PREGERMINATION SEED TREATMENTS

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The objective of this research is to develop a technique for improving the rate of germination of four cool-season turfgrasses through pregermination seed soaking treatments. Since seed soaking was tried in the early 1900's, very little work has been undertaken on soaking turfgrass seeds. Justification for this investigation includes: 1) the demand by homeowners and businesses for "instant lawns" -- in other words the popularity of sodding vs. seeding due to the time factor necessary for a seed established site to mature compared to a sodded site; 2) vigorized seeds are becoming more common on the market, particularly crop and vegetable seeds, which indicates a demand for increased emergence rates and vigor for seed establishment; 3) that fast germinating ryegrasses are often used in seed mixtures, especially with slow germinating species like Kentucky bluegrass, to stabilize the soil until the more desired species are established; and 4) soil erosion, mulching, and weed infestation could be significantly reduced by decreasing the time between seeding and emergence.

Four turfgrasses, Penncross creeping bentgrass, Pennlawn red fescue, Merion Kentucky bluegrass, and Manhattan perennial ryegrass, were included. The four major studies were: Study A. Soaking seeds in distilled water then germinating on petri dishes. Study B. Soaking seeds in distilled water, drying, and then germinating in petri dishes. Study C. Soaking seeds in Carbowax 6000®, polyethylene glycol, a potential seed stimulant, aeration with a bubbler, drying, and then germinating in petri dishes, and Study D. Field plot establishment of selected superior treatment combinations from the three previous studies.

For studies A, B, and part of D, 120 ml., capped bottles filled with distilled water were used for soaking the seeds. Thus, there was minimal oxygen present during soaking under these conditions. Growth chambers were utilized for the various temperature treatments during seed soaking, and were also used for germination tests after the soaking treatments were imposed on the seeds. Conditions in the germination chamber were 8 hours of light at 77°F followed by 16 hours of darkness at 59°F. Ten centimeter diameter plastic petri dishes with #3 qualitative filter paper were used for the seeds during germination tests. The petri dishes were watered to maintain moist conditions at all times.

Germination counts were made on specific days after establishment, 5, 10, 15, 20, and 30 days after placement of seed in the petri dishes. Each dish contained 25 seeds, and each soaking treatment was replicated three times. Germination was defined as the point at which the shoot first emerged from the seed.

Study A. Soaking (distilled water) time and temperature were the two variables. A total of 25 treatments were imposed on each of the 4 turfgrasses. The five soaking temperatures were: 41°, 50°, 59°, 77°, and alternating between 59° and 77°F every six hours. Soaking times were: 6, 12, 24, 48, and 168 hours. After the appropriate treatment period the soaking bottle was removed from the growth chamber, and the seed was germinated in the petri dishes. Germination counts were made at 5, 10, 15, 20, and 30 days from time of placement on the petri dishes in the germination chamber.

Results from this investigation are applicable to possible use in hydroseeding. Observations for Study A were as follows:

Penncross creeping bentgrass: Up to ten days after establishment, the seeds soaked at 48 and 168 hours were significantly higher in total seeds germinated than the unsoaked control.

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Pennlawn red fescue: No significant improvement in seed germination from the untreated controls.

Merion Kentucky bluegrass: Most treatments were equal to or better than the control at the 15-day reading. In general, the longer the soaking time, the better the results.

Manhattan perennial ryegrass: No significant improvement in germination from the unsoaked controls.

Study B. Soaking (distilled water) time, temperature, and drying method were the three variables. This study was the same as Study A except that the seeds were dried by two procedures before germinating. The two drying treatments were oven dried 18 hours at 113°F and air dried one week at an average temperature of 75°F. Selected treatments were chosen from Study A for Study B. Key observation times were 5, 10, 15, 20, and 30 days from time of placement of seed in the petri dishes.

Results from this investigation are applicable to the seed marketing industry, landscapers, sod farms, and other persons involved in establishing seed in a dry form. Observations from the two drying methods used in Study B were as follows:

Penncross creeping bentgrass: No differences between oven and air drying.

Pennlawn red fescue: Air drying was more productive than oven drying.

Merion Kentucky bluegrass: No differences between oven and air drying.

Manhattan perennial ryegrass: No differences between oven and air drying.

Study C. Soaking (polyethylene glycol, Carbowax 6000®, time, temperature concentration, aeration, and drying were the five variables. Only Merion Kentucky bluegrass was used in Study C. Soaking was done in Erlenmeyer flasks with soaking times of 7, 12, and 21 days. Temperature treatments were 50°, 59°, room temperature (approx. 72°F), and alternating between 59° and 77°F every six hours. Polyethylene glycol concentrations were (a) 145 grams in 1 liter of distilled water, (b) 290 grams in 1 liter of distilled water, and (c) only pure distilled water. Aeration treatments were aerated or not aerated. Aeration was achieved by a pump which had a bubbler on the end of the air line. The aeration was intense enough to keep the solution and seed in constant motion. Drying treatments were either air dried at 75°F for 1 week or oven dried at 113°F for 18 hours. Key observation times were 5, 10, 15, 20, and 30 days from placement of seed in the petri dishes.

Observations for Study C were that no polyethylene glycol soaking treatments significantly improved the rate of germination as compared to an untreated control.

Study D. Thirteen promising treatments were randomly established in the field September 20, 1974, on 5' x 5' plots, with four replicates of each treatment. One half of the plot area was irrigated to maintain moist soil, while the other half was only irrigated for the first week after establishment.

Observations from Study D were as follows:

The most promising field plots appear to be:

1. Soaked 6 hours at 59°F, and seeded wet.
2. Soaked 24 hours at 59°F, and air dried before planting.
3. Soaked 168 hours at 77°F, and seeded wet.

Summary. The best potential for improving emergence rates of the four cool-season turfgrasses studied appears to be by wet application hydroseeding - after a soaking treatment. Each turfgrass studied responded differently to soaking time and temperature. Thus each cultivar and species has unique soaking requirements for optimum germination. Also, air drying produced better results than oven drying, yet rarely better than an untreated control.

Finally, further investigations are needed in the area of pregermination seed treatment in order to determine all effects of such treatments, including germination rates under disease, drought, cold, and heat stress.