The Seed Head
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A three year comparative study of the plant growth regulator trinexapac-ethyl on timothy seed crops in the Peace River region

Lodging of timothy seed crop

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Introduction

Plant growth regulators, in particular trinexapac-ethyl (TE), are commonly used on grass seed crops in the main grass seed growing areas in the world. Studies have shown that TE will reduce the internode length on a grass seed plant which results in reduced plant heights, reductions in lodging and improved seed set and harvesting conditions which increase seed yields (Rolston *et al*, 2004; Chastain *et al*, 2014). On perennial ryegrass, TE was found to be effective at increasing seed yield when applied between BBCH stages 32 (2 node) and 51 (early heading) (Chastain *et al,* 2014). In Canada, TE is currently registered as Parlay™ for use on turf-type perennial ryegrass seed crops only. TE is expected to be registered in Canada on wheat crops in 2019.

Trials were conducted in 2015, 2016 and 2017 at the Agriculture and Agri-Food Canada Research Station at Beaverlodge to evaluate the effects of three rates of TE at two growth stages on timothy seed crops (Table 1). The study also examined the effects of additional spring applied liquid UAN (28-0-0) with and without one rate of TE.

Methods

Treatments were applied to first year timothy stands in 2015 and 2016 and second year stands in 2016 and 2017. Stands were fertilized with 70 kg/ha of nitrogen in the form of urea the previous fall. The treatments were arranged in a randomized complete block design with four replicates. Plot size was 2 x 10 m. UAN treatments were applied at a rate of 130 l/ha with a hand held plot sprayer and a 2 m boom with four stream jet nozzles. TE was applied with a hand held plot sprayer and 2 m boom with four 8001 TeeJet nozzles using a pressure of 270 kPa. Water volume was 100 l/ha. Application dates for UAN, TE and data collection are listed in Table 2.

Data collected from the trials included plant heights, visual lodging ratings, seed yields, germination and 1000 seed weight. A lodging rating of 10 indicates no lodging. Seed yield data was collected by harvesting 2 rows (30 cm row spacing) by the length of the plots. Area harvested was 6 m^2. The timothy was cut with a Japanese rice binder and placed in cotton bags.

Table 1. TE and UAN treatments applied to timothy seed stands

Treatment	TE Rate Ai (kg/ha)	Growth Stage	Nitrogen as UAN
1	0.200	2 node	-
2	0.300	2 node	-
3	0.400	2 node	-
4	0.200	heading	-
5	0.300	heading	-
6	0.400	heading	-
7	0.300 + UAN	2 node	35 kg/ha
8	0.300 + UAN	heading	35 kg/ha
9	UAN		35 kg/ha
10	Check	-	

Samples were dried and later thrashed with a stationary thrasher. Seed samples were weighed and cleaned.

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Table 2. Treatment application, measurement and harvest dates for timothy seed stands

Stand	UAN	TE 2-node	TE heading	Lodging rating	Plant height	Harvest
2015 1st year	May 8	May 19	June 17	June 25	July 5	Aug 10
2016 1st year	April 15	June 1	June 13	July 18	July 5	Aug 10
2016 2nd year	April 15	June 1	June 13	July 5	July 4	Aug 16
2017 2nd year	May 5	May 30	June 13	July 4 Aug 7	-	Aug 10

Table 3. Growing season precipitation (inches), Beaverlodge

	2015	2016	2017	30 Year Long-term average
May	1.2	2.6	2.9	1.6
June	3.6	4.5	4.4	2.5
July	5.8	2.3	1.4	2.8
August	1.9	8.5	1.4	2.3
September	0.8	1.1	0.0	1.7
October	1.1	1.5	1.3	1.0
Total	14.4	20.5	11.4	11.9

Results

Growing season precipitation was above average in the first two years of the study (Table 3). The application of TE to timothy reduced plant heights over the check and UAN treatments in all trials where plant heights were recorded. TE also reduced lodging in trials where lodging was an issue, particularly in treatments where spring UAN had been applied.

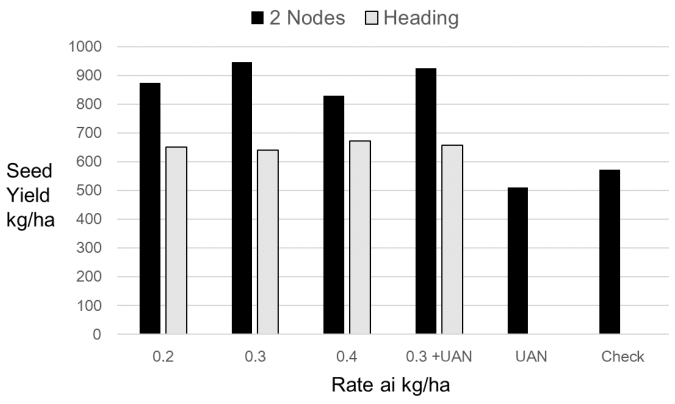
TE significantly increased seed yields over the check and UAN treatments when applied to first year stands (Figure 1). There was also a trend for increased seed yields over the check and UAN treatments in one of the two trials conducted on second year stands (Figure 2). Additional UAN with or without TE did not significantly improve seed yields; however, there was a very slight trend for TE+UAN to be a higher yielding treatment. Seed yields following TE applied at the 2 node stage were higher than early heading stage in the 2015 trial but differences were minimal between the two stages of application in the other three trials. There was no seed yield benefit from using the highest rate of TE over the two lower rates. Trial data for all years are shown in Tables 4 and 5.

The application of TE did not have any effects on seed germination or 1000 seed weight.

In 2017, the timothy was visually injured by the application of TE at all rates and stages of application although seed yields were not reduced except with the highest rate of TE alone.

Figure 1. Effect of trinexapac-ethyl on first year stands of timothy seed crop

Beaverlodge, 2015



Beaverlodge, 2016

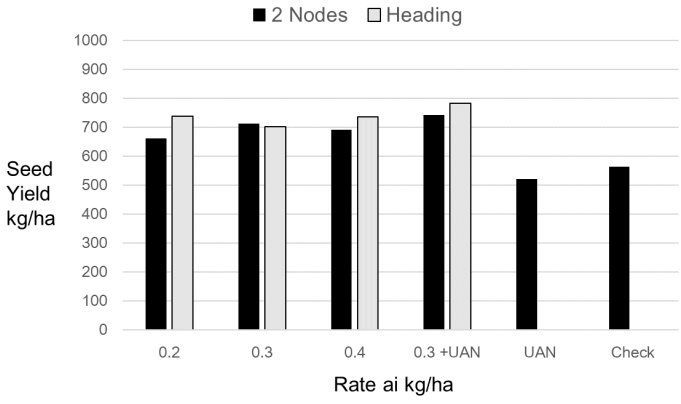


Table 4. Effect of trinexapac-ethyl on first year stands of timothy seed crop

	2015 results					2016 results				
Treatment	Plant Height (cm)	Lodging (0-10)	Seed Yield (kg/ha)	Germination (%)	1000 swt (g)	Plant Height (cm)	Lodging (0-10)	Seed Yield (kg/ha)	Germination (%)	1000 swt (g)
0.200 at 2 nodes	115 abc	10	875 a	96.3	0.483	109 ab	10	661 abc	99.2	0.449 ab
0.300 at 2 nodes	118 abc	10	947 a	94.5	0.481	107 ab	10	712 abc	97.7	0.469 a
0.400 at 2 nodes	95 d	10	829 a	96.5	0.477	107 ab	10	691 abc	97.5	0.478 a
0.200 at heading	120 abc	10	652 b	95.5	0.477	110 a	10	738 ab	98.0	0.455 ab
0.300 at heading	105 cd	10	640 b	95.0	0.467	102 b	10	701 ab	97.5	0.460 a
0.400 at heading	109 bcd	10	672 b	92.8	0.457	105 ab	10	735 ab	98.5	0.464 a
0.300 at 2 nodes + UAN	105 cd	10	926 a	94.8	0.493	110 a	10	741 ab	98.5	0.477 a
0.300 at heading + UAN	111 a-d	10	658 b	96.0	0.483	104 ab	10	783 a	98.2	0.479 a
UAN	120 a	10	510 c	97.3	0.457	111 a	6.0	520 c	98.2	0.408 b
Check	128 ab	10	573 bc	96.0	0.456	112 a	7.2	564 bc	98.7	0.450 ab
CV%	7.8	-	8.7	2.1	4.1	3.1	-	13.0	0.40	5.3
LSD (p=0.05)	12.8	-	91	NSD	NSD	5	-	130	NSD	0.036

CV - coefficient of variance; LSD - least significant difference; NSD - not significantly different
a, b, c, d - results followed by the same letter do not significantly differ (p=0.05, Student-Newman-Keuls)

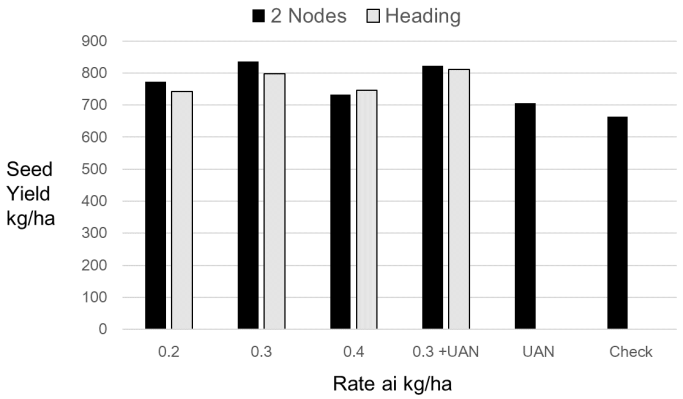
Table 5. Effect of trinexapac-ethyl on second year stands of timothy seed crop

	2016 results					2017 results				
Treatment	Plant Height (cm)	Lodging (0-10)	Seed Yield (kg/ha)	Germination (%)	1000 swt (g)	Plant Height (cm)	Lodging* (0-10)	Seed Yield (kg/ha)	Germination (%)	1000 swt (g)
0.200 at 2 nodes	108 cd	10	774	92.9	1.196	NM	10	583	97.5	0.420
0.300 at 2 nodes	109 cd	10	836	91.8	1.216	NM	10	622	98.5	0.428
0.400 at 2 nodes	90 e	10	732	93.4	1.221	NM	10	552	97.0	0.418
0.200 at heading	106 cd	10	742	88.6	1.187	NM	10	559	99.5	0.438
0.300 at heading	104 cd	10	798	93.3	1.223	NM	10	631	99.0	0.426
0.400 at heading	101 d	10	747	92.3	1.210	NM	10	605	96.8	0.437
0.300 at 2 nodes + UAN	102 d	10	822	93.8	1.209	NM	10	689	97.8	0.438
0.300 at heading + UAN	116 bc	10	811	91.2	1.204	NM	10	592	99.0	0.439
UAN	123 ab	10	706	86.6	1.207	NM	10	554	98.5	0.427
Check	130 a	10	664	95.3	1.236	NM	10	572	99.3	0.408
CV%	5.9	-	10.6	5.9	4.9	-	-	3.7	2.7	3.7
LSD (p=0.05)	9.4	-	NSD	NSD	NSD	-	-	NSD	NSD	NSD

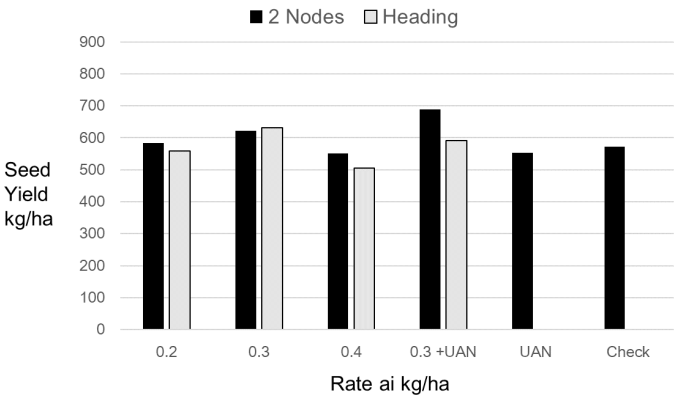
CV - coefficient of variance; LSD - least significant difference; NM - not measured; NSD - not significantly different
a, b, c, d, e - results followed by the same letter do not significantly differ (p=0.05, Student-Newman-Keuls)
** Visual lodging ratings undertaken on two separate dates. See Table 2 for more information. Results from first rating not shown (no lodging noted).*

Figure 2. Effect of trinexapac-ethyl on second year stands of timothy seed crop

Beaverlodge, 2016



Beaverlodge, 2017



Summary

- TE reduced plant height and lodging in timothy when lodging was an issue.
- TE increased seed yields in 2015 and 2016 over the check and UAN-alone treatments and appeared to be more effective on first year stands over second year stands.
- No significant response to spring UAN application with or without TE; however, there was a very slight trend for TE+UAN to be a higher yielding treatment.
- Interestingly, TE increased seed yields in 2015 over the check and UAN treatments even though the check and UAN treatments did not lodge.
- Applications of TE at the 2 node stage appeared to be slightly more effective than applications at early heading.
- No apparent benefit for seed yield with the higher TE rate (0.400 ai kg/ha).
- TE did not appear to have any effects on seed germination or 1000 seed weights.
- Positive response of timothy seed crops to TE will depend on yield potential and moisture conditions during the year. There is some concern that TE may cause some damage to timothy if the crop is under stress.
- TE has potential for use on timothy but further data should be collected, particularly in years where stands are subject to stress conditions.

Effects of TE on first year timothy seed crop, 2015

References

Rolston, M.P., McCloy, B.L. & Pyke, NB. 2004. Grass seed yields increased with plant growth regulators and fungicides. *Proceedings of the New Zealand Grassland Association 66*:127-132.

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