Gibberellic Shows Promise As Regulator of Turfgrass Growth

Researcher Discusses Qualities of Plant Stimulator for Rapid Germination and Reducing Dormancy Periods

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GIBBERELLIC ACID, a plant growth substance, promotes growth of a wide variety of plants including grasses. The gibberellins, of which gibberellic acid is the most common, are isolated culture filtrates of the fungus Gibberella fujikuroi. This fungus causes a disease of rice seedlings in many countries of the Far East and in Italy, giving rise to elongation of the shoot so that diseased plants are spindly and much taller than the healthy ones.

The crystalline material causing many symptoms characteristic of the disease was first isolated by the Japanese in 1939 from a liquid portion of the culture medium on which the fungus was grown. Gibberellic acid is produced commercially by growing the fungus in a culture medium. The process is somewhat similar to that used in the production of antibiotics such as penicillin. Gibberellic acid in pure form is not readily soluble in water; therefore, water soluble formulations generally contain a water miscible solvent or the acid is converted to a water soluble salt form.

Outside of Japan, experimental work with gibberellic acid was delayed by language barriers and war. It was not until 1951 that our Dept. of Agriculture resumed work with gibberellic. It shows promise as a growth regulator since it stimulates overall plant growth at extremely low concentrations. High amounts generally show slight to severe adverse effects of over stimulation and weak plants. The action of gibberellic acid, therefore, is different than that of 2, 4-D which is highly toxic at greater concentrations. Gibberellic acid in its dry form as an acid or as a potassium salt of the acid (*Potassium gibberellate*) is apparently fairly staple. Once dissolved, the material should be used within a week or two because it will gradually lose its growth stimulating properties.

Effect of gibberellic acid in promoting growth of Kentucky bluegrass. Starting in foreground (directly behind the sign), rectangular plots were sprayed July 17, 1957, with solutions containing 10, 0, 50, 0, 100, 0, 250, 0, and 500 ppm of gibberellic. (Photo taken Aug. 6, 1957).

Probably the greatest plant response to gibberellic acid is stem elongation or distance between nodes of the plant stem. Research indicates it may help plant growers in several ways, depending upon the crop. With some crops, gibberellic treated seed may emerge earlier. It may promote more rapid seedling growth; however, rate of root growth may be reduced where stem growth has been greatly stimulated. On many ornamental plants, the acid may be applied in a lanolin paste. A small amount of the acid is dissolved in the lanolin and stirred thoroughly to form a paste which can be applied just below the growing point of the plants. Perhaps a more common method is to apply gibberellic acid as a foliar spray.

For experimental purposes various ranges in parts per million (ppm) of gibberellic can be readily applied. For grasses, 1 to 2 ozs. per acre of gibberellic (equivalent to 100-200 ppm when 100 gallons of water are applied) are generally effective. Since gibberellic acid is a growth regulator or growth inducer and not a plant food, it will not replace fertilizer. In fact, probably more fertilizer will be needed to produce balanced growth when gibberellic is used.

Merion and Kentucky Bluegrass Treatment

Bluegrasses are relatively slow to germinate. Thus a chemical hastening germination by several days would be valuable in the establishment of turfgrasses. Rapid germination provides faster coverage, decreases erosion and enables seedlings to compete with weeds.

Seed of both Merion and Kentucky received the following treatments: a) untreated — dry seed; b) control-soaked in

Water treated and gibberellic acid treated seed were soaked for 24 hours prior to planting on Mar. 28, 1957. Observations taken after germination began indicated that water soaked seed germinated as soon as the seed was treated with various concentrations of gibberellic acid. Dry seed (untreated) and seed treated with gibberellic dust did not show any difference in time of germination. Seed soaked in both water and gibberellic acid germinated 2-3 days earlier than dry seed. Other workers found water and KNO_3 treatments on Kentucky bluegrass equal to or superior to gibberellic acid. Growth after emergence was not affected by gibberellic treatments; apparently, gibberellic acid dissipates rather rapidly in moist soil.

Effect on Bermuda, Bent, Zoysia

Supts. and others using vegetative material for the establishment of turf are tremendously interested in obtaining rapid cover for new turf areas. With this thought in mind stolons of Bermudagrass, bent and zoysia were soaked 24 hours in water only or in solutions containing 5 ppm, 10 ppm, 50 ppm, 100 ppm and 500 ppm of gibberellic acid. Measurements of stolon growth were taken six times during a period of 22 days following treatment.

(*See table on following page*)

TABLE : Response of Bentgrass, Bermudagrass and Zoysiagrass Stolons to Gibberellic Acid Treatments Under Greenhouse Conditions

Ave. increase in length of stolons (cms.)

Treatments	Cohansey Bentgrass	U-3 Bermuda	Meyer Zoysia
Water	10.4	14.5	.3
5 ppm	13.7	6.8	.5
10 ppm	15.4	12.7	.5
50 ppm	19.0	15.4	.9
100 ppm	16.2	24.0	1.1
500 ppm	9.5	31.4	1.2

Stolons were soaked for 24 hours before planting.

Growth period: Mar. 29-Apr. 20, 1957.

Growth of Cohansey increased with each concentration of gibberellic to 50 ppm, after which increase in growth of stolons began to decrease. Treatments of 500 ppm reduced growth of stolons below that of the control. The 50 ppm treatments increased the length of stolon growth approximately 1/3 over the control. U-3 Bermula, with the exception of the 5 ppm treatments, showed a continuous increase in stolon growth through the entire range of treatments and rate of growth for Bermuda was more rapid than bentgrass at higher concentrations. Meyer zoysia stolons used for this experiment showed very little response to gibberellic acid. The 500 ppm treatments increased growth of stolons only .9 cm over the controls. This may be because zoysia species are much slower to become established from stolons than either bermudagrass or bentgrass.

Test Several Grasses

To further test the response of Bermuda, bent and zoysia grasses to gibberellic, 4-in. plugs of each species were planted in replicated plots in the field. Plugs were planted in June and allowed to become well established before treatments were applied in July. Treatments included a control, 10 ppm, 50 ppm, 100 ppm, 250 ppm and 500 ppm of gibberellic acid. The first application was made on July 17, 1957.

An application of 10 ppm gave a decided increase in growth of bentgrass over the control; whereas, considerable etiolation and yellowing began to appear at 50 ppm. Concentrations over 50 ppm affected bentgrass adversely causing thin, anemic growth. Growth of Meyer zoysia was not stimulated except at high concentrations in which case the zoysia plant grew taller and leaves became more yellow. Zoysia plants which received 500 ppm of gibberellic acid were 2-1/2 times taller than the controls; however, there was no apparent increase in stolon extension. At the higher concentrations, zoysia stolons no longer grew prostrate but began to turn upward exhibiting a geotropic reaction. Reversal of the upward growth of stolons occurred later in the season. California workers have reported that gibberellic acid applied to zoysia vegetative material did not improve the rate of turf establishment.

John Price (left), supt. at Southern Hills CC, Tulsa, recently received the GCSA 'Award of Merit' from L. E. (Red) Lambert, who presented it in behalf of the national organization. About 75 persons attended the presentation ceremonies which got wide newspaper coverage in the Southwest. Following the presentation and a luncheon, several persons at the Price party played Southern Hills to get an idea of how well John had prepared it for the Open.

Greenhouse vs. Field

U-3 Bermuda responded to gibberellic somewhat similarly to Meyer zoysia with respect to top growth, although geotropism of stolons was not observed. The high response of bermudagras stolons to gibberellic acid obtained in the greenhouse was not evident in the field; moreover, a concentration of 500 ppm inhibited growth of Bermuda selections.

A pronounced growth response was obtained in Kentucky blue by treating with gibberellic. Increased growth, yellowing and etiolation were roughly proportional

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Gibberellic Acid

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to the concentrations applied. The effect of gibberellic on Kentucky blue was observed in 3 to 4 days and was still evident three months after treatment.

Leben obtained an increase in both fresh and dry weight of Kentucky blue clippings treated with gibberellic acid especially when it was used in conjunction with fertilizer. Once a dense turf is established, it would be preferable for lawn purposes to have grass grow slowly in order to decrease maintenance costs.

May Induce Fall Growth

Field tests indicate that gibberellic acid may be useful for inducing the growth of some grasses in the fall and again in the spring. Gibberellic acid has been used successfully in Michigan in the spring to induce growth in bluegrasses and Bermudas when growth would not have otherwise occurred. Bermuda was dark green within 10 days when treated on Apr. 16, 1957, with 2 ounces of gibberellin per acre.

Gibberellic may prove to have a place on golf courses where it could be used to enable play to start earlier in the spring and to extend it later in the fall. However, the effect of gibberellic for breaking spring and fall dormancy has not been well established.

Summary

Merion Kentucky blue and Common Kentucky seed were treated with various concentrations of gibberellic acid. Seed treated with gibberellic did not germinate earlier than the control, nor was subsequent seedling growth more rapid.

Stolons of bentgrass, Bermudagrass and zoysia were soaked for 24 hours in different concentrations of gibberellic acid. In the greenhouse, bentgrass was most responsive followed by Bermuda. Zoysia responded very little to gibberellic acid treatments.

In the field, the best growth of bentgrass was observed at 10-50 ppm; above these rates spindling growth was evident. At the 500 ppm concentration Bermuda stolon growth was slightly inhibited. In Meyer zoysia additional upright growth was observed following application of gibberellic acid but no improvement was obtained in rate of turf establishment.

Additional research is necessary to determine the value of gibberellic for breaking spring and fall dormancy of both cool and warm-season grasses; its usefulness as an adjunct for weed control; and to determine whether rate of root growth is affected adversely by the high concentrations of gibberellic acid.

Use Forceful Approach in Selling Club on Improvements

An article in the Green Breeze, monthly publication of the Greater Cincinnati GCSA, written by a fellow with the pen name of Edsel Midiron, declares that many a supt. doesn't use the right approach in requisitioning a new piece of equipment or a course improvement.

Too often, says Edsel, an oral request is made and the official to whom it is given forgets it, or the supt. doesn't follow it up. Many times a proposal is merely scratched on a piece of handy paper and doesn't make much of an impression when it is passed around at a green committee or board meeting.

Edsel says he has been guilty of such practices. But he has noticed that when he carefully draws up a proposal with plans, diagrams, costs, etc., clearly explained, his chances of getting favorable action are increased 100 per cent.

Model Put on Display

A year ago when Edsel wanted to replace a poorly constructed green that had given him a great deal of trouble for as long as he could remember, he made up a Pastalena clay model of a new green that showed drainage contours, sandtraps, mounds and surrounding trees and a creek. It was mounted on plywood and even sand was put in the traps. The green committee couldn't okay it fast enough. Then the model was displayed in the clubhouse lounge for two weeks with the supt's name prominently displayed as the architect.