Screening of onion genotypes for sets production and raising of early kharif crop

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Abstract

An experiment was conducted to screening of onion varieties suitable for sets production and raising of early kharif crop through sets. Eighteen onion varieties including advance lines were sown in three replications at the Experimental Farm of ICAR-Directorate of Onion and Garlic Research, Rajgurunagar, Pune (Maharashtra). The significant differences were observed in varieties under onion sets production. Maximum number of onion sets were recorded in DOGR-1203 (554.83/m²) followed by Bhima Super (530.17/m²), B-780 (518.00/m²), Bhima Raj (475.33/m²) and RGO-53 (462.08/m²). The sets were graded according to their diameter as <10 mm, 10-15 mm, 16-20 mm and >20 mm onion sets. Highest percentage of 10-15 mm onion sets was recorded in W-448 (44.88%) followed by DOGR-1203 (44.55%), Agrifound White (44.03%), JNDWO-85 (43.80%) and Phule Safed (42.44%). Different groups of onion sets were planted with three replications for production of early kharif crop through sets. Little variations were observed among four groups of onion sets in respect of marketable yield of all the varieties. Days for bulbs maturity varied from 75 to 95 days in crop through onion sets whereas, 96 to 113 days in transplanted crop. On the basis of overall mean of all the onion sets groups, highest marketable yield was recorded in R-Kh-M-I (22.09 t/ha) followed by RGO-53 (20.16 t/ha), Bhima Shweta (20.13 t/ha), Bhima Super (19.13 t/ha), R-Kh-M-III (18.50 t/ha) and these varieties gave higher yield under cultivation through sets in comparison to transplanted crop except Bhima Super. The results clearly indicated that early and higher bulb yield can be obtained through onion sets during kharif cultivation.

Key words: Onion sets, bulblets, sets’ production, kharif onion.

Introduction

Kharif onion plays a very important role in bridging the critical gap of demand and supply from November to February throughout the country when price of onion shoots up a level and becomes a serious concern for food supply. Because of its high export potential, it comes under cash crop. About 55-60% of onion comes from rabi and 40-45% from kharif and late kharif seasons. Because of its special characteristic of pungency, it has more value than other vegetable crops. Apart from its importance for regular supply in domestic markets, it has got very good export potential for earning valuable foreign exchange for the country (Singh and Gupta 2016). Onion is grown either from seeds, seedlings or sets for both green and dry bulbs (Elhag and Osman 2013). Availability of healthy, disease-free seedlings will play the most critical factor for growing onion in kharif season (Mandal et al. 2016). Though, kharif crop is more sensitive and vulnerable forms, plays a crucial role for maintaining demand and supply and price stabilization. Usually, kharif onion is grown by raising nursery in April-May under hot and humid conditions, thus making it difficult to properly manage nursery seedlings. Kharif onion can be successfully grown through sets or bulblets which largely avoid the risk of seedling raising during heavy rains in June-July (Singh and Gupta 2013). Sets, being much larger than seeds have greater vigour for the early establishment of plants which allows to grow successfully in less favourable growing conditions where the use of seedlings or direct sowing is difficult. The seed-set-seed production method implies lower costs and duration than the traditional seed-bulb-seed method (Peluffo et al. 2016). Onion sets production is affected by cultivar, density and environmental conditions (Cheema et al. 2003; Anonymous 2011). The main environmental factors which affects onion bulb and sets production are temperature, photoperiod and interaction between them (Im et al. 2002; Diaz-Perez et al. 2003; Huh et al. 2002). The use of sets can help in extending the availability of the commodity throughout the season. Also, there is significant demand from professional growers to produce early crops through sets. In this
a research was conducted with a view to assess the onion cultivars with appropriate set size suitable for sets production for raising early *kharif* crop.

**Materials and Methods**

The effect of set size on bulb yield in 18 onion genotypes including varieties and advance lines were evaluated at the Experimental Farm of ICAR-Directorate of Onion and Garlic Research, Rajgurunagar, Pune (Maharashtra) during 2010-11 and 2011-12. Seeds of all the genotypes were sown in raised beds @ 15 g/m² in last week of January in both the years. Harvesting of onion sets of different genotypes were done in first week of May in both years on different dates according to maturity. Number of onion sets (per square meter) produced from different varieties were recorded. The onion sets were graded according to the diameter as <10 mm, 10-15 mm, 16-20 mm and >20 mm sets and stored at room temperature in a ventilated storage structure till plantion in the field. Comparison between crop raised through onion sets and seedlings transplanted was done. Different groups of onion set and seedlings were planted 17th July, 2010 and 21st July, 2011 on raised beds with three replications in Randomized Block Design with spacing of 10×15 cm for both sets and seedlings crop. Number of sets and seedlings used were 400 sets/6 m² and 400 seedlings/6 m², respectively.

All the recommended agronomic and plant protection practices were adopted for raising the healthy crop. The performance of the cultivars were assessed on the basis of twenty-one important growth, yield and quality parameters. viz., plant height (cm), number of leaves/plant, collar thickness (mm), polar diameter (cm), equatorial diameter (cm), neck thickness (mm), A grade bulbs (%), B grade bulbs (%), C grade bulbs (%), double bulbs (%), unmarketable bulbs (%), bolter bulbs (%), rotted bulbs (%), marketable bulbs (%), marketable yield (t/ha), total yield (t/ha), total soluble solids (%), number of centerness, average marketable bulb weight (g), days to harvesting after planting and plant establishment (%). Mean data for all the sets groups were utilized for comparing the result. Steps involved in raising of early *kharif* onion crop through sets technology. Statistical analysis was done according to the methods suggested by Panse and Sukhatme (1967).

**Results and Discussion**

Significant differences were observed in different varieties in respect of onion sets production. Maximum number of onion sets were recorded in DOGR-1203 (554.83 sets/m²) followed by Bhima Super (530.17 sets/m²), B-780 (518.00 sets/m²), Bhima Raj (475.33 sets/m²) and RGO-53 (462.08 sets/m²). Highest initial weight of onion sets was recorded in B-780 (1.73 kg/m²) followed by RGO-53 (1.57 kg/m²), Bhima Shweta (1.41 kg/m²), R-Kh-M-I (1.36 kg/m²) and Agrifound White (1.29 kg/m²). Percentage of less than 10 mm onion sets varied from 11.84% (B-780) to 42.36% (R-Kh-M-IV) whereas, more than 20 mm onion sets ranged from 6.67% (DOGR-1203) to 26.64% (B-780). Highest percentage of 10-15 mm onion sets was recorded in W-448 (48.88%) followed by DOGR-1203 (44.55%), Agrifound White (44.03%), JNDWO-85 (43.80%) and Phule Safed (42.44%) (Table 1).

Onion set size is one of the important factors for producing onion bulb or green onion (Khokhar et al. 2001). The results of this experiment revealed that marketable yield of <10 mm, 10-15 mm, 16-20 mm, >20 mm onion sets and transplanted crop varied from 3.36 to 26.02 t/ha, 7.74 to 23.51 t/ha, 5.56 to 22.50 t/ha, 3.87 to 21.36 t/ha and 0.00 to 19.49 t/ha, respectively (Table 2). Little variations were observed among four groups of onion sets in respect of marketable yield of all varieties (13.80 to 16.75 t/ha) whereas, seedlings transplanted crop recorded 12.35 t/ha marketable yield. Irrespective of variety, marketable yield was higher when appropriate sized sets (10-20 mm) were used. Patil et al. (2009) and Sharma et al. (2009) also reported that the size of sets exhibited significant bearing on the bulb yield and the large sets recorded highest yield of onion bulb. The results also agreed with those of Verma et al. (1971), Mohanty et al. (1990), Madisa (1993), Seetohul and Hanoomanjie (2001), Khokhar et al. (2001) and Gupta et al. (2016).

The time to bulb maturation increased with decreasing size of sets. The small size sets took relatively more time i.e. in case of <10 mm size onion sets, it took 93.76 days for bulbs to mature as compared to 10-15 mm (92.75 days), 16-20 mm (90.71 days) and >20 mm (87.29 days). The results are in conformity with those of Heath and Holdsworth (1948), and Jones and Mann (1963), who reported that large sets are used to produce early matured bulbs. However, results differ with those of Khokhar et al. (2001) who reported delayed maturity of onion bulbs by large sets. Days to bulb maturity ranged from 75 to 95 days in crop through onion sets whereas 96 to 113 days in transplanted crop which revealed that onion sets are useful for early production of onion bulbs as compared to transplanted crop (Fig. 1). This is in conformity with Brewster (1994), O’ Connor De (2006) and Ansari (2007). Minimum days to harvest in case of crop through sets were recorded in DOGR-1203 (74.88 days) followed by Agrifound White (87.08 days), JNDWO-85 (87.13 days), RGO-53 (87.13 days) and W-448 (87.13 days).
during onion crop through sets and through seedling transplanted crop, respectively. Progressively increased with increasing set size. In case of sets crop, Rabinowitch (1979) reported that neck diameter of the onion bulblets in L-28 (106.50 days), Arka Kalyan (108 days) and Bhima (96 days) followed by Agrifound White (105.50 days), minimum days to harvest were recorded in DOGR-1203 (89.88 days) whereas, in case of transplanted crop, in DOGR-1203 (96 days) followed by Agrifound White (105.50 days), Arka Kalyan (108 days) and Bhima Shweta (110 days).

Higher number of doubles and bigger neck thickness in onion bulbs are considered as undesirable traits which render the bulb as unmarketable. Highest percentage of doubles were recorded in >20 mm sets (9.32%) followed by <10 mm sets (7.18%) and 16-20 mm sets (6.85%) whereas, lowest in 10-15 mm sets (6.59%). Results showed that percentage of doubles increased with the increasing set size. Rabinowitch (1979) also found the similar results and explained the differences in doubling between plants developing from small or large onion sets, as large sets of a variety probably have a higher number scales i.e. leaf bases and hence, large sets either have the required number of leaves before planting or they are just a few leaves off the minimum number needed for doubling. These results are in conformity with those of Thompson (1934), Chipman and Thorpe (1977), Seetohul and Hanoomanjee (2001) and Khokhar et al. (2002). On the basis of varietal differences in sets group, minimum doubles were observed in DOGR-1203 (0.15%) followed by Bhima Super (1.86%), B-780 (2.31%) and RGO-53 (2.60%).

In case of transplanted onion crop, doubles were found absent or less in Bhima Raj, Bhima Shweta, Bhima Super, DOGR-1203, JNDWO-85, Phule Safed, R-Kh-M-I and W-448. The results also agreed with those of Gupta et al. (2011) and (2016).

Mean neck thickness was recorded minimum in 10-15 mm (4.40 mm) followed by <10 mm sets (4.71 mm) and 16-20 mm sets (5.01 mm) whereas, >20 mm sets recorded maximum neck thickness (5.57 mm). Neck thickness increased with increasing set size. This is in conformity with Seetohul and Hanoomanjee (2001) who reported that higher levels of bulbs with more neck thickness were obtained when large sets were used. Hirave et al. (2015) and Tarai et al. (2015) reported cultivar variation for this trait of onion. Mandal et al. (2018) reported that neck diameter of the onion bulblets progressively increased with time. In case of sets crop,
on the basis of overall mean, minimum neck thickness was recorded in DOGR-1203 (3.20 mm) followed by JNDWO-85 (3.93 mm), Phule Safed (4.29 mm), L-28 (4.38 mm) and Agrifound White (4.58 mm) whereas, in case of transplanted crop, minimum neck thickness was recorded in L-28 (3.96 mm) followed by Agrifound White (4.35 mm), R-Kh-M-I (5.01 mm), R-Kh-M-IV (5.36 mm) and Phule Samarth (5.52 mm). Irrespective of variety and set size, percentage of plant establishment through sets was found higher as compared to that of transplanted crop. The mean percentage of plant establishment through sets was found 74.77% as compared to transplanted crop (63.09%). This is in agreement with Brewster (1997) and Gupta et al. (2011).

The only dis-advantage observed in cultivation of onion through sets while comparing it with cultivation through seedlings transplanted is that the number of bolters which were higher in case of the crop through sets as compared to the transplanted crop (Fig. 2). It ranged from 0 to 4.73% in onion crop through sets whereas, from 0 to 0.65% in transplanted crop. On the basis of overall mean of all the onion sets, the minimum bolters were observed in DOGR-1203 (0.00) followed by Agrifound White (0.37%), L-28 (0.50%), Arka Kalyan (0.59%) and JNDWO-85 (0.83%). In case of transplanted crop, bolters were absent in almost all the entries.

Table 2: Performance of different varieties/lines for production of bulb yield through different sized sets during kharif 2010-11 and 2011-12

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Entries</th>
<th>&lt;10 mm sets (MY t/ha)</th>
<th>10-15 mm sets (MY t/ha)</th>
<th>15-20 mm sets (MY t/ha)</th>
<th>&gt;20 mm sets (MY t/ha)</th>
<th>Mean</th>
<th>MY through the all sets groups (t/ha)</th>
<th>MY through Seedlings transplanted (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Agrifound White</td>
<td>14.12 7.14 10.63</td>
<td>11.46 5.47 8.47</td>
<td>10.57 1.71 6.14</td>
<td>37.73 0.00 18.67</td>
<td>18.37 3.58 10.98</td>
<td>4.00 5.56 4.78</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Bhima Shweta</td>
<td>22.22 17.30 19.76</td>
<td>28.55 17.95 23.25</td>
<td>25.93 9.15</td>
<td>17.54 34.31</td>
<td>5.40 19.85 27.75</td>
<td>12.45 20.10 20.56</td>
<td>9.57 15.07</td>
</tr>
<tr>
<td>9</td>
<td>DOGR-1203</td>
<td>3.23 3.49 3.36</td>
<td>7.62 7.86 7.74</td>
<td>7.10 7.44</td>
<td>9.07 20.83</td>
<td>8.25 14.54 10.60</td>
<td>7.68 8.68</td>
<td>- 0.00 0.00</td>
</tr>
<tr>
<td>10</td>
<td>JNDWO-85</td>
<td>13.44 6.30 9.87</td>
<td>18.68 3.46</td>
<td>11.07 13.98</td>
<td>3.33 8.66</td>
<td>25.00 0.00</td>
<td>12.50 17.78 2.37</td>
<td>10.53</td>
</tr>
<tr>
<td>15</td>
<td>R-Kh-M-I</td>
<td>31.56 20.48 26.02</td>
<td>25.76 17.44 21.60</td>
<td>34.92 10.09</td>
<td>22.50</td>
<td>31.88 4.60</td>
<td>18.24 31.03</td>
<td>13.15 22.09</td>
</tr>
<tr>
<td>17</td>
<td>R-Kh-M-IV</td>
<td>23.69 9.26 16.47</td>
<td>25.71 6.67 16.19</td>
<td>34.17 8.52</td>
<td>21.34 4.00</td>
<td>0.00 20.00</td>
<td>30.89 6.11</td>
<td>18.50 21.67</td>
</tr>
<tr>
<td>18</td>
<td>W-448</td>
<td>22.48 17.42 19.95</td>
<td>20.74 15.30</td>
<td>18.02 27.81</td>
<td>4.69</td>
<td>16.25</td>
<td>33.33</td>
<td>1.59 17.46</td>
</tr>
</tbody>
</table>

Fig. 2: Percent bolters comparison between cultivation of onion crop through sets and through seedlings transplanted during kharif 2010-11 and 2011-12

varieties under observation except Agrifound Dark Red, Phule Samarth (0.43%) and B-780 (0.65%).

On the basis of overall mean of all the onion sets group, highest marketable yield was recorded in R-Kh-M-I (22.09 t/ha) followed by RGO-53 (20.16 t/ha), Bhima Shweta (20.10 t/ha), Bhima Super (19.13 t/ha) and R-Kh-M-IV (18.50 t/ha) (Table 2). These varieties also gave higher marketable yield under crops through onion sets in comparison of transplanted crops except Bhima Super. The results clearly indicated that early and higher

MY = Marketable yield (t/ha)
bulb yield was obtained by crop through onion sets in comparison with transplanted crop. It can be concluded that R-Kh-M-I, RGO-53, Bhima Shweta, Bhima Super and R-Kh-M-IV can be utilized for sets production to raise kharif onion crop. Mandal et al. (2018) also found Bhima Shweta as one of the suitable variety for producing bulblets/sets targeting bulb or green onion production during kharif season under Red and Laterite Zone of West Bengal.

For production of onion sets, 15 g seeds per sq m in nursery found significantly superior than other treatments. 10-20 mm sets with 2-4 g weight found suitable for commercial cultivation of kharif onion. Maximum number of sets were recorded in DOGR-1203 (554.83/m²) followed by Bhima Super (530.17/m²), RGO-53 (462.08/m²) and RGO-53 (20.16 t/ha), Bhima Shweta (20.10 t/ha) and Bhima Super (19.13 t/ha) through sets. Through sets technology, crop matures about one month earlier than transplanted crop. Bhima Super and RGO-53 performed better in production of sets as well as commercial bulb crop raised through sets and are recommended for Sets Technology.

References


