

**Effect of different varieties and spacing on  
growth, yield and quality of cabbage  
(*Brassica oleracea* L. var. capitata)**

**ABSTRACT**

SUBMITTED TO THE  
BABASAHEB BHIMRAO AMBEDKAR UNIVERSITY  
(A CENTRAL UNIVERSITY)  
LUCKNOW



For the Award of the Degree of  
*Doctor of Philosophy*  
IN  
*HORTICULTURE*

Supervisor  
*Prof. Sanjay Kumar*

Submitted By  
*Shatrunjay Yadav*  
Enrollment No.: 1180/18

DEPARTMENT OF HORTICULTURE  
SCHOOL OF AGRICULTURAL SCIENCES AND TECHNOLOGY  
BABASAHEB BHIMRAO AMBEDKAR UNIVERSITY  
(A Central University)  
Vidya- Vihar, Rae-Bareilly Road, Lucknow-226025  
(U.P.) India

2023

## ABSTRACT

---

---

The current finding of the experiment entitled “**Effect of different varieties and spacing on growth, yield and quality of cabbage (*Brassica oleracea* L. var. capitata)**” conducted at Horticulture Research Farm-1, Department of Horticulture, School of Agricultural Sciences and Technology, Babasaheb Bhimrao Ambedkar University, Lucknow, (U.P.), India during the Rabi season 2020-21 and 2021-22, respectively. The studies on vegetative growth, yield and quality. The result was discussed in light of literature available and research work reported by earlier workers on cabbage and related. The experimental finding is now summarized and presented below:

### **Effect of varieties:**

1. The maximum plant height (15.21cm) at 20 DAT and (36.75cm) at harvesting stage was obtained under the treatment V<sub>2</sub> (Golden Acre), followed by V<sub>3</sub> (Cabbage Pusa Hybrid-1). While, the minimum plant height (13.14cm) at 20DAT and (32.14cm) at harvesting stage was noticed in V<sub>1</sub> (Pusa Mukta).
2. The maximum stem diameter (1.96cm) at 20 DAT and (8.15cm) at harvesting stage was obtained under the treatment V<sub>2</sub> (Golden Acre), followed by V<sub>3</sub> (Cabbage Pusa Hybrid-1). While, the minimum plant height (1.71cm) at 20DAT and (7.12cm) at harvesting stage was noticed in V<sub>1</sub> (Pusa Mukta).
3. The maximum plant spreading (North-South) (13.10cm) at 20 DAT and (49.42cm) at harvesting stage was obtained under the treatment V<sub>2</sub> (Golden Acre), followed by V<sub>3</sub> (Cabbage Pusa Hybrid-1). While,

4. the minimum plant spreading (North-South) (11.41cm) at 20 DAT and (43.07cm) at harvesting stage was noticed in V<sub>1</sub> (Pusa Mukta).
5. The maximum plant spreading (East-West) (12.58cm) at 20 DAT and (49.12cm) at harvesting stage was obtained under the treatment V<sub>2</sub> (Golden Acre), followed by V<sub>3</sub> (Cabbage Pusa Hybrid-1). While, the minimum plant spreading (East-West) (10.93cm) at 20 DAT and (42.80cm) at harvesting stage was noticed in V<sub>1</sub> (Pusa Mukta).
6. The maximum number of leaves per plant (7.12) at 20 DAT and (19.91) at harvesting stage was obtained under the treatment V<sub>2</sub> (Golden Acre), followed by V<sub>3</sub> (Cabbage Pusa Hybrid-1). While, the minimum number of leaves per plant (6.21) at 20 DAT and (17.39) at harvesting stage was noticed in V<sub>1</sub> (Pusa Mukta).
7. The maximum length of leaf (13.10cm) at 20 DAT and (33.09cm) at harvesting stage was obtained under the treatment V<sub>2</sub> (Golden Acre), followed by V<sub>3</sub> (Cabbage Pusa Hybrid-1). While, the minimum length of leaf (12.12cm) at 20 DAT and (30.55cm) at harvesting stage was noticed in V<sub>1</sub> (Pusa Mukta).
8. The maximum width of leaf (7.09cm) at 20 DAT and (27.21cm) at harvesting stage was obtained under the treatment V<sub>2</sub> (Golden Acre), followed by V<sub>3</sub> (Cabbage Pusa Hybrid-1). While, the minimum width of leaf (5.71cm) at 20 DAT and (25.93cm) at harvesting stage was noticed in V<sub>1</sub> (Pusa Mukta).
9. The earlier head initiation days (51.32) was obtained under the treatment V<sub>2</sub> (Golden Acre), followed by V<sub>1</sub> (Pusa Mukta). While, the late head initiation days (53.07) was noticed in V<sub>3</sub> (cabbage Pusa Hybrid-1).

- 10.** The earlier days to head harvest (72.97) was obtained under the treatment  $V_2$  (Golden Acre), followed by  $V_1$  (Pusa Mukta). While, the late days to head harvest (78.54) was noticed in  $V_4$  (cabbage Pusa Hybrid-82).
- 11.** The maximum weight of whole plant (kg) (3.71kg) was observed in treatment  $V_2$ (Golden Acre), followed by  $V_4$  (Cabbage Pusa Hybrid-82). While the minimum weight of whole plant (kg) (3.16kg) was noticed in  $V_1$ (Pusa Mukta).
- 12.** The maximum weight of head (kg) (1.48kg) was observed in treatment  $V_2$ (Golden Acre), followed by  $V_4$  (Cabbage Pusa Hybrid-82). While the minimum weight of head (kg) (1.14kg) was noticed in  $V_1$ (Pusa Mukta).
- 13.** The maximum number of heading leaves per head (18.08) was observed in treatment  $V_2$  (Golden Acre), followed by  $V_4$  (cabbage Pusa Hybrid-82). While, the minimum number of heading leaves per head (16.14) was noticed in  $V_1$  (Pusa Mukta).
- 14.** The maximum diameter of head (15.67cm) was observed in treatment  $V_2$  (Golden Acre), followed by  $V_4$  (cabbage Pusa Hybrid-82). While, the minimum diameter of head (13.42cm) was noticed in  $V_1$  (Pusa Mukta).
- 15.** The maximum polar length (15.38cm) was observed in treatment  $V_2$  (Golden Acre), followed by  $V_4$  (cabbage Pusa Hybrid-82). While, the minimum polar length (13.93cm) was noticed in  $V_1$  (Pusa Mukta).
- 16.** The maximum equatorial length (14.72cm) was observed in treatment  $V_2$  (Golden Acre), followed by  $V_4$  (cabbage Pusa Hybrid-

- 82). While, the minimum equatorial length (13.04cm) was noticed in V<sub>1</sub> (Pusa Mukta).
- 17.** The maximum core length (6.21cm) was observed in treatment V<sub>2</sub> (Golden Acre), followed by V<sub>4</sub> (cabbage Pusa Hybrid-82). While, the minimum core length (5.38cm) was noticed in V<sub>1</sub> (Pusa Mukta).
- 18.** The maximum volume of head (1654.76cc) was observed in treatment V<sub>2</sub> (Golden Acre), followed by V<sub>4</sub> (cabbage Pusa Hybrid-82). While, the minimum volume of head (1241.76cc) was noticed in V<sub>1</sub> (Pusa Mukta).
- 19.** The maximum dry matter (8.00%) was observed in treatment V<sub>4</sub> (Cabbage Pusa Hybrid-82), followed by V<sub>3</sub> (Cabbage Pusa Hybrid-1). While, the minimum dry matter (7.36%) was noticed in V<sub>1</sub> (Pusa Mukta).
- 20.** The maximum yield kg/plot (18.98kg) was observed in treatment V<sub>2</sub> (Golden Acre), followed by V<sub>3</sub> (Cabbage Pusa Hybrid-1). While, the minimum yield kg/plot (16.31kg) was noticed in V<sub>1</sub> (Pusa Mukta).
- 21.** The maximum yield q/ha (600.67q/ha) was observed in treatment V<sub>2</sub> (Golden Acre), followed by V<sub>4</sub> (Cabbage Pusa Hybrid-82). While, the minimum yield q/ha (507.48q/ha) was noticed in V<sub>1</sub> (Pusa Mukta).
- 22.** The maximum total soluble solids (6.748 °Brix) were observed in treatment V<sub>4</sub> (Cabbage Pusa Hybrid-82), followed by V<sub>3</sub> (Cabbage Pusa Hybrid-1). While, the minimum total soluble solids (6.692 °Brix) were noticed in V<sub>1</sub> (Pusa Mukta).
- 23.** The maximum total sugar (3.934%) was observed in treatment V<sub>4</sub>(Cabbage Pusa Hybrid-82), followed by V<sub>1</sub> (Pusa Mukta). While, the minimum total sugar (3.81%) was noticed in V<sub>1</sub> (Pusa Mukta).

24. The maximum reducing sugar (2.86%) was observed in treatment V<sub>4</sub>(Cabbage Pusa Hybrid-82), followed by V<sub>2</sub> (Golden Acre). While, the minimum reducing sugar (2.76%) was noticed in V<sub>1</sub> (Pusa Mukta).
25. The maximum on-reducing sugar (1.21%) was observed in treatment V<sub>1</sub>(Pusa Mukta), followed by V<sub>4</sub> (Cabbage Pusa Hybrid-82). While, the minimum non-reducing sugar (0.96%) was noticed in V<sub>2</sub> (Golden Acre).
26. The maximum gross returns (48,0536Rs/ha) were noted in treatment V<sub>2</sub> (Golden Acre), followed by V<sub>3</sub>(Cabbage Pusa Hybrid-1). While, the minimum gross returns (405988Rs/ha) were noted in V<sub>1</sub> (Pusa Mukta).
27. The maximum net returns (308221.50Rs/ha) was noted in treatment V<sub>2</sub> (Golden Acre), followed by V<sub>3</sub> (Cabbage Pusa Hybrid-1). While the minimum net returns (233673.50Rs/ha) was noted in V<sub>1</sub> (Pusa Mukta).
28. The maximum B:C ratio (2.78) was noted in treatment V<sub>2</sub> (Golden Acre), followed by V<sub>3</sub>(Cabbage Pusa Hybrid-1). While, the minimum B:C ratio (2.35) was noted in V<sub>1</sub> (Pusa Mukta).

### **Effect of spacing**

29. The maximum plant height (15.39cm) at 20 DAT and (37.63cm) at harvesting stage was found in spacing S<sub>4</sub> (60×60cm). Followed by S<sub>3</sub> (60×45cm). While, the minimum plant height (14.40cm) at 20 DAT and (32.14cm) at harvesting stage was noticed in S<sub>1</sub> (45×30cm).
30. The maximum stem diameter (2.00cm) at 20 DAT and (8.33cm) at harvesting stage was found in spacing S<sub>4</sub> (60×60cm). Followed by S<sub>3</sub>

- (60×45cm). While, the minimum stem diameter (1.61cm) at 20 DAT and (6.69cm) at harvesting stage was noticed in S<sub>1</sub> (45×30cm).
- 31.** The maximum plant spreading (North-South) (13.37cm) at 20 DAT and (50.43cm) at harvesting stage was found in spacing S<sub>4</sub> (60×60cm). followed by S<sub>3</sub> (60×45cm). While, the minimum plant spreading (North-South) (10.75cm) at 20 DAT and (40.58cm) at harvesting stage was noticed in S<sub>1</sub> (45×30cm).
- 32.** The maximum plant spreading (East-West) (12.86cm) at 20 DAT and (50.12cm) at harvesting stage was found in spacing S<sub>4</sub> (60×60cm). Followed by S<sub>3</sub> (60×45cm). While, the minimum plant spreading (East-West) (10.27cm) at 20 DAT and (40.26cm) at harvesting stage was noticed in S<sub>1</sub> (45×30cm).
- 33.** The maximum number of leaves per plant (7.26) at 20 DAT and (20.26) at harvesting stage was found in spacing S<sub>4</sub> (60×60cm). followed by S<sub>3</sub> (60×45cm). While, the minimum number of leaves per plant (5.88) at 20 DAT and (16.45) at harvesting stage was noticed in S<sub>1</sub> (45×30cm).
- 34.** The maximum length of leaf (12.95cm) at 20 DAT and (33.05cm) at harvesting stage was found in spacing S<sub>4</sub> (60×60cm). followed by S<sub>3</sub> (60×45cm). While, the minimum length of leaf (12.32) at 20 DAT and (31.17cm) at harvesting stage was noticed in S<sub>1</sub> (45×30cm).
- 35.** The maximum width of leaf (7.22cm) at 20 DAT and (26.93cm) at harvesting stage was found in spacing S<sub>4</sub> (60×60cm). followed by S<sub>3</sub> (60×45cm). While, the minimum width of leaf (5.55cm) at 20 DAT and (26.41cm) at harvesting stage was noticed in S<sub>1</sub> (45×30cm).
- 36.** The earlier head initiation days (51.93) was obtained under the treatment S<sub>2</sub> (45×45cm), followed by S<sub>1</sub> (45×30cm). While, the late

- head initiation days (52.53) was noticed in V<sub>3</sub> (cabbage Pusa Hybrid-1).
- 37.** The earlier days to head harvest (74.74) was obtained under the treatment S<sub>2</sub> (45×45cm), followed by S<sub>1</sub> (45×30cm). While, the late days to head harvest (75.91) was noticed in S<sub>4</sub> (60×60cm).
- 38.** The maximum weight of head (kg) (3.95kg) was observed in treatment S<sub>2</sub>(45×45cm), followed by S<sub>3</sub> (Cabbage Pusa Hybrid-1). While the minimum weight of head (kg) (2.38kg) was noticed in S<sub>1</sub>(45×30).
- 39.** The maximum weight of head (kg) (1.56kg) was observed in treatment S<sub>2</sub>(45×45cm), followed by S<sub>3</sub> (Cabbage Pusa Hybrid-1). While the minimum weight of head (kg) (0.799kg) was noticed in S<sub>1</sub>(45×30cm).
- 40.** The maximum number of heading leaves per head (18.19) was observed in treatment S<sub>2</sub> (45×45cm), followed by S<sub>3</sub> (cabbage Pusa Hybrid-1). While, the minimum number of heading leaves per head (15.21) was noticed in S<sub>1</sub> (45×30cm).
- 41.** The maximum diameter of head (16.20cm) was observed in treatment S<sub>2</sub> (45×45cm), followed by S<sub>3</sub> (Cabbage Pusa Hybrid-1). While, the minimum diameter of head (13.55cm) was noticed in S<sub>1</sub> (45×30cm).
- 42.** The maximum polar length (15.84cm) was observed in treatment S<sub>2</sub> (45×45cm), followed by S<sub>3</sub> (Cabbage Pusa Hybrid-1). While, the minimum polar length (12.48cm) was noticed in S<sub>1</sub> (45×30cm).
- 43.** The maximum equatorial length (15.11cm) was observed in treatment S<sub>2</sub> (45×45cm), followed by S<sub>3</sub> (Cabbage Pusa Hybrid-1).

- While, the minimum equatorial length (11.46cm) was noticed in  $S_1$  (45×30cm).
- 44.** The maximum core length (6.01cm) was observed in treatment  $S_2$  (45×45cm), followed by  $S_3$  (Cabbage Pusa Hybrid-1). While, the minimum core length (5.56cm) was noticed in  $S_1$  (45×30cm).
- 45.** The maximum volume of head (1863.75cc) was observed in treatment  $S_2$  (45×45cm), followed by  $S_3$  (Cabbage Pusa Hybrid-1). While, the minimum volume of head (979.12cc) was noticed in  $S_1$  (45×30cm).
- 46.** The maximum dry matter (7.82%) was observed in treatment  $S_2$  (45×45cm), followed by  $S_4$  (Cabbage Pusa Hybrid-82). While, the minimum dry matter (7.54%) was noticed in  $S_1$  (45×30cm).
- 47.** The maximum yield kg/plot (21.43kg) was observed in treatment  $S_2$  (45×45cm), followed by  $S_1$  (45×30cm). While, the minimum yield kg/plot (14.04kg) was noticed in  $S_4$  (60×60cm).
- 48.** The maximum yield q/ha (695.53q/ha) was observed in treatment  $S_2$  (45×45cm), followed by  $S_1$  (45×30cm). While, the minimum yield q/ha (408.24q/ha) was noticed in  $S_4$  (60×60cm).
- 49.** The maximum total soluble solids (7.155<sup>0</sup>Bri×) was observed in treatment  $S_4$  (60×60cm), followed by  $S_2$  (45×45cm). While, the minimum total soluble solids (6.6176<sup>0</sup>Bri×) were noticed in  $S_1$  (45×30cm).
- 50.** The maximum total sugar (4.371%) was observed in treatment  $S_2$  (45×45cm), followed by  $S_3$  (60×45cm). While, the minimum total sugar (3.50%) was noticed in  $S_1$  (45×30cm).

- 51.** The maximum reducing sugar (3.10%) was observed in treatment S<sub>4</sub> (45×45cm), followed by S<sub>3</sub> (60×45cm). While, the minimum reducing sugar (2.58%) was noticed in S<sub>4</sub> (60×60cm).
- 52.** The maximum on-reducing sugar (1.26%) was observed in treatment S<sub>2</sub> (45×45cm), followed by S<sub>3</sub> (60×45cm). While, the minimum non-reducing sugar (0.90%) was noticed in S<sub>1</sub> (45×30cm).
- 53.** The maximum gross returns (556424Rs/ha) were obtained under the treatment S<sub>2</sub> (45×45cm), followed by S<sub>1</sub> (45×30cm). While, the minimum gross returns (326588Rs/ha) were observed under the treatment S<sub>4</sub> (60×60cm).
- 54.** The maximum net returns (384109.50Rs/ha) was obtained under the treatment S<sub>2</sub> (45×45cm), followed by S<sub>1</sub> (45×30cm). While, the minimum net returns (154273.50Rs/ha) was observed under the treatment S<sub>4</sub> (60×60cm).
- 55.** The maximum B:C ratio (3.23) was noted in treatment S<sub>2</sub> (45×45cm), followed by S<sub>1</sub> (45×30cm). While, the minimum B:C ratio (1.89) was obtained under the treatment S<sub>4</sub> (60×60cm).

## CONCLUSION

---

On the basis of results obtained in present investigation, it can be concluded that the effect of varieties and spacing on growth, yield and quality of cabbage was significantly. The variety Golden Acre with spacing of 60×60cm proved to be most effective in increasing the growth characters like, plant height, stem diameter, number of leaves per plant, plant spreading (North-South and East West), width of leaf and length of leaf etc. While, the maximum yield and net returns were obtained in Golden Acre with spacing 45×45cm. In quality traits like, total soluble solids, total sugar, reducing sugar and non-reducing were found in Cabbage Pusa Hybrid -82 with spacing 45×45cm. Hence, Golden Acre with spacing 45×45cm may be recommended for successful cultivation under Lucknow condition of Uttar Pradesh. Further studied are needed to selection of variety and plant spacing for the highest yield of cabbage.