



## RESEARCH ARTICLE

### EFFECTS OF DIFFERENT PLANTING DATES ON GROWTH AND YIELD OF CAULIFLOWER (*BRASSICA OLERACEA L. VAR. BOTRYTIS*) UNDER PUNJAB CONDITIONS

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#### ABSTRACT

Results of the field experiment entitled “Impact of Cauliflower (*Brassica oleracea* var. *botrytis*) varieties for growth and yield characters by different sowing dates” conducted at the Guru Kashi University Research Farm during the rabi season of the year 2022. The objective was to evaluate the effect of two planting dates (8<sup>th</sup> September and 23<sup>rd</sup> October) on growth and yield attributes of ten varieties Kanchan, Noval, Golden 1100, Pusa snowball, Syngenta lucky, PSC666, Syngenta jasska, Shubhra, Joti-2 and Selection-1. The field experiment was laid out in randomized complete block design (RCBD) with three replications. Significantly maximum breadth of leaf 24.23 cm with sowing date 8<sup>th</sup> September and leaf breadth 22.67 cm with sowing date 23<sup>rd</sup> October in Syngenta lucky. Polar diameter was 16.57 cm (8<sup>th</sup> September) and was 17.34 cm (23<sup>rd</sup> October) maximum in Golden 1100. Maximum plant height (28.69 cm) and number of leaves (24.45) was recorded from Selection-1 variety; the highest leaf length (42.17 cm), equatorial diameter (27.15) and minimum days to harvest (91.16days) in Joti-2 variety; maximum weight without folded leaves (825.09gm), maximum curd yield/plot 36.53 kg and maximum total yield 610.21 (q/ha) was recorded in Syngenta Jasska when crop was sown date 8<sup>th</sup> September. The maximum plant height was 28.57 cm, maximum equatorial diameter 25.37 cm, maximum 40.35 cm leaf length and minimum days to harvest 90.16 was recorded in Joti-2 variety; the number of leaves significantly maximum shown by Pusa snowball (22.34), significantly maximum fresh weight of curd 821.45gm, maximum curd yield/plot 35.67kg and maximum total yield 608.34 (q/ha) was recorded in Syngenta Jasska when crop was sown on 23<sup>rd</sup> October. The combined effect of sowing dates and varieties showed that sowing on 8<sup>th</sup> September Joti-2 variety performed well in growth contributing characters and Syngenta Jasska was found to be the best in yield parameters from all other varieties.

## INTRODUCTION

Cauliflower (*Brassica oleracea L. var. botrytis*) a member of Brassicaceae, is one of the most important vegetables in the world. The present tropical Indian cauliflower developed as a result of intercrossing between European and Cornish types. Another development also took place in India, resulting in tropical types resistant to high temperature and high rainfall. The development of Indian cauliflower types made it possible to extend its growing area in the tropics and subtropics of the world. It has high quality of proteins and peculiar in stability of vitamin C after cooking. It is rich in minerals such as potassium, sodium, iron, phosphorus, calcium, magnesium, etc. It also contains vitamin A. The genetic constitution of the plants determines their yielding ability but the extent to which the potential actually depends is suitable environment in which they grow.

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The date of sowing is governed mainly by temperature, sunlight intensity, duration an drain fall. These are the crucial factors that can decide establishment, growth and performance of crop through changing morphological system, physiological functioning and time available for the crop to complete its life cycle. Cauliflower is highly sensitive to climatic factors that play an important role in the initiation and growth of the curds. Fuzzy, riceyness and loosed curds could be produced due to higher temperatures above 20°C in the late winter season (Fujime, 1983; Swiader *et al.*, 1992). Initiation of curds in cauliflower also depends on the genetic characteristics of the varieties (Saini, 1996). Early varieties of the cauliflower require higher temperature (20-25°C) for curd initiation while late varieties require low temperature (10-16°C) (Bose and Som, 1993; Chatterjee, 1993). The optimum temperature for cauliflower withstands is 10<sup>0</sup> to 15<sup>0</sup>C (Din *et al* 2007). The present study was undertaken to evaluate the effect of different sowing dates on the growth and yield characteristics of cauliflower.

## MATERIALS AND METHODS

The experiment was carried out at Guru Kashi University Research Farm during the year 2022. The experiment comprised of two main parameters, namely the sowing dates and the cultivars. Two different dates of sowing were selected i.e. 8<sup>th</sup> September 2022 (S-1) and 23<sup>rd</sup> October 2022 (S-2) and ten cultivars were selected for the evaluation. The experiment consisted of 20 treatment combinations, and was laid out in randomized complete block design (RCBD) with three replications. The whole experimental area was divided into three equal blocks. A distance of 45 cm is maintained between the ridges and 45 cm between the plants within the each plot. The blocks were kept to facilitate different intercultural operations. The crop was raised by following the package of practice recommended by PAU, Ludhiana. 40 tonnes of farmyard manure, with 50 kg of N (110 kg of Urea), 25 kg of P<sub>2</sub>O<sub>5</sub> (155 kg of Single Superphosphate) and 25 kg of K<sub>2</sub>O (40 kg of Muriate of Potash) per acre was applied to all these varieties. Whole farmyard manure, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O and half N was applied before transplanting and the remaining half of N as top-dressing four weeks after transplanting. The following observations were recorded during the course of investigation namely plant height (cm), number of leaves per plant, leaf length (cm), breadth of leaf (cm), equatorial diameter (cm), polar diameter (cm), number of days taken to harvest, fresh weight of curd (g), curd yield/plot (Kg), yield (q/ha). In addition to this, composite soil sample was taken from 0-15 cm depth from three spots of experimental field before planting crop. The sample collected from field was first air dried in the shade and then sieved through 2.0 mm sieve and analyzed for the determination of available nitrogen, phosphorus, potassium, electrical conductivity (EC), organic carbon (OC) and pH of the soil. All data from the experimental field were analysed separately for each experiment for different growth characters and yield attributes with the help of OPSTAT (Statistical Software Package for Agricultural Research Workers) (Sheoran *et al.* 1998). The critical difference at 5% level of implication was calculated to equate the mean different treatments.

## RESULTS AND DISCUSSION

The results obtained from the study are shown in given tables. Table 1 describes the results of chemical soil analysis done at sowing. It was observed that the soil was sandy loam and had normal range of pH whereas availability of Potassium (kg/ha) was medium. All the other tested parameters namely EC (dSm<sup>-1</sup>), organic carbon (%), availability of Nitrogen (kg/ha) and availability of Phosphorus (kg/ha) were in the lower range. It can be observed from Table 2 that plant height was significantly affected by varieties and sowing time and maximum plant height (28.69 cm) was recorded in Selection-1 variety sown in S-1 which was at par with Joti-2 variety with plant height of 28.10cm. While, minimum plant height (12.09 cm) was observed in Kanchan variety. The results of Joti-2 showed the maximum plant height (28.57 cm) and at par with Syngenta Jasska variety with plant height 27.57cm when crop was sown during S-2 and minimum plant height of 13.90 cm was shown by variety Kanchan. The number of leaves under S-1 conditions was recorded the highest in 24.45 under Selection-1 variety which was at par with Pusa snowball (24.33) and the lowest value was recorded in Joti-2 (19.48). Furthermore, under S-2 conditions, the number of leaves was maximum in Pusa snowball (22.34) and lowest number of

leaves was noted in Joti-2 i.e. 17.78. The findings indicated that a warmer temperature encourages more vegetative growth which may be the reason for more leaves in early planting (8<sup>th</sup> September) which can be seen in Table 2. Table 3 depicts that the highest leaf length (42.17 cm) was observed in Joti-2 variety under S-1 conditions whereas lowest leaf length was noted in Kanchan (30.38 cm) genotype. The crop sown during S-2 showed that Joti-2 shows significantly maximum (40.35 cm) leaf length and followed by Syngenta Jasska (39.29) genotype. Lowest leaf length i.e. 29.56 cm was noted in Kanchan variety. Kumar *et al* (2002) also recorded that the vegetative characters such as stalk length and leaf number of cauliflower significantly differ with the changes in planting dates. It can also be observed from Table 3 that the breadth of leaf increased significantly due to different planting dates. The maximum breadth of leaf (24.23 cm) was recorded in Syngenta lucky and it was lowest leaf breadth i.e. 17.53 cm was recorded in Joti-2 under S-1 sowing whereas the crop which was sown under S-2 conditions showed maximum leaf breadth to be 22.67 cm which was recorded in Syngenta lucky and followed by Syngenta Jasska with 19.58 cm leaf breadth. Lowest leaf breadth of 14.26 cm was noted in Selection-1 variety.

Data in Table 4 revealed that equatorial diameter increased significantly due to different planting dates. Significantly maximum equatorial diameter of 27.15 cm was recorded in Joti-2 variety and it was followed by Shubhra with 25.63 cm equatorial diameter. Lowest equatorial diameter of 21.65 cm was recorded in Kanchan variety in S-1 conditions. In S-2, the maximum equatorial diameter of 25.37 cm was recorded in Joti-2. The smallest equatorial diameter of 19.78 cm was noted in Kanchan. They recorded wide variation among vegetative growth of the different genotypes of cauliflower (Zaki *et al* 2012; Meena 2017). Polar diameter were markedly enhanced by sowing seeds on early date (8<sup>th</sup> September) in comparison with the early sowing crop (23<sup>th</sup> September). In the early sowing date (S-1) polar diameter was 16.57 cm in Golden 1100 whereas smallest polar diameter was noted in Kanchan (13.4 cm). In the late sowing date (S-2), polar diameter was 17.34 cm in Golden 1100 variety and smallest polar diameter i.e. 11.13 cm was noted in Kanchan. A serious deduction in head diameter was noted with later sowing date. Jaiswal *et al* (1996) reported that greatest curd and curd weight (16 cm diameter and 832 g) were found in early sown plants. The days taken to harvest of cauliflower as affected by different varieties and sowing dates were recorded in all the plots and the data are given in Table 5.

The analysis of variance suggested significant impact of sowing dates on varieties on the number of days taken to harvest of cauliflower heads. The cauliflower took minimum days to harvest (91.16 days) when crop sowing was done in S-1 in Joti-2 and followed by Selection-1 with 93.24 days to harvest. However, the maximum days to harvest (101.12 days) were recorded in Kanchan under the same sowing date. Significantly minimum days to harvest 90.16 were recorded in Joti-2 and it was at par by 92.13 days to harvest by Selection-1 under S-2 conditions whereas the maximum days to harvest i.e. 100.23 were recorded in Kanchan variety. Fresh weight of cauliflower head without folded leaves as affected by different sowing dates was weighed and the results are shown in Table 5. The analysis of variance depicted significant ( $P < 0.05$ ) effect of varying sowing dates on the weight of cauliflower head without folded leaves.

**Table 1. Chemical analyses of soil of the experimental field at sowing**

Soil properties	Soil depth (0-15 cm)	Rating	Method used for estimation
pH	7.10	Normal	1:2, soil : water suspension with Beckman's glass electrode pH meter (Jackson 1973)
EC (dSm <sup>-1</sup> )	0.21	Low	1:2, soil : water suspension with Solubridge conductivity meter (Jackson 1973)
Organic carbon (%)	0.30	Low	Walkley and Black's rapid titration method (Piper 1966)
Available N (kg ha <sup>-1</sup> )	114.25	Low	Alkaline potassium permanganate method (Subbiah and Asija 1956)
Available P (kg ha <sup>-1</sup> )	8.17	Low	0.5N Sodium bicarbonate extractable P (Olsen <i>et al</i> 1954)
Available K (kg ha <sup>-1</sup> )	102.56	Medium	Sodium bicarbonate extractable K (Olsen <i>et al</i> 1954)
Textural class	Sandy Loam		International Pipette method (Piper 1966)

**Table 2. Impact of Cauliflower (*Brassica oleracea* var. *botrytis*) varieties for Plant height (cm) and number of leaves by different sowing dates**

Parameters	Plant height (cm)		Number of leaves	
	S-1	S-2	S-1	S-2
Varieties				
Kanchan	12.09	13.90	22.15	20.12
Noval	14.09	15.12	21.48	19.34
Golden 1100	17.09	18.05	20.29	18.12
Pusa Snowball	19.1	20.01	24.33	22.34
Syngenta Lucky	21.08	22.07	22.48	20.35
PSC666	22.16	23.12	23.22	21.23
Syngenta Jasska	26.16	27.59	21.29	18.23
Shubhra	24.09	24.67	20.41	18.26
Jyoti-2	28.1	28.57	19.48	17.78
Selection-1	28.69	27.15	24.45	21.89
CD at 5%	1.16	1.05	0.22	0.19

**Table 3 Impact of Cauliflower (*Brassica oleracea* var. *botrytis*) varieties for length of leaf (cm) and breadth of leaf (cm) by different sowing dates**

Parameters	Length of leaf (cm)		Breadth of leaf (cm)	
	S-1	S-2	S-1	S-2
Varieties				
Kanchan	30.38	29.56	18.65	17.34
Noval	33.15	31.45	17.93	16.34
Golden 1100	38.83	36.57	17.85	16.25
Pusa Snowball	36.10	34.35	19.46	18.56
Syngenta Lucky	38.43	35.37	24.23	22.67
PSC666	40.15	38.49	19.82	17.23
Syngenta Jasska	41.34	39.29	21.09	19.58
Shubhra	39.63	37.59	17.83	16.26
Jyoti-2	42.17	40.35	17.53	16.58
Selection-1	33.66	30.66	15.82	14.26
CD at 5%	0.13	0.15	0.06	0.06

**Table 4. Impact of Cauliflower (*Brassica oleracea* var. *botrytis*) varieties for equatorial diameter (cm) and polar diameter (cm) by different sowing dates**

Parameters	Equatorial diameter (cm)		Polar diameter (cm)	
	S-1	S-2	S-1	S-2
Varieties				
Kanchan	21.65	19.78	13.4	11.13
Noval	24.39	23.17	14.27	17.17
Golden 1100	23.63	21.47	16.57	17.34
Pusa Snowball	23.25	21.36	15.57	14.37
Syngenta Lucky	20.71	19.74	16.26	15.46
PSC666	25.84	23.67	14.22	14.26
Syngenta Jasska	22.49	20.37	15.36	15.13
Shubhra	25.63	23.27	14.81	14.25
Jyoti-2	27.15	25.37	14.47	14.12
Selection-1	24.56	23.43	14.72	14.45
CD at 5%	0.09	0.08	0.26	0.24

**Table 5. Impact of Cauliflower (*Brassica oleracea* var. *botrytis*) varieties for Mean Days to Harvest (Days) and Fresh wt of curd (g) by different sowing dates**

Parameters	Mean days to harvest		Fresh wt. of curd (g)	
	S-1	S-2	S-1	S-2
Varieties				
Kanchan	101.12	100.23	635.37	636.35
Noval	98.12	97.34	660.09	660.12
Golden 1100	96.14	95.13	701.09	701.12
Pusa Snowball	96.70	94.34	730.10	731.13
Syngenta Lucky	94.94	93.45	760.12	761.23
PSC666	94.24	93.12	780.13	782.25
Syngenta Jasska	94.31	92.13	825.09	821.45
Shubhra	94.12	94.25	800.16	803.23
Jyoti-2	91.16	90.16	810.38	816.34
Selection-1	93.24	93.12	812.28	814.45
CD at 5%	0.45	2.14	4.70	5.15

The cauliflower plants produced head with maximum weight without folded leaves (825.09 g) in Syngenta Jasska in S-1 condition closely followed by 812 g weight of head without folded leaves, recorded in Joti-2. However, the weight of head without folded leaves in cauliflower was lowest in Kanchan 635.37 g in S-1. Significantly maximum fresh weight of curd 821.45 g was recorded in Syngenta Jasska in S-2 and it was at par by Joti-2 with 816.34 g fresh weight of curd. Lowest fresh weight of curd 636.35 g was recorded in Kanchan. Fresh weight of curd were markedly enhanced by sowing seeds on mid-season date (8<sup>th</sup> September) in comparison with the late sowing crop (23<sup>th</sup> October). The perusal of data indicated in Table 6 shows that all the varieties increased the curd yield/plot (Kg). Significantly maximum curd yield/plot 36.53 kg was recorded in Syngenta Jasska in S-1 and lowest curd yield/plot 27.087 kg recorded in Kanchan. Significantly maximum curd yield/plot 35.67 kg was recorded in Syngenta Jasska and it was at par Joti-2 with 34.95 kg curd yield/plot whereas the lowest curd yield/plot 28.95 kg was recorded in Kanchan under S-2 conditions. Data presented in Table 6 also depicts that all the treatments increased the total yield (q/ha). Significantly maximum total yield 610.21 q/ha was recorded in Syngenta Jasska in S-1 followed by Joti-2 with yield 599.10 q/ha. Lowest total yield of 469.17 q/ha was recorded in Kanchan. Under S-2 conditions, significantly maximum total yield 608.34 q/ha was recorded in Syngenta Jasska and it was followed by Joti-2 with total yield 600.25 q/ha and the lowest total yield (470.23q/ha) was recorded in Kanchan.

## CONCLUSION

Overall, it could be concluded that the combined effect of sowing dates and varieties showed that sowing on September 8th, all varieties performed well in respect of contributing characters and yield. Selection-1, Joti-2 and Syngenta Jasska were found to be the best from all other varieties.

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