

ENHANCING SEEDLING EMERGENCE BY SEED TREATMENTS - THE FUTURE

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Field and greenhouse trials have shown that seed preconditioning can enhance seedling emergence (1,2,3,4,5,6,7,8)¹. Preconditioning is most advantageous when seed is planted in cold, wet soils or when soil crusting prevents seedling emergence from slow germinating seed. When environmental and soil conditions are favorable, seed preconditioning did not improve final plant stands, although seedling emergence was more rapid from preconditioned seed than from unconditioned seed.

This report will present results from 1987 seed preconditioning trials and suggest future activities for seed treatments designed to enhance seedling emergence.

PROCEDURES

In 1987, trials were conducted at two sites on the Kimberly Research and Extension Center and near Hazelton, Aberdeen and Parma, ID. Commercially-processed, decorticated, size number 2 sugarbeet seed, variety WS-88 were used at all locations except Kimberly (Site No. 1) where variety WS-76 was used.

Kimberly (Site No. 1)

Commercially processed, decorticated size number 2 sugarbeet seeds, variety W76, were treated for 3 days in 30% aerated PEG solutions at temperatures of 59°F. Other treatments included water soak for 24 hours at 86°F; water soak + 3 days PEG treatment; and untreated controls. Treated and untreated seeds were hand-planted on April 21. Each treatment was replicated six times. Seeds were planted 0.75 inches deep with 60 seeds per 30 foot of row. Seedling counts were made from first seedling emergence 8 days after planting until the end of emergence, 27 days after planting.

Hazelton

Seeds were preconditioned for 2 days in 30% aerated polyethylene glycol (PEG) solutions at a temperature of 71°F. Preconditioned and unconditioned seed were commercially planted on April 8. The field was irrigated on April 13. Seedling counts were made between two sets of wheel line tracks on April 25, 27 and May 4.

Kimberly (Site No. 2) and Aberdeen

Seeds were treated for 3 days in 30% aerated, PEG solutions at a temperature of 71°F. Preconditioned and unconditioned seeds were planted in adjacent rows on April 20 and April 15-16 at Kimberly and Aberdeen, respectively. Nine replications of conditioned and unconditioned seeds were planted at each location. Seedling emergence was recorded from 8 to 21 d after planting at Kimberly and 11 to 40 d after planting at Aberdeen.

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¹Numbers in parenthesis refer to reference number in Literature Cited Section.

Parma

Seeds were preconditioned for 3 d in 25% aerated PEG solutions at a temperature of 71°F. Preconditioned and unconditioned seeds were commercially planted in mid-March in adjacent rows. Seedling emergence was observed periodically.

RESULTS

Kimberly (Site No. 1)

Seedling emergence from seed preconditioned with water and PEG or PEG alone was more rapid than emergence from unconditioned seed (Table 1). Final plant stands from PEG-treated seeds averaged 90% and were better than stands from unconditioned seed. In these trials, water soaking alone did not improve seedling emergence rates or final plant stands compared to stands obtained from untreated seed.

Seedbed temperatures were relatively warm and the soil dry at planting time. Some recent work with celery (2) and tomato (5) showed that PEG treatment improved rate and final emergence of seedlings under moisture-deficit conditions. Sugarbeet seeds may show similar response to PEG preconditioning provided that soils contain enough moisture for continuation of the germination process.

Hazelton

At 17 d after planting, seedling emergence from preconditioned seed averaged 41% more than emergence from unconditioned seeds (Table 2). Final plant stands were 35% better from preconditioned seeds than stands from unconditioned seed.

Soils were cold and dry at planting time (April 8) at this location. An irrigation 5 d after planting probably prolonged the cool soil conditions. Under these conditions, the preconditioned seeds allowed earlier and more complete seedling establishment than the unconditioned seeds. Two probable reasons for improved seedling performance from preconditioned seeds at this location are: 1) rapid cold water uptake may have reduced germination and seedling vigor of unconditioned seeds, and 2) the preconditioned seeds had a "head start" on the germination process, allowing faster emergence.

Kimberly (Site No. 2), Aberdeen and Parma

Preconditioned seeds did not improve seedling emergence at these locations (Table 2). Warm soils and favorable moisture conditions may have contributed to the lack of enhanced response from preconditioned seeds. Method of preconditioning may also have reduced expected seedling enhancement from PEG treatment. Seeds at these locations were treated in large batches within aerated columns. Laboratory germination of the treated seedlots was not as good as when seeds were treated in small amounts within Petri dishes. Aeration and overpriming are two additional possibilities for reduced performance of PEG-treated seeds in these trials.

The Future

Preconditioning and other seed treatments can improve seedling emergence. Priming seeds in PEG or water, soaking in water to remove inhibitors, addition of fungicides during the priming process, pelletizing, hot water treatment to remove some seedborne pathogens and addition of growth regulators have all increased seedling performance in given situations. Combinations of these seed treatments could potentially give even further enhancement of seedling growth than use of each treatment singly. Combinations of seed treatment for enhanced seedling growth and commercialization of those treatments for grower use should be explored.

Table 1. Influence of preconditioning on emergence of WS76 sugarbeet seedlings at Kimberly, ID (Site No. 1) in 1987.

Treatment	Days after planting						
	8	9	10	11	12	14	21
	%						
Control	1	6	54	69	79	84	84
Water soak	0	9	56	72	80	84	87
Water + PEG	6	19	72	76	83	83	88
PEG alone	8	22	76	80	87	91	90
LSD (0.05)*	4	7	14	8	8	6	6

*Means within a column that equal or exceed the LSD value are significantly different at the 0.05 level of probability.

Table 2. Influence of preconditioning on emergence of WS88 sugarbeet seedlings at Hazelton, Aberdeen and Kimberly, ID (Site No.2) in 1987.

Treatment	Days after planting											
	Hazelton			Aberdeen				Kimberly				
	17	19	26	13	15	18	26	9	10	12	15	21
	no. seedlings+			----- % -----								
Control	67	89	121	6	78	82	91	1	40	65	76	86
PEG	114	140	187	8	69	74	88	1	36	56	73	79
LSD (0.05)*	-	-	-	NS	6	NS	NS	NS	NS	9	NS	NS

*Means within a column that equal or exceed the LSD value are significantly different at the 0.05 level of probability.

+Number of seedlings between two sets of wheel line tracks

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