Effect of spacing, bulb size and time of planting on onion seed yield (Allium cepa L.)

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Abstract
An investigation on Effect of Spacing, Bulb Size and Time of Planting on Onion Seed Yield (Allium cepa L.) was undertaken at the experimental farm, College of Agriculture, V.N.M.K.V Parbhani, during rabi season 2016-2017. The experiment was laid out in factorial randomized block design (FRBD) with three factors replicated twice by using the variety Agri Found Light Red. There were total eighteen treatment combinations.

The regarding yield attribute revealed that significantly maximum number of seeds per umbel (819.66, 806.50, 813.25, respectively) was recorded in treatment comprising of spacing at 60 x 45cm, bulb size of 71 - 80 g and planting on 15th October. The interaction effect of S1B2P1 recorded maximum number of seed per umbel (924.50). The maximum seed weight per umbel (6.95, 6.75, 6.70g respectively) was recorded in treatment comprising of spacing at 60 x 45cm, bulb size of 71 - 80 g and planting on 15th October. The interaction effect of S1B2P1 recorded maximum seed weight per umbel (7.82 g). Maximum seed yield per plant (19.15, 18.94, 18.91 g, respectively) was recorded in treatment comprising of spacing at 60 x 45cm, bulb size of 71 - 80 g and planting on 15th October. The interaction effect of S1B2P1 recorded maximum seed yield per plant (22.39 g). The maximum seed yield per plot (587.55, 575.66, 593.83 g, respectively) was recorded in treatment comprising of spacing at 60 x 45cm, bulb size of 71 - 80 g and planting on 15th October as compared to the rest of the treatment of onion. The interaction effect of S1B2P1 recorded maximum seed yield per plot (629.50 g). The maximum seed yield per hectare (6.81, 6.49, 6.49 q/ha, respectively) was recorded in treatment comprising of spacing at 60 x 45cm, bulb size of 71 - 80 g and planting on 15th October. The interaction effect of S1B2P1 recorded maximum seed yield per hectare (7.47 q/ha, respectively). An overall planting of medium sized bulb at 60 x 45 cm on 15th October produces higher yield of onion seed.

Keywords: Spacing, planting, bulb, yield

Introduction
Onion (Allium cepa L.), a member of Alliaceae family, is one of the most important commercial vegetable crops grown in almost all parts of the world. Every year the area under onion cultivation in India is increasing but the farmers are facing with the shortage of high quality seeds. Generally, onion seed is produced from planting mother bulbs. According to (Mondal Choudhary, 1980) onion seed price is directly proportional to onion bulb price used for growing seed crop. Although, onion seed can be produced either by planting mother bulb or by sowing seed directly. For this reason, planting of mother bulb for seed production is preferred. The quality onion seed production is still dealt by small farmers, who have inadequate knowledge for selecting proper grade of the bulbs. The farmers of our country always use small bulbs for onion seed production. Further, mother bulb size exerts significant influence on quality onion seed production. Lack of awareness of onion seed growers to take up the seed production of onion, commercially, regarding bulb size is responsible for poor onion seed yield and low quality of onion seed. Good seed is the basic and most important input requiring relatively less cost, amongst all the inputs involved in the production of onion crop. Hence pure and quality seed supply of basic need of onion cultivation. It can be grown in a wide range of agro-climatic conditions. In Maharashtra state good agro-climatic condition being favourable for the seed production of onion crop, either state government or private companies produce seed of this crop. In this region one of the main reason being that sufficient information on package of practices for onion bulb and seed production according this the present experiment was carried out.
Material and Methods

The field experiment on onion was carried out at Department of Horticulture, Vasantrao Naik Marathwada Agricultural University, and Parbhani during winter (rabi) season of 2016-17. The design of the experiment based on three factors viz., two levels of spacing i.e. S1: 60 X 30; S2: 60 X 45; three types of bulb size i.e. B1: 60-70g; B2: 71-80g; B3: 81-90g and three different dates of planting i.e. P1: 15 October; P2: 30 October; P3: 15 November. The experimental design laid out in FRBD (Factorial Randomized Block Design), there are eighteen different combinations with two replication. The cultural practices of onion crop were carried out as per recommendation of vnmkv parbhani. Regarding the observations for the yield parameters, five plants were selected randomly from each plot of two replications. Plants were selected from each plot and stakes were fixed near each of the selected plants labeled, and recorded the observation as per procedure Viz., number of umbels of selected plants was recorded after completion of flowering. The diameter of umbels was measured at full bloom stage with the help of Vernier - calipers, and their mean was calculated. Also recorded the number of seeds per umbel, seed weight per umbel (g), seed yield per plant (g) seed yield per plot (g) and seed yield per hectare (q/ha). Data obtained on various variables were analyzed by analysis of variance of factorial randomized block design as suggested by Panse and Sukhatme, 1987.

Result and Discussion

Seed yield attribute

The yield attributes as influenced by plant spacing, bulb size, planting time alone and their interaction effect revealed significant differences presented in table 1.

1. Number of umbels per plant

The maximum number of umbels per plant was recorded in wider spacing treatment S2 (60x45cm), medium bulb size (B2) i.e. (71-80 g), P1 i.e. (15th October). The maximum number of umbels per plant was recorded in crop planted in first week of October, which was found statistically superior to all other planting dates. This might be because of low temperature and long day conditions received by the October planted crop during December-January since by this time, the plants reached to a stage of good growth, which might have contributed the highest number of umbels per plant. The results of present study confirm the findings of Healy and Karam, 2012 [3], who also obtained the maximum number of umbels per plant from early planted crop and the minimum from late planted crop.

The treatment combination consisting of wider spacing and medium sized bulbs (S2B2), wider spacing and planting time of 15th Oct (S2P1), medium bulb size and planting time of 15th Oct (B2P1), wider spacing, medium bulb size and planting date of 15th October i.e. S2B2P1; recorded maximum umbels per plant. The results of present study are similar to the findings of Ashrafuzzaman et al. (2009) [2].

2. Umbel diameter (cm).

The treatments of different plant densities used significantly influenced the umbel diameter where maximum umbel diameter was recorded in wider spacing treatment S2 (60x45cm), medium bulb size (B2) and P1 (15th October). The results of present study are in agreement with the findings of Healy and Karam (2012) [3]. The treatment combination consisting of wider spacing and medium sized bulbs (S2B2), wider spacing and planting time of 15th Oct (S2P1), medium bulb size and planting time of 15th Oct (B2P1) and treatment combination of S2B2P1 i.e. wider spacing, medium bulb size and planting date of 15th October recorded maximum umbel diameter. However, these results are contradictory to the findings of Mollah et al. (2015) [5], who obtained the maximum number of umbels per plant from crop planted on 15th November and with big size bulb as planting material.

3. Number of seeds per umbel

The maximum number of seeds per umbel was recorded in wider spacing treatment S2 (60x45cm), medium bulb size (B2) i.e. (71-80 g), P1 i.e. (15th October). The highest number of seeds per umbel was recorded when the crop was planted in first week of October, while the lowest number of seeds per umbel was recorded when the crop was planted in first week of November. This might be due to the reason that the November planted crop resulted in poor plant growth and delayed bolting and high temperature at umbel forming stage might have reduced the number of seeds per umbel. The present results are in good accordance with those obtained by Singh and Singh (1984) [10], Mishra (1986) [4], Nehra et al. (1989) [9] and Ashagrie et al. (2014) [1] have also reported the similar results that early planted crop produced the maximum number of seeds per umbel.

The interaction effect treatment combination consisting of wider spacing and medium sized bulbs (S2B2), wider spacing and planting time of 15th Oct (S2P1), medium bulb size and planting time of 15th Oct (B2P1) and the treatment combination of S2B2P1 i.e. wider spacing, medium bulb size and planting date of 15th October recorded maximum number of seeds per umbel. Similar results were obtained by Singh et al. (1999) [11].

4. Seed weight per umbel (g)

The treatment of different plant densities resulted significant differences influenced where maximum seed weight per umbel was recorded in treatment S2 (60x45cm), medium bulb size (B2) i.e. (71-80 g and P1 i.e. (15th October) The crop planted in first week of October and wider spacing resulted in maximum seed yield per umbel, which might be due to the favourable climatic conditions for pollination, thereby more number of seed set per umbel while the crop planted in first week of November resulted in minimum seed yield per umbel, which might be due to higher temperature and rainfall adversely affecting the pollination and seed set, resulting in lesser seed yield per plant. The reduction in seed yield in late-planted crop might also be due to flower abortion (Healy and Karam, 2012) [3]. These results are in harmony with the results of Mostafa (1983) [7].

The interaction effect of plant spacing and bulb size resulted significantly maximum seed weight per umbel in the treatment combination consisting of wider spacing and medium sized bulbs (S2B2), wider spacing and planting time of 15th Oct (S2P1), medium bulb size and planting time of 15th Oct (B2P1) and S2B2P1 i.e. wider spacing, medium bulb size and planting date of 15th October recorded maximum seed weight per umbel. Muktadir (2000) [8], Healy and Kadam (2012) [3] and Ashagrie et al. (2014) [1], also reported similar type of findings which confirms present findings.

5. Seed yield per plant (g)

Seed yield per plant maximum recorded in treatment S2 (60x45cm), medium bulb size (B2) i.e. (71-80 g and P1 i.e. (15th October). The interaction effect of plant spacing and
bulb size significantly affected seed yield per plant of onion recorded after harvest. Significantly maximum seed yield per plant was recorded in the treatment combination consisting of wider spacing and medium sized bulbs (S₂B₂), wider spacing and planting time of 15th Oct (S₂P₁), medium bulb size and planting time of 15th Oct (B₂P₁) and the treatment combination of S₁B₁Pᵢ i.e. wider spacing, medium bulb size and planting date of 15th October. Muktadir (2000) [8], Healy and Karam (2012) [3] and Ashagrie et al. (2014) [1], also reported similar type of findings which confirms present findings.

6. Seed yield per plot (g)
The seed yield per plot of onion recorded after harvest as influenced by plant spacing, bulb size, planting time alone and their interaction effect. The maximum seed yield per plot was recorded in wider spacing treatment S₂ (60x45cm), medium bulb size (B₂) i.e. (71-80 g) and P₁ i.e. (15th October). The crop planted in first week of October and wider spacing resulted in maximum seed yield per plot. Which might be due to the favourable climatic conditions for pollination, thereby more number of seed set per umbel and plant thus resulted in higher seed yield per plot. The results of the present investigation corroborate the findings of Rizk et al. (1996) The interaction effect of plant spacing and bulb size significantly affected seed yield per plot of onion recorded after harvest. Significantly maximum seed yield per plant was recorded in the treatment combination consisting of wider spacing and medium sized bulbs (S₂B₂), wider spacing and planting time of 15th Oct (S₂P₁), medium bulb size and planting time of 15th Oct (B₂P₁) and the treatment combination of S₁B₁Pᵢ i.e. wider spacing, medium bulb size and planting date of 15th October. Muktadir (2000) [8], Healy and Karam (2012) [3] and Ashagrie et al. (2014) [1], also reported similar type of findings which confirms present findings.

Table 1: Effect of spacing, bulb size, planting time and their interaction effect attributing characters of onion.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Number of umbels per plant</th>
<th>Umbel diameter (cm)</th>
<th>Number of seeds per umbel</th>
<th>Seed weight per umbel (g)</th>
<th>Seed yield per plant (g)</th>
<th>Seed yield per plot (g)</th>
<th>Seed yield (q/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S₁ x 60 x 30</td>
<td>8.05</td>
<td>7.11</td>
<td>761.61</td>
<td>5.80</td>
<td>17.19</td>
<td>523.00</td>
<td>6.05</td>
</tr>
<tr>
<td>S₂ x 60 x 45</td>
<td>9.45</td>
<td>9.29</td>
<td>819.66</td>
<td>6.95</td>
<td>19.15</td>
<td>587.55</td>
<td>6.81</td>
</tr>
<tr>
<td>SEM ±</td>
<td>0.31</td>
<td>0.24</td>
<td>7.28</td>
<td>0.02</td>
<td>0.32</td>
<td>11.72</td>
<td>0.15</td>
</tr>
<tr>
<td>CD at 5% level</td>
<td>0.95</td>
<td>0.73</td>
<td>21.85</td>
<td>0.23</td>
<td>0.98</td>
<td>35.17</td>
<td>0.45</td>
</tr>
</tbody>
</table>

Bulb size (g) (B):
- B₁: Small (60-70) | 8.05 | 7.50 | 762.58 | 5.90 | 17.59 | 509.25 | 5.89 |
- B₂: Medium (71-80) | 9.46 | 9.06 | 806.50 | 6.75 | 18.94 | 575.66 | 6.49 |
- B₃: Large (81-90) | 9.45 | 8.05 | 782.83 | 6.47 | 18.36 | 520.91 | 6.00 |
| SEM ± | 0.38 | 0.30 | 8.92 | 0.09 | 0.40 | 14.36 | 1.80 |
| CD at 5% level | 1.16 | 0.90 | 26.76 | 0.29 | 1.20 | 43.08 | 5.50 |

Planting Time (P):
- P₁: 15 October | 9.25 | 8.89 | 813.25 | 6.70 | 18.91 | 593.83 | 6.49 |
- P₂: 30 October | 8.19 | 7.97 | 780.08 | 6.31 | 17.57 | 542.25 | 6.27 |
- P₃: 15 November | 8.11 | 7.56 | 758.58 | 6.11 | 16.85 | 510.75 | 5.62 |
| SEM ± | 0.38 | 0.30 | 8.92 | 0.09 | 0.40 | 14.36 | 0.18 |
| CD at 5% level | 1.16 | 0.90 | 26.76 | 0.29 | 1.20 | 43.08 | 0.55 |

Interactions
- S x B:
  - S₁B₁ | 7.09 | 6.91 | 719.83 | 5.21 | 16.27 | 488.33 | 5.55 |
  - S₁B₂ | 9.25 | 8.08 | 827.83 | 6.60 | 17.72 | 530.16 | 6.13 |
  - S₁B₃ | 9.09 | 7.50 | 785.16 | 6.37 | 17.57 | 525.83 | 6.08 |
  - S₂B₁ | 7.22 | 6.92 | 737.16 | 5.87 | 17.47 | 516.00 | 5.92 |
  - S₂B₂ | 9.99 | 10.62 | 845.33 | 7.18 | 20.82 | 596.50 | 6.57 |
  - S₂B₃ | 9.86 | 9.18 | 828.50 | 7.07 | 19.15 | 554.83 | 6.42 |
  - SEM ± | 0.54 | 0.42 | 12.61 | 0.13 | 0.56 | 20.30 | 0.26 |
  - CD at 5% level | 1.64 | 1.27 | 37.85 | 0.41 | 1.70 | 60.92 | 0.78 |
- S x P:
  - S₁P₁ | 9.28 | 8.72 | 794.5 | 6.54 | 18.58 | 533.50 | 6.17 |
  - S₁P₃ | 8.82 | 7.57 | 788.83 | 6.18 | 17.65 | 533.33 | 6.12 |
  - S₂P₁ | 7.10 | 6.77 | 733.33 | 5.53 | 16.81 | 506.16 | 5.79 |
  - S₂P₃ | 9.69 | 10.00 | 837.66 | 7.23 | 20.18 | 588.33 | 6.86 |
  - S₃P₁ | 9.37 | 9.16 | 826.83 | 7.08 | 18.68 | 551.00 | 6.37 |
  - S₃P₃ | 8.24 | 7.00 | 762.66 | 5.68 | 17.11 | 529.33 | 5.85 |
  - SEM ± | 0.54 | 0.42 | 12.61 | 0.13 | 0.56 | 20.30 | 0.26 |
  - CD at 5% level | 1.64 | 1.27 | 37.85 | 0.41 | 1.70 | 60.92 | 0.78 |

7. Seed yield per hectare (q/ha)
The seed yield per hectare of onion as influenced by plant spacing, bulb size, planting time. The maximum seed yield per hectare was recorded in wider spacing treatment S₂ (60x45cm), medium bulb size (B₂) i.e. (71-80 g) and P₁ i.e. (15th October). The maximum seed yield per hectare in early planted and wider spacing was due to the cumulative contribution of all the yield contributing characters influenced by comparatively favourable temperature and day length (Ud-Deen, 2008). The interaction effect of plant spacing and bulb size significantly affected seed yield per hectare of onion recorded after harvest. Significantly maximum seed yield per hectare was recorded in the treatment combination consisting of wider spacing and medium sized bulbs (S₂B₂), wider spacing and planting time of 15th Oct (S₂P₁), medium bulb size and planting time of 15th Oct (B₂P₁) and the treatment combination of S₁B₁Pᵢ i.e. wider spacing, medium bulb size and planting date of 15th October. Muktadir (2000) [8], Healy and Karam (2012) [3] and Ashagrie et al. (2014) [1], also reported similar type of findings which confirms present findings.
Conclusion

In present experiment, Wider spacing of S₂ i.e. (60x45 cm), medium size i.e. (71 - 80 g), Planting on 15ᵗʰ October and the interaction effect of wider spacing and medium sized bulbs (S₂P₁), wider spacing and planting time of 15ᵗʰ Oct (S₁P₁), medium bulb size and planting time of 15ᵗʰ Oct (B₁P₁) and the treatment combination of S₂B₁P₁ i.e. wider spacing, medium bulb size and planting date of 15ᵗʰ October recorded significantly maximum yield attributes of onion seed.

References