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Systemic Induction of Parthenocarpic Fruit Set in Cotton with Gibberellin[1]

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AMONG the numerous responses of plants to gibberellins, increased set of fruit, including parthenocarpic fruit, has been noted in several species (4). Walhood[3] increased fruit set in Upland cotton (*Gossypium hirsutum* L.) by applying a solution of 100 ppm of gibberellic acid to the flowers at anthesis. Arndt[4] using foliar application of potassium gibberellate did not find any effect on fruit retention. Rates up to 1 gram per acre were applied weekly for 6 weeks. Dransfield (1) found a single spray of gibberellic acid at 10 ppm failed to increase fruit set, although shedding was delayed. Jackson and Fadda (3) reported shedding of fruit was increased by the application of gibberellic acid (up to 500 μg. per plant) to the leaves of a variety of the *Gossypium barbadense* species. Also, foliar application of gibberellin affects the growth and composition of stems and petioles of the cotton plant as well as the leaves (2).

This paper reports the effect of foliar application of a gibberellin on the set of parthenocarpic fruit in cotton.

MATERIALS AND METHODS

Forty plants, of each of 2 cotton varieties of the *Gossypium hirsutum* L. species, 'Rex' and 'Blightmaster', were grown in 40-inch rows, with a spacing of 2 feet between plants. Plants of each variety were divided into 20 pairs and 1 plant of each pair was treated by dipping all expanded leaves in a solution of 500 ppm of an ester of gibberellic acid.[5] The other plant of each pair remained untreated throughout the experiment. Plants were treated about the time the first blooms appeared. During the 15-day period following treatment with the gibberellin, flowers were emasculated the day prior to anthesis and the stigmas covered with short sections of soda straws to prevent pollination. Actually, because of interference of irrigation and rainfall, flowers could be emasculated only on the 2nd, 3rd, 6th, 7th, and 15th days following treatment.

RESULTS AND DISCUSSION

Since similar results were obtained with both Rex and Blightmaster, no differential effect could be attributed to varieties. Therefore, only the pooled data on varieties are reported here. Some of the emasculated flowers on the treated plants set fruits. They were all parthenocarpic, a rare phenomenon in cotton under natural conditions. All fruits from the emasculated flowers on the untreated plants abscised a few days after emasculation. The ability of the gibberellin to induce parthenocarpic fruit set was greatest when applied immediately prior to emasculation (Figure 1). The percent of parthenocarpic fruit set decreased linearly as the time between treatment and emasculation increased, and there was very little effect on flowers reaching anthesis 15 days after treatment.

The action of the gibberellin was more than just the prevention of abscission of the fruit. The fruits enlarged, although the extent of their development varied considerably. Some of the parthenocarpic fruits produced only infinitesimal amounts of lint (fibers), while others produced considerable quantities, all, of course, on empty (unfertilized) seeds. The mean dry weight of the mature parthenocarpic bolls, including carpels, seed coats and lint, was 0.93 gram. However, the largest and most fully developed bolls may provide a better indication of the potential of gibberellin in the induction of boll development. The mean weight of the 3 largest bolls was 1.41 g., about one-sixth of the weight of a normal boll. The greatest development of the boll components was found in the carpels, their dry weight being about one-half that of normal bolls. As mentioned, some parthenocarpic development of the maternal tissue of the seeds occurred. Of course, the seeds did not contain embryos, and as the seed coats were shriveled, their size was difficult to estimate. The largest seeds were approximately 3 mm. long. The mean weight of lint from the largest bolls was 0.22 g., about one-tenth that of normal bolls, and the maximum fiber length was about 16 mm. Under normal conditions, where fertilization occurs, these varieties would have produced fibers about 28 mm. long. As the cotton fibers normally elongate for about 20 days after fertilization, probably 10 to 12 days of fiber development occurred in the parthenocarpic bolls.

The period from anthesis to dehiscence of the capsule, henceforth referred to as boll period, averaged 62 days for the parthenocarpic fruits. A comparable number of bolls, which were pollinated and which developed normally, had a boll period of 65 days. This close agreement between the boll periods of the parthenocarpic and normal fruits suggests that dehiscence of capsules is independent of matu-

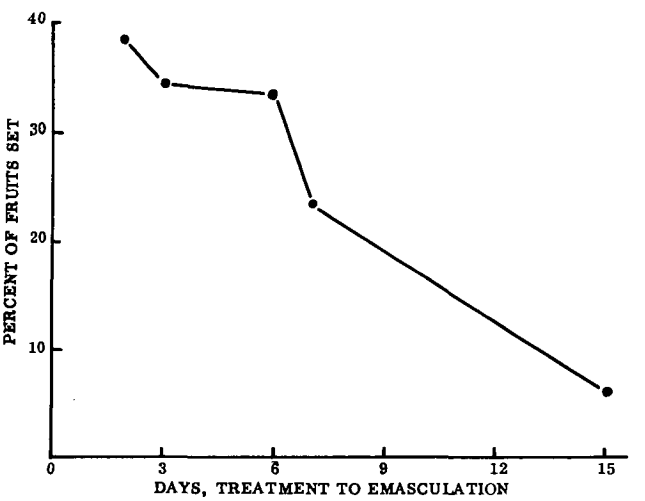

Figure 1—Effect of an ester of gibberellic acid, applied as a foliar treatment, on the set of parthenocarpic fruit in cotton. Activity decreased linearly as the time between treatment and emasculation increased.

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[3] Walhood, V. T. The effect of gibberellins on boll retention and cut-out in cotton. Proc. 12th Ann. Cotton Defoliation and Physiol. Conf. 1957.

[4] Arndt, C. H. (Abstract) The effect of potassium gibberellate on the fruiting of the cotton plant. Proc. 12th Ann. Cotton Defoliation and Physiol. Conf. 1957.

[5] Ethylene glycol monobutyl ether gibberellate; formulation supplied by Merck and Co., Inc.

rity of seeds. More likely, maturation processes within the capsules determine the length of the boll period.

A systemic response of cotton to an ester of gibberellic acid was demonstrated by the set and partial development of parthenocarpic fruit as a result of the foliar application of this material. This technique may be useful in evaluating the response of cotton to other gibberellins or other growth regulators. If male-sterile lines were used, the necessity of emasculating flowers would be eliminated.

LITERATURE CITED

1. DRANSFIELD, M. Some effects of gibberellic acid on cotton. Empire Cotton Growing Rev. 38:3–15. 1961.
2. ERGLE, D. R. Compositional factors associated with the growth responses of young cotton plants to gibberellic acid. Plant Physiol. 33:344–346. 1958.
3. JACKSON, J. E., and FADDA, N. R. Effects of gibberellic acid on the flowering and fruiting of *Gossypium barbadense*. Empire Cotton Growing Rev. 39:125–130. 1962.
4. VAN OVERBEEK, J. Endogenous regulators of fruit growth. *In* Proc. Plant Sci. Symp., Camden, N. J. 1962.