Does Trinexapac-ethyl Improve Lodging Control and Seed Yield in Kentucky Bluegrass Crops in Northeastern Oregon?

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Introduction

Trinexapac-ethyl (TE) is a plant growth regulator (PGR) that inhibits a key enzyme in the gibberellic acid biosynthesis pathway which prevents cell elongation resulting in shortened stem internodes. PGRs are widely utilized worldwide in forage and turf grass seed production systems to increase seed yield potential via reduced lodging, improved pollination, and harvest efficiency.

Extensive PGR research has been conducted in perennial ryegrass, tall fescue, and fine fescue seed production in western Oregon (Chastain et al. 2015 and 2014; Zapiola et al. 2014). Results from these studies have demonstrated that crop response to PGR application rates and timing varies among grass species, however, there is overwhelming evidence that TE effectively increases seed yield in several cool-season turf grass species. Unfortunately, PGR research in Kentucky bluegrass (*Poa pratensis*) seed production is limited (Butler et al. 2012) and warrants further investigation of PGR utility for improved KBG seed production over multiple years of stand life.

Objective

A three-year study was conducted (2018-2020) to evaluate the effect of TE on lodging control, seed yield, and seed quality of three different cultivars of KBG representative of BVMG, Midnight, and Shamrock-type turf quality classes (Honig et al 2012).

Materials and Methods

The large scale, on-farm study was conducted in three different center-pivot irrigated, commercial KBG seed production sites located in the Grande Ronde Valley of northeastern OR (Table 1). Elevation 823-884 m. Annual precipitation 42 cm. Longevity of KBG seed production fields range 4-6 yrs.

Table 1. Kentucky bluegrass cultivars, turfgrass classification, and seed production years for each site.

Site	Cultivar	Turfgrass Classification	Seed Production Year
1	Baron	Baron, Victa, Merit, Gnome (BVMG) moderate turf quality	1st, 2nd, & 3rd
2	Skye	Midnight – elite turf quality	2nd, 3rd, & 4th
3	Gaelic	Shamrock – elite turf quality	1st, 2nd, & 3rd

- Randomized complete block design with four treatments and three replications at each site. Individual plot dimensions were 9 m X 91 m.
- TE (Palisade EC®) was applied at 0, 112, 196, and 392 g ai ha⁻ (0, ½, 1, and 2X rates) when KBG developed the 2nd stem node (BBCH 32).
- TE was applied using a tractor-mounted research sprayer with a 8.2 m boom width delivering 149.7 L ha⁻ output volume (Fig. 1)
- Standard crop production practices (e.g. fertility, pest management, irrigation, etc.) were managed by grower cooperators.
- KBG seed yield was determined using grower cooperator harvest equipment and a research weigh wagon.
- At approx. 18% seed moisture level, the center 4.6 m X 91 m section of each plot was swathed then combine threshed after biomass had dried.
- Seed sub-samples collected during harvest were cleaned with a small scale 3-screen cleaner (Westrup LA-LS) to determine clean seed yield.
- Seed germination, tetrazolium, and accelerated aging tests were conducted by the OSU Seed Lab – Corvallis, OR.

Figure 1. TE was applied in the spring at the 2nd node stage (BBCH 32) of KBG development.

Large-scale, on-farm trials engage cooperators in the research process and facilitate interactive educational outreach activities.

Results

Tiller Height: Increasing TE rates significantly reduced tiller height of each cultivar in all years, but response varied significantly for each cultivar and production year. Regression analysis was conducted to determine the best linear or quadratic response equations for each site and year (Fig. 2).

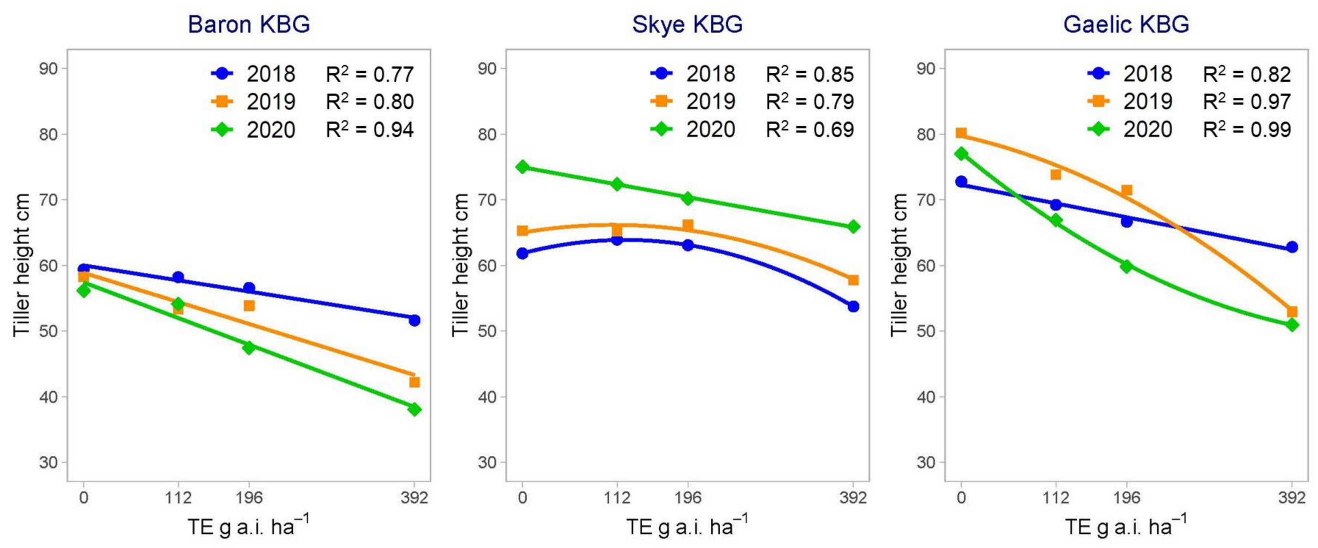

Figure 2. Relationship of tiller height (cm) and TE application rate by cultivar in each year of the study.

Lodging: TE applied at the 2X rate completely controlled lodging for all varieties across years (Fig. 3). Baron KBG showed a linear decrease in lodging in response to increasing TE rate in 2018 (Fig. 3c) but no occurred in 2019 or 2020 (data not shown). The response of Skye KBG to TE treatments was consistent across years (Fig. 3A). Error bars represent 95% C.I. for the means. Lodging in Sky KBG was greater than 95% in the control and was not significantly reduced with the 1/2X TE rate. Lodging was reduced by about 50% at the 1X TE rate. Gaelic KBG exhibited a linear decrease in lodging in response to increase TE rate in 2018 and 2019 (Fig. 3B). In 2020, lodging in Gaelic KBG was effectively controlled at the 1/2X TE rate (Fig. 3D).

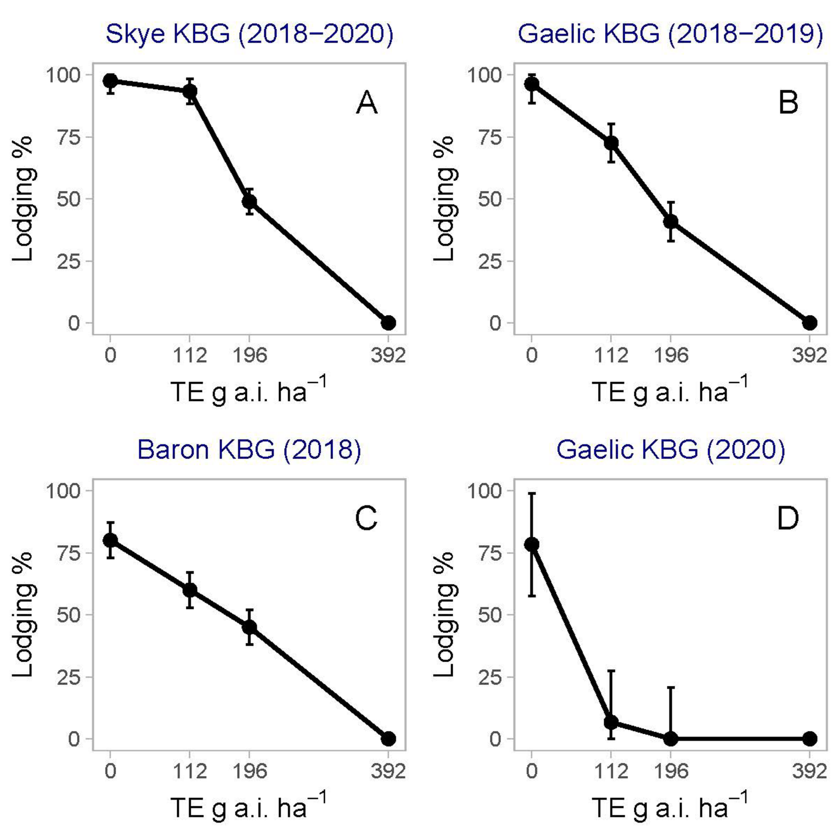

Figure 3. KBG lodging levels at time of swathing in response to TE rates at 0X, 1/2X, 1X, and 2X applied at 2-node stage.

Results (con't)

Seed Yield: The effects of TE rates on seed yield were less consistent than for lodging and tiller height. Significant seed yield differences were observed in only 3 site years for Baron and Skye KBG (Table 2). An across site analysis indicated significant TE x cultivar x year interactions. The tendency for KBG seed yields to decline as stands age was evident in this study.

Table 2. Average clean seed yield (kg ha⁻¹) for TE treatments by cultivar and seed production year.

Cultivar	TE g a.i. ha⁻¹	2018	2019	2020
Baron	Control	1135 b†	1076	492 a
	112	1411 a	1022	433 a
	196	1369 a	1059	420 a
	392	1282 ab	793	283 b
Skye	Control	978	574 c	655
	112	1098	686 b	695
	196	1119	849 a	743
	392	1055	746 b	611
Gaelic	Control	905	1172	1633
	112	1528	1521	1395
	196	2066	1499	1385
	392	2106	1294	1035

†Letters indicate results for LSD tests at sites and years where the effects of TE levels in the ANOVA were significant (α = 0.05). Means within columns that have the same letters are not significantly different.

Summary

- KBG cultivars vary in tiller height and lodging potential. Skye and Gaelic KBG may require increased TE application rates, whereas, Baron KBG may not need TE except in the first seed production year.
- Lodging response at lower TE application rates varied by cultivar and year.
- TE effectively reduces lodging in KBG, however, further study is needed to determine if there is an optimal TE rate in between 196 and 392 g a.i. ha⁻¹
- Effect of TE rates on seed yield and panicles meter⁻² (data not shown) were not consistent across cultivars and years
- In this study, consistent seed yield increases from TE application were not achieved as previously reported for other cool-season turf grass species.
- TE did not effect above-ground biomass production (tons ha⁻¹) or seed quality (1000 seed weight, purity, viability, vigor), nor # spikelets panicle⁻¹ (data not shown).

TE utility in KBG seed production is more apt to improve swathing efficiency, rather than increase seed yield, by reducing costs (labor, time, and machinery breakdowns) associated with swathing lodged KBG.

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