EFFECT OF AZOTOBACTER AND INORGANIC FERTILIZERS ON FRUIT AND SEED YIELD OF OKRA CV. HISAR UNNAT

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ABSTRACT

An experiment was conducted during the summer season of 2006 to study the effect of Azotobacter and inorganic fertilizers on growth, fruit and seed yield of okra cv. Hisar Unnat. Among all the treatments, T5 (Azotobacter + ½ N + P + K) recorded maximum green fruit yield (18300kg/ha) as well as seed yield (3490kg/ha) mainly due to over all better performance of the treatment in different yield contributing parameters i. e. plant height (157.2 cm), number of branches/ plant (2.2), number of nodes/plant (19.6), number of fruits/plant (14.3), number of pods/plant (14.2), pod weight (13.9 g), number of seeds/pod (57.5) and seed weight/pod (6.1 g).

Key words: Azotobacter, Fruit yield, Inorganic fertilizer, Okra, Seed yield.

INTRODUCTION

Okra (Abelmoschus esculentus L.Moench) is one of the most important vegetable crops in India covering an area of 3.58 lakh hectare with an annual production of about 32.5 lakh tones (FAO, 2006). In J & K state, it is cultivated on an area of 2050 ha with an annual production of 28700 metric tones (Anonymous, 2005). It is a nutrient exhaustive vegetable crop which requires heavy nutrient application for its production potential (Naik and Srinivas, 1992). However, indiscriminate use of inorganic fertilizers, besides being expansive, leads to nutrient imbalance in soil causing ill effect on soil health and micro flora (Bahadur and Manohar, 2001). Therefore, in order to reduce the consumption of harmful energy intensive chemical fertilizers, there is an urgent need to encourage the use of the use of organic and biofertilizers to the maximum possible extent (Raj and Geethakumari, 2001) which will not only maintain higher productivity but also provide greater stability to the crop production (Nambiar and Abrol, 1992). Thus, the present investigation has been undertaken to develop a suitable nutrient management strategy for okra cultivation grown for green fruits as well as seed production under subtropical conditions of Jammu region.

MATERIALS AND METHODS

A field experiment was conducted during summer season of 2006 at Vegetable Research Farm, Chatha, SKUAST-Jammu to study the effects of inorganic fertilizers and Azotobacter on green fruit and seed yield of okra. The soil of the experimental field was sandy loam in texture and available N was 159.89kg/ha, P of 14.01 kg/ha and K of 87.24kg/ha. The experiment was laid out in randomized block design consisting of 12 treatments each replicated thrice. Seeds of okra variety ‘Hissar Unnat’ were sown in the month of April in plots of 2x5m size with plant spacing of 50x20 cm. Depending upon the treatment combinations, Azotobactor chroococum strain obtained from Indian Institute of Integrative Medicine(IIIM), Jammu was applied as seed inoculation @ 200g/kg seed before sowing. It was thoroughly mixed with seed after seed dipping in water for 2 hours and kept in shade for 30 minutes before sowing. However, nitrogen was applied in three splits with one third of N and full dose of P₂O₅ and K₂O was applied at sowing as per treatments and rest of nitrogen was applied in two equal splits at 30 and 50 days after sowing (DAS). Recommended dose of fertilizer used in various treatment combinations is 100:50:50 kg of N, P and K per hectare. All the other recommended cultural
practices were performed uniformly for all the treatments as per the recommendations of package of practices of SKUAST-J. Different observations on growth parameters, yield attributes, seed characters, fruit yield and finally, seed yield were recorded treatment wise. The green fruit yield was calculated on the basis of whole plot yield where as seed yield was calculated on the basis of five randomly selected plants in each treatment. The mean data were statistically analyzed following standard procedure.

**RESULTS AND DISCUSSION**

**Effect of Azotobacter and inorganic fertilizers on growth and green fruit yield**

Data from Table 1 revealed that application of Azotobacter along with half dose of nitrogen and full dose of P and K (T<sub>5</sub>) gave the highest fruit yield (18300 kg/ha) followed by T<sub>6</sub> (16500 kg/ha) and T<sub>4</sub> (15950 kg/ha). The yield levels of treatments T<sub>5</sub>, T<sub>6</sub> and T<sub>4</sub> were found to be significantly higher of 138.6 %, 115.8 % and 108% as compared to control (T<sub>1</sub>). Moreover, these three treatment i.e. T<sub>5</sub>, T<sub>6</sub> and T<sub>4</sub> also performed better than the recommended fertilizer dose alone (T<sub>1</sub>) by 56.2%, 40.8% and 36.1% respectively. The significant increase in fruit yield in T<sub>5</sub> treatment was attributed to overall better performance of growth parameters i.e. plant height (157.2 cm), number of branches/plant (2.2), number of nodes/plant (19.6) and number of fruits per plant (14.3). The findings of present experiments were in consonance with the findings of Treatment T<sub>7</sub> recorded maximum number of nodes per plant (20.2) which were statistically at per with T<sub>5</sub> (19.6) and T<sub>6</sub> (19.2). However, it did not reflected in yield mainly due to the poor performance of other agronomic traits particularly first fruit node formation (6.3) which was significantly higher than T<sub>5</sub> (5.3) by 18.8%. Similar results were obtained by Shaheen et al, 2007 who recorded highest yield in okra in treatment comprising of Azotobacter/Azospirillium seed treatment + 50% nitrogen and could be attributed to the synthesis of plant growth regulating substances such as IAA, GA3 and cytokines produced by Azotobacter/Azospirillium (Tiwary et al, 1998).

**Effect of Azotobacter and inorganic fertilizers on seed yield of okra**

Data from Table 2 revealed that treatment T<sub>5</sub> recorded significantly highest seed yield (3490 kg/ha) followed by T<sub>6</sub> (2630 kg/ha), T<sub>4</sub> (2520 kg/ha), T<sub>11</sub> (2480 kg/ha) and T<sub>2</sub> (2360 kg/ha) which were statistically at par with each other. However, T<sub>5</sub> recorded 47.88 and 131.12 per cent increase in seed yield over recommended fertilizer dose (T<sub>1</sub>) and control (T<sub>12</sub>) respectively. The increased seed yield in treatment T<sub>5</sub> can be attributed to better over all performance in terms of seed characters viz. number of pods per plant (14.2), pod weight (13.9g), number of seeds per pod (57.5) and seed weight per pod (6.1g) which were significantly better than all other treatments where as pod length and pod girth, although not the highest in T<sub>5</sub>, were found to be statistically at par when compared with the highest

**TABLE 1:** Effect of Azotobacter and inorganic fertilizers on growth and fruit yield of okra cv. Hisar Unnat.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Plant height (cm)</th>
<th>No. of branches per plant</th>
<th>No. of nodes per plant</th>
<th>First fruit node</th>
<th>No. of fruits per plant</th>
<th>Fruit yield Kg/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>T&lt;sub&gt;1&lt;/sub&gt;: Ab+No+Po+K</td>
<td>119.7</td>
<td>1.4</td>
<td>17.7</td>
<td>3.7</td>
<td>14.1</td>
<td>14450</td>
</tr>
<tr>
<td>T&lt;sub&gt;2&lt;/sub&gt;: N+P+K</td>
<td>127.8</td>
<td>1.5</td>
<td>9.4</td>
<td>5.3</td>
<td>10.1</td>
<td>11718</td>
</tr>
<tr>
<td>T&lt;sub&gt;3&lt;/sub&gt;: Ab+N+P+K</td>
<td>132.4</td>
<td>1.8</td>
<td>18.2</td>
<td>5.3</td>
<td>12.9</td>
<td>11443</td>
</tr>
<tr>
<td>T&lt;sub&gt;4&lt;/sub&gt;: Ab+No+P+K</td>
<td>139.4</td>
<td>1.3</td>
<td>16.1</td>
<td>5.7</td>
<td>10.4</td>
<td>15950</td>
</tr>
<tr>
<td>T&lt;sub&gt;5&lt;/sub&gt;: Ab+1/2N+P+K</td>
<td>157.2</td>
<td>2.2</td>
<td>19.6</td>
<td>5.3</td>
<td>14.3</td>
<td>18300</td>
</tr>
<tr>
<td>T&lt;sub&gt;6&lt;/sub&gt;: Ab+N+1/2P+K</td>
<td>153.3</td>
<td>2.0</td>
<td>19.2</td>
<td>6.0</td>
<td>13.2</td>
<td>16500</td>
</tr>
<tr>
<td>T&lt;sub&gt;7&lt;/sub&gt;: Ab+N+Po+K</td>
<td>133.3</td>
<td>1.1</td>
<td>20.2</td>
<td>6.33</td>
<td>13.8</td>
<td>14043</td>
</tr>
<tr>
<td>T&lt;sub&gt;8&lt;/sub&gt;: Ab+1/2N+1/2P+K</td>
<td>124.4</td>
<td>1.4</td>
<td>11.8</td>
<td>4.7</td>
<td>7.1</td>
<td>8325</td>
</tr>
<tr>
<td>T&lt;sub&gt;9&lt;/sub&gt;: Ab+No+1/2P+K</td>
<td>120.5</td>
<td>1.9</td>
<td>14.3</td>
<td>4.7</td>
<td>9.6</td>
<td>11493</td>
</tr>
<tr>
<td>T&lt;sub&gt;10&lt;/sub&gt;: No+P+K</td>
<td>125.0</td>
<td>1.4</td>
<td>12.2</td>
<td>4.3</td>
<td>7.9</td>
<td>12360</td>
</tr>
<tr>
<td>T&lt;sub&gt;11&lt;/sub&gt;: No+1/2P+K</td>
<td>115.5</td>
<td>1.7</td>
<td>18.3</td>
<td>5.0</td>
<td>13.3</td>
<td>10783</td>
</tr>
<tr>
<td>T&lt;sub&gt;12&lt;/sub&gt;: Control (No Po Ko)</td>
<td>108.5</td>
<td>1.7</td>
<td>15.5</td>
<td>4.3</td>
<td>11.2</td>
<td>7668</td>
</tr>
<tr>
<td>CD (0.05)</td>
<td>10.99</td>
<td>0.25</td>
<td>1.24</td>
<td>0.66</td>
<td>1.00</td>
<td>528</td>
</tr>
</tbody>
</table>

Ab- Azotobacter.
 value. The results revealed significant increase in both fruit as well as seed yield when seed treatment with Azotobacter along with half dose of nitrogen and full dose of phosphorus and potassium (T₅) was applied. Khan et al., (2007) also reported that application of reduced nitrogen (60 kg/ha) + Azotobacter seed treatment significantly increased the growth and yield of okra. Similar results were given on okra cv. Pusa Kranti (Ganesha et al., 1998). Bio fertilizer application to non legume crops including okra significantly increased vegetative growth as well as yield (Pandey and Kumar, 1989), (Sharma and Bhalla, 1995), (Bahadur and Manohar, 2001) and (Nuruzzamam et al., 2003). Ray et al.,(2005) reported maximum number of fruits per plant, plant height and plant yield replacing fifty per cent nitrogen with organic manure whereas the results or this experiment revealed seed treatment of okra with Azotobacter coupled with half the recommended of nitrogen recorded ,maximum growth and yield could be obtained. Swain et al., (2003) also observed that integrated treatments had better crop growth, higher nutrient uptake and fresh fruit yield in okra crop as compared to chemical fertilizers alone which were in consonance with the findings or this experiments. Increase in fruit yield and seed yield by Azotobacter inoculation can be explained in terms of a cumulative effect of various roles played by Azotobacter which helps not only in promoting nitrogen fixation but also in the release of various growth promoting agents that might have led to better root development, better uptake of water and nutrient. Similar observations were also been made by various other workers on using biofertilizers as inoculants on different vegetable (Bahadur and Manohar, 2001), (Deka et al., 1996) and (Chatoo et al., 1997). It could be concluded from the present study that seed treatment with Azotobacter in okra not only reduced the nitrogen dose through inorganic sources but enhances the over all productivity and production levels both in terms of fruit as well as seed yield.

REFERENCES


