OREGON STATE UNIVERSITY SEED LABORATORY

SUMMIT SEED COATINGS- Caldwell ID

Final Report "Second Study" – June 2010

Effect of various seed coating treatments on viability and vigor of one blend of Kentucky bluegrass

Objective

Evaluate the effect of five seed coating treatments (plus untreated control) on final germination percentage (G), speed of germination index (SGI) and growth rate (GR), i.e., dry mater content (DM) of one Kentucky bluegrass (KBG) blend.

Materials and Methods

Materials

One Kentucky bluegrass blend was used in the study.

Treatments

The following treatments were used:

No.	Treatment
1	Raw Check
2	Pinnacle + Polymer
3	Pinnacle + Polymer + Biological 1
4	Pinnacle + Polymer + Biological 1 + Turf Protocol
5	Pinnacle + Polymer + Biological 2
6	Pinnacle + Polymer + Biological 2 + Turf Protocol

* All seed coatings/treatments were prepared by Summit Seed Coatings.

Methods

- **Two main studies were conducted**:
  1) Growth chamber study, and
  2) Greenhouse study.

Tests used to evaluate the treatments in both growth chamber and greenhouse:

To measure the effect of treatments on seed and seedling performance, the following tests were conducted:

Standard germination test (G): Four replications of 100 seeds of each treatment were planted in growth chamber according to the AOSA Rules (2009). No pre-chilling treatment or KNO_3 was applied. The standard germination test was used to establish the initial quality of each seed lot for the untreated control samples. The test periods were 28 days in the growth chamber and in the greenhouse.

- In the greenhouse study, three replications (3-greenhouse trays each with 38 individual plants) were used.
  - Type of soil: sandy soil (no nutrients were added).
  - Water regime: continuous water from the bottom tray (no water stress).
  - Temperature: 24C (+2°C day/-5°C night).

Speed of germination index (SGI) (also called Germination Index): The speed of germination test is an index of seed vigor. The faster the seeds germinate, the higher the quality of seeds and the more effective the treatment that may enhance germination. The test was conducted on the standard germination test seedlings by counting the emerged seedlings after 5 days from planting, and continuing to count the seedlings that emerged every other day in the growth chamber and every three days in the greenhouse until the end of the test period (28 days). The speed of germination index was calculated according to the procedures described in the AOSA Seed Vigor Testing Handbook (2009), using the following formula:

$$GI = \frac{Number\ of\ normal\ seedlings}{days\ of\ first\ count} + \ldots\ldots\ldots\ldots + \frac{Number\ of\ normal\ seedlings}{days\ of\ final\ count}$$

The germination index for each treatment was compared to determine the effectiveness of the treatments.

3. **Seedling growth rate (GR) test (= dry matter content 'DM'):** This test was conducted according to the AOSA Seed Vigor Testing Handbook (2009). The growth rate is used as a vigor index to differentiate between seed qualities, in this case as affected by various treatments. The dry weight of seedlings was determined at the end of the standard germination tests in both the growth chamber and greenhouse. Four replications of 50 seedlings were randomly collected from each treatment from the growth chamber study, and

20 seedlings were collected from the greenhouse study at the end of the growing period (28 days). Roots were washed thoroughly from soil using tap water and seedlings were allowed to dry in the oven at 100°C for 24 hours. The dry weight of each treatment was determined on the fresh weight basis.

Statistical analysis: The experimental design used was a one-factor randomized complete block design. Factor A is the seed coating materials. The data was subjected to ANOVA to determine the effect of each treatment on germination, speed of germination and the growth rate. The LSD test was used to separate the means. The statistical package "MSTAT" was used to analyze the data.

Timetable: The study started in May 2010 and was completed in approximately six weeks.

RESULTS AND DISCUSSION

I. Growth chamber study

The ANOVA indicated that the seed coating treatments significantly affected final germination percentage (G), speed of germination index (SGI), and growth rate (i.e., dry matter 'DM'content) as measured by the standard germination, the speed of germination and the dry matter content tests (Table 1). All treated seeds germinated faster and had higher final germination percentage compared to the untreated control seed (Table 2). Treatment No. 4 (Pinnacle + Polymer + Biological 1 + Turf Protocol) had the highest speed of germination index (47.2) and treatment No. 3 (Pinnacle + Polymer + Biological 1) had the highest final germination percentage (G) with 89% (Table 2). The lowest final germination percentage (75%) and speed of germination index (29.7) were recorded for the untreated control (Table 2).

Table 1. Analysis of variance (ANOVA) for the effect of six coating treatments on final germination percent, speed of germination and dry matter content of one Kentucky bluegrass blend grown in growth chamber and greenhouse.

Source of variation	df	Germination Percent		Speed of Germination Index		Dry Matter Content (Growth Rate)	
		Growth chamber	Green-house	Growth chamber	Green-house	Growth chamber	Green-house
Coating Treatment (T)	**5**	***	**NS**	***	**NS**	***	*

*, **, *** Significant at the 0.05 and 0.001 probability levels, respectively; NS, not significant at 0.05 probability level.

With the exception of treatment No. 5 (Pinnacle + Polymer + Biological 2) which had a final germination of 83.0%, treatments No. 2, 3, 4 and 6 were not significantly different from each other with final germination of 87, 89, 87, and 86% (Table 2).

The results indicated that any of the seed coating treatments used in the study (No. 2, 3, 4, 5, or 6) significantly improved the dry matter content compared to the untreated control sample. The growth rate of the treated seeds was approximately twice as fast compared to the uncoated control seed after 28 days of planting (Table 2). This is a very important factor to establish fast health stand, especially if the growth rate observed in this study can be repeated under field conditions. The highest dry matter content was recorded for treatments No. 4 (Pinnacle + Polymer + Biological 1 + Turf Protocol) with 36.0 mg; and treatment No. 5 (Pinnacle + Polymer + Biological 2) with 35.6 mg (Table 2).

Table 2. Means of germination percentage, speed of germination index, and dry matter content of six seed coating treatments of one Kentucky bluegrass (KBG) blend grown in a growth chamber. †

No.	Treatment	Germination (%)	Speed of Germination Index	Dry Matter (mg)
1	Raw Check	75 c‡	29.7 d	15.4 b‡
2	Pinnacle + Polymer	87 a	38.9 c	34.1 a
3	Pinnacle + Polymer +Biological 1	89 a	44.6 b	32.8 a
4	Pinnacle + Polymer +Biological 1 + Turf Protocol	87 a	47.2 a	36.0 a
5	Pinnacle + Polymer +Biological 2	83 b	43.4 b	35.6 a
6	Pinnacle + Polymer +Biological 2 + Turf Protocol	86 ab	43.9 b	33.5 a

† Four replications of 100 seeds each were used for each germination test. Four replications of 50 seedlings each were used for dry matter tests.

‡ Within columns, means followed by the same letters are not significantly different according to LSD (0.05).

In summary, the improvement in the final germination percentage and the speed of germination of any of the five treated seeds over the untreated control sample was significant (Tables 1 and 2). Furthermore, the positive effect of the coating treatment was clearly manifested by increasing the rate of growth that was measured by the dry matter content at the end of the germination period (Table 2). The dry matter content was more than doubled in all treatments of the Kentucky bluegrass seed lot used in comparison to the untreated seeds (Table 2). Plants with higher growth rate usually grow better under various adverse field conditions.

II. Greenhouse study

Although the ANOVA did not show significant difference between the untreated seeds and the treated seeds in the final germination percentage after 28 days in the greenhouse (Table 1), some treatments clearly improved the germination of the seeds over the untreated control sample. The highest final germination percentages were recorded in treatments No. 2 and No. 6, with 86% in both treatments compared to 81% in the untreated control (Table 3). In general, most coated seeds had higher germination rates than the untreated control sample with the exception of treatment No. 5 which had 76%.

No significant differences between the untreated control seed and the treated seeds in the speed of germination were detected (Table 1). However, treatments No. 2 and No. 4 had better speed of germination index of 22.4 in both treatments in comparison to 18 for the untreated control (Table 3).

Likewise, in the growth chamber study, coating treatments improved the dry matter contents over the untreated seeds significantly while measuring in the greenhouse (Tables 1 and 3). The highest dry matter content was recorded for treatment No. 2 (Pinnacle + Polymer), with 50.3 mg in comparison to 34.4 mg for the untreated control (Table 3).

In general, the various coating treatments used in this study improved seed performance in many cases in both the growth chamber and the greenhouse studies. It is worthy to note that the effectiveness of seed coating would be more important if proved to be effective under various field conditions.

Table 3. Means of final germination percent, speed of germination index, and dry matter content of six seed coating treatments of one Kentucky bluegrass blend grown in a greenhouse†.

		Germination (%)	Speed of Germination Index	Dry Matter (mg)
1	Raw Check	81 ab‡	18.0 c‡	34.4 b
2	Pinnacle + Polymer	86 a	22.4 a	50.3 a
3	Pinnacle + Polymer + Biological 1	82 ab	20.9 abc	45.9 a
4	Pinnacle + Polymer + Biological 1 + Turf Protocol	83 ab	22.4 a	44.2 a
5	Pinnacle + Polymer + Biological 2	76 b	19.1 bc	45.7 a
6	Pinnacle + Polymer + Biological 2 + Turf Protocol	86 a	21.4 ab	46.3 a

† Three replications of 38 seedlings each were used for each germination test and speed of germination index. Three replications of 20 seedlings each were used for dry matter content test.

‡ Within columns, means followed by the same letters are not significantly different according to LSD (0.10).

CONCLUSION

The various seed coating treatments used in this study improved final germination percentage, the speed of germination, and the dry matter content of plants over the untreated seeds in most cases. Coating pure seeds that have high initial seed quality adds more value to the seeds. A field study to confirm the usefulness of the coating treatments used in this experiment is recommended.