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Improvement of Sugarbeet Seedling Emergence by Seed Priming

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Sugarbeet seedling emergence is often slow and irregular because of internal seed factors and environmental conditions at planting time. Seed factors include germination sensitivity to both wet and dry soil conditions, germination inhibitors and seedborne diseases. Cold, wet and dry soils, soil crusting and soilborne diseases further aggravate emergence stresses imposed by seed factors.

Adding water to the seed (priming) in a controlled manner can reduce these stresses by reducing the seed's sensitivity to cold, wet conditions, and by giving seed germination a head start over untreated seed. Faster germination and emergence usually reduce disease incidence and the probability of soil crusting before emergence, which can make "planting to stand" more reliable. Planting to stand would reduce production costs by eliminating thinning and overseeding costs.

This publication presents results and recommendations from 3 years of field trials conducted in southern Idaho with primed sugarbeet seed. Details on various priming techniques, concepts, how priming works, seed responses to priming and experimental priming systems are covered in an earlier publication, University of Idaho Bulletin No. 677, *Priming Seed for Improved Vigor.*

Field Trials

Primed and unprimed sugarbeet seeds were planted with either commercial air seeders, plate planters or an experimental cone seeder at several locations in 1985, 1986 and 1987. Sugarbeet seed (usually cultivar WS-88, size 2) was primed for 3 to 7 days with 25 to 30 percent polyethylene glycol (PEG) solutions. Seed was rinsed to remove PEG, then dried before planting and usually planted within 2 weeks of priming.

Aberdeen, Minidoka and Murtaugh, Idaho — 1985

Commercially processed, decorticated sugarbeet seed (WS76 and WS88) were primed with aerated solutions of PEG (30 percent for 7 days at 68°F). Treated and untreated seed were planted with an experimental cone seeder in border plots of sugarbeet variety trials at Minidoka and Aberdeen. At Murtaugh, treated and untreated seed (WS88 only) were planted in adjacent rows by a commercial planter.

Initial seedling emergence was improved with PEG treatment at Minidoka and at Murtaugh, but total seedling emergence was reduced at both locations by PEG treatment (Fig. 1). Seven days of priming was apparently too long for improvement of final seedling emergence from these seedlots. No differences in seedling emergence related to PEG treatment were noted at Aberdeen. Both varieties responded the same to PEG treatment.

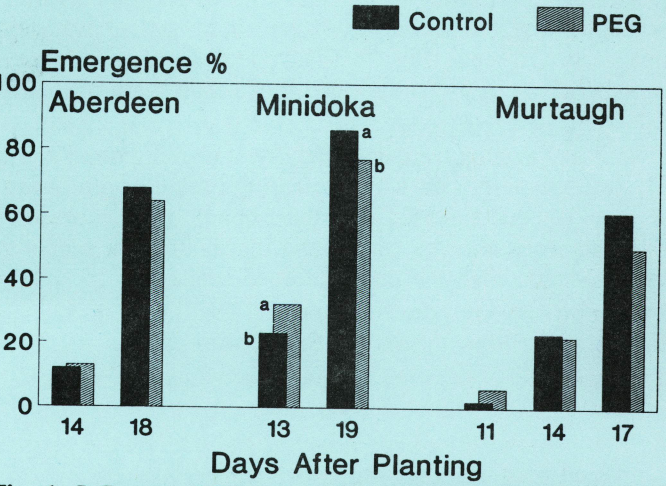

Fig. 1. Influence of 7 days of PEG treatment on emergence of sugarbeet seedlings at three locations in 1985. (Column means within a location with different letters are significantly different; column means within a location without letters are not different. At Murtaugh, statistical comparisons were not possible.)

Kimberly, Minidoka and Gooding, Idaho — 1986

Seedlings from PEG-preconditioned seed showed faster emergence than seedlings from unconditioned seed at all locations (Fig. 2). Initial emergence from preconditioned seed was 6 to 19 percent better than emergence from untreated seed.

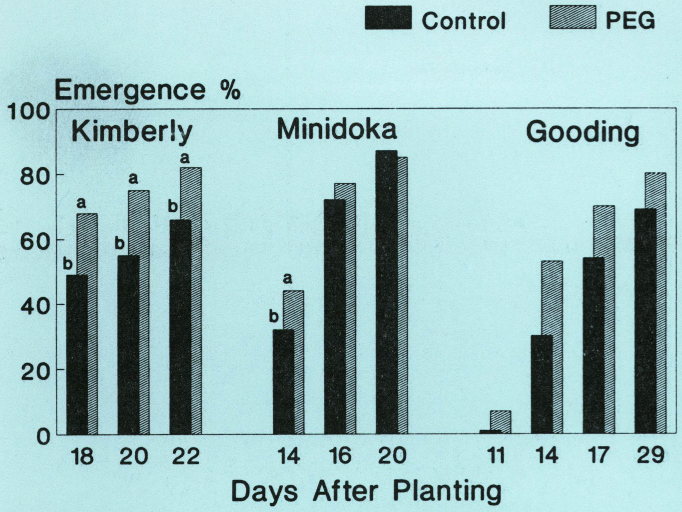

Fig. 2. Influence of 3 days of PEG treatment on emergence of sugarbeet seedlings at three locations in 1986. (Column means within a location with different letters are significantly different; column means within a location without letters are not different. At Gooding, statistical comparisons were not possible.)

Final plant stand from treated seed was better than final stand at Kimberly and Gooding (Fig. 2). Total emergence from treated seed at Kimberly and Gooding was 82 and 80 percent, respectively, compared to 66 and 69 percent from untreated seed. Final emergence of PEG-treated seed and untreated seed was not different at Minidoka.

Hazelton, Kimberly and Aberdeen, Idaho — 1987

At Hazelton 17 days after planting, seedling emergence from preconditioned seed was 41 percent more than that from unconditioned seeds (Fig. 3). Final plant stands were 35 percent better from preconditioned seeds than from unconditioned seeds.

Soils at Hazelton were cold and dry at planting time (April 8). An irrigation 5 days 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.
2. The preconditioned seeds had a head start on the germination process, allowing faster emergence.

Preconditioning did not improve seedling emergence at Kimberly and Aberdeen in 1987 (Fig. 3). 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 planted 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. Insufficient aeration and overpriming are two additional possibilities for reduced performance of column-treated PEG-treated seeds in these trials.

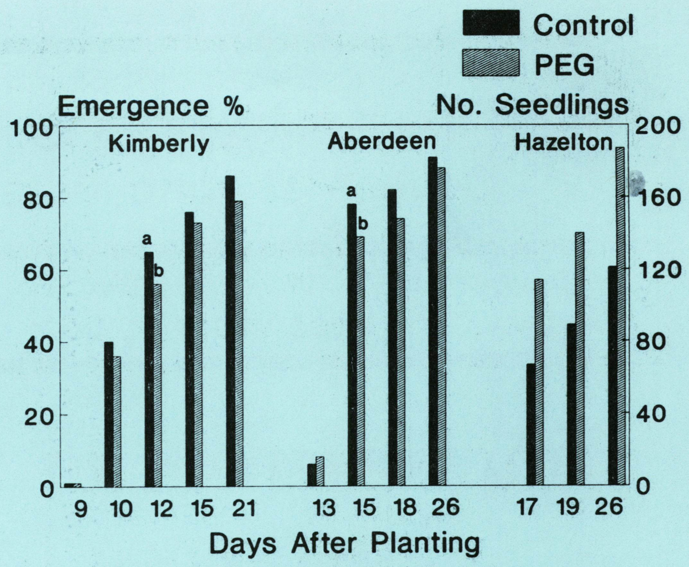

Fig. 3. Influence of 3 days of PEG treatment on emergence of sugarbeet seedlings at Kimberly and Aberdeen in 1987. (Column means within a location with different letters are significantly different; column means within a location without letters are not different. At Hazelton, statistical comparisons of number of seedlings were not possible.)

Summary

Preconditioning improved initial emergence of sugarbeet seedlings at five of eight locations in 3 years of testing. Final emergence was improved by preconditioning in three of eight locations, was reduced at one location and was not changed at four locations. The greatest response to preconditioning was observed when germination conditions were least favorable.

These studies and other research indicate that preconditioning and other seed treatments can improve seedling emergence of sugarbeets. Combining seed priming with other seed treatments such as water soaking to remove inhibitors, adding fungicides or hot water treatment to control seedborne pathogens, adding growth regulators and pelletizing could enhance seedling growth more than use of priming alone. Combinations of seed treatment for enhanced seedling growth and commercialization of those treatments for grower use should be explored.

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