Effect of integrated nutrient management on yield and quality of tuberose grown on Vertisol

PRITI R. SHIRSA, OMMALA D. KUCHANWAR, SAGAR N. INGLE, SAINATH ZALTE AND NILESH P. ABGAD

Introduction
Tuberose (Polianthes tuberosa L.) belongs to family Amaryllidaceae, is native of Mexico. In India, it is popularly known as Rajanigandha, Nishigandha, Sugandharaja, Gulcheri and Gul-e-Shahu. Among the commercially grown flowers in India, tuberose occupies a prime position because of its popularity as cut flower, loose flowers as well as for its potential in perfume industry. Today floriculture is recognized as a lucrative profession with much higher potential for returns per unit area than the field crop. The annual demand for flowers is growing at a rate of over 25 per cent annually. In recent years, the area under floriculture in India is expanding at a faster rate. The area devoted to floriculture in India is estimated to be around 183 thousand ha during 2009-10 providing over 1021 thousand MT of loose flowers and 66671 million cut flowers (Anonymous, 2010). In Maharashtra, the area under...
floriculture is 17,500 hectares with the production of flowers are estimated to be 91.1 thousand MT of loose flowers and 7914.0 lakh (numbers) of cut flowers in 2009-10 (Anonymous, 2010).

Resource and Research Methods

The field investigation in relation to effect of integrated nutrient management on yield and quality of tuberose was conducted on field of Horticulture (Bhajiwadi), College of Agriculture, Nagpur (M.S.) during Kharif season of 2012-13. The treatments comprised of the eleven combinations of organic manures and inorganic fertilizers i.e. T₁ - RDF, T₂ - 50 per cent N through FYM + 50 per cent N through urea + P and K (RDF), T₃ - 50 per cent N through vermicompost + 50 per cent N through urea + P and K (RDF), T₄ - 50 per cent N through press mud cake + 50 per cent N through urea + P and K (RDF), T₅ - 50 per cent N through neem cake + 50 per cent N through urea + P and K (RDF), T₆ - 50 per cent N through city compost + 50 per cent N through urea + P and K (RDF), T₇ - 75 per cent N through FYM + 50 per cent N through urea + P and K (RDF), T₈ - 75 per cent N through vermicompost + 25 per cent N through urea + P and K (RDF), T₉ - 75 per cent N through press mud cake + 25 per cent N through urea + P and K (RDF), T₁₀ - 75 per cent N through neem cake + 25 per cent N through urea + P and K (RDF), T₁₁ - 75 per cent N through city compost + 25 per cent N through urea + P and K (RDF). The experiment was laid out in Randomized Block Design with three replications. The Recommended dose of fertilizer was 200:300:200 kg of N₄, P₄O₁₀ and K₂O, respectively. Each treatment was assigned to plot and five plants at random were selected for the recording of the observation in each plot. Parameter for which observations were recorded included days to spike emergence, length of the spike, length of rachis, length of floret, diameter of florets, number of florets per spikes, vase life of cut spike, diameter of spike and oil content of florets. The observation on the length of spike was recorded from the nodal base of spike on the top most floret at the time of complete opening of all the flowers.

Research Findings and Discussion

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

Flowering parameter:

The data regarding days required for flowering after the initiation of first flower with the minimum days (99.13) required for initiation of first flower stalk was in treatment receiving 50 per cent N through vermicompost + 50 per cent N through urea + P and K (RDF). However the maximum days (103.67) required for flowering recorded in plots with application of 75 per cent N through city compost + 25 per cent N through urea + P and K (RDF) (Table 1). Minimum days required for initiation of flowering in receiving 50 per cent N through vermicompost + 50 per cent N through urea + P and K (RDF) may be due to availability of nutrients to the plant are more in vermicompost due to which plant has vigorous growth. This might be due to effective change in physico-chemical properties and fertility of soil caused by application of vermicompost. These results are in accordance with the findings of Athavle et al. (2006) in golden rod.

The data regarding to 50 per cent flowering revealed that, the significant differences among treatments were observed in respect of 50 per cent flowering. The minimum numbers of days required for 50 per cent flowering were observed in treatment receiving 50 per cent N through vermicompost + 50 per cent N through urea + P and K (RDF). This was statistically significant. This may be due to vermicompost is rich source of major and micro nutrients, so availability of nutrients are more to plants for growth, so maturity takes place early. Gharat et al. (2008) confirmed these findings with use of vermicompost in aster flower. The maximum days required for 50 per cent flowering were recorded in the treatment receiving 75 per cent N through city compost + 25 per cent N through urea + P and K (RDF).

The data regarding days to harvest flowers from the initiation of first flower, the minimum days required for harvest from the initiation of first flower stalk were observed in treatment with use of 50 per cent N through vermicompost + 50 per cent N through urea + P and K (RDF). Treatments with 50 per cent N through FYM + 50 per cent N through urea + P and K (RDF), 50 per cent N through press mud cake + 50 per cent N through urea + P and K (RDF), 50 per cent N through neem cake + 50 per cent N through urea + P and K (RDF) were at par with 50 per cent N through vermicompost + 50 per
cent N through urea + P and K (RDF). However, the maximum days required for harvesting from the initiation of first flower was recorded in treatment receiving 75 per cent N through city compost + 25 per cent N through urea + P and K (RDF).

The minimum days required for flowering after initiation of the spike to harvest of flower on plant was recorded with the application of vermicompost along with inorganic fertilizer. This may be due to, the application of vermicompost resulting in easy mineralization and thus, availability of essential nutrients. Besides, vermicompost releases humic acid which heads the soil towards neutrality, the rate of energy transformation and transport of metabolites increase which may result into earliness. Similar findings were reported by Chopde et al. (2007) in tuberose, Mankar (2005) and Verma et al. (2011) in chrysanthemum.

**Flower quality parameters:**

The data regarding length of spike, the maximum length of spike (98.13 cm) was recorded in plots receiving 50 per cent N through vermicompost + 50 per cent N through urea + P and K (RDF). The treatments RDF, 50 per cent N through FYM + 50 per cent N through urea + P and K (RDF) were at par 50 per cent N through vermicompost + 50 per cent N through urea + P and K (RDF), whereas significantly superior over all other treatments. These results are in conformity with the findings of Godse et al. (2006) who stated that, the use of vermicompost which is rich in nutrients like P, Ca, Fe, Mg, B, Zn and Mn which pramots production of quality of flowers and also increased length of spike in gladiolus. The minimum length of spike (92.33 cm) was recorded in treatment receiving 75 per cent N through city compost + 25 per cent N through urea + P and K (RDF).

The data regarding diameter of spike resulted that, the maximum diameter of flower spike (0.82 cm) was recorded in treatment with application of 50 per cent N through vermicompost + 50 per cent N through urea + P and K (RDF) and 50 per cent N through FYM + 50 per cent N through urea + P and K (RDF). These results were confirmed by the findings of Gangadharan and Gopinath (2000) and Deshmukh (2007) in gladiolus and chrysanthemum, respectively. The minimum diameter (0.78 cm) was recorded in treatment with application of 75 per cent N through city compost + 25 per cent N through urea + P and K (RDF).

The data in respect to length of rachis revealed that, application of 50 per cent N through vermicompost + 50 per cent N through urea + P and K (RDF) recorded maximum length of rachis (24.99 cm) which was highly significant over rest of the treatments. Chopde et al. (2007) and Yadav et al. (2005) also found highest length of rachis in tuberose with application of vermicompost. From the tabulated data, it is clear that, the maximum length of spike, diameter of spike and length of rachis

**Table 1 : Effect of integrated nutrient management on quality parameter of tuberose**

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Days to initiation of first flower</th>
<th>Days to 50% flowering</th>
<th>Days to harvest from the initiation of first flower</th>
<th>Length of spike (cm)</th>
<th>Diameter of spike (cm)</th>
<th>Length of rachis (cm)</th>
<th>Length of floret (cm)</th>
<th>Diameter of floret (cm)</th>
<th>Vase life of flower (days)</th>
<th>Oil content in fresh flower (%)</th>
<th>Oil content in dry flower (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>102.73</td>
<td>134.07</td>
<td>31.60</td>
<td>96.53</td>
<td>0.79</td>
<td>23.56</td>
<td>5.77</td>
<td>3.05</td>
<td>9.27</td>
<td>0.17</td>
<td>0.18</td>
</tr>
<tr>
<td>T2</td>
<td>101.13</td>
<td>128.73</td>
<td>26.87</td>
<td>97.93</td>
<td>0.82</td>
<td>24.37</td>
<td>5.91</td>
<td>3.21</td>
<td>10.13</td>
<td>0.26</td>
<td>0.27</td>
</tr>
<tr>
<td>T3</td>
<td>99.13</td>
<td>121.40</td>
<td>26.20</td>
<td>98.13</td>
<td>0.82</td>
<td>24.99</td>
<td>6.06</td>
<td>3.27</td>
<td>10.40</td>
<td>0.27</td>
<td>0.28</td>
</tr>
<tr>
<td>T4</td>
<td>102.87</td>
<td>129.60</td>
<td>27.07</td>
<td>96.20</td>
<td>0.80</td>
<td>21.25</td>
<td>5.81</td>
<td>3.26</td>
<td>10.07</td>
<td>0.24</td>
<td>0.25</td>
</tr>
<tr>
<td>T5</td>
<td>102.93</td>
<td>133.73</td>
<td>28.33</td>
<td>95.40</td>
<td>0.80</td>
<td>21.05</td>
<td>5.86</td>
<td>3.06</td>
<td>9.53</td>
<td>0.21</td>
<td>0.20</td>
</tr>
<tr>
<td>T6</td>
<td>103.27</td>
<td>131.40</td>
<td>28.80</td>
<td>93.20</td>
<td>0.80</td>
<td>20.89</td>
<td>5.68</td>
<td>3.07</td>
<td>9.67</td>
<td>0.18</td>
<td>0.19</td>
</tr>
<tr>
<td>T7</td>
<td>102.33</td>
<td>133.87</td>
<td>27.47</td>
<td>93.33</td>
<td>0.81</td>
<td>21.73</td>
<td>5.61</td>
<td>2.99</td>
<td>9.43</td>
<td>0.17</td>
<td>0.17</td>
</tr>
<tr>
<td>T8</td>
<td>103.00</td>
<td>134.93</td>
<td>31.73</td>
<td>92.53</td>
<td>0.81</td>
<td>20.25</td>
<td>5.87</td>
<td>2.99</td>
<td>9.33</td>
<td>0.18</td>
<td>0.23</td>
</tr>
<tr>
<td>T9</td>
<td>102.43</td>
<td>133.73</td>
<td>29.67</td>
<td>94.00</td>
<td>0.79</td>
<td>20.63</td>
<td>5.80</td>
<td>3.06</td>
<td>9.60</td>
<td>0.16</td>
<td>0.19</td>
</tr>
<tr>
<td>T10</td>
<td>102.47</td>
<td>134.67</td>
<td>30.73</td>
<td>92.80</td>
<td>0.78</td>
<td>19.95</td>
<td>5.24</td>
<td>2.95</td>
<td>9.20</td>
<td>0.15</td>
<td>0.16</td>
</tr>
<tr>
<td>T11</td>
<td>103.67</td>
<td>135.87</td>
<td>32.13</td>
<td>92.33</td>
<td>0.78</td>
<td>18.74</td>
<td>5.57</td>
<td>3.02</td>
<td>9.00</td>
<td>0.14</td>
<td>0.16</td>
</tr>
<tr>
<td>F test</td>
<td>Sig.</td>
<td>Sig.</td>
<td>Sig.</td>
<td>Sig.</td>
<td>Sig.</td>
<td>Sig.</td>
<td>Sig.</td>
<td>Sig.</td>
<td>Sig.</td>
<td>Sig.</td>
<td>Sig.</td>
</tr>
<tr>
<td>S.E. ±</td>
<td>0.79</td>
<td>1.39</td>
<td>1.18</td>
<td>0.84</td>
<td>0.008</td>
<td>1.20</td>
<td>0.13</td>
<td>0.06</td>
<td>0.26</td>
<td>0.023</td>
<td>0.017</td>
</tr>
<tr>
<td>C.D. (P&lt;0.05)</td>
<td>2.31</td>
<td>4.09</td>
<td>3.48</td>
<td>2.47</td>
<td>0.024</td>
<td>3.5</td>
<td>0.39</td>
<td>0.20</td>
<td>0.76</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

NS=Non-significant
were recorded in treatment plot treated with 50 per cent N through vermicompost + 50 per cent N through urea + P and K (RDF), which was significantly superior over all other treatments. This might be due to integration of inorganic fertilizer like vermicompost which enhanced the plant growth and resulted in maximum length of spike, diameter of spike and length of rachis.

There is slight variation in values of length of fully opened floret. The maximum length of floret of (6.06 cm) was recorded with application of 50 per cent N through vermicompost + 50 per cent N through urea + P and K (RDF), while minimum length of floret (5.24 cm) was observed in treatment receiving 75 per cent N through neem cake + 25 per cent N through urea + P and K (RDF). The results are in agreement with findings of Gangadharan and Gopinath (2000) in gladiolus.

The values of diameter of tuberose florets were in range of 2.95 cm to 3.27 cm. The maximum diameter (3.27 cm) was observed in treatment with 50 per cent N through vermicompost + 50 per cent N through urea + P and K (RDF). The application of adequate nutrients through inorganic fertilizers in combination with vermicompost might result in cell elongation which would have been resulted into an increase in length and diameter of floret. The results are in conformity with finding of Gharat et al. (2008) in aster flower, Deshmukh et al. (2008) in gallardia.

Treatments 50 per cent N through FYM + 50 per cent N through urea + P and K (RDF), 50 per cent N through press mud cake + 50 per cent N through urea + P and K (RDF), and 50 per cent N through city compost + 50 per cent N through urea + P and K (RDF) were found at par with 50 per cent N through vermicompost + 50 per cent N through urea + P and K (RDF), which was also significantly superior over rest of treatments. The increase in vase life of flower might be due to reason that, application of inorganic fertilizer with organic manure i.e. vermicompost, which is adequate to supply plant nutrients. This resulted into increased vegetative growth, early maturity and produce appropriate carbohydrate before reproductive stage. Later on the plant might have transferred their nutritive and metabolic energy for longer vase life. Similar results were published by Chaitra and Patil (2007) and Netra et al. (1999) in China aster and Chopde et al. (2007) in tuberose. The minimum vase life of flower (9.00) was recorded in treatment receiving 75 per cent N through city compost + 25 per cent N through urea + P and K (RDF).

**Oil content in fresh and dry flowers :**

Application of 50 per cent N through vermicompost + 50 per cent N through urea +P and K (RDF) in treatment T₃ resulted in highest oil content (0.27 %) in fresh flowers, which was significantly superior over rest of treatments. Treatments T₂, T₄ and T₅ were at par with T₁. While the minimum oil content in fresh flowers (0.14%) was observed in treatment with application of 75 per cent N through city compost + 25 per cent N through urea + P and K (RDF). The same results were reported by Lobna and Eid Rawia (2011) in tuberose.

The oil content in dry flowers of tuberose ranged between 0.16 per cent to 0.28 per cent. Treatment with application of 50 per cent N through vermicompost + 50 per cent N through urea +P and K (RDF) recorded maximum oil content (0.28 %) which was significantly superior over rest of treatments. The minimum oil content in dry flower (0.16%) was recorded in treatment receiving 75 per cent N through city compost + 25 per cent N through urea + P and K (RDF). Similar results were reported by Lobna and Eid Rawia (2011) in tuberose.

**Literature Cited**


