Effect of Gibberellin on Germination and Early Growth of the Sugar Beet

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A recent report shows that pea and bean seeds treated with small amounts of gibberellin produce seedlings which emerge from soil more rapidly than those of non-treated seeds, particularly at low temperature (2). This paper reports the effect of gibberellin on germination, emergence, and early seedling growth of sugar beet.

Methods and Results

Whole seedballs of the US 400 variety were used throughout this study.

Soaking Treatments: Seedballs were soaked in 250 parts per million (p.p.m.) of gibberellin for 1½ or 3 hours and dried quickly in a current of air from an electric fan. The following day they were placed in contact with water or nutrient solution of 10.1 atmospheres osmotic pressure (1). The gibberellin treatment had very little effect on speed of germination or elongation of the seedlings as compared with untreated samples.

Seedballs were soaked for 18 hours in (a) distilled water and (b) 125 p.p.m. or 250 p.p.m. solutions of gibberellin. The seedballs were blotted to remove excess solution and then germinated at room temperature using nutrient solution of 10.1 atmospheres osmotic pressure. After nine days a greater proportion of the seedlings from seedballs treated with gibberellin had elongated hypocotyls than from seedballs soaked in distilled water.

Seedballs were soaked for 4 hours in distilled water or solutions of gibberellin ranging in concentration from 100 to 10,000 p.p.m. They were blotted and then planted in sand. Some were placed at a temperature approximating 65 to 75° F. and some at a temperature mainly in the fifties. The gibberellin treatments did not hasten emergence. However, the higher concentrations (5,000 and 10,000 p.p.m.) did stimulate elongation of the hypocotyl and first internode of many of the seedlings as compared to those from untreated seedballs.

Dust Treatments: Seedballs were stored in high humidity for approximately 22 hours prior to treating them with Gibrel “88” dust. Some seedballs were treated at the rate recommended by

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3 Numbers in parentheses refer to literature cited.
the formulator and some at twice the recommended rate. Following treatment, they were planted in sand. The dust treatments of seedballs neither speeded up emergence nor induced stem elongation in the seedlings when compared with the untreated.

While sugar beet seedballs treated with gibberellin failed to germinate more rapidly, the question as to why they were relatively unaffected remained unexplained. Possibly the structure of the seedball impeded entrance of the gibberellin into the seed. To rule out the possibility that the substance did not penetrate in sufficient quantity, seeds were removed from the seedball and soaked for 4 hours in 50 and 250 p.p.m. solutions and others were soaked two hours in a 10,000 p.p.m. solution of gibberellin. The seeds were blotted and germinated in contact with nutrient solution of 10.1 atmospheres osmotic pressure in the laboratory. Seedlings from treated seeds were comparable to those of untreated seeds, both in speed of germination and stem elongation.

Discussion

The seeds of sugar beet did not germinate faster or seedlings emerge more rapidly when treated with gibberellin. Miyamoto\(^4\), using concentrations of gibberellin up to 1,000 p.p.m., also failed to observe any faster emergence of sugar beet seedlings from soil maintained at different temperatures. Only the 5,000 and 10,000 p.p.m. treatments slightly stimulated stem elongation as compared with untreated samples. Elongation of the hypocotyl in a sugar beet crop would be undesirable under field conditions. Since such seedlings tend to lodge. In experiments concerned with floral induction, relatively high concentrations of gibberellin are required to produce any stimulatory effect as compared with some other crop plants.

Summary

Soaking either sugar beet seedballs or seeds in gibberellin solutions as concentrated as 10,000 parts per million did not hasten germination. The higher concentrations stimulated stem elongation. A dust formulation of potassium gibberellate at twice the rate recommended by the formulator was ineffective.

Acknowledgment

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Literature Cited


\(^4\) Oral communication. T. Miyamoto, Dept. Farm Crops, Michigan State University.