Bitter gourd (Momordica charantia L.) is one of the most important tropical vegetable crops. It belongs to the family Cucurbitaceae and popularly known as balsam pear, karela, or bitter melon. In India, it is cultivated on an area of 26,004 hectare (ha) with a production of 1,62,196 tonnes and the productivity level is 6.23 tonnes per ha. In Karnataka, it is cultivated in an area of 1,872 ha with a production of 13,676 tonnes and the productivity is 7.0 tonnes per ha (Anonymous, 2008).

The plant growth regulators (PGR’s) are considered as a new generation agrochemicals after fertilizers, pesticides and herbicides. In bitter gourd, it is possible to increase the yield by increasing the fruit set by using growth regulators. Use of PGR’s and micro nutrient like boron might be a useful alternative to increase crop production. GA, and NAA are also important growth regulators that may have ability to modify the growth, sex ratios and yield contributing characters of plant (Shantappa et al., 2007).

The micronutrient and cations are involved in enzyme systems as cofactors with the exception of Zn, Mn, Cu and B. These are capable of acting as ‘electron carriers’ in the enzyme systems and are responsible for the oxidative-reduction process in the plant system. To obtain the higher yield with better quality, a renewed interest on the role of micronutrients in nutrition of bitter gourd is very essential. In the present study efforts were made to know the effect of plant growth regulators (NAA and triacontanol) and chemical (B) on seed yield and quality of bitter gourd (Momordica charantia) cv. PUSA VISESH.

RESEARCH METHODS

A field experiment was conducted at College of Agriculture, Raichur, Karnataka during Rabi 2009 to know the effect of plant growth regulators (NAA and triacontanol) and chemical (B) on seed yield and quality of bitter gourd (Momordica charantia) cv. PUSA VISESH. Experiment consisted...
of eight treatments with three replications were tested using Randomized Block Design. The healthy and bold seeds of bitter gourd were dibbled with a spacing of 120 cm x 80 cm to a depth of 4.0 cm. After germination one seedling per hill was maintained. The gross size of the plot was 10.80 x 8.0 = 86.4 m² and net plot size: 8.4 x 6.4 m = 76.8 m². The plant protection measures were adopted as and when required. Two growth regulators viz., NAA (25 and 50 ppm), triacontanol (0.5 and 1.0 ppm) and boron (3 and 4 ppm) were used for foliar application at concentrations with absolute control and water spray at 60 DAS, 75 DAS and 90 DAS. Precaution was taken to prevent drifting of spray solution from one treatment plot to other. In each treatment five plants were randomly selected and tagged for recording various biometric observations as detailed below. Growth parameters like vine length, leaf area, leaf area index (LAI) and leaf chlorophyll content at 70, 85 and 100 DAS. Leaf area was computed by using leaf area meter LAI Ceptometer Model L8-80, Decagon devices, inc. USA. LAI was expressed as cm² per plant. Leaf area index was measured from base of the plant to the tip of fully opened top leaf at 70, 85, 100 DAS. Leaf chlorophyll content was measured using portable chlorophyll meter SPAD – 502 (Spectrum tech. org,inc, USA.) and expressed in SPAD value. Fruits were harvested as an when they turn orange red colour and seeds were harvested manually and observations on number of fruits per vine, fruit yield per hectare, number of seeds per fruit, filled seeds per fruit, seed yield per hectare, test weight of seeds, germination percentage, seedling length, seedling dry weight, seedling vigour index –I, seedling vigour index –II, electrical conductivity and dehydrogenase enzyme activity were recorded. The germination test, electrical conductivity and dehydrogenase enzyme activity was conducted as per International Seed Testing Association (ISTA) procedure by rolled towel method. From the germination test, ten normal seedlings were selected randomly from each treatment on the day of final count. The seedling length was measured from tip of shoot to root tip. Ten normal seedlings used for measuring seedling length were taken in butter paper and dried in a hot-air oven maintained at 90°C for 24 hours. Then ten seedlings were removed and allowed to cool in a desiccator for 30 minutes before weighing in an electronic balance. The seedling vigour index -I was computed using the formula as suggested by Abdul-Baki and Anderson (1973) and expressed as whole number.

\[
\text{Seedling vigour index (SVI –I) = Germination (\%) x Mean length of seedlings (cm)}
\]

The seedling vigour index- II was computed multiplying germination percentage with the ten seedlings dry weight and expressed as whole number.

\[
\text{Seedling vigour index (SVI –II) = Germination (\%) x Dry weight of seedlings (mg)}
\]

**RESEARCH FINDINGS AND DISCUSSION**

The present investigation spraying of NAA at 50 ppm recorded significantly highest vine length (192.33 cm and 260.67 cm) followed by NAA at 25 ppm (186.60 cm and 252.33 cm, respectively) at 85 DAS and 100 DAS, respectively. The lowest vine length (168.33 cm and 214.10 cm, respectively) at 85 DAS and 100 DAS, respectively was noticed in absolute control (Table 1). Increase in the vine length thought to be by increasing plasticity of the cell wall followed by hydrolysis of starch to sugars which lowers the water potential of cell, resulting in the entry of water into the cell causing elongation and rapid cell division in the growing portion in ridge gourd (Hilli et al., 2010).

NAA at 50 ppm also recorded highest leaf area and LAI (2.965 cm²/vine and 2.760) at 100 DAS, followed by boron at 4 ppm (2.525 cm²/vine and 2.630, respectively) and NAA at 25 ppm (2.493 cm²/vine and 2.597, respectively). The lowest leaf

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Vine length (cm)</th>
<th>Leaf area (cm²/vine)</th>
<th>Leaf area index (LAI)</th>
<th>Leaf chlorophyll content (SPAD value)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>70 DAS</td>
<td>85 DAS</td>
<td>100 DAS</td>
<td>70 DAS</td>
</tr>
<tr>
<td>T&lt;sub&gt;1&lt;/sub&gt; : Absolute control</td>
<td>144.31</td>
<td>168.33</td>
<td>214.10</td>
<td>1.258</td>
</tr>
<tr>
<td>T&lt;sub&gt;2&lt;/sub&gt; : Water spray</td>
<td>145.33</td>
<td>169.33</td>
<td>218.67</td>
<td>1.276</td>
</tr>
<tr>
<td>T&lt;sub&gt;3&lt;/sub&gt; : Naphthalene acetic acid @ 25 ppm</td>
<td>150.67</td>
<td>186.60</td>
<td>252.33</td>
<td>1.421</td>
</tr>
<tr>
<td>T&lt;sub&gt;4&lt;/sub&gt; : Naphthalene acetic acid @ 50 ppm</td>
<td>152.33</td>
<td>192.33</td>
<td>260.67</td>
<td>1.434</td>
</tr>
<tr>
<td>T&lt;sub&gt;5&lt;/sub&gt; : Triacontanol @ 0.5 ppm</td>
<td>150.67</td>
<td>183.40</td>
<td>229.33</td>
<td>1.407</td>
</tr>
<tr>
<td>T&lt;sub&gt;6&lt;/sub&gt; : Triacontanol @ 1.0 ppm</td>
<td>152.93</td>
<td>185.87</td>
<td>230.67</td>
<td>1.379</td>
</tr>
<tr>
<td>T&lt;sub&gt;7&lt;/sub&gt; : Boron @ 3.0 ppm</td>
<td>153.17</td>
<td>183.67</td>
<td>228.00</td>
<td>1.346</td>
</tr>
<tr>
<td>T&lt;sub&gt;8&lt;/sub&gt; : Boron @ 4.0 ppm</td>
<td>154.00</td>
<td>185.87</td>
<td>232.67</td>
<td>1.447</td>
</tr>
</tbody>
</table>

S.E.±: 4.41 5.33 6.91 0.066 0.051 0.075 0.069 0.054 0.079 2.15 2.17 1.98

C.D. (P<0.05): NS 16.16 20.96 NS 0.156 0.228 NS 0.162 0.238 NS 5.77 6.02

DAS – Days after sowing

NS=Non-significant

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area and LAI (2.291 cm²/vine and 2.387, respectively) was noticed in absolute control (Table 1). This might be due to its additional availability of NAA in seed, which might have increased the level of amylase in the aleurone tissues of seed for better conversion of complex starch into simple sugars for providing energy for its growth and leaf area increased with an increase in time to a maximum coinciding with maximum top growth and steady decline at later stage in muskmelon (Ram Asrey et al., 2001).

The maximum leaf chlorophyll content (Table 1) was observed with NAA 50 ppm (39.23 and 38.90 SPAD value) which was at par with boron 4 ppm (38.57 and 36.82 SPAD value) whereas, control recorded 32.17 and 31.70 SPAD value at 85 and 100 DAS, respectively. This might be due to decrease chlorophyll degradation and increase chlorophyll synthesis.

Increase in fruit yield (119.68 q/ha) was recorded with foliar application of NAA (50 ppm) and was on par with boron 4 ppm (118.64 q/ha). The lowest fruit yield (35.58 q/ha) was recorded in control (Table 2). This could be attributed to the stimulatory effect of NAA on cell division and cell elongation. In addition, the fruit yield also depends on the plant vigour, better source-sink relationship. Similarly, the higher fruit yield was obtained as a result of more number of hermaphrodite flowers per plant and better vegetative growth in muskmelon (Sidhu et al., 1982).

Application of boron at 4 ppm recorded significantly highest values for seed yield (Table 2) and quality parameters and produced 29.00 seed/fruit, 24.33 filled seed per fruit and 35.90 per cent increase seed yield (6.84 q/ha) over control similarly, test weight (185.11 gm) were also maximum in this treatment and was followed by NAA at 50 ppm (27.84, 24.17, 34.9 per cent increase seed yield (6.70 q/ha) over control treatment and was followed by NAA at 50 ppm (27.84, 24.17, 34.9 per cent increase seed yield (6.70 q/ha) over control. The highest seed yield was also due to higher fruit number per vine and higher filled seeds per fruit. Such beneficial effect of growth regulators and chemical were also reported by Gedam et al. (1996) in bitter gourd which is in conformity with the present results. The similar finding obtained with NAA on seed yield attributes by Shantappa et al. (2007) in bitter gourd and Hilli et al. (2010) in ridge gourd.

After the harvest of the crop, the resultant seeds were analyzed for various seed quality parameters (Table 3). Growth regulators and nutrient sprayed treatments showed beneficial significant influence on seed quality parameters over control.
The seeds harvested from the plant received NAA 50 ppm showed higher germination (83.25 %), seedling vigour index -I (1757) and lowest electrical conductivity (0.316 dSm\(^{-1}\)) which was at par with boron 4 ppm (83.00 %, 1756 and 0.323 dSm\(^{-1}\)) while, control recorded lowest (79.50 %, 1335 and 0.342 dSm\(^{-1}\)) in germination, SVI-I and electrical conductivity (Table 3). This might be due to adequate supply of food reserves to resume embryo growth and synthesis of hydrolytic enzymes which are secreted and act on starchy endosperm in turn affecting physiology of seed germination, establishment of seedling and ultimately the vigour index. Similar effect of NAA on seed germination and vigour index was also earlier reported by Shantappa et al. (2007) in bitter gourd and Hilli et al. (2010) in ridge gourd.

Significant increase in 1000 seed weight (185.11 g) and dehydrogenase enzyme activity (0.0352 OD value) with boron 4 ppm was at par with NAA at 50 ppm (184.80 g and 0.333 OD value) whereas, lowest 1000 seed weight (181.05 g and 0.275 OD value) recorded in control (Table 3). This might be due to adequate supply of food reserves to resume embryo growth and in addition to release enzymes responsible for degradation of macromolecules into micromolecules to be utilized in growth promoting processes (Gedam et al., 1996) in bitter gourd.

**REFERENCES**


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