EFFECT OF PLANTING DATES AND PLANT SPACINGS ON GROWTH, YIELD AND QUALITY OF BROCCOLI UNDER RAYALASEEMA ZONE OF ANDHRA PRADESH, INDIA

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Abstract

A field experiment was carried out at HC & RI, Anantharajupet, Y.S.R. district, Andhra Pradesh (India) during the winter season of 2013-2014. December 10th planting was recorded maximum plant height, plant spread, number of leaves per plant and less number of days to flower bud initiation and high yield/ha. January 20th planting was recorded less number of days to first and final harvest and chlorophyll content. Among the plant geometries, 60 × 45 cm recorded maximum values for plant spread, number of leaves per plant, ascorbic acid content and chlorophyll content. While, 50 × 30 cm geometry was noticed highest plant height, yield/ha and less number of days to flower bud initiation. Interaction of dates of planting and geometries were significantly recorded maximum plant height and yield/ha in December 10th planting with spacing of 50 × 30 cm, whereas December 10th planting with a spacing of 60 × 45 cm was noticed maximum number of leaves per plant. While, January 20th planting with a spacing of 60 × 45 cm recorded highest chlorophyll content.

Key words: Chlorophyll content, planting dates, sulphoraphane, planting dates, Broccoli.

Introduction

Broccoli (Brassica oleracea var. italica L.) is one of the important temperate exotic and cole group vegetable. It is highly nutritious, rich in vitamins and minerals and is a good source of Sulphoraphane, a compound associated in reducing the risk of cancer. Broccoli has large flower heads, usually green in colour, arranged in a tree like structure on branches sprouting from a thick, edible stalk. The mass of flower heads is surrounded by leaves. Broccoli mostly resembles cauliflower, which is a different cultivar group of the same species. There are two types of broccoli, heading and sprouting. Most garden broccoli is of the heading type, which is closely related to cauliflower and forms a large central head. Since this crop was introduced recently in Andhra Pradesh, there is a dire need to standardize the dates of planting as well as plant geometry to suit the local conditions. The planting dates have directly affecting yield and quality parameters in broccoli (Kunicki et al., 1999). Broccoli yields are highly dependent on plant spacing, as it was found that the curd size increased with wider plant spacing (Chung, 1982).

Materials and Methods

The present field experiment was conducted at Horticultural College and Research Institute, Dr. Y. S. R. Horticultural University, Anantharajupet, Y.S.R. district of Andhra Pradesh (India) during rabi 2013-2014 to study the effect of date of transplanting and plant spacing on growth, curd yield and quality of Broccoli with four planting dates viz., 20th November, 10th December, 31st December and 20th January and three spacings viz., 50 × 30cm, 45 × 45cm and 60 × 45cm comprising twelve treatment combinations in a factorial RBD with three replications. Fantasy-F₁ hybrid was used in this experiment and it is a single head type. Well-rotten farm yard manure @ 15-20 t ha⁻¹ was incorporated at the time of final ploughing. A basal dose of half of the nitrogen @ 70 kg ha⁻¹, full dose of phosphorous @ 100 kg ha⁻¹ and potash @ 100 kg ha⁻¹ was applied at the time of land preparation. The remaining dose of nitrogen was top dressed in 2 equal splits, one at 30 days after transplanting and other at curd initiation stage. Healthy seedlings of 30 days old were transplanted in evening hours as per the...
treatments and observations on plant height, plant spread, number of leaves per plant (cm), days to flower bud initiation, days to first and final harvest, yield per hectare (t), ascorbic acid content (mg/100g) and chlorophyll content (mg/g) were recorded.

Results and Discussion

Plant height (cm)

Different planting dates and spacings significantly influence plant height of broccoli (table 1). December 10th planting (D2) has recorded highest plant height (43.13 cm) whereas lowest plant height (36.64 cm) was from January 20th planting (D3). Among the plant spacings, closer spacing of 50 x 30 cm (S1) recorded highest plant height (41.17 cm). This might be due to more terminal increase in closer spaced plants (50 x 30 cm) than wider spaced plants (60 x 45 cm), where lateral growth is more. Among the interactions maximum plant height (44.16 cm) was recorded from December 10th planting and 50 x 30 cm spacing (D2S1). Similar findings were reported by Saikia et al. (2010) in broccoli.

Plant spread (cm)

Maximum plant spread (86.66 cm) was recorded from mid planting (December 10th) and minimum plant spread was from late planting (January 20th). Among the plant spacings, 60 x 45 cm (S3) has recorded highest plant spread (84.38 cm) followed by 45 x 45 cm (S2). Interaction effect was non-significant for plant spread.

Number of leaves plant-1

Data on number of leaves plant-1 significantly affected by different planting dates, spacings and their interaction in broccoli (table 1). The highest number of leaves per plant (27.50) was produced when planted on December 10th. This might be due to optimum temperatures prevailing during vegetative growth period resulting in greater photosynthetic activity and higher mobilization of assimilates. Among the spacings, 60 x 45 cm has recorded maximum number of leaves per plant (26.77). Similar results were reported by Saikia et al. (2010) in broccoli. Regarding the geometries, December 10th planting with a spacing of 60 x 45 cm (D2S3) produced maximum number of leaves/plant (28.53).

Days to flower bud initiation

December 10th (D2) and January 20th planting (D3) took less (34.22) and more (39.50) number of days to flower bud initiation respectively. Early flower bud initiation in December 10th planting might be due to the better meteorological conditions i.e. temperature, sunshine, day length and relative humidity during that period when compared with late planting (January 20th). Similar results were reported by Thapa et al. (2002) in cauliflower and Saikia et al. (2010) in broccoli. Regarding the geometries, a closer spacing of 50 x 30 cm (S1) recorded least number of days to bud initiation (36.32). Interaction effect on days to flower bud initiation was non-significant in broccoli (table 2).

Days to first and final harvest

Planting dates and geometries significantly influence the days to first and final harvest (table 2). January 20th planting took least number of days to first (53.08) and final harvest (58.50). Plant geometries and interactions showed non-significant effect on days to first and final harvest in broccoli. However, 60 x 45 cm geometry (S3) took less number of days to first (54.64) and final (63.54) harvest.

Yield hectare-1 (tones)

Data in table 3 showed significance of planting dates, spacings and their interactions on curd yield/ha. Maximum

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Plant height (cm)</th>
<th>Plant spread (cm)</th>
<th>Number of leaves plant&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>D&lt;sub&gt;1&lt;/sub&gt;</td>
<td>D&lt;sub&gt;2&lt;/sub&gt;</td>
<td>D&lt;sub&gt;3&lt;/sub&gt;</td>
</tr>
<tr>
<td>S&lt;sub&gt;1&lt;/sub&gt;</td>
<td>43.10</td>
<td>44.16</td>
<td>40.13</td>
</tr>
<tr>
<td>S&lt;sub&gt;2&lt;/sub&gt;</td>
<td>42.31</td>
<td>43.05</td>
<td>37.62</td>
</tr>
<tr>
<td>S&lt;sub&gt;3&lt;/sub&gt;</td>
<td>41.31</td>
<td>42.16</td>
<td>36.99</td>
</tr>
<tr>
<td>Mean</td>
<td>42.24</td>
<td>43.13</td>
<td>38.15</td>
</tr>
</tbody>
</table>

Source: D: Different planting dates, S: Plant spacings, D x S: Interaction. (tones)

CD at 5%: 0.40 0.35 0.70 1.25 1.08 NS 0.34 0.30 0.60

Table 1 : Effect of dates of planting and plant spacings on plant height, plant spread and number of leaves/plant in broccoli.
Effect of Planting Dates and Plant Spacings on Growth, Yield and Quality of Broccoli

Curd yield/ha has recorded when planted on December 10th (37.04 t) and also in closer spacing of 50 × 30 cm (38.62 t) followed by 45 × 45 cm (32.75 t). The closer spacing of 50 x 30 cm accommodated 55% and 33.33% extra plants than 60 × 45 cm and 45 × 45 cm spacing, respectively. The beneficial effect of closer spacing towards higher yield per ha have also been observed by Hossian et al. (2011) and Sighal et al. (2009) in broccoli.

Highest curd yield/ha (43.51 t) was observed in a treatment combination of December 10th planting with a spacing of 50 × 30 cm (D₂S₁).

Ascorbic acid content (mg 100 g⁻¹)

Maximum ascorbic acid content has recorded from December 10th (D₂) planting (125.50 mg/100g). Among the spacings, wider spacing of 60 × 45 cm showed highest ascorbic acid content (113.52 mg/100g) as against other spacings. Similar trend was also reported by Singhal et al. (2009) in broccoli. The interaction between dates of planting and spacing showed non-significant effect on ascorbic acid content.

Chlorophyll content (mg g⁻¹)

Different planting dates, geometries and their interactions showed significant effect on chlorophyll content of broccoli curds (table 3). Chlorophyll content was maximum (0.31 mg/g) in late planting (December 20th) than early planting (November 20th). Chlorophyll content was increased with increased spacing and highest chlorophyll content (0.21 mg/g) was from 60 × 45 cm spacing followed by 45 × 45 cm (0.18 mg/g). Similar findings were reported by Kumar and Rawat (2002) in cabbage. Regarding the interactions, higher chlorophyll content was observed in a treatment combination of December 20th planting with a spacing of 60 × 45 cm (D₄S₃).

Table 2. Effect of dates of planting and plant spacings on days to flower bud initiation, days to first and final harvest in broccoli.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Days to flower bud initiation</th>
<th>Days to first harvest</th>
<th>Days to final harvest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S₁</td>
<td>S₂</td>
<td>S₃</td>
</tr>
<tr>
<td>D₁</td>
<td>37.60</td>
<td>38.53</td>
<td>38.73</td>
</tr>
<tr>
<td>D₂</td>
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<tr>
<td>D₃</td>
<td>35.06</td>
<td>35.73</td>
<td>35.86</td>
</tr>
<tr>
<td>D₄</td>
<td>38.86</td>
<td>39.60</td>
<td>40.03</td>
</tr>
<tr>
<td>Mean</td>
<td>36.32</td>
<td>37.00</td>
<td>37.35</td>
</tr>
</tbody>
</table>

Source D S D x S D S D x S D S D x S
S. Em ± 0.13 0.12 0.24 0.22 0.19 0.38 0.21 0.18 0.36
CD at 5% 0.40 0.35 NS 0.65 NS NS 0.62 NS NS

D₁: November 20th, D₂: December 10th, D₃: December 31st and D₄: January 20th
S₁: 50x30 cm, S₂: 45x45 cm and S₃: 60x45 cm, NS: Non-significant.

Table 3: Effect of dates of planting and plant spacings on yield per hectare, ascorbic acid content and chlorophyll content in broccoli.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Yield per hectare (tones)</th>
<th>Ascorbic acid content (mg/100g)</th>
<th>Chlorophyll content (mg/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S₁</td>
<td>S₂</td>
<td>S₃</td>
</tr>
<tr>
<td>D₁</td>
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<td>34.45</td>
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</tr>
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<td>D₂</td>
<td>43.51</td>
<td>37.24</td>
<td>30.38</td>
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<tr>
<td>D₃</td>
<td>36.87</td>
<td>31.55</td>
<td>26.60</td>
</tr>
<tr>
<td>D₄</td>
<td>31.02</td>
<td>27.78</td>
<td>23.64</td>
</tr>
<tr>
<td>Mean</td>
<td>38.62</td>
<td>32.75</td>
<td>27.03</td>
</tr>
</tbody>
</table>

Source D S D x S D S D x S D S D x S
S. Em ± 0.22 0.19 0.39 0.30 0.24 0.36 0.24 0.36 0.39 0.30 0.24 0.36
CD at 5% 0.60 0.003 0.003 0.005 0.003 0.003 0.005 0.003 0.003 0.005 0.003 0.005

D₁: November 20th, D₂: December 10th, D₃: December 31st and D₄: January 20th
S₁: 50x30 cm, S₂: 45x45 cm and S₃: 60x45 cm, NS: Non-significant.

Different planting dates, geometries and their interactions showed significant effect on chlorophyll content of broccoli curds (table 3). Chlorophyll content was maximum (0.31 mg/g) in late planting (December 20th) than early planting (November 20th). Chlorophyll content was increased with increased spacing and highest chlorophyll content (0.21 mg/g) was from 60 × 45 cm spacing followed by 45 × 45 cm (0.18 mg/g). Similar findings were reported by Kumar and Rawat (2002) in cabbage. Regarding the interactions, higher chlorophyll content was observed in a treatment combination of December 20th planting with a spacing of 60 × 45 cm (D₄S₃).

References


