# SPRING-APPLIED NITROGEN AND PLANT GROWTH REGULATOR EFFECTS ON SEED YIELD OF SECOND-YEAR ORCHARDGRASS

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## Introduction

Forage grass seed crops, including orchardgrass (*Dactylis glomerata* L.), are a vital part of seed production enterprises in Oregon. Like other cool-season grasses, orchardgrass produces only a fraction of its potential seed yield. Making better use of nitrogen (N) and plant growth regulators (PGRs) is a way to achieve increased yield. In comparison with tall fescue and perennial ryegrass, seed yield response to spring N and PGRs in orchardgrass is relatively understudied.

Since lodging is exacerbated in the high-N environments present in grass seed production systems, additional work is needed to determine possible interactions between PGRs and spring-applied N under western Oregon conditions. Recommendations for application rates of N fertilizer in orchardgrass have not been revised and have not appeared in the international seed production literature since PGRs were introduced in this important forage seed crop. In Oregon, OSU fertilizer recommendations (Doerge et al., 2000) for orchardgrass seed crops are more than 15 years old, and new information is needed to evaluate whether N rate recommendations should be adjusted to further increase seed yield in current management environments.

The objectives of this multiyear study were to (1) measure the effects of multiple N fertilizer rates in the presence and absence of trinexapac-ethyl (TE) and TE + chlormequat chloride (CCC) PGRs, and (2) define optimal treatment and timing of applications of TE and TE + CCC PGR combinations for orchardgrass seed crops.

The first-year results of this study indicate that a combination of spring-applied N and PGRs can increase orchardgrass seed yield in western Oregon conditions (Anderson et al., 2018). Maximum seed yield was attained with 100 lb N/acre, and there was no additional benefit from higher N rates. Seed yield was also significantly increased (by 55%) by TE and TE + CCC PGR treatments. An interaction of spring-applied N and PGR for seed yield was evident in this first-year study. One interesting finding is that, despite this positive interaction, seed yield was enhanced by PGRs even when no spring N was applied.

## Materials and Methods

A field trial with 'Persist' orchardgrass was established in October 2015 at OSU's Hyslop Research Farm. The experimental design for the trial is a randomized complete block with a split-plot arrangement of treatments and three replications. Plot size is 11 feet x 38 feet. Fungicide and insecticide treatments are applied to manage pests as needed. During 2015–2017, fall N was applied to all plots at a rate of 40 lb N/acre. The second harvest was taken in 2018. Nitrogen was applied to the main plots in the spring at the following rates:

- 0 lb N/acre
- 100 lb N/acre
- 140 lb N/acre
- 180 lb N/acre

PGR subplots included the following treatments and application rates:

- Untreated control (no PGR)
- 1.5 pt/acre TE applied at BBCH 32 (two nodes)
- 1.5 pt/acre TE applied at BBCH 51 (panicles 10% emerged)
- 0.75 pt/acre TE + 1.34 lb/acre CCC at BBCH 32 (two nodes)

Nitrogen was applied on February 9, 2018 using a tractor-mounted orbit-air spreader system with appropriate amounts of 46-0-0. The PGR treatments were applied at the two-node stage (BBCH 32) and when panicles were 10% emerged (BBCH 51) using a bicycle-type boom sprayer operated at 20 psi delivering 20 gpa with XR Teejet 8003VS nozzles. Above-ground biomass samples were taken from each plot near crop maturity, and dry weight of the standing crop was determined. Total tissue N content was measured from the above-ground biomass samples. Tiller height was measured for each treatment at harvest maturity.

Seed was harvested by a small-plot swather and combine, and seed was cleaned to determine yield. Seed weight was determined by counting two 1,000-seed samples with an electronic seed counter and weighing these samples on a laboratory balance. Harvest index (HI), the ratio of seed yield to above-ground biomass, was also quantified.

**Results and Discussion**

All treatments containing spring-applied N increased seed yield in second-year orchardgrass, in comparison with the untreated control (Table 1). Similar to the first-year study, maximum seed yield was attained with 100 lb N/acre, and there was no additional benefit from higher N rates. Nitrogen also increased seed number but had no effect on percent cleanout, seed weight, fertile tiller number, biomass, or HI. Total tissue N concentration did not increase when rates above 100 lb/N acre were applied (data not shown).

Seed yield was also significantly increased (37%) by PGR treatments (Table 2). Unlike the first year of this study, PGR application at the two-node stage (BBCH 32), with both TE and the TE + CCC mixture, resulted in significantly increased seed yields and HI compared to TE applied when panicles were 10% emerged (BBCH 51). All PGR treatments increased seed number and decreased tiller height, but there were no effects on seed weight, biomass, or fertile tiller number.

An interaction of spring-applied N and PGR for seed yield was not evident in this second-year study. Spring N and PGRs enhanced seed yield independently of one another. This work will be repeated in 2019 to examine the effects of these treatments on a second-year stand.

**References**

Anderson, N.P., T.G. Chastain, A.D. Moore, and C.J. Garbacik. 2018. Spring-applied nitrogen and plant growth regulator effects on orchardgrass seed yield. In N.P. Anderson, A.G. Hulting, and D.L. Walenta (eds.). *2017 Seed Production Research Report*. Oregon State University, Ext/CrS 154.

Doerge, T., H. Gardner, T.L. Jackson, and H. Youngberg. 2000. *Fertilizer Guide: Orchardgrass Seed (Western Oregon)*. Oregon State University, FG 45.

Table 1. Effect of nitrogen (N) on seed yield, yield components, and growth characteristics in second-year orchardgrass.[1]

| N treatment | Yield | Cleanout | Seed weight | Seed no. | Biomass | Fertile tillers | Tiller height | Harvest index |
|---|---|---|---|---|---|---|---|---|
| (lb/a) | (lb/a) | (%) | (mg/seed) | (no./m$^2$) | (kg/ha) | (no./ft$^2$) | (cm) | (%) |
| 0 | 570 a | 16.6 | 0.911 | 70,144 a | 16,702 | 82.5 | 111 | 4.0 |
| 100 | 793 b | 14.1 | 0.912 | 97,714 b | 26,381 | 100.0 | 117 | 3.7 |
| 140 | 772 b | 14.7 | 0.915 | 94,390 b | 23,970 | 93.4 | 110 | 3.9 |
| 180 | 779 b | 13.9 | 0.907 | 96,592 b | 24,185 | 95.3 | 113 | 3.8 |

[1]Means followed by the same letters are not significantly different at LSD ($P$ = 0.05).

Table 2. Effect of plant growth regulators (PGRs) on seed yield, yield components, and growth characteristics of second-year orchardgrass.[1]

| PGR treatment | Yield | Cleanout | Seed weight | Seed no. | Biomass | Fertile tillers | Tiller height | Harvest index |
|---|---|---|---|---|---|---|---|---|
| | (lb/a) | (%) | (mg/seed) | (no./m$^2$) | (kg/ha) | (no./ft$^2$) | (cm) | (%) |
| Control (no PGR) | 572 a | 14.3 | 0.908 | 70,664 a | 22,117 | 96.3 | 129 a | 3.2 a |
| Palisade 1.5 pt/a (BBCH 32) | 792 c | 15.0 | 0.919 | 96,683 bc | 22,160 | 90.0 | 109 c | 4.3 b |
| Palisade 1.5 pt/a (BBCH 51) | 747 b | 15.0 | 0.914 | 91,415 b | 25,291 | 95.8 | 115 b | 3.5 a |
| Palisade 0.75 pt/a + CCC 1.34 lb ai/a (BBCH 32) | 804 c | 15.0 | 0.902 | 100,109 c | 21,669 | 80.0 | 101 d | 4.4 b |

[1]Means followed by the same letters are not significantly different at LSD ($P$ = 0.05).