Effect of organic and inorganic fertilizers on growth, yield and quality of garlic cv. GG-1

MOHD. T. A., J.D. DESAI, S.B. PARMAR AND B.R. PARMAR

ABSTRACT

A field experiment was conducted on effect of organic and inorganic fertilizers on growth, yield and quality of garlic cv. GG-1 and from the results, it is seen that 25 per cent RDF + 75 per cent through FYM produced more average bulb weight. In case of quality parameters 25 per cent RDF + 75 per cent through FYM was showing maximum TSS and ascorbic acid over all other treatments. The 50 per cent RDF + 50 per cent through FYM also showed beneficial effect over all other treatments with control in respect to growth, yield and quality parameters of garlic. In general, it is seen that application of organic manures with their different level of combination with reduced doses of inorganic fertilizer significantly influenced the growth characters.

Garlic (Allium sativum, Family-Alliaceae) is one of the most important bulbous spice crop. It is mainly used for flavouring and seasoning vegetables and meat dishes. The important garlic growing states in India are Madhya Pradesh, Gujarat, Orissa, Rajasthan, Maharashtra and Uttar Pradesh. Garlic production percentage in different states is around in Madhya Pradesh (29.41%), Gujarat (17.96%), Rajasthan (11.68%), Orissa (10.62%), Maharashtra (9.65%) and in Uttar Pradesh (9.56%). Thus, 45 per cent production is from Madhya Pradesh and Gujarat only. In India the main reason for lower productivity in garlic is due to inadequate and improper adoption of agronomic practices, pest and disease management, market support, etc. Among the cultural practices, nutrient plays an important role in deciding the yield of any crop. The interactive advantage of inorganic and organic sources of nutrients generally proved superior to the use of each component applied separately. The role of farm yard manure (FYM) in enhancing efficient use of chemical fertilizers is well documented. Singh and Attrey (2002) reported that the organic farming makes positive contribution not only to the soil and environment but human health also. So, to eliminate all these bad effects, integrated plant nutrient farming is best alternative. Now a day, vegetables production with minimum or no use of inorganic fertilizers is preferred in export market. Organically grown food is expected to fetch higher price and this can offset any loss due to lower yields. Organic market analysis has forecasted 20 to 30 per cent growth in global demand for $ 100 million in the ensuring decade (Somsundaram et al., 2004).

MATERIALS AND METHODS

A field experiment was conducted at Instructional Farm, Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari during Rabi season in the year 2007-2008 by using Randomized Block Design, with three replications which included ten treatment combinations comprised of 25 % RDF + 75 % FYM, 25 % RDF + 75 % VC. (Vermi-compost), 25 % RDF + 75 % BC. (Bio-compost), 50 % RDF + 50 % FYM, 50 % RDF +50 % VC., 50 % RDF + 50 % BC., 75 % RDF + 25 % FYM., 75 % RDF + 25 % BC., 75 % RDF + 25 % VC., 75 % RDF + 25 % BC. and control 100 % RDF (100: 50: 50) NPK kg/ha. In each treatment gross plot size (2.25m x 1.5m) was taken. Harvesting of mature bulbs were done when the tops (leaves) turn yellow and brownish showing signs of drying up and bending and bulbs which were used for the further physico-chemical observations.
RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarised under following heads:

Number of leaves per plant:
Significantly more number of leaves per plant (10.86) at 120 DAP were recorded under the 25 per cent RDF + 75 per cent through FYM as compared to other treatments (Table 1). This effect could be attributed to the solubilization effect of plant nutrients by addition of farm yard manure on native and applied plant nutrients as well as chelating effect on metal ions leading to higher subsequent up take of NPK by plant (Subbiah and Asija, 1982). FYM might have enhanced the efficiency of chemical fertilizers also. The results obtained in the present study are supported by the findings of Waghachavare (2004) in onion.

Height of plant (cm):
The maximum height of plant (68.27 cm) at 120 DAP was observed in the treatment 25 per cent RDF + 75 per cent N through FYM than all other treatments (Table 1). Because it is a well known fact that the plants require number of macro and micro elements for their normal and healthy growth which were subsequently supplied by organic manures. The results obtained in the present study are supported by the findings of Mankar (2005) in garlic. Minimum plant height at all growth stages was recorded in the treatment T10 (Control).

Maturity (days):
The data (Table 1) clearly indicated that the treatment T4 i.e. 50 per cent RDF + 50 per cent FYM recorded the earliness in maturity (123 days). The hormones and organic acid secreted by organic manures during decomposition might have lead to early maturity. The results in present study are supported by the findings of Waghachavare (2004) in onion and Mankar (2005) in garlic. The treatment T10 (control) took maximum days (139 days) for maturity. Inadequate availability of nutrients resulted into more time to complete the vegetative growth in control.

Neck thickness (cm):
The lowest neck thickness of cured bulb (0.93 cm) was recorded in treatment T1 i.e. 25 per cent RDF + 75 per cent FYM (Table 2). Maximum neck thickness (1.23 cm) was recorded in the treatment T10. It is evident from the data that the combined use of organic manures and inorganic fertilizers at both the levels produced bulbs with thin neck as compared single application of inorganic fertilizer alone and without application of fertilizer of manure. Treatment receiving more amount of nitrogen through chemical fertilizers produced shorter and healthier plants, which resulted in to increased neck thickness. Increasing in neck thickness with higher level of inorganic fertilizers may be due to abnormal maturity of bulbs resulting in graded drying of the leaves from tops downward while the neck remained rigid, thick and erect. The results are supported by the findings of Mankar (2005) in garlic.

Bulb diameter (cm):
The results in respect of polar and equatorial diameter, the treatment T1 i.e. 25 per cent RDF + 75 per cent FYM recorded the earliness in maturity (123 days). The hormones and organic acid secreted by organic manures during decomposition might have lead to early maturity. The results in present study are supported by the findings of Waghachavare (2004) in onion and Mankar (2005) in garlic. The treatment T10 (control) took maximum days (139 days) for maturity. Inadequate availability of nutrients resulted into more time to complete the vegetative growth in control.

Table 1: Influence of integrated nutrient management on vegetative growth and maturity (days) of garlic cv. GG-1

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Number of leaves/plant</th>
<th>Height of plant (cm)</th>
<th>Maturity (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>at 30</td>
<td>60</td>
<td>90</td>
</tr>
<tr>
<td>T1: 25 % RDF + 75 % through FYM</td>
<td>3.90</td>
<td>7.69</td>
<td>9.36</td>
</tr>
<tr>
<td>T2: 25 % RDF + 75 % through VC</td>
<td>3.71</td>
<td>7.35</td>
<td>8.73</td>
</tr>
<tr>
<td>T3: 25% RDF + 75 % through BC</td>
<td>3.40</td>
<td>7.04</td>
<td>8.67</td>
</tr>
<tr>
<td>T4: 50 % RDF + 50 % through FYM</td>
<td>3.72</td>
<td>7.58</td>
<td>9.26</td>
</tr>
<tr>
<td>T5: 50 % RDF + 50 % through VC</td>
<td>3.49</td>
<td>7.20</td>
<td>9.20</td>
</tr>
<tr>
<td>T6: 50 % RDF + 50 % through BC</td>
<td>3.66</td>
<td>7.08</td>
<td>8.54</td>
</tr>
<tr>
<td>T7: 75 % RDF + 25 % through FYM</td>
<td>3.55</td>
<td>7.38</td>
<td>9.14</td>
</tr>
<tr>
<td>T8: 75 % RDF + 25 % through VC</td>
<td>3.60</td>
<td>7.37</td>
<td>8.67</td>
</tr>
<tr>
<td>T9: 75 % RDF + 25 % through BC</td>
<td>3.55</td>
<td>7.15</td>
<td>8.67</td>
</tr>
<tr>
<td>T10: 100 % RDF (N: P: K) 100: 75: 75 kg/ha</td>
<td>3.40</td>
<td>6.94</td>
<td>8.48</td>
</tr>
<tr>
<td>S.E. ±</td>
<td>0.06</td>
<td>0.11</td>
<td>0.10</td>
</tr>
<tr>
<td>C.D. (P=0.05)</td>
<td>NS</td>
<td>0.34</td>
<td>0.28</td>
</tr>
</tbody>
</table>

NS=Non-significant

[Asian J. Hort., Vol. 6 (1); June, 2011]
cent FYM recorded highest value (4.50 cm) (Table 2). The size of bulb was directly influenced by the enhanced vegetative growth on the plants, the comparative significant increase in height, and number of green leaves due to combined effect in these treatments. This might have accumulated more carbohydrates, resulting in to increased diameter of the bulb, which is the storage organ. These results are in agreement with those reported by Singh et al. (1997) in onion.

Mean fresh and cured weight of bulbs (g):

Average bulb weight is one of the most important yield contributing traits. Mean bulb weight was significantly affected due to various treatments (different levels of organic and inorganic fertilizers) in respect of fresh and cured weight of garlic bulb, (Table 2). Significantly maximum fresh weight of bulb (35.64 g) and maximum weight of cured bulb (33.27g) were obtained in the treatment 25 per cent RDF + 75 per cent through FYM and significantly minimum fresh and cured weight of bulbs was obtained in the treatment $T_9$ (27.15g and 26.06 g, respectively). The increase in average bulb weight with the combined treatments was mainly due to increased bulb diameter as discussed earlier. Increase in weight of bulb resulted in increase yield.

Yield per plot and yield per hectare:

Data pertaining to bulb yield per plot and per hectare are presented in Table 2. The bulb yield per plot and per hectare significantly increased in plants given integrations of fertilizer with farm yard manure treatment receiving 25 per cent RDF + 75 per cent through FYM, recorded significantly highest bulb yield per plot (5.06 kg) and per hectare (179.43 q) over rest of the treatments except the treatments $T_4$ and $T_{10}$. The increase in yield with integrated nutrient approach might be attributed to increased growth of plants in respect of height of plant and number of leaves. The healthy top growth might be responsible for higher rate of photosynthesis, might have accumulated carbohydrates which resulted increased the size of bulbs as indicated by diameter and average bulb weight, and ultimately the over all yield. Thus integrated effect of the nutrients as discussed under growth parameters might have definitely been responsible for increase in yield. The results are in conformity with findings of Rai et al. (2004) in garlic.

Quality parameters:

Total soluble solids (°Brix):

Maximum T.S.S. (46.28 °Brix) was observed in the $T_1$ (treatment 25 per cent RDF + 75 per cent through...
FYM) (Table 2). It might be due to the organic manures are capable of supplying adequate macro and micro plant nutrients which play major role in quality improvement through desirable enzymatic changes taking place during growth. Response of farm yard manure in improving soil nutrition is well established fact and combined use of inorganic fertilizer with farm yard manure and further enhanced the effect on quality. These results are in confirmity with the findings of Singh and Tripathi (1993) in garlic.

Ascorbic acid (mg/100g):
Maximum ascorbic acid content in garlic bulbs (14.12 mg/100g) was recorded in the treatment 25 per cent RDF + 75 per cent through FYM followed by the treatment T₄ (14.05 mg/100g) (Table 2). This might be due to physiological influence of FYM in combination with inorganic sources of nutrient on activity of number of enzymes and availability of more energy and food material to the bulb due to strong vegetative growth. Similar results were also reported by Naruka and Dhaka (2004) in garlic.

Authors’ affiliations:
J.D. DESAI, S.B. PARMAR AND B.R. PARMAR, Department of Horticulture, N.M. College of Agriculture, Navsari Agricultural University, NAVSARI (GUJARAT) INDIA

REFERENCES


*************