Effect of Application of a Plant Growth Regulator and Micronutrients on Insect Pest Infestation and Yield Components of Cotton

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Abstract: Studies were carried out on the effect of hormone and micronutrients on plant growth and insect infestation of cotton crop under field conditions. Cotton (TH-3/83) was sown in randomized block design with four replications on May 15, 2001. Planosolix (plant growth regulator) and two micronutrients (Bonus Non-chelated and Bonus chelated) were applied on August 20, 2001 and two subsequent applications were made at weekly intervals. The results indicated that there was significant effect of application of hormone and micronutrients on plant height, number of fruiting bodies (bolls), volume of bolls and yield in comparison to control. There was no significant effect of application of hormone and micronutrients on multiplication of thrip, Scirtothrips dorsalis, Jassid, Amrasca devastans, Whitefly, Bemisia tabaci and percent infestation of bollworms. However, application of plant growth regulator and micronutrients significantly delayed the maturity of cotton.

Key words: Plant growth regulators, micronutrients, insect infestation, cotton

INTRODUCTION

Cotton, Gossypium hirsutum L., is one of the important cash crops of Pakistan. Cotton plays important role in the economy of the country. Pakistan occupies fourth position in area and production of cotton in world but ranks 9th in average yield amongst the top cotton producing countries of the world[1].

Yield is an outcome of genotype with environment. All cotton varieties always have a huge genetic potential exploitable under optimal growing conditions. Growing conditions include climate and input applications. About 50% of the present cotton yields in world are attributable to the use of agrochemicals[2]. Since the use of agrochemicals has become popular in agriculture, technological innovations for best utilization of inputs have become of critical importance for realization of optimum yields.

Plant growth regulators are applied to control undesirable vegetative growth of crop plants, enhancing fruiting bodies and increasing yield. Plant growth regulators are reported to have improved plant water relationships and rate of photosynthesis. The changes incurred in crop plants due to use of plant growth regulators may also affect plant insect relationships. Application of ethephon caused significant abscission of fruiting forms but yield was not affected[3], increased cotton yield[4]. Application of triacontanol, NAA, Atonik, Recine and Cytoxyme significantly increased seed cotton yield[5].

Micronutrients are essential for normal growth and development processes of plants because these work as mediators or activators of many enzyme systems, for example, the carboxylase of Proteus vulgaris catalyse oxidative decarboxylation of pyruvic acid to acetic acid. Iron is not constituent of chlorophyll but is essential for its formation. Manganese is related to oxidation reduction balance in plants specially in connection with iron and nitrogen metabolism. Zinc is needed by plants in some of their enzyme systems[6,7]. Micronutrients disorder is known to be a widespread and serious problem in Pakistan soils[8,9]. Further, under adverse conditions of water stress due to high temperature even with good irrigation system, cotton may need additional supply of micronutrients to realize the yield potential. High soil pH and low level of organic matter further limits the availability of nutrients to cotton crop[10]. The deficiency or biological unavailability of nutrients/micronutrients adversely affects the growth and development of plants for example, effects of nutrient elements on fruiting efficiency has been reviewed by Joham[11] and has divided into two groups with respect to fruiting index. A deficiency of one group of elements (P, K, Ca, Mg, B and Zn) limits fruit production to a greater extent than vegetative growth; whereas the deficiency of a second group of elements (N, S, Mo and Mn) restricts vegetative

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RESULTS AND DISCUSSION

Growth and yield components

Plant height: The effect of application of hormone and micronutrients on cotton plant height (Table 1) indicate that there was significant (P<0.05) effect of application of plant growth regulator and micronutrients on plant height. The maximum plant height of 114.6±6.3 cm was recorded in planofix applied plants, followed by Bonus non-chelated micronutrients, whereas, the control treatment plants attained the minimum height in present study.

Fruiting bodies (bolls): Application of plant growth regulator and micronutrients significantly (P<0.01) increased the number of fruting bodies (bolls) of cotton compared with control. The maximum number of bolls (155.8±93.4 plant⁻¹) was recorded in planofix treated plants followed by Bonus chelated micronutrient applied plants (Table 1).

Volume of bolls: The results revealed that there was a significant (P<0.05) effect of application of plant growth regulator and micronutrients on the development of boll size in cotton. The maximum boll size of 2.84 cm was found in cotton applied with planofix followed by Bonus chelated with boll size of 2.78 cm. The cotton plants which did not receive any treatment had the minimum boll size (Table 1).

Maturity of cotton: Application of plant growth regulator and micronutrients significantly (P<0.05) delayed the maturity of cotton. The minimum days to maturity (43.01) was found in control plants followed by Bonus (non-chelated) (Table 1). Whereas, planofix treatment significantly delayed the maturity of cotton plants which was 55.7±3.0 days as determined with Fry¹⁷ method.

Yield: There was significant effect of application of plant growth regulator and micronutrients on yield of cotton. The maximum yield was recorded with the application of planofix followed by Bonus (chelated) (Table 1) and minimum yield was recorded in control plot receiving no treatment.

Present study clearly demonstrated that application of plant growth regulator and micronutrients increased the number and volume of bolls resulting in the significantly enhancement of yield. There are many studied reported in
Table 1: Effect of microminerals and hormone on yield components of cotton X:5D

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Plant height (cm)</th>
<th>No. of bolls</th>
<th>Ball volume (cm)</th>
<th>Crop maturity (days)</th>
<th>Yield (kg)</th>
<th>Plant</th>
<th>Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonus non-chelated</td>
<td>110.4±4.58a</td>
<td>123±6±2.28c</td>
<td>2.7±0.09a</td>
<td>48.6±5.4a</td>
<td>2.2±0.1b</td>
<td>565.2</td>
<td></td>
</tr>
<tr>
<td>Bonus chelated</td>
<td>195.4±5.58b</td>
<td>153±5±7.1b</td>
<td>2.8±0.08a</td>
<td>53±7±1.6a</td>
<td>2.4±0.0c</td>
<td>619.7</td>
<td></td>
</tr>
<tr>
<td>Phalofox</td>
<td>114±6±5.3a</td>
<td>155±8±9.4a</td>
<td>2.8±0.05a</td>
<td>55±7±3.0a</td>
<td>2.8±0.0d</td>
<td>741.5</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>106.4±7±4.2c</td>
<td>140±5±6.2c</td>
<td>2.6±0.08c</td>
<td>43±0±4.4c</td>
<td>2.0±0.0e</td>
<td>521.2</td>
<td></td>
</tr>
</tbody>
</table>

Means followed by same letter(s) in the column are not significantly (P<0.05) different from each other.

Table 2: Effect of application of microminerals and hormone on infestation of A. A. devastans, B. S. dorsalis, C. B. tabaci and D. boilworm infestation (%) in cotton

<table>
<thead>
<tr>
<th>Date</th>
<th>A. devastans</th>
<th>B. tabaci</th>
<th>A. chelated</th>
<th>Phalofox</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.8.2001</td>
<td>0.45</td>
<td>0.48</td>
<td>0.42</td>
<td>0.48</td>
<td>0.48</td>
</tr>
<tr>
<td>27.8.2001</td>
<td>0.64</td>
<td>0.65</td>
<td>0.71</td>
<td>0.73</td>
<td>0.73</td>
</tr>
<tr>
<td>03.9.2001</td>
<td>0.94</td>
<td>1.05</td>
<td>1.02</td>
<td>1.32</td>
<td>1.32</td>
</tr>
<tr>
<td>10.9.2001</td>
<td>0.42</td>
<td>0.48</td>
<td>0.43</td>
<td>0.57</td>
<td>0.57</td>
</tr>
<tr>
<td>17.9.2001</td>
<td>0.52</td>
<td>0.53</td>
<td>0.55</td>
<td>0.63</td>
<td>0.63</td>
</tr>
<tr>
<td>27.9.2001</td>
<td>0.49</td>
<td>0.45</td>
<td>0.56</td>
<td>0.59</td>
<td>0.59</td>
</tr>
<tr>
<td>4.10.2001</td>
<td>0.45</td>
<td>0.44</td>
<td>0.40</td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td>13.10.2001</td>
<td>0.33</td>
<td>0.37</td>
<td>0.41</td>
<td>0.46</td>
<td>0.46</td>
</tr>
<tr>
<td>26.10.2001</td>
<td>0.37</td>
<td>0.48</td>
<td>0.48</td>
<td>0.60</td>
<td>0.60</td>
</tr>
</tbody>
</table>

Table 3: Effect of application of microminerals and hormone on insect pest infestation in cotton

<table>
<thead>
<tr>
<th>Seasonal X:5.D pest population (leaf’s)</th>
<th>Thrips</th>
<th>Jassid</th>
<th>Whitley</th>
<th>Bollworm infestation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bonus non-chelated</td>
<td>0.52±0.18a</td>
<td>0.51±0.18a</td>
<td>0.49±0.13a</td>
<td>23.5±5.4a</td>
</tr>
<tr>
<td>Bonus chelated</td>
<td>0.51±0.20a</td>
<td>0.55±0.20a</td>
<td>0.50±0.17a</td>
<td>21.4±5.1a</td>
</tr>
<tr>
<td>Phalofox</td>
<td>0.52±0.18a</td>
<td>0.56±0.20a</td>
<td>0.51±0.17a</td>
<td>22.8±6.8a</td>
</tr>
<tr>
<td>Control</td>
<td>0.60±0.16a</td>
<td>0.67±0.26a</td>
<td>0.48±0.22a</td>
<td>28.9±9.4a</td>
</tr>
</tbody>
</table>

Means followed by same letter(s) in the column are not significantly (P<0.05) different from each other.

Literature which support findings of present study. Application of microminerals increased the seed cotton yield[13-16]. Khandagave et al.[13] reported that application of zinc sulphate at 25 mg ha⁻¹ significantly increased that dry matter, harvested bolls and seed cotton yield per plant. Zn application increased yield and yield components in cotton[13], application of P, Ca and Zn increased the uptake, open bolls per plant, boll weight and seed index[20]. Khan and Arain[21] and Khan et al.[22] found combination of Mg, Zn and B increased the yield of seed cotton by 18% which was mainly due to increase in the number of bolls per plant.

Plant growth regulators are used in many countries of world to control undesirable vegetative growth of crop plants, enhance fruiting bodies and increasing yield. Plant growth regulators are reported to have improved plant water relationships and rate of photosynthesis. Application of plant growth regulators, ethephon caused significant abscission of fruiting form but yield was not affected[12], increased cotton yield in the first harvest[13]. Application of triacontanol, NAA, atomik, Recine and cytozyme significantly increased seed cotton yield[23]. The application of pix (mesopiqué chloride) has enhancing effects on fruiting bodies of cotton which increased yield[24-26]. Nobrepa et al.[27] found highest cotton yield with application of 60 g ha⁻¹ mesopiqué chloride 50 days after seedling emergence. Thakar et al.[28] tested different growth regulators on cotton and found thiadiazuran; to increase harvestable bolls per plant, boll opening percentage, yield, earliness index, fiber fineness and decreased days to maturity. Application of cytokinin and gibberellic acid significantly increased the cotton yield compared with control[29]. Mesopiqué chloride improves boll retention and reduces vegetative growth[29]. Lamas[30] reported greater cotton boll weight with the application of mesopiqué chloride and chlormequat chloride. Bioregulators pix and cytokine enhanced the boll number, size and retention power of plant and increase the seed cotton yield[32].

Pest infestation

Thrips, Scirtothrips dorsalis: There was no significant effect of application of plant growth regulator and microminerals on the multiplication of thrips in cotton.
(Table 2 and 3). However, the maximum thrip population of 0.59 insects leaf\(^{-1}\) was recorded in control plot followed by planosix and Bonus non-chelated treated plants with an average population of 0.521 insects leaf\(^{-1}\).

**Jassid, Amrasca devastans:** Population fluctuation of Jassid after application of planosix and micronutrients in cotton (Table 2 and 3). The results indicated that on overall seasonal mean basis, there was no significant effect of plant growth regulator and micronutrients on Jassid multiplication. However, maximum population of 0.67 insects leaf\(^{-1}\) was recorded in control plants. Plant growth regulator and micronutrients treated plants harboured less jassid population compared with control.

**Whitfly, Bemisia tabaci:** There was no significant effect of application of plant growth regulator and micronutrients on the population development of whitfly on cotton (Table 2 and 3). The maximum whitfly population of 0.509 insects leaf\(^{-1}\) was recorded in Planosix treated plot followed by Bonus non-chelated and Bonus chelated plots with average population of 0.49 and 0.49 insects leaf\(^{-1}\), respectively.

**Bollworm infestation:** The results of infestation of bolls by bollworms (Table 2 and 3) which indicated that on overall mean basis, there was no significant effect of application of plant growth regulator and micronutrients on infestation. However, maximum percent (28.86) infestation was recorded from control plots compared with treated plots. While the minimum percent infestation (21.39) was recorded from Bonus chelated treated plot.

The changes incurred in crop plants due to the application of micronutrients and plant growth regulators may affect insect-plant relationships. For example, gibberelllic acid significantly increased the development period of *Bactrocera cucurbitae*. This inhibition in growth was directly related to increasing gibberelllic acid concentration\[1\]. Campbell et al. \[5\] reported significant reduction in the population of green bug, *Schizaphis graminum* (Rond.) and its reproduction in sorghum crop and induced resistance against *H. zea* in tomato plants after application of plant growth regulators. Application of bioregulators pux and cytokine significantly reduced infestation of pink and spotted bollworm and were also effective in checking infestation of jassid, thrips and whitfly in cotton\[15\]. Almost similar observations were recorded in the present study. Ettipibool et al.\[17\] conducted experiments on the effect of mepiquat chloride on leaf characteristics of cotton and incidence of jassid, *Amrasca biguttula* infestation. Mepiquat chloride reduced mid-vein and hair length on lamina but increased lamina thickness and hair density. The growth regulator did not show significant effect on jassid infestation, however, injury was higher on treated plants. Similarly, the effect of plant growth regulators on other insects have also been reported by Zummo et al.\[18\], Henneberry et al.\[20\], Heddi et al.\[20\], Coffelt and Schultz\[20\].

**REFERENCES**


