

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

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ABSTRACT

The field experiment was conducted at Horticulture Research Farm-I, Babasaheb Bhimrao Ambedkar University, Lucknow (U.P.) during rabi season of 2020-21 and 2021-22 to study the effect of varieties and spacing on growth and yield of cabbage (*Brassica oleracea* var. *Capitata* L.). Four varieties and four spacings with three replications were evaluated in Factorial Randomized Block Design. The results revealed that the maximum plant height (36.75 cm), number of leaves (19.91), leaf length (33.09 cm), leaf width (27.21 cm), plant spread N-S (49.42 cm), plant spread E-W (49.12 cm) and stem diameter (8.15 cm) were noted in variety Golden Acre. The minimum values (51.67) of head initiation, maximum weight of head (1.430 kg) and yield (595.67 q ha⁻¹) is observed in Golden Acre. The maximum plant height (37.63 cm), number of leaves (20.26), leaf length (33.05cm), leaf width (26.93 cm), plant spread N-S (50.43 cm) plant spread E-W (50.12 cm) and stem diameter (8.33 cm) was observed in 60 cm x 60 cm. While the maximum weight of head (1.560 kg) and the maximum yield (695.53 q ha⁻¹) were recorded in 45 cm x 45 cm spacing.

Key words: Cabbage, Varieties, Spacing, Growth and yield

Introduction

Cabbage (*Brassica oleracea* var. *capitata* L.) under the family Brassicaceae (Cruciferae) having chromosome number $2n=2x=18$ is one of the most popular vegetable in the world. The characteristic bulging heads of cabbage, generated by the thickening of edible buds and closely overlapping, closely-packed leaves, give the vegetable its name. These vegetables, which include cabbage, kale, Brussels sprouts, cauliflower, broccoli and kohlrabi are referred to as cole crops and are multipurpose crops that can withstand harsh treatment. The wild cabbage, which served as the ancestor of all of these

crops, was indigenous to the Mediterranean region, from which a wide variety of cultivars such as *B. oleracea* var. *botrytis* and var. *Capitata* (Singh and Sharma, 2001 Kochhar, 2010) have developed. Crop spacing can change depending on the climate, soil fertility and cultivar compatibility for a particular area. When the spacing was wider, the plant was much more robust in terms of leaf size, which may be because there was less demand for light, nutrients, and water than when the spacing was narrower (Bairwa *et al.*, 2017). Cabbage is widely grown in India and other nations. It arrived in India from Portugal in the 15th century (Singh *et al.*, 2004). High population densities, which are frequently employed for

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a range of crops are necessary for the development of vegetable crops. Increased soil protection, improved weed control, improved fertilizer efficiency and higher yields can all be achieved with closer spacing (Neto *et al.*, 2016). A reduction in variability in cabbage plant growth, development and ultimately head size can be achieved by using uniform plant stands, plant spacings and production and management techniques (Rahman, 2007; Prasad *et al.*, 2010 and Moniruzzaman, 2011). **Materials and Methods**

The experiments were conducted during winter season of 2020-21 and 2021-22 at Horticulture Research Farm-I, Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Lucknow (U.P.), India. The experimental site is situated at 80° 92' East longitude and 26° 76' North latitude and 123 meter above MSL (Mean Sea Level). The climate of Lucknow is characterized by subtropical with hot, dry summer and cool winters. The soil of experimental field is sandy loam and slightly alkaline in nature with soil pH 8.2, 85.46 kg ha⁻¹ available nitrogen, 16.62 kg ha⁻¹ and 142.07 kg ha⁻¹ available potash. In a Factorial Randomized Block Design with three replications, four varieties: V₁ (Pusa Mukta), V₂ (Golden Acre), V₃ (Pusa Cabbage Hybrid-1) and V₄ (Pusa Cabbage Hybrid-82) with four spacings: S₁ (45 x 30 cm), S₂ (45 x 45 cm), S₃ (60 x 45 cm) and S₄ (60 x 60 cm) respectively. The application of recommended dose of fertilizer (180: 120: 100 kg/ha NPK) through Urea, diammonium phosphate and muriate of potash. To raise the crop, appropriate management practices have been used. Randomly five plants were selected in each plot and data was recorded on the following growth and yield parameters viz.- plant height, number of leaves per plant, leaf length, leaf width, plant spread, weight of head, diameter of head, volume of head and yield/plot, yield/ha, (Anonymous, 1995). The observations on growth and yield parameters were statistically analysis of the data obtained in different set of experiments was calculated following the standard procedure as stated by (Panse and Sukhatme, 1985). The data were analysed and are presented at the 5% level of significance.

Results and Discussion

Growth Parameters

Effect of varieties on growth parameters

The data on pooled mean basis (Table 1 and Fig. 1)

revealed that the tallest plant (36.75 cm) was recorded in Golden Acre followed by Pusa Cabbage Hybrid-1 (35.85 cm) while, the shortest plant (32.14 cm) was found in Pusa Mukta. The variation observed in different varieties may be due to genetic nature of the cultivars. The maximum number of leaves per plant (19.91) was noticed in Golden Acre followed by Pusa Cabbage Hybrid-1 (19.43) and minimum leaves (17.39) in Pusa Mukta. The variation in number of leaves per plant might be due to prevailing climatic conditions and genetic makeup of different cultivars (Yadav *et al.*, 2013). The maximum plant spread N-S (49.42 cm), plant spread E-W (49.12 cm), length of leaf (33.09 cm) and width of leaf (27.21 cm) were noticed in Golden Acre whereas, the minimum values of plant spread N-S (43.07 cm) plant spread E-W (42.80 cm) leaf length (30.55 cm) and width of leaf (25.93 cm) were observed in Pusa Mukta. The stem diameter was found maximum in Golden Acre (8.15 cm) followed by Pusa Cabbage Hybrid-1 (7.92 cm) whereas, the minimum value was observed in Pusa Mukta (7.12 cm).

Effect of spacing on growth parameters

The Pooled data (Table 2 and Fig. 2) revealed that the maximum plant height (37.63 cm) was recorded in 60 cm x 60 cm which is followed by 60 cm x 45 cm and minimum plant height (30.34 cm) was observed in 45 cm x 30 cm. The similar trend of results were also observed by Sarker *et al.* (2002), and highest number of leaves per plant (20.26) were recorded in spacing 60 cm x 60 cm followed by 60 cm x 45 cm (18.90). However, the minimum number of leaves (16.45) were observed in 45 cm x 30 cm. The variation may be due to more sunlight and nutrients with wider spacing. The maximum plant spread N-S (50.43 cm), plant spread E-W (50.12) was recorded in 60 cm x 60 cm which is followed by 60 cm x 45 cm (46.80 cm and 46.55 cm respectively), length of leaf (33.05 cm) and width of leaf (26.93 cm) were obtained in spacing 60 cm x 60 cm while, minimum values for leaf length (31.17 cm) and leaf width (26.41 cm) were recorded in 45 cm x 30 cm spacing. Plants with wider spacing received more sunlight and nutrients due to fewer plants that might enhance vegetative growth of plant (Moniruzzaman, 2011). The stem diameter was found maximum in 60 cm x 60 cm (8.33 cm) followed by 60 cm x 45 cm (7.72 cm) whereas, the minimum value was observed in 45 cm x 30 cm (6.69).

Table 1. Effect of varieties on growth and yield of cabbage

Varities	Plant height (cm)	No. of leaves	Plant spread (N-S) (cm)	Plant spread (E-W) (cm)	Leaf length (cm)	Leaf width (cm)	Stem diameter (cm)	Head initiation	Day to head harvest	Weight of whole plant (kg)	Weight of trimmed head (g)	Polar length (cm)	Equatorial length (cm)	Yield (kg/plot)	Yield (q/ha)
Pusa Mukta	32.14	17.39	43.07	42.80	30.55	25.93	7.12	51.84	73.52	3.16	1.147	13.93	13.04	16.31	507.48
Golden Acre	36.75	19.91	49.42	49.12	33.09	27.21	8.15	51.67	72.97	3.71	1.480	15.38	14.72	18.98	595.67
Pusa Cabbage H-1	35.85	19.43	48.10	47.75	31.85	26.82	7.92	53.06	76.13	3.26	1.238	14.56	13.81	18.02	569.25
Pusa Cabbage H-82	33.33	17.72	43.94	43.70	31.34	26.53	7.23	52.04	78.54	3.61	1.310	15.04	13.86	16.83	564.23
SE (m)	0.36	0.23	0.54	0.48	0.22	0.08	0.042	0.70	0.18	0.050	0.025	0.14	0.14	0.22	6.98
CD (%)	1.03	0.66	1.53	1.38	0.62	0.24	0.118	N.S.	0.51	0.143	0.071	0.41	0.41	0.63	19.74

Table 2. Effect of spacing on growth and yield of cabbage

Spacings	Plant height (cm)	No. of leaves	Plant spread (N-S) (cm ²)	Plant spread (E-W) (cm ²)	Leaf length (cm)	Leaf width (cm)	Stem diameter (cm)	Head initiation	Day to head harvest	Weight of whole plant (kg)	Weight of trimmed head (g)	Polar length (cm)	Equatorial length (cm)	Yield (kg/plot)	Yield (q/ha)
45x30	30.34	16.45	40.58	40.26	31.17	26.41	6.69	51.97	75.01	2.38	0.799	12.48	11.46	18.46	590.48
45x45	34.82	18.83	46.73	46.45	31.18	26.55	7.68	51.93	74.74	3.95	1.560	15.84	15.11	21.43	695.53
60x45	35.40	18.90	46.80	46.55	31.44	26.60	7.72	52.53	75.49	3.80	1.415	15.36	14.48	16.20	542.39
60x60	37.63	20.26	50.43	50.12	33.05	26.93	8.33	52.18	75.91	3.61	1.402	15.24	14.39	14.04	408.24
SE (m)	0.36	0.23	0.54	0.48	0.22	0.08	0.042	0.70	0.18	0.050	0.025	0.14	0.14	0.22	6.98
CD (%)	1.03	0.66	1.53	1.38	0.62	0.24	0.118	N.S.	0.51	0.143	0.085	0.41	0.41	0.63	19.74

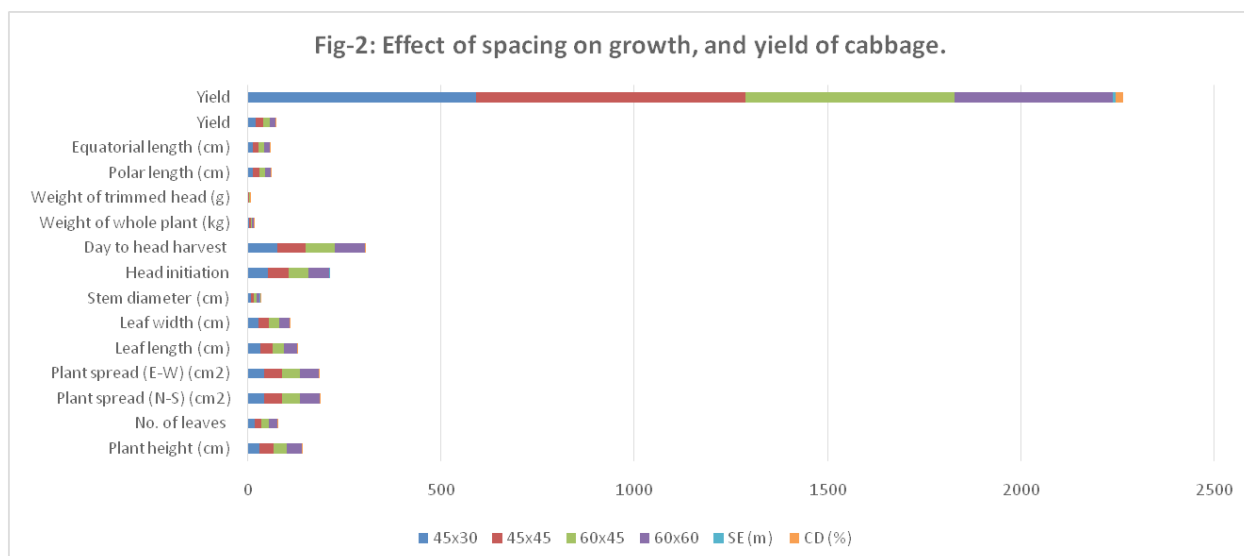
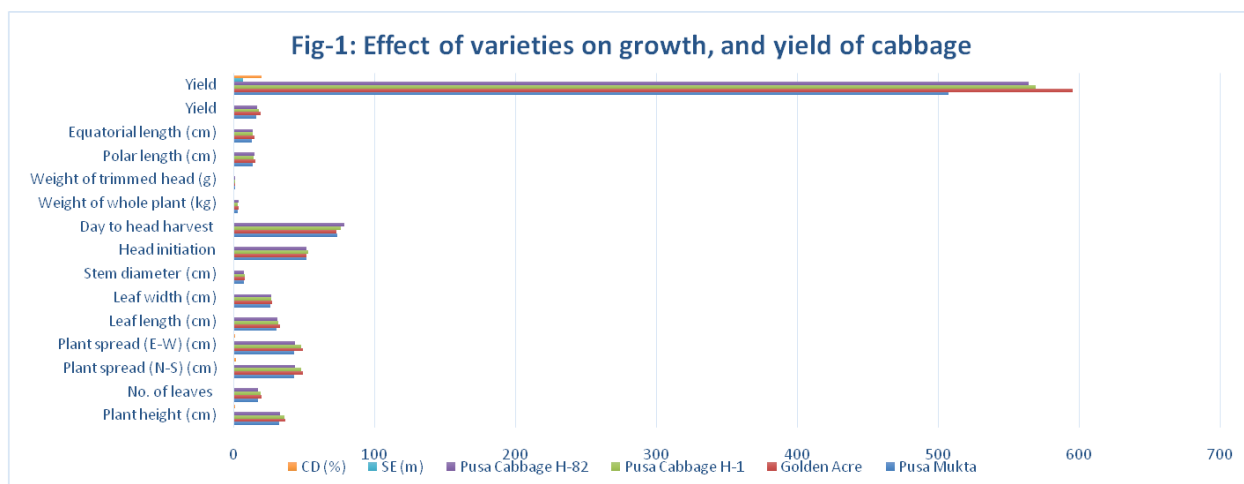
Yield Parameters

Effect of varieties on yield attributes

The effect of varieties on head initiation found non-significant. However, the data on pooled mean basis (Table 1) revealed that the minimum head initiation days taken (51.67) was found in Golden Acre. While the maximum head initiation days (53.06) was recorded in Pusa Cabbage Hybrid -1 followed by Pusa Cabbage Hybrid-82 (52.04). The maximum days to head harvest (78.54) was noticed in Pusa Cabbage Hybrid-82 followed by Pusa Cabbage Hybrid-1 (76.13) and minimum days to head harvest (72.97) in Golden Acre. The maximum weight of whole plant (3.71 kg) was noticed in Golden Acre whereas, the minimum values (3.16) was observed in Pusa Mukta. Maximum weight of head (1.480 kg) was found in Golden Acre followed by Pusa Cabbage Hybrid-82 (1.310 kg) whereas, the minimum value (1.147 kg) was observed in Pusa Mukta. The maximum polar length (15.38 cm) was found in Golden Acre followed by Pusa Cabbage Hybrid-82 (15.04 cm) and minimum value (13.93 cm) was observed in Pusa Mukta. The maximum equatorial length (14.72 cm) was found in Golden Acre followed by Pusa Cabbage Hybrid-82 (13.86 cm) and minimum value (13.04 cm) was observed in Pusa Mukta. The significant and maximum yield per plot (18.98 kg) was observed in Golden Acre followed by (18.02 kg) Pusa Cabbage Hybrid -1 and minimum (16.31 kg) was noticed in Pusa Mukta. The maximum yield per hectare (595.67q/ha) was observed in Golden Acre followed by (569.25 q/ha) Pusa Cabbage Hybrid-1 and minimum (507.48 q/ha) was noticed in Pusa Mukta. Similar finding were reported by Iqbal *et al.* (2010) in knolkhol crop.

Effect of spacing on yield attributes

The effect of spacing also on head initiation found non-significant. However, the data on pooled mean basis (Table 3) revealed that the head initiation days



(52.53) was recorded in 60 cm x 45 cm followed by 60 cm x 60 cm (52.18) while, the minimum head initiation days taken (51.73) was found in 45 cm x 45 cm. The maximum days to head harvest (75.91) was noticed in 60 cm x 60 cm followed by 60 cm x 45 cm (75.49) and minimum days to head harvest (74.74) in 45 cm x 45 cm. The maximum weight of whole plant (3.95 kg) was noticed in 45 cm x 45 cm whereas, the minimum values (2.38 kg) was observed in 45 cm x 30 cm. Maximum weight of head (1.560 kg) was found in 45 cm x 45 cm followed by 60 cm x 45 cm (1.415 kg) whereas, the minimum value (0.799 kg) was observed in 45 cm x 30 cm. The maximum polar length (15.84 cm) was found in 45 cm x 45 cm followed by 60 cm x 45 cm (15.36 cm) and minimum value (12.48 cm) was observed in 45 cm x 30 cm. The maximum equatorial length (15.11 cm) was found in

45 cm x 45 cm followed by 60 cm x 45 cm (14.48 cm) and minimum value (11.46 cm) was observed in 45 cm x 30 cm. The significant and maximum yield per plot (21.43 kg) was observed in 45 cm x 45 cm followed by 45 cm x 30 cm (18.46 kg) and minimum (14.04 kg) was noticed in 60 cm x 60 cm. The maximum yield per hectare (695.53 q/ha) was observed in 45 cm x 45 cm followed by 45 cm x 30 cm (590.48 q/ha) and minimum (408.24 q/ha) was noticed in 60 cm x 60 cm. These findings are supported by those of Kumar and Rawat (2002) and (Firoj Asadul Haque *et al.* 2015) in cabbage. These results are in close conformity with the findings of Thirupal *et al.* (2014) in broccoli.

It may be concluded from the results that the varieties and spacing showed significant variation among the different parameters. Generally, the

wider plant spacing (60×60cm) better is the growth performance of the cabbage. While, the variety Golden Acre and spacing 45×45 cm affected that yield attributes of cabbage.

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