Effect of plant growth regulators on growth, yield and yield attributing traits of Greengram [Vigna radiata L]

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Abstract

The present investigation entitled “Effect of plant growth regulators on morphological characters in Green Gram” was conducted during Kharif (2017) at Field Experimentation Centre of Department of Genetics and Plant Breeding, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, U.P. The experiment was laid out in a Randomized Block Design with three replications in field with an objective to study the effect of 10 different treatments on quantitative characters. Observations were recorded and analyzed for 11 yield characters viz: Plant height (cm), days to 50% flowering, number of branches, number of pods, seed index, pods weight (g), days to maturity, number of seeds, biological yield and seed yield per plant (g) were significantly higher due to plant growth regulators. The treatment T3 [Cytokinins @ 75 ppm] exhibited maximum effect on five growth and yield characters viz., (seed yield per plant, biological yield, days to 50% flowering, seed yield and pods weight) followed by T9 [Cytokinins @ 50 ppm]. The treatment T9 [NAA @ 75 ppm] exhibited maximum effect on plant height and T3 [NAA @ 50 ppm] exhibited maximum value for number of branches.

Keywords: Growth, PGRs treatment, yield and greengram

Introduction

Greengram (Vigna radiata L.) is commonly known as moong, golden gram, mug, or mung. It belongs to the family Leguminocae (Fabaceae) and had originated from India and Central Asia. greengram is one of the important pulse crops and rank third in area and production after pigeonpea and chickpea. In India, production of pulses is around 13.5- 15 million tonnes during the last decade, while annual domestic demand is 18-19 million tonnes. The yield of pulses has remained virtually stagnant for the last 40 year (339 kg/ha in 1961 to 444 kg/ha in 2001 to 696 kg/ha in 2016-17). India is short of supply by 2 to 3 million tonnes annually (FAO STAT, 2016-17). In India, it is the third important pulse crop after chickpea and pigeon pea, green gram is cultivated in state of Rajasthan, Madhya Pradesh, Punjab, Haryana, U.P., Maharashtra, Karnataka, Andhra Pradesh and Tamil Nadu. Mungbean is short day, warm season crop, grown mainly in semi-arid to sub humid tropics and tropics with 600 to 1000 mm annual rainfall, for a high yield, a warm climate and deep well drained loam or sandy loam soils are desired. Mungbean is rapidly growing, erect or sub-erect annual usually 40 to 120 cm in height. Recently plant growth regulators (PGRs) are considered as new generation agrochemicals which are known to modify plant architecture, enhance source-sink relationship and stimulate the translocation of photo-assimilates there by helping in better retention of flower, pod and seed development and enhance seed yield and quality. Foliar application of nutrient and growth regulator at pre flowering and flowering stage was seen on reduction in flower shed and flower drop and significantly highest reproductive efficiency and grain yield of rice fallow pulses (Ganapathy et al., 2008). Keeping all these factors in view present investigation was carried out with the objectives to determine the effect of plant growth regulators on morphological characters and the economics of greengram.

Materials and Methods

The present experiment was with nine treatments and one control in three replications having thirty plots of Greengram. The chemicals (growth regulators) were mixed with water to make different concentrations. The Greengram plots were sprayed with growth regulators after germination and before flowering (two sprays) to increase growth and yield.
The concentrations were made to spray plots. T0 Control, T1 Naphtylene Acetic Acid @25 ppm, T2 Naphtylene Acetic Acid @50 ppm, T3 Naphtylene Acetic Acid @75 ppm, T4 Gibberelic Acid @25 ppm, T5 Gibberelic Acid @50 ppm, T6 Gibberelic Acid @75 ppm, T7 Cytokinrin @25 ppm, T8 Cytokinrin @50 ppm, T9 Cytokinrin @75 ppm. The observation were recorded on three randomly selected competitive plants in each plot of each replication for all characters except for days to 50% flowering and to maturity which are recorded on the plot basis. Plant height (cm), Number of branches per plant, Days to 50 percent flowering, Days to maturity, Number of pods per plant, Number of seeds per plant, Seed index (Hundred seed weight), Seed yield per plant, Pod weight (g), Biological yield (g), Seed yield (kg/ha), Cost of cultivation, Gross monetary returns (GMR), Net monetary returns (NMR), Benefit - cost ratio (B: C ratio) these observation were recorded. The analysis of variance was worked out to test the significant differences among genotypes by F- test. It was carried out according to the procedure of randomized complete block design for each character as per methodology suggested by Fisher and Yates (1936).

Results and Discussion

The perusal of data given in Table 1, reveals that the days to 50% flowering was significantly affected by different plant growth treatments. Days to 50% flowering ranged from 86.00 to 92.00 with mean value of 89.83. The treatment T9 [Cytokinrin @75 ppm] exhibited early days to 50% flowering (86.00) whereas treatment T0 [control] exhibited late days to 50% flowering (92.00).

The perusal of data given in Table 1 reveals that the number of seeds per plant was significantly affected by different plant growth treatments. Number of seeds per plant ranged from 29.36 to 40.37 with mean value of 35.28. The treatment T9 [Cytokinrin @75 ppm] exhibited maximum number of seed per plant (40.37) whereas T0 [control] exhibited minimum number of seed per plant (29.36). These findings also correlate with Hayat et al. (2005) and Devi et al. (2011) [11].

The data pertaining from the table 1 the plant height (cm) was significantly affected by different plant growth regulators. Mean value of plant height ranged from 63.30 to 81.53 with average 71.30 cm. The treatment T1 [NAA @25 ppm] exhibited minimum plant height (63.30 cm) and treatment T5 [NAA @75 ppm] exhibited highest plant height (81.53 cm). Similar results were observed by Mislevy et al. (1989) who found that the application of NAA (100 ppm) increased the plant height 34.85% over control.

The perusal of data given in Table 1 reveals that the number of branches was significantly affected by different plant growth treatments. Number of branches ranged from 4.17 to 5.63 with mean value of 4.82. Maximum number of branches (5.63) was recorded in the treatment T2; [NAA @50 ppm] and the treatment T7 [Cytokinrin@ 25 ppm] exhibited minimum number of branches per plant (4.17). Fathy et al. (2003) stated that foliar application of NAA increased the branch number per plant.

The perusal of data given in Table 1, reveals that the days to maturity was significantly affected by different plant growth treatments. Days to maturity ranged from 140.00 to 146.00 with mean value of 142.10. The treatment T9 [control] exhibited longer days to maturity (146.00) where as treatment T6 [GA3 @75 ppm] exhibited less days to maturity (140.33). The perusal of data given in Table 1 reveals that the number of pods per plant was significantly affected by different plant growth treatments. Number of pods per plant ranged from 15.33 to 27.43 with mean value of 20.15. The treatment T9 [Cytokinrin @70 ppm] exhibited maximum number of pods per plant (27.43) whereas T0 [control] exhibited minimum number of pods per plant (15.33). These findings are in close conformity with the results of Murugan et al. (2011) and Bahadur and Tiwari (2014) reported that application of plant growth regulators increases pod number in black gram. The perusal of data given in Table reveals that the seed yield per plant (g) was significantly affected by different plant growth treatments. Seed yield per plant ranged from 34.77 to 56.00 with mean value of 48.38. The treatment T9 [Cytokinrin @75 ppm] exhibited maximum seed yield per plant (56.00) whereas T0 [control] exhibited minimum number of seed yield per plant (34.77).

Economic of treatments

It is evident from data given in Table 2 that among the different treatments in green gram crop, the plots receiving Naphtylene Acetic Acid @75 ppm had maximum GMR (Rs 56853.6/ha), followed by (Rs 55778.4/ha) plots receiving Cytokinrin @50 ppm, while minimum GMR (Rs 42418.4/ha) was noted under the control plots. These results are in close agreements to the findings by Kumawat et al. (2009). In greengram, the NMR was maximum (Rs 36278.4/ha) with the plots receiving Cytokinrin @50 ppm followed by (Rs 35929.6/ha) plots receiving Cytokinrin @75 ppm while minimum NMR (Rs 20491.2/ha) was noted under the control plots than other treatments. These results are in close agreements to the findings by Kumawat et al. (2009). The B:C ratio was maximum (2.91:1) under the plots receiving 25 Cytokinrin @75 ppm followed by (2.86:1) in plots receiving Cytokinrin @50 ppm and the ratio was minimum (1.91:1) under the Gibberelic Acid @75 ppm plots.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Plant height (cm.)</th>
<th>Number of branches</th>
<th>Days to 50% flowering</th>
<th>Number of seeds per plant</th>
<th>Days to maturity</th>
<th>Number of pods per plant</th>
<th>Seed yield per plant (g)</th>
<th>Seed index (g)</th>
<th>Seed weight (g)</th>
<th>Pods Yield (g)</th>
<th>Biological Yield (q)</th>
<th>Seed Yield (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>73.87</td>
<td>4.83</td>
<td>91.33</td>
<td>29.36</td>
<td>146.00</td>
<td>20.73</td>
<td>34.77</td>
<td>37.07</td>
<td>60.30</td>
<td>45.33</td>
<td>530.23</td>
<td>530.23</td>
</tr>
<tr>
<td>T1</td>
<td>63.30</td>
<td>4.40</td>
<td>87.67</td>
<td>31.81</td>
<td>140.67</td>
<td>18.63</td>
<td>50.10</td>
<td>59.87</td>
<td>75.17</td>
<td>50.00</td>
<td>567.14</td>
<td>567.14</td>
</tr>
<tr>
<td>T2</td>
<td>67.73</td>
<td>5.69</td>
<td>89.67</td>
<td>31.80</td>
<td>141.00</td>
<td>17.53</td>
<td>44.87</td>
<td>51.40</td>
<td>74.17</td>
<td>51.33</td>
<td>572.83</td>
<td>572.83</td>
</tr>
<tr>
<td>T3</td>
<td>81.53</td>
<td>4.97</td>
<td>90.00</td>
<td>34.30</td>
<td>144.00</td>
<td>25.50</td>
<td>47.83</td>
<td>68.07</td>
<td>72.80</td>
<td>51.33</td>
<td>572.83</td>
<td>572.83</td>
</tr>
<tr>
<td>T4</td>
<td>69.83</td>
<td>4.63</td>
<td>89.67</td>
<td>35.66</td>
<td>141.33</td>
<td>27.43</td>
<td>47.50</td>
<td>57.53</td>
<td>73.13</td>
<td>57.00</td>
<td>691.90</td>
<td>691.90</td>
</tr>
<tr>
<td>T5</td>
<td>72.50</td>
<td>4.53</td>
<td>89.67</td>
<td>35.45</td>
<td>141.00</td>
<td>16.63</td>
<td>50.87</td>
<td>59.50</td>
<td>75.93</td>
<td>58.00</td>
<td>614.34</td>
<td>614.34</td>
</tr>
<tr>
<td>T6</td>
<td>74.10</td>
<td>4.63</td>
<td>92.00</td>
<td>40.37</td>
<td>140.33</td>
<td>22.17</td>
<td>49.40</td>
<td>79.83</td>
<td>74.93</td>
<td>51.67</td>
<td>581.90</td>
<td>581.90</td>
</tr>
<tr>
<td>T7</td>
<td>67.63</td>
<td>4.17</td>
<td>91.00</td>
<td>36.45</td>
<td>143.67</td>
<td>20.30</td>
<td>48.93</td>
<td>65.30</td>
<td>76.90</td>
<td>51.33</td>
<td>684.12</td>
<td>684.12</td>
</tr>
<tr>
<td>T8</td>
<td>71.53</td>
<td>5.40</td>
<td>91.33</td>
<td>38.95</td>
<td>141.67</td>
<td>17.07</td>
<td>53.50</td>
<td>79.40</td>
<td>79.93</td>
<td>54.33</td>
<td>697.23</td>
<td>697.23</td>
</tr>
<tr>
<td>T9</td>
<td>70.97</td>
<td>4.97</td>
<td>86.00</td>
<td>39.09</td>
<td>141.33</td>
<td>15.53</td>
<td>56.00</td>
<td>68.53</td>
<td>81.53</td>
<td>61.67</td>
<td>710.67</td>
<td>710.67</td>
</tr>
</tbody>
</table>

Table 1: Mean Performance of Morphological Data of Greengram (Vigna radiata L.)
Table 2: Effect of different plant growth regulators on economics of green gram.

<table>
<thead>
<tr>
<th>TREATMENT</th>
<th>Gross monetary Returns (Rs/ha)</th>
<th>Net monetary Returns (Rs/ha)</th>
<th>B: C ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>(T0) Control</td>
<td>42418.4</td>
<td>20491.2</td>
<td>2.07:1</td>
</tr>
<tr>
<td>(T1) Naphthalene Acetic Acid @25 ppm.</td>
<td>45371.2</td>
<td>21002.4</td>
<td>2.16:1</td>
</tr>
<tr>
<td>(T2) Naphthalene Acetic Acid @50 ppm.</td>
<td>52577.6</td>
<td>25697.6</td>
<td>1.95:1</td>
</tr>
<tr>
<td>(T3) Naphthalene Acetic Acid @75 ppm.</td>
<td>56853.6</td>
<td>28223.6</td>
<td>1.98:1</td>
</tr>
<tr>
<td>(T4) Gibberellic Acid @25 ppm.</td>
<td>55352.0</td>
<td>33392.0</td>
<td>2.55:1</td>
</tr>
<tr>
<td>(T5) Gibberellic Acid @50 ppm.</td>
<td>49147.2</td>
<td>26497.2</td>
<td>2.16:1</td>
</tr>
<tr>
<td>(T6) Gibberellic Acid @75 ppm.</td>
<td>46552.0</td>
<td>22223.2</td>
<td>1.91:1</td>
</tr>
<tr>
<td>(T7) Cytokinin @25 ppm.</td>
<td>45826.4</td>
<td>25426.4</td>
<td>2.24:1</td>
</tr>
<tr>
<td>(T8) Cytokinin @50 ppm.</td>
<td>55778.4</td>
<td>30278.4</td>
<td>2.86:1</td>
</tr>
<tr>
<td>(T9) Cytokinin @75 ppm.</td>
<td>54729.6</td>
<td>35929.6</td>
<td>2.91:1</td>
</tr>
</tbody>
</table>

Conclusion

It can be concluded from the present study that different treatments showed significant difference on all yield characters studied. Treatment (T9) Cytokinin @75 ppm exhibited high mean value for seed yield per plant, biological yield, days to 50% flowering, seed yield and pod weight whereas (T5) NAA @75 ppm showed high mean performance for plant height, (T6) GA3 @75 ppm showed the high mean value for seed index, number of seeds and (T2) NAA @50 ppm showed the high mean performance of number of branches. The highest benefit cost ratio was estimated in treatment (T9) Cytokinin @75 ppm. Plant growth regulators fastened maturity as control showing high mean value for days to maturity indicating late maturity and (T2) took more to days 50% flowering.

References