# Impact of Fertilizer Type, Seed Coating, and Duration of Exposure on the Germination of Orchardgrass Seed

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**Keywords:** Orchardgrass; seed; coating; fertilizer; mixtures; germination.

**Abstract.** Cool-season grasses such as orchardgrass, are important components of forage systems in transition zone states like Kentucky. To maintain dense and vigorous sods, improved cool-season grass varieties are sometimes overseeded into existing stands in late-winter or early-spring. In many cases seed is mixed with fertilizer and top-dressed onto pastures. Little data are available on the impact of fertilizer type or duration of exposure on the germination of raw and coated grass seed. The objective of this study was to evaluate the impact of two fertilizer types, muriate of potash and a blended fertilizer (urea, diammonium phosphate, and muriate of potash), and the duration of exposure (1 to 28 days) on the germination of an improved orchardgrass variety that was raw or coated. Mixing seed with the blended fertilizer resulted in a quadratic decrease in germination rate for the raw seed and coated seed. This rate of decrease was greater for the coated seed in the blended fertilizer. Combining seed with muriate of potash resulted in a linear decline in germination with the decline being similar for both the coated and raw seed. Overall, the rate of decrease was considerably less than that of the blended fertilizer. Results of this study indicate that the combination of seed coating and blended fertilizer had the most detrimental impact on orchardgrass germination.

## Introduction

Cool-season grasses such as orchardgrass (*Dactylis glomerata* L.), are important components of forage systems in transition zone states like Kentucky (Ball et al., 2015). Orchardgrass is a perennial, cool-season, grass that is well suited for utilization in Kentucky pastures and hayfields (Ball et al., 2015). Mixing seed with fertilizer to top-dress pastures or hayfields is an efficient method of overseeding forages into existing stands (Lacefield and Smith, 2009). While not as common of a practice as overseeding with a legume, cool-season grasses such as orchardgrass are sometimes overseeded into existing stands of forages to strengthen existing forage stands. It is recommended that these seed/fertilizer mixtures be spread immediately after mixing to reduce potential negative effects on seed germination. However mechanical issues and inclement weather can delay spreading and prolong seed exposure to the fertilizer mix. There is little information on the impact of prolonged exposure to fertilizer on the germination of orchardgrass seed. The objective of this study was to evaluate the impact of two fertilizer types, muriate of potash and a blended fertilizer (urea, diammonium phosphate, and muriate of potash), and the duration of exposure (0 to 28 days) on the germination of an improved orchardgrass variety that was raw or coated.

## Methods and Study Site

A study with a randomized complete block design with factorial treatment arrangement and four replications was conducted at the University of Kentucky Research and Education Center located in Princeton, KY. The entire experiment was repeated. Beginning and ending dates were 15-Jun-20 and 12-Jul-20 and 22-June-20 and 20-Jul-20, for trials 1 and 2, respectively. Treatments were fertilizer types, seed coating, and duration of exposure to fertilizer. The fertilizer types were muriate of potash (0-0-60), a blended fertilizer (19-19-19) comprised of urea, diammonium phosphate, and muriate of potash, and a no fertilizer control. Orchardgrass seed (same variety and seed lot) was either raw (no coating) or coated with a propriety lime-based seed coating (Summit Seed Coating, Caldwell, ID). Seed was mixed with 100 g fertilizer and placed in a 120 ml cup on a table under a pop-up canopy in a wooden barn in equilibrium with ambient environmental conditions. This allowed the seed-fertilizer mixture to be exposed to ambient temperature and humidity but protected it from rainfall. Orchardgrass seed (raw and coated) was added at

3.88 g and 5.88 g in the blended fertilizer and 10 g and 15 g for the muriate of potash fertilizer, respectively. Germination was evaluated after 1, 3, 5, 7, 10, 14, 21, and 28 days of fertilizer exposure. Seed-fertilizer mixes were taken to the lab where 50 random seeds were gently extracted using tweezers. Seeds were then placed in a 10-cm petri dish that was lined with Whatman Grade 4 filter paper that had been saturated with 10 ml of distilled water. Tops were secured on the petri dishes using parafilm. Germination counts were made at 7, 10 and 14 days. At each count, germinated seeds were removed from the petri dish. Data were entered into a spreadsheet and final germination was calculated. Data were analyzed across trials using the General Linear Model Procedure (SAS, Cary, NC). SigmaPlot 15.0 (SYSTAT Software, San Jose, CA) was used for regression analysis.


Figure 1. Seed and fertilizer were weighed out and placed into 120 ml cups (top right) and uncapped cups were placed under a canopy in a tobacco barn (top left) for 1 to 28 days. Cups were transported back to the lab at specified exposure intervals and 50 random seeds were extracted (bottom left) and placed into a petri dish for germination (bottom right).

## Results and Discussion

No trial x treatment interactions occurred ($P < 0.05$) so data are being presented averaged over trials. Within trials, fertilizer x treatment interactions occurred ($P < 0.05$) so data are being presented by fertilizer type. Muriate of potash resulted in a linear decrease in germination and this decrease was initially greater for the orchardgrass seed that was coated until the last two storage times where a slight shift occurred (Figure 2). The control treatments exhibited a slight decrease in germination (Figure 2 and 3). The blended fertilizer resulted in a quadratic decrease in seed germination with the coated seed declining at a greater rate (Figure 3). In general, the decreases in germination observed in the blended fertilizer were greater (Figure 3). At the end of 28-day period, the seed-blended fertilizer mixture had absorbed enough moisture to become a slurry at ambient temperature and humidity. In contract, the muriate of potash was still dry.

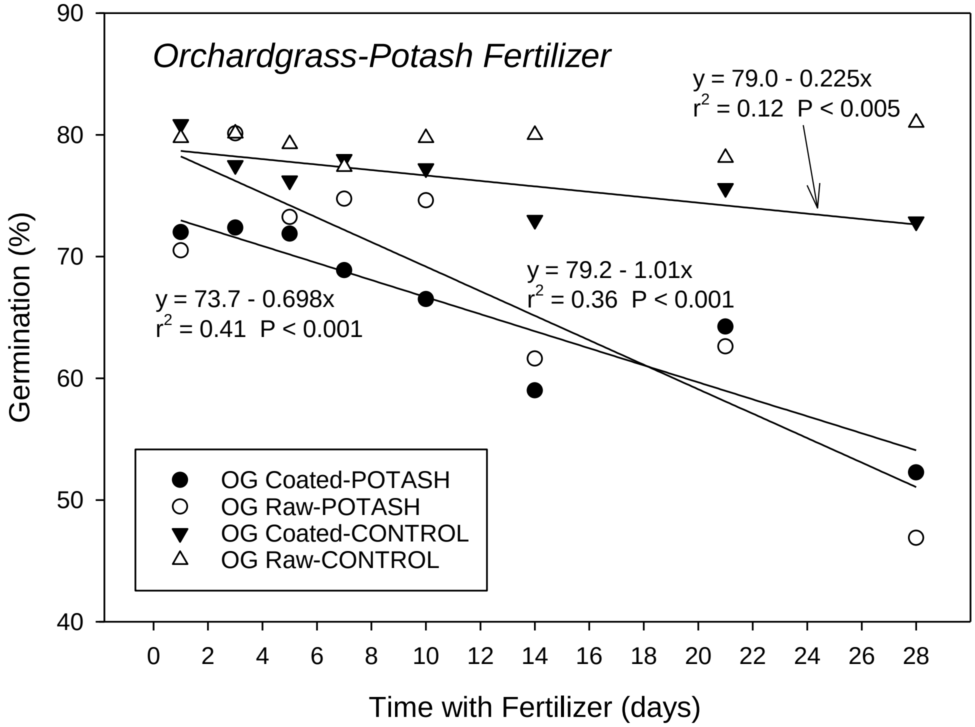


Figure 2. Impact of exposure time to muriate of potash (0-0-60) on the germination of raw and coated orchardgrass seed averaged across Trials 1 and 2.

The result of the slurry likely influenced germination results. Germination of the orchardgrass in the blended fertilizer was much lower initially with the raw seed but both the coated and raw seed declined greatly over time, where they both resulted in less than 10% germination at the end of the 28-day exposure time. Seed coating also caused a greater decline in seed germination for both the potash and blended fertilizer, although the rate of decline was greatest for the blended fertilizer. Seed coating may have enhanced imbibition leading to higher levels of salt injury. This was likely due to the hygroscopic nature of the blended fertilizer (Adams and Merz, 1929).

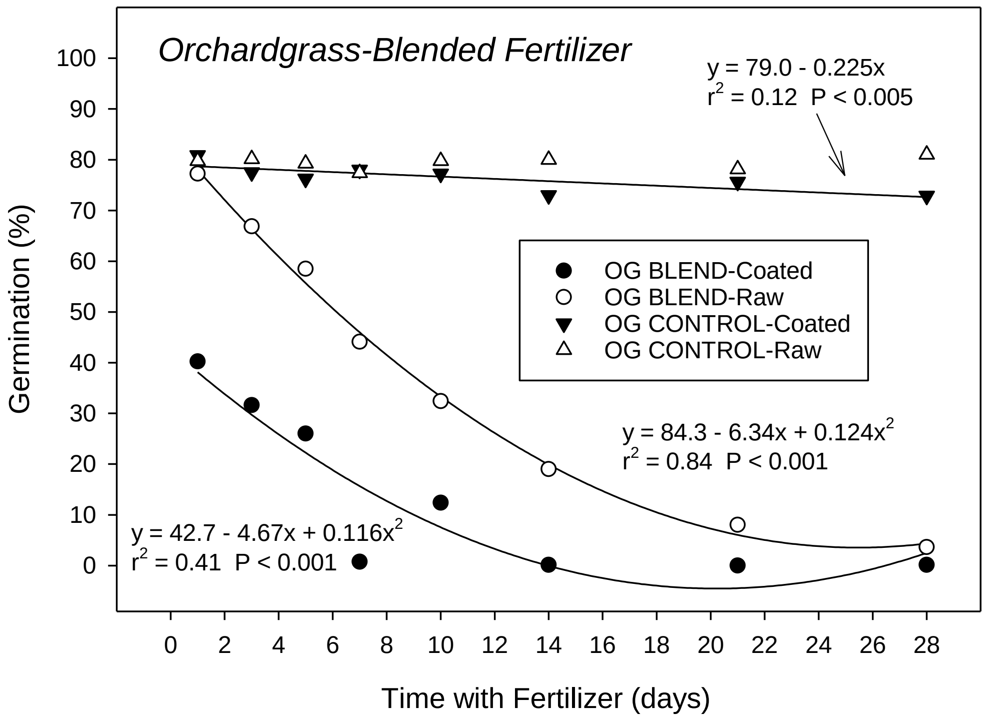


Figure 3. Impact of exposure time to blended fertilizer (19-19-19) on the germination of raw and coated orchardgrass seed averaged across Trials 1 and 2.

## Conclusions

The results of this study indicate that prolonged exposure to fertilizer has a detrimental impact on the germination of orchardgrass seed. This impact is greater for fertilizer materials that are more hygroscopic. In addition, seed coatings that increase seed imbibition also tend to increase salt injury and decrease germination due to a greater association of the salt mixture with the seed. One limitation of this study is the size of the experimental unit. The small size of the experimental units, 120 ml cups, likely increased the rate of decline in germination observed compared to what might be found in larger piles or loads in spreader trucks. In the case of larger quantities of seed-fertilizer mixtures a crust would likely form that may slow the rate of germination decline in the interior of the pile. More work is needed to test this hypothesis.

## References

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