INDUCED GROWTH CORRELATIONS AT DIFFERENT STAGES FOR THE CONTROL OF FLOWERING IN COTTON PLANT

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INTRODUCTION

Cotton is considered an important source of textile fibers all over the world. Egyptian cotton is characterized by its fiber length and smoothness all over the world. Although the Egyptian cotton is facing a dangerous competition from synthetic fibers nowadays, it is still considered the backbone of our Agricultural exports and local textile industry in both public and private sectors.

Nitrogen is known to be the most critical nutritive element in Egyptian agriculture because it is needed in fairly high amounts, as it constitutes several important chemical groups, which in turn play a major role in plant metabolism and development. A plant with good nutritional status is expected to react more positively to growth regulating substance than with plants poorly nourished.

The present investigation aimed to throw spot lights on cotton plant growth correlations. Cotton usually flowers over a very wide range of time, that might last for 70-75 days. This is considered unfortunate because cotton is being more subjected to natural enemies and pests such as bollworm due to this character. Another disadvantage is that mechanization in cotton fields is becoming more difficult specially at harvest time (picking). Thus, it was thought that through maintaining good vegetative growth of cotton plants prior to flower induction by spraying with plant growth regulators (that are known to induce such effect), we might be able to shorten greatly the flowering period of cotton fields and such artificial induction will enable cotton growers to control pests and use mechanization in cotton fields more efficiently. In addition better production in quantity and quality of cotton yield and fibers is also aimed at, through minimizing the number of pickings as a result of shortening the flowering period and earlier induction of flowering.

Hoping to achieve results that might realize the present objectives, we could be able to introduce helpful contributions that might be adopted as a new technology in cotton growing to the welfare of our country.

REVIEW OF LITERATURE

The literature concerning the present study is voluminous and therefore, the review will be discussed under the following headings to facilitate the presentation of complex growth correlations of cotton in simple relations for better understanding of the whole picture. The effect of nitrogen fertilization and some plant growth regulators (CCC, alar, pix and ethrel) on growth and development i.e. vegetative and reproductive growth and yield as well as chemical constituents and endogenous hormonal analyses will be presented separately.

1. Vegetative growth :

1.1. Effect of Nitrogen Fertilization:

Dastur and Dabir (1962) and Machenzie and Van Schaik (1963), observed that the application of nitrogen significantly increased cotton plant height. Gardner and Tucker (1967), also concluded that nitrogen deficiency at early stages of growth limited internode elongation and development of vegetative branches.

Chaudhry (1969) in the same connection, reported that the level of N fertilizer exerted statistically significant positive influence on final plant height and number of fruiting branches/plant.

In Egypt, Eid (1969) found that the height of cotton plants and the number of fruiting branches increased by increasing the amount of nitrogen added up to 60 kg N/ feddan.

El-Bayoumy (1971) also reported that nitrogen application caused a linear response in plant height and dry matter content of cotton leaves.

Saad (1971) reported that there was an increase in plant height and number of leaves with the increase in the amount of nitrogen added to cotton plants, but nitrogen did not exert statistical significant effect on the dry matter content of leaves and stems.

Hunsigi (1973), observed that the application of nitrogen also increased the total leaf area per cotton plant and also the leaf area index.

Anderson (1974) reported that increasing nitrogen level resulted in an increase in plant height of cotton plant.

Abdel-Malik (1976) found that plant height values were significantly increased with the higher nitrogen fertilizer rates.

Manjura and Sunderman (1976) showed that the dry matter production per plant was increased by increasing N application up to 90 kg N/hectar.

Ali (1977) concluded that plant height and the number of fruiting branches increased significantly by increasing nitrogen levels.

Helal (1978), reported that dry weight of cotton leaves increased by raising nitrogen level.

Zeng et al. (1982) studied the effect of different amounts of N fertilizer on the development and N content of the cotton plant and bollworm in pots. They applied ammonium sulfate at 0, 2, 4 and 16 g/pot respectively, at the flowering stage . After the application of ammonium sulfate, total N in the soil increased. Increased N in soil enhanced the dry matter accumulations in both bolls and leaves and also their N contents.

1.2. Effect of plant growth regulators:

1.2.1. Cycocel (CCC) or (Chlormequat):

Thomas (1964), found that CCC applied at various rates and stages of growth to cotton plants, gave significant reduction in plant height compared with that of control plants. This reduction resulted from restriction in length of the main-stem internodes, in which the greatest number of internodes were affected by treatment before flowering and by higher concentration in treatments made at the onset of flowering.

Khan and Sultan (1968), showed that plant height was reduced upon spraying cotton plants with chlor mequat at 0.1, 0.2, or 1 lb/ac.

Silva (1971) found that applications of 125 or 250 ppm chlormequat to cotton plants at 38, 59, or 85 days after emergence decreased plant height and increased the number of monopodial nodes/plant.

Yuldashev et al. (1972) observed that when cotton c.v. 108-F and S-460 were given foliar applications of 0.01-0.05% chlormequat at the 4 leaf stage, chlormequat decreased height and number of sympodial branches in both varieties.

Zur et al. (1972), reported that on a soil with high nitrogen status, chlormequat was applied at concentrations of 50, 100 and 150 g a.i/ha. on 3 dates to cotton c.v. Acala 4-42. Plant height was reduced when chlormequat was applied at an earlier date. Early applications also delayed ripening.

Marani et al. (1973), found that CCC decreased the height of cotton plants when sprayed during the first week of flowering at 50 g a.i/ha on the Upland Acala 4 -42 cotton plant.

Roland (1974), published data on CCC and NAA when applied to cotton at various concentrations and growth stages. NAA has no effect on growth and chlormequat reduced plant height and internode length of main stems and fruiting branches.

Imamaliev et al. (1975), reported that application of chlormequat to cotton at early flowering inhibited growth.

Howell and Diaz (1976) treated cotton plants with 50 or 70 g chlormequat/ha at squaring or at full flowering or left them untreated. They indicated that chlormequat treatments reduced plant height and the greatest reduction in dry weight was resulting from early application.

Abdallah and Mahmoud (1978) found that, in cotton plants, chlormequat decreased plant height, internode length, and increas number of nodes/plant. The highest dry weight of roots and leaves were recorded at 100 ppm CCC.

1.2.2. Alar or B_9:

As regarding the effect of alar (B_9) on vegetative growth Riddel et al. (1962), Dahlgren and Simmerman (1963) reported that B_9 was found to be the most active compound to retard foliage growth in legumes, potatoes and ornamental plants which are unstable in water.

Cathey (1964) indicated that the reaction of growth retardants was limited by the method of application. CCC drenches or sprays and B_9 sprays suppressed further vegetative growth of Azaleas, and induced flower buds to form earlier than in untreated plants. By sprays promoted earlier flower buds on Rododendron and Ilex sp.

Coyne (1969) applied CCC at 500 ppm and B_9 at 1500 ppm to Phaseolus vulgaris seedlings. He indicated that B_9 caused the first flower to open at higher nodes while CCC was the only chemical to induce early flowering under long photoperiod.

Younis (1970) found that spraying broad bean plants with B_9 at 100 ppm retard stem elongation and improved root growth.

1.2.3. PIX or Mepiquat chloride (MC):

Mulder *et al*. (1981) found that spraying mepiquat chloride 50, 75, 150 g.a.i/ha at early reproductive stages caused slightly decreased plant height at any concentration and the growth reduction did not differ when 50 g/ha mepiquat chloride was applied in spray volume 250 or 500 L/ha.

Makram *et al*. (1981), reported that 1, 1 Dimethyl piperidinium chloride (pix) decreased plant height of cotton without affecting the number of sympodia per plant as compared with untreated plants.

Khafaga (1983) found that pix reduced vegetative growth by 20-30% for cotton (*G. vitifolium* cv.) reacted more strongly than *G. hirsutum* cv. The same auther (1984) studied the application of BA (benzyladenine) at 400 mg/L at early stages development of cotton plant and pix at 200 mg a.i. at the beginning of flowering. He found that pix and BA were the most efficient compounds for shortening the vegetative period and increasing the yield of cotton and pix had the additional advantage of reducing the vegetative growth by 20-30%. Cultivars of *G. vitifolium* reacted more strongly to the treatments than cultivars of *G. hircutum*.

Kerby (1985), found high reduction of cotton plant height when treated with MC (Mepiquat chloride) as the average number of main stem nodes was consistently reduced, from 21.8 to 20.8 for MC treated plots.

1.2.4. Ethrel :

Concerning the effect of ethrel on vegetative growth Scott and Leopold (1967), indicated that the effect of GA and ethrel on growth are drastically different and even mutually antagonistic in some systems.

Burg (1968), suggested that the primary effect of ethrel on plant growth is to induce or increase senescence as evidenced by its effect on abscission, fruit ripening and degradation of chlorophyll.

Morgan (1969) reported that ethephon produced both apical and basal abscission.

El-Beltagy and Hall (1974) found that the higher concentration of ethylene were correlated with reduced growth rate and increased leaf and flower abscission in Vicia Faba plants.

Skytt-Anderson (1970) suggested that ethrel was found to induce growth of buds which influence the apical dominance. At the same time the compound reduced the final height of the main stem and reduced fruit yields.

The same auther in (1971) found that ethrel reduced the growth of the main axis of pea plants, presumably by the intracellular ethylene released when the compound enters the cell. Ethrel at low concentrations increased vegetative mass by producing lateral shoots, at higher concentrations, however, it decreased vegetative plant mass.

In this connection Beyer (1973), also reported that cotton plants (Gossypium hirsutum L. cv. Stoneville 213) placed in 14 μl/l of ethylene for 24 or 48 hours showed an increase in leaf abscission and reduced capacity to transport auxin, but when returned to air, auxin transport gradually increased and abscission decreased.

Wraight and Rogers (1978) reported that beans, Phaseolus vulgaris were sown at 4 different spacings and being either sprayed with ethrel (ethephon) at 0.25 kg a.i/ha at the true 2-leaf stage or not sprayed. They found that ethrel caused apical bud stopping and additional branching and harvesting was delayed.

2. Reproductive Growth:

2.1. Effect of Nitrogen Fertilization:

There are so many instances in literature indicating that high levels of nitrogen fertilizer induce greater number of flowers and bolls in cotton (Abdel-Rheem (1960), Salluma (1962), Hamdi *et al*. (1964), Qureshi (1965), Eid (1969), Reddy and Rao (1970), Saad (1971), Girgis (1972).

On the other hand Thompson (1965) noticed that over-applications of nitrogen resulted in poor and late fruiting. While Verma *et al*. (1965), El-Banna (1969), Abdel-Malik (1976), Ali (1977), reported that the number of open bolls increased by raising nitrogen rates.

Jones *et al*. (1974) however, found that carbohydrate and nitrogen stresses caused fruit shedding and this was more pronounced in severe nitrogen deficiency.

Basinski *et al*. (1975), also in this connection reported that the decline in the rate of nitrogen absorption tended to cause fruit shedding.

Ali (1977) found that shedding percentage decreased as nitrogen level was raised from 40 to 60 kg N/feddan, while nitrogen level from 60 to 80 kg N/f increased the shedding percentage.

On the contrary Helal (1978), reported that shedding percentage was decreased as nitrogen level was increased.