations in 2010 when ethephon was applied, even at the lower application rate.
- Less straw left in the field reduces residue and facilitates planting of double crop soybeans immediately following wheat harvest and without tillage.
- In 2009, all PGR applications reduced lodging of both lines at the Harrisonburg location, but not at Blacksburg where lodging was less severe.
- In 2010 and over years, there was a trend toward decreased lodging when either PGR was applied, however this was not always significant.
- Lodging is often responsible for increased seed diseases and sprouting since trapped moisture results in favorable conditions for disease development, thus grain quality is typically increased when lodging is reduced.
- At Blacksburg in 2010, the higher rate of both products produced less lodging than the check or when the lower labeled rates were applied.
- Grain yields were significantly higher than the check when ethephon was applied at the highest rate to Snowglenn at Blacksburg and to VA05WD-42 at Harrisonburg in 2009.
- Measured yields were lower in some instances where PGR's were applied, but no common trend was identified.
- Grain test weight, a common measure of grain quality, was decreased with ethephon application at Blacksburg in 2009 and with application of either chemical at Harrisonburg in 2010.
- Similar results have been reported by other researchers and indicates that care must be taken when using growth regulators.
- PGR application should be limited to cultivars with known lodging problems and when environmental conditions will result in the least damage, such as when plants have received adequate moisture.

