Effect of different planting time and spacing on growth, yield and quality of cabbage (Brassica oleracea var. capitata) cv. Golden Acre under Bundelkhand region in U.P.

Rohit Yadav, Safik Ahamad, Nikita Sharma and Rikesh Raj

DOI: https://doi.org/10.22271/chemi.2021.v9.i2f.11845

Abstract
A field experiment was carried out to know the optimum planting time and spacing for cabbage cultivation in Bundelkhand region at Organic Research Farm, Karguwan ji, Bundelkhand University, Jhansi (U.P.). The treatments comprises three planting times viz., 5th November (P₁), 15th November (P₂) and 25th November (P₃) and three spacing viz., 60 × 45 cm (S₁), 60 × 30 cm (S₂) and 45 × 30 cm (S₃). The experiment was laid out in Factorial Randomized Design with three replications. The observations were made on growth, yield and quality parameters of cabbage. The results revealed that highest plant height, number of leaves per plant, plant spread, stem diameter, head weight, head yield, head diameter and Total Soluble Solid content was obtained with early seedlings transplanting on 5th November while, minimum days taken to head maturity and highest head compactness was observed with seedlings transplanted on 25th November. There was no significant difference observed between planting times for dry matter content. Among the spacing’s, highest growth and quality parameters were observed with seedlings transplanted on wider spacing (S₃) while, highest head yield was recorded with seedlings transplanted on medium spacing (S₂). The interaction effect of planting times and spacing were non-significant effect for all the parameters except yield however, highest plant height, number of leaves per plant, plant spread, stem diameter, head weight, head diameter, TSS and dry matter content was observed with treatment combination of P₃S₁ (5th November + 60 cm × 45 cm). The significantly highest yield (490.98 q ha⁻¹) was obtained with treatment combination of P₃S₃ (5th November + 60 cm × 30 cm). Minimum number of days taken to head maturity and crop harvest as well as highest head compactness was recorded with treatment combination of P₃S₃ (25th November + 60 cm × 45 cm).

Keywords: Cabbage, planting time, spacing, growth, yield, quality

Introduction
Cabbage (Brassica oleracea var. capitata Linn.) is an important leafy vegetable belonging to the family Cruciferae having chromosome number (2n) 18. It is herbaceous biennial grown during winter season in temperate, subtropical and tropical regions and now grown almost throughout the year. The word cabbage has been derived from the French word *Cobache*, meaning head, which is best described as a single large terminal bud comprised of tightly overlapped numerous thick leaves attached to and enclosing most of the un-branched short stem. It is rich in minerals and vitamins, 100 g of cabbage contain protein (1.4 g), Fat (0.2 g), Carbohydrate (5.7 g), Fiber (1.5 g), Vitamin A (70 IU), Vitamin B₁ (0.05 mg), Vitamin B₂ (0.05 mg), Vitamin B₆ (0.11 mg), Vitamin C (46 mg), Vitamin E (0.7 mg), Fe (0.08 mg) etc. (Watt and Merrill, 1963) [14].

Planting date and plant spacing are of the important factors for production practices of cabbage. The use of suitable planting date and proper plant spacing effects on the yield contributing characters and consequently on the overall yield. Moreover, the head quality attributes are mainly affected. The effect of planting date on cabbage vegetative characters, yield and head attributes has been reported in earlier investigations (Singh et al., 2010; Thirupal et al., 2014 and Jayamanne et al., 2015) [9, 12, 4]. Planting date plays a direct role in the maturity and harvesting time of cabbage plants. It is associated with temperature, day length and light intensity. The suitable planting date determines the favourable environmental climatic conditions for cabbage growing. Planting date affects total and marketable yield of
cabbage as well (Kleinhenz and Wszelaki, 2003). The late planting date resulted in denser cabbage heads and head volume, but the early planting date produced heavier heads with larger diameters and wider core width than late planting as well as the head diameter and head weight were also reduced at delayed planting date (Khan et al., 2015) [3].

As we know that the farmers of the Bundelkhand region are grow cabbage at different time and using different plant spacing without knowing their effect on yield of cabbage. The cabbage growers of this region are in need of the information regarding the effect of planting time and plant spacing on cabbage production while very scanty information is available on this aspect for Bundelkhand region. Hence, considering the need of the farmers, the present investigation entitled “Effect of different planting time and spacing on growth, yield and quality of cabbage (Brassica oleracea var. capitata) cv. Golden Acre under Bundelkhand region in U.P.”

Material and Methods
The present investigation was carried out at organic research farm karguwan ji, Bundelkhand University, Jhansi (Uttar Pradesh) during rabi season 2019-2020. The soil of experimental field was sandy loam with good drainage and uniform texture with low to N (110.46 kg ha⁻¹), medium to P (15.36 kg ha⁻¹), K (162.31 kg ha⁻¹) status and soil pH (7.36). Seed of Golden Acre variety of cabbage were used in the experiment. The experiment was laid out in factorial randomized block design with three replications. The experiment was comprised of three planting time (P₁ = 5 November; P₂ = 15 November; P₃ = 25 November) and three levels of spacing (S₁ = 60 cm × 45 cm; S₂ = 60 cm × 30 cm and S₃ = 45 cm × 30 cm). There were altogether twenty nine plots each of 2.40 x 1.80 m spread at all the growth stages.

Interaction effect of planting times and spacing, all the treatment combinations were statistically at par with each other.

The highest plant height 30 DAT (13.05 cm), 60 DAT (20.21 cm) and at harvest stage (25.35 cm) was recorded with spacing 60 cm × 45 cm) and at harvested stage (19.26 cm) was recorded with seedlings transplanted on 5th November (P₁) and wider plant spacing (60 cm × 45 cm) was significantly superior over other treatments and it was recorded highest stem diameter 30 DAT (9.53 cm, 60 DAT (15.72 cm) and at harvest stage (19.26 cm) was recorded with early seedlings transplanted on 5th November (P₁) and wider plant spacing S₁ (60 cm × 45 cm) was significantly superior over other treatments and it was recorded highest stem diameter 30 DAT (9.53 cm, 60 DAT (15.72 cm) and at harvest stage (19.98 cm). Interaction effect with respect to stem diameter was found non-significant at all the growth stage.

The Seedlings transplanted on minimum number of days was taken to head maturity (19.25) by seedlings transplanted on 25th November (P₂). Early transplanted seedling was taken more days to head maturity as compare to late transplanted seedlings. Plant spacing was also significantly affected to days taken to head maturity. Wider plant spacing was shown early head maturity as compare to closer spacings. Minimum number of days taken to head maturity (20.54) was noted with wider spacing S₁ (60 cm × 45 cm). The treatment combination of P₃S₁ (25 November + 60 cm × 45 cm) was taken minimum number of days for head maturity (18.27). However, all the treatment combinations were statistically at par with each other.

The seedlings transplanted on 25th November (P₃) was taken significantly minimum number of days to harvest (97.32) and minimum number of days taken to head maturity (96.89) was noted with wider spacing S₁ (60 cm × 45 cm). The treatment combination P₃S₁ (25 November + 60 cm × 45 cm) was taken minimum number of days for head maturity (93.22) for head maturity. These findings are in conformity with Ullah et al., (2013) [13], Abed et al., (2015) [11], Choudhary et al., (2015) [2] and Patel et al., (2019) [8]. The minimum change in diameter of main stem might be to lower day and night average temperatures prevailed during the vegetative growth period when compared to earlier dates of planting reported by Kanse et al., (2018) [6]. This might be due to early planted crop got more duration for growth period as well as lower day and night average temperature prevailed during the vegetative growth period as compared to delayed transplanting. Similar results were also found by Kanse et al., (2018) [6] and Thakre and Dalal (2019) [11]. Decreasing plant growth with decrease in temperatures during vegetative growth period leads to delay in head maturity and crop harvest reported by Kanse et al., (2018) [6].
Table 1: Effect of different planting time and spacing on Plant height and Number of leaves per plant of cabbage

| Treatment   | Plant height (cm) | Number of leaves per plant |
|-------------|-------------------|-----------------------------|
|             | 30 DAT | 60 DAT | At harvest | 30 DAT | 60 DAT | At harvest |
| **Planting times (P)** |         |         |            |         |         |            |
| P₁          | 13.10  | 19.61  | 25.35      | 7.62    | 15.99  | 18.20      |
| P₂          | 12.05  | 18.20  | 23.89      | 7.36    | 15.21  | 16.95      |
| P₃          | 10.71  | 16.92  | 22.50      | 6.96    | 13.54  | 15.13      |
| SE±         | 0.16   | 0.19   | 0.25       | 0.19    | 0.21   | 0.21       |
| CD at 5% level | 0.47   | 0.58   | 0.76       | NS      | 0.63   | 0.62       |

| Treatment   | Plant spacing (S) | Plant height (cm) | Number of leaves per plant |
|-------------|-------------------|-------------------|-----------------------------|
|             | 30 DAT | 60 DAT | At harvest | 30 DAT | 60 DAT | At harvest |
| **Plant spacing (S)** |         |         |            |         |         |            |
| S₁          | 13.05  | 20.21  | 26.69      | 7.72    | 16.76  | 18.79      |
| S₂          | 11.91  | 18.10  | 23.50      | 7.23    | 14.91  | 17.05      |
| S₃          | 10.89  | 16.53  | 21.54      | 6.99    | 13.06  | 14.44      |
| SE±         | 0.16   | 0.19   | 0.25       | 0.19    | 0.21   | 0.21       |
| CD at 5% level | 0.47   | 0.58   | 0.76       | NS      | 0.63   | 0.62       |

| Treatment   | Plant height (cm) | Number of leaves per plant |
|-------------|-------------------|-----------------------------|
|             | 30 DAT | 60 DAT | At harvest | 30 DAT | 60 DAT | At harvest |
| **Interaction (P×S)** |         |         |            |         |         |            |
| P₁S₁        | 14.40  | 21.65  | 28.18      | 8.11    | 18.21  | 20.71      |
| P₁S₂        | 13.03  | 19.35  | 25.32      | 7.42    | 15.84  | 18.09      |
| P₁S₃        | 11.85  | 17.84  | 22.54      | 7.33    | 14.21  | 15.81      |
| P₂S₁        | 13.20  | 20.11  | 26.85      | 7.64    | 16.87  | 18.88      |
| P₂S₂        | 12.22  | 17.96  | 23.17      | 7.35    | 15.32  | 17.22      |
| P₂S₃        | 10.72  | 16.52  | 21.64      | 7.10    | 13.45  | 14.75      |
| P₃S₁        | 11.54  | 18.87  | 25.05      | 7.42    | 15.21  | 16.77      |
| P₃S₂        | 10.49  | 16.68  | 22.02      | 6.92    | 13.88  | 15.85      |
| P₃S₃        | 10.11  | 15.22  | 20.43      | 6.54    | 11.52  | 12.77      |
| SE±         | 0.27   | 0.25   | 0.44       | 0.33    | 0.36   | 0.36       |
| CD at 5% level | NS    | NS    | NS         | NS      | NS    | NS         |

Table 2: Effect of different planting time and spacing on Plant spread (cm) and Stem diameter (mm) of cabbage

| Treatment   | Plant spread (cm) | Stem diameter (mm) |
|-------------|-------------------|--------------------|
|             | 30 DAT | 60 DAT | At harvest | 30 DAT | 60 DAT | At harvest |
| **Planting times (P)** |         |         |            |         |         |            |
| P₁          | 17.59  | 36.77  | 47.06      | 8.99    | 14.92  | 19.26      |
| P₂          | 16.44  | 34.33  | 43.94      | 8.52    | 14.13  | 17.74      |
| P₃          | 14.49  | 29.33  | 37.54      | 7.95    | 13.14  | 16.39      |
| SE±         | 0.37   | 0.39   | 0.41       | 0.28    | 0.46   | 0.60       |
| CD at 5% level | 1.09   | 1.19   | 1.21       | 0.83    | 1.38   | 1.74       |

| Treatment   | Plant spread (cm) | Stem diameter (mm) |
|-------------|-------------------|--------------------|
|             | 30 DAT | 60 DAT | At harvest | 30 DAT | 60 DAT | At harvest |
| **Plant spacing (S)** |         |         |            |         |         |            |
| S₁          | 17.06  | 38.13  | 48.80      | 9.53    | 15.72  | 19.98      |
| S₂          | 16.22  | 33.57  | 42.97      | 8.58    | 14.21  | 17.97      |
| S₃          | 15.24  | 28.73  | 36.77      | 7.36    | 12.27  | 15.45      |
| SE±         | 0.37   | 0.39   | 0.41       | 0.28    | 0.46   | 0.60       |
| CD at 5% level | 1.09   | 1.19   | 1.21       | 0.83    | 1.38   | 1.74       |

| Treatment   | Plant spread (cm) | Stem diameter (mm) |
|-------------|-------------------|--------------------|
|             | 30 DAT | 60 DAT | At harvest | 30 DAT | 60 DAT | At harvest |
| **Interaction (P×S)** |         |         |            |         |         |            |
| P₁S₁        | 18.69  | 42.05  | 53.82      | 9.94    | 16.40  | 21.32      |
| P₁S₂        | 17.37  | 36.48  | 46.69      | 9.06    | 15.04  | 19.55      |
| P₁S₃        | 16.72  | 31.77  | 40.66      | 7.99    | 13.34  | 17.34      |
| P₂S₁        | 17.10  | 38.48  | 49.25      | 9.57    | 15.79  | 19.89      |
| P₂S₂        | 16.56  | 34.78  | 44.51      | 8.58    | 14.25  | 17.96      |
| P₂S₃        | 15.65  | 29.73  | 38.05      | 7.40    | 12.37  | 15.58      |
| P₃S₁        | 15.39  | 33.85  | 43.33      | 9.08    | 14.99  | 18.73      |
| P₃S₂        | 14.73  | 29.46  | 37.71      | 8.10    | 13.33  | 16.67      |
| P₃S₃        | 13.34  | 24.68  | 31.59      | 6.68    | 11.09  | 13.86      |
| SE±         | 0.63   | 0.69   | 0.70       | 0.48    | 0.79   | 1.00       |
| CD at 5% level | NS    | NS    | NS         | NS      | NS    | NS         |
Table 3: Effect of different planting time and spacing on Days taken to head maturity, Days taken to harvest, Head weight of cabbage (kg), Head yield per plot (kg) and Head yield (q ha$^{-1}$) of cabbage

| Treatment | Days taken to head maturity | Days taken to harvest | Head weight of cabbage (kg) | Head yield per plot (kg) | Head yield (q ha$^{-1}$) |
|-----------|-----------------------------|-----------------------|-----------------------------|-------------------------|-------------------------|
| Planting times (P) | | | | | |
| P1 | 24.32 | 104.41 | 1.13 | 24.22 | 455.26 |
| P2 | 22.28 | 100.81 | 1.01 | 21.25 | 399.50 |
| P3 | 19.25 | 97.32 | 0.88 | 17.41 | 327.19 |
| SEm± | 0.31 | 0.43 | 0.03 | 0.37 | 3.67 |
| CD at 5% level | 0.93 | 1.28 | 0.08 | 1.10 | 11.00 |

| Plant spacing (S) | Days taken to head maturity | Days taken to harvest | Head weight of cabbage (kg) | Head yield per plot (kg) | Head yield (q ha$^{-1}$) |
|-------------------|-----------------------------|-----------------------|-----------------------------|-------------------------|-------------------------|
| S1 | 20.54 | 96.89 | 1.35 | 20.15 | 378.82 |
| S2 | 21.59 | 99.79 | 0.98 | 22.43 | 421.68 |
| S3 | 23.72 | 105.86 | 0.68 | 20.29 | 381.45 |
| SEm± | 0.31 | 0.43 | 0.03 | 0.37 | 3.67 |
| CD at 5% level | 0.93 | 1.28 | 0.08 | 1.10 | 11.00 |

| Interaction (P×S) | Days taken to head maturity | Days taken to harvest | Head weight of cabbage (kg) | Head yield per plot (kg) | Head yield (q ha$^{-1}$) |
|-------------------|-----------------------------|-----------------------|-----------------------------|-------------------------|-------------------------|
| P1S1 | 22.52 | 100.34 | 1.46 | 22.36 | 420.30 |
| P1S2 | 23.53 | 103.67 | 1.13 | 26.12 | 490.98 |
| P1S3 | 27.12 | 109.23 | 0.79 | 24.18 | 454.51 |
| P2S1 | 20.82 | 97.11 | 1.38 | 20.88 | 392.48 |
| P2S2 | 22.23 | 99.44 | 0.98 | 22.32 | 419.55 |
| P2S3 | 23.78 | 105.87 | 0.68 | 20.56 | 386.47 |
| P3S1 | 18.27 | 93.22 | 1.22 | 17.22 | 323.68 |
| P3S2 | 19.21 | 96.26 | 0.84 | 18.86 | 354.51 |
| P3S3 | 20.26 | 102.49 | 0.57 | 16.14 | 303.38 |
| SEm± | 0.54 | 0.74 | 0.05 | 0.63 | 6.36 |
| CD at 5% level | NS | NS | NS | NS | 19.06 |

Yield parameter
The results presented in Table 3. It is apparent from data that planting times had significant influence on head weight of cabbage.

The early transplanting of seedlings on 5th November (P1) was recorded highest head weight (1.13 kg) and further it was revealed that different plant spacing also had highly significant effects on head weight of cabbage. Highest head weight (1.35 kg) was recorded with seedlings transplanted on wider spacing at 60 cm × 30 cm (S1). The interaction effect of planting times and plant spacing in respect to head yield was found non-significant.

It is apparent from data that head yield per plot was significantly reduced with delay in planting time. The highest head yield per plot (24.22 kg) was recorded with early planting on 5th November (P1) and effect of spacing was also found significant on head per plot. The highest head yield per plot (22.43 kg) was observed with S2 (60 cm × 30 cm). The interaction effect of planting times and plant spacing in respect to head yield per plot was found non-significant.

The data revealed that head yield per hectare was significantly reduced with delay in planting time. The highest head yield per hectare (455.26 q) was recorded with early planting on 5th November (P1) and it was further revealed that spacing also had significant effect on head yield per hectare. The highest head yield per plot (242.68 q) was observed with S2 (60 cm × 30 cm). The interaction effect of planting times and plant spacing in respect to head yield per hectare was found non-significant. Seedling transplanted on 5th November with 60 cm × 30 cm spacing (P1S2) was recorded highest yield per hectare (490.98 q ha$^{-1}$). A perusal of data presented in previous chapter revealed that yield attributes and yield was also significantly influenced by planting times. Early transplanting of seedlings on 15th November (P1) was obtained significantly higher head weight, per plot yield as well as per hectare yield as compare to delayed transplanting on 5th November (P2) and 25th November (P3). Reduction in weight of head with delayed plantings might be due to gradual increase in temperatures during head development stage which leads to reduction in yield of crop. Such influence of climate factors on head weight were reported by Hossain et al., (2011) [3], Abed et al., (2015) [4], Singh et al. (2017) [5] and Kanse et al., (2018) [6]. Moderate temperatures during crop growth allow better photosynthesis and translocation of metabolites reflecting increases in vegetative growth and consequently head yield reported by Kanse et al., (2018) [6].

Quality parameter
The results presented in Table 4. As regards to planting times, early planting on 5th November (P1) was found significantly superior and recorded highest head diameter (14.78 cm) and it was further observed that head diameter significantly influenced with plant spacing. The highest head diameter (14.72 cm) was observed under seedlings planted on wider spacing (60 cm × 45 cm). The interaction effect of planting times and plant spacing in respect to head diameter was found non-significant. The highest head compactness (38.96) was noted with planting on 25th November (P3) and the significantly higher head compactness (42.49) was recorded with wider spacing S1 (60 cm × 45 cm). The interaction effect of planting times and plant spacing in respect to head compactness was found non-significant.

The revealed that total soluble solids were significantly influenced with planting times and spacing. The highest TSS...
(8.65%) was obtained with early planting on 5th and further data showed that TSS level in cabbage was significantly influenced with plant spacing in which wider plant spacing S1 (60 cm × 45 cm) observed highest TSS (8.77%). The interaction effect of planting times and plant spacing in respect to TSS was found non-significant. The dry matter content was non-significantly affected by planting times and spacing. The highest dry matter content (11.62 g) was recorded with early planting on 5th November (P1) and further it was revealed that dry matter content was also non-significantly influenced with plant spacing. The highest dry matter content (11.57 g) was recorded with wider spacing (S1). The interaction effect of planting times and plant spacing in respect to dry matter content was also found non-significant.

| Treatment          | Head diameter (cm) | Head compactness | TSS (%) | Dry matter content (%) |
|--------------------|--------------------|------------------|---------|------------------------|
| Planting times (P) |                    |                  |         |                        |
| P1                 | 14.78              | 34.25            | 8.65    | 11.62                  |
| P2                 | 13.96              | 36.20            | 8.59    | 11.51                  |
| P3                 | 12.95              | 38.96            | 8.33    | 11.33                  |
| SEm±               | 0.27               | 0.54             | 0.03    | 0.10                   |
| CD at 5% level     | 0.80               | 1.61             | 0.09    | NS                     |

| Treatment          | Head diameter (cm) | Head compactness | TSS (%) | Dry matter content (%) |
|--------------------|--------------------|------------------|---------|------------------------|
| Plant spacing (S)  |                    |                  |         |                        |
| S1                 | 14.72              | 42.49            | 8.70    | 11.57                  |
| S2                 | 13.91              | 36.44            | 8.51    | 11.50                  |
| S3                 | 13.07              | 30.48            | 8.37    | 11.39                  |
| SEm±               | 0.27               | 0.54             | 0.03    | 0.10                   |
| CD at 5% level     | 0.80               | 1.61             | 0.09    | NS                     |

| Interaction (P×S)  | Head diameter (cm) | Head compactness | TSS (%) | Dry matter content (%) |
|--------------------|--------------------|------------------|---------|------------------------|
| P1S1               | 15.41              | 39.90            | 8.77    | 11.68                  |
| P1S2               | 14.82              | 34.72            | 8.65    | 11.62                  |
| P1S3               | 14.11              | 28.12            | 8.54    | 11.56                  |
| P2S1               | 14.84              | 42.23            | 8.72    | 11.57                  |
| P2S2               | 13.94              | 36.18            | 8.59    | 11.52                  |
| P2S3               | 13.11              | 30.18            | 8.47    | 11.44                  |
| P3S1               | 13.91              | 45.33            | 8.61    | 11.45                  |
| P3S2               | 12.98              | 38.41            | 8.28    | 11.37                  |
| P3S3               | 11.98              | 33.19            | 8.11    | 11.18                  |
| SEm±               | 0.47               | 0.93             | 0.05    | 0.18                   |
| CD at 5% level     | NS                 | NS               | NS      | NS                     |

Conclusion

Thus, it may be concluded that the cabbage planted on 5th November at 60 cm × 30 cm plant spacing found significantly superior in terms of productivity, profitability and quality over other treatments under Bundelkhand region of Uttar Pradesh.

References

1. Abed MY, El-Said EM, Shebl EF. Effect of Planting Date and Spacing on yield and Quality of Cabbage (Brassica oleracea var. capitata L.) Journal of Plant Production, Mansoura University 2015;6(12):2093-2102.

2. Chaudhari AH, Vadodaria JR, Patel HT, Patel GS. Performance of Different Varieties and Planting Date on Growth of Knolkhil (Brassica oleracea var. gongylodes). International Journal of Research in Applied, Natural and Social Sciences 2015;3(8):39-42.

3. Hossain MF, Ara N, Uddin MR, Dey S, Islam MR. Effect of Time of Sowing and Plant Spacing on Broccoli Production. Tropical Agricultural Research & Extension 2011;14(4):90-92.

4. Jayamanne JMDDE, Elangeshwaran A, Harris KD, Dharmena HMVS. Market demand for head size of cabbage and suitable plant spacing for downsizing it to meet the demand. Annals of Sri Lanka Department of Agriculture 2015;17:144-153.

5. Kavalgi A, Rajyalakshmi R, Jyothi KU, Krishna KU. Studies on the Effect of Planting Dates on Growth, Yield Components and Quality of Red Cabbage (Brassica oleracea var. capitata f. rubra). International Journal of Current Microbiology and Applied Sciences 2019;8(12):2219-2225.

6. Kanse VJ, Bhosale AM, Shinde VN. Studies on Effect of Planting Dates on Growth, Yield and Quality of Broccoli (Brassica oleracea L. var. italica) cv. Green Magic. International Journal of Current Microbiology and Applied Science, Special 2018;6:78-86.

7. Khan F, Khan TU, Namatullah S, Tajuddin. Vegetative growth of cabbage in relation to sowing time, plant spacing and NPK grown under different localities of

http://www.chemijournal.com
Azad Kashmir and Gilgit-Baltitan. Journal of Agricultural and Biological Science 2015;10(1):365-370.
8. Patel SJ, Varma LR, Verma P, Rathva VD. Effect of Different Dates of Planting on Performance of Different Varieties with Respect to Growth of Broccoli (Brassica oleracea var. italica). International Journal of Agriculture Sciences 2019;11(13):8750-8753.
9. Singh BK, Pathak KA, Sarma KA, Manju T. Effect of transplanting dates on plant growth, yield and quality traits of cabbage cultivars. Indian Journal of Hill Farming 2010;23(2):1-5.
10. Singh VP, Prasad VM, Deepanshu. Effect of sowing date on growth and yield of broccoli (Brassica oleracea var. italica). Plant Archives 2017;17(2):1063-1070.
11. Thakare SG, Dalal SR. Effect of sowing dates on growth, curd initiation and curd maturity of broccoli. International Journal of Chemical Studies 2019;7(1):977-979.
12. Thirupal D, Madhumathi C, Reddy PSS. Effect of planting dates and plant spacing on growth, yield and quality of broccoli under Rayalaseema zone of Andhra Pradesh. Plant Archives 2014;14(2):1095-1098.
13. Ullal A, Islam MN, Hossian MI, Sarkar MD, Moniruzzaman M. Effect of Planting Time and Spacing on Growth and Yield of Cabbage. International journal of Bio-resource and stress management 2013;4(2):182-186.
14. Watt BK, Merrill AL. Composition of foods, Agricultural Handbook #8, Agricultural Research Service, United States Department of Agriculture, Washington, DC 1963.