THE EFFECT OF PLANT GROWTH REGULATORS ON SEED YIELDS OF GRASS CROPS

G.A. Gingrich and M.E. Mellbye

Introduction

The application of synthetic plant growth regulators (PRGs) is an accepted production practice on a number of agronomic crops. They are commonly used to reduce lodging and increase yields of cereal grains. In the 1980s, Parlay, a soil active growth regulator was labeled and used on commercial grass seed fields in western Oregon. However, due to its persistence in the soil and residual activity on certain rotation crops the label was withdrawn and Parlay use was discontinued.

In 1997, researchers at OSU began experimental work with a new group of PGRs on grass seed crops. These products are primarily foliar active, break down rapidly in the soil and have no activity on succeeding crops. The early trial plots on perennial ryegrass demonstrated that plant height could be reduced, lodging controlled and seed yields significantly increased. Additional small plot trials conducted in 1998 at the OSU Hyslop Field station provided similar results.

In the spring of 1999 Novartis Crop Protection, Inc. was successful in getting a registration to apply Palisade EC (trinexapac-ethyl) on a limited number of perennial ryegrass acres in western Oregon. At the same time research trials were expanded to include small and large-scale plots on several commercial seed fields though out the Willamette Valley. In addition to perennial ryegrass several other grass species were included in these studies. In 2000 the Palisade label was expanded to allow its use on fine fescue seed fields in western Oregon. A second PGR, Apogee (prohexadione-calcium), manufactured by BASF Corp. was also tested but has not yet received approval or a label for use on grass seed crops. BASF continues to pursue a registration for the application of Apogee DF on several commercial crops.

Methods

Large scale, on-farm trials were established on seven commercial grass seed fields in the Willamette Valley. Trials were conducted on fields of perennial ryegrass, fine fescue, tall fescue and orchardgrass. Trials were arranged in a randomized complete block design with three replications. Individual plots ranged in size from 20 to 24 ft. wide by 250 to 425 ft. long to fit individual fields and accommodate using grower equipment for harvest. A weigh wagon was used to determine seed yields harvested from each plot. Sub-samples of the harvested seed were collected to determine percent cleanout and calculate total clean seed weights.

The PGRs were applied with an ATV mounted boom sprayer equipped with TeeJet 11002 VS nozzles at 30 psi applying a spray volume of 14 gpa. The surfactant Preference@ 0.25% by spray volume was added to all Apogee treatments. No surfactant was used with Palisade. Application dates and crop growth stage at time of treatment for each location are listed below the data tables. All treatments were applied on the same date at each trial location except for the second treatment of the split Apogee application. There was no split Apogee or 2.0 pint/acre rate of Palisade treatment at the Plantation tall fescue and the orchardgrass sites. Growers made all fertilizer applications and treated fields with fungicides as needed. None of the fields were irrigated during the spring growing season.

Results

Perennial ryegrass. Treated plots at both locations gave significantly higher seed yields than the untreated plots (Table 1). This is consistent with similar on-farm trials conducted in 1999 where all PGR applications resulted in significantly greater seed yields. At the Palmer III site seed yields increased 10 to 16%, and on the Blackhawk site seed yields increased from 17 to 21% over the untreated checks. Although not statistically higher, the split application of Apogee yielded the highest at both locations. PGR treatments had no effect on seed cleanout percentage.

Table 1. Effect of PGR applications on seed yields of perennial ryegrass, 2000.

		Clean seed yield		
Treatment	Rate	Palmer III	Black-hawk	2-site avg.
	(product/acre)	---------- (lb/a) ----------		
Check	0	2453	1285	1869
Palisade EC	1.5 pt	2745	1521	2133
Palisade EC	2.0 pt	2698	1557	2128
Palisade EC	2.5 pt	2710	1543	2127
Apogee DF	0.45 lb / 0.45 lb	2844	1558	2201
Apogee DF	0.91 lb	2811	1536	2174
Apogee DF	1.36 lb	2774	1505	2140
LSD(0.05)		158	147	--

Application dates and stage of growth at treatment.

Palmer III

May 12	all treatments	2-3 nodes, flag leaves emerging
May 23	2nd Apogee only	heads emerging, some completely emerged

Blackhawk

May 5	all treatments	2 node to boot stage
May 15	2nd Apogee only	100% headed to pre-flowering stage

Fine fescue. Again in 2000 the on-farm trials resulted in significantly greater seed yields from PGR applications on fine fescue (Table 2). All treatments yielded higher than the untreated checks. Fine fescue had a greater response to PGR applications than other species included in this set of trials. Seed

yield increases on treated plots ranged from 32 to 48 % over the untreated checks. Cleanout was unaffected by PGR applications.

Table 2. Effect of PGR applications on seed yields of fine fescue, 2000.

Treatment	Rate	Clean seed yield K2	Southport	2-site avg.
	(product/acre)	---------- (lb/a)	----------	
Check	0	1057	1195	1126
Palisade EC	1.5 pt	1394	1766	1580
Palisade EC	2.0 pt	1485	1693	1589
Palisade EC	2.5 pt	1505	1731	1618
Apogee DF	0.45 lb / 0.45 lb	1491	1615	1553
Apogee DF	0.91 lb	1474	1615	1545
Apogee DF	1.36 lb	1516	1647	1582
LSD(0.05)		169	112	--

Application dates and growth stage at treatment.

K2

May 12	all treatments	flag leaves emerged to 60% of headed
May 23	2nd Apogee only	heads mostly emerged

Southport

April 6	all treatments	flag leaves emerged to 50% of headed
May 12	2nd Apogee only	most heads fully emerged

Tall fescue. At each location all PGR treatments resulted in increased seed yields over the untreated checks (Table 3). Only the high (2.5 pt/a) rate of Palisade at the Heritage location failed to provide a significantly greater seed yield. In a similar trial on tall fescue in 1999 none of the PGR treatments provided significantly higher seed yields. Yield increases in 2000 ranged from 20 to 32% for the Heritage and 19 to 26% for the Plantation tall fescue sites. Similar to the results from the other sites there was no apparent affect of treatment on percent cleanout. *Neither PGR product tested is currently labeled for use on tall fescue.*

Table 3. Effect of PGR applications on seed yields of tall fescue, 2000.

Treatment	Rate	Clean seed yield Heritage	Plantation	2-site avg.
	(product/acre)	---------- (lb/a)	----------	
Check	0	1405	2254	1830
Palisade EC	1.5 pt	1838	2796	2317
Palisade EC	2.0 pt	1838	----	----
Palisade EC	2.5 pt	1685	2781	2233
Apogee DF	0.45 lb / 0.45 lb	1859	----	----
Apogee DF	0.91 lb	1824	2675	2250
Apogee DF	1.36 lb	1843	2834	2339
LSD(0.05)		417	226	--

Application dates and stage of growth at treatment.

Heritage

May 5	all treatments	2-3 nodes to boot stage
May 15	2nd Apogee only	80% headed, pre-flowering stage

Plantation

May 6	all treatments	flag leaves emerged, 30% of heads emerging

Orchardgrass. Of the four grass species included in these on-farm trials orchardgrass was the least responsive to PGR applications (Table 4). Although all treatments increased seed yields, only the high rate of Palisade provided a statistically significant yield increase over the untreated check. This is the first year of OSU trials on orchardgrass and application-timing data has not yet been developed. Additional trials are needed to determine optimum application timing and rate ranges. There was also a greater variation in the percent cleanout between treatments in the orchardgrass when compared with the other grass species. *Neither PGR product tested is currently labeled for use on orchardgrass.*

Table 4. Effect of PGR applications on seed yields of orchardgrass, var. Stampede, 2000.

Treatment	Rate	Clean seed yield
	(product/acre)	(lb/a)
Check	0	1041
Palisade EC	1.5 pt	1185
Palisade EC	2.5 pt	1241
Apogee DF	0.91 lb	1139
Apogee DF	1.26 lb	1179
LSD(0.05)		177

Application dates and stage of growth at treatment.

April 14 all treatments most flag leaves emerged, <1% heads emerged

Results the past two seasons from these large, on-farm trials have shown consistent seed yield increases from PGR applications on perennial ryegrass and fine fescue. However, there has been less consistency on the tall fescue and we have only one year of data on orchardgrass. Additional trials should be conducted on both tall fescue and orchardgrass to determine optimum rates and application timing.

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