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## Evaluation of early cauliflower (*Brassica oleracea* var. *botrytis* L.) elite material for maturity, yield and quality characters

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### Abstract

The present investigation titled was carried out at University college of Agriculture, Vegetable research farm, Guru Kashi University, Talwandi Sabo (Bathinda) during winter season 2023-2024 to evaluate cauliflower varieties. The experiment was laid out in RBD with three replications. Total 13 genotypes were evaluated for horticultural traits including one check genotype (Pusa Katki). The analysis of variance showed significant variation among different genotypes for all the traits under study. The main objective of this study was to evaluate early-season cauliflower genotypes with desirable curd quality and yield. The result showed that maximum yield was found in Selection 11 and minimum in Selection 1 while Selection 2 took minimum days to curd initiation and days to first harvest so this selection is early maturing. The curd quality of Selection 2 was also good. Genetic analysis indicate that Phenotypic Coefficient of Variation (PCV) were higher than those of Genotypic Coefficient of Variation (GCV). Phenotypic coefficient of variation was highest in Self blanching leaves whereas genotypic coefficient of variation, Heritability and genetic gain were maximum recorded in height of plant.

**Keywords:** Cauliflower, genetic variability, genetic gain, heritability, coefficient

### Introduction

A highly significant vegetable crop that is grown all over India is cauliflower (*Brassica oleracea* var. *botrytis* L.) ( $2n\ 2x\ 18$ ) (Singh *et al.*, 2005) <sup>[18]</sup>. High-suppressed pre-floral apical meristem, also called "curd," is the portion of the vegetable that can be eaten (Sidki, 1962) <sup>[11]</sup>. Higher yields, compactness, white colour, and medium-sized curds free of diseases or disorders are generally desired for a higher-quality cauliflower crop (Varalaxmi, 2009) <sup>[17]</sup>. According to Horne's 1954 assessment, cauliflower is thought to have originated in the Mediterranean region because it exhibits the highest recorded level of diversity.

Cauliflower is rich source of minerals and vitamins. It provides good quantity of vitamin C and folate. Cauliflower has moisture content approx. 90% protein 2.6 g, fat 0.4 g, thiamine 0.04 mg, riboflavin 0.10 mg per 100 g It has 53 mg sodium, 57 mg phosphorus 138 mg potassium, 33 mg Calcium, 18 mg Magnesium, 0.4 mg Zinc 1.23 Iron, 231 mg Sulphur 0.003 mg Chromium, 0.13 mg Copper per 100 g. Vitamins includes 30 mg Carotene, 0.04 mg Thiamine, 0.1 mg Riboflavin, 1 mg Niacin per 100 g. Total 4 carbohydrates are present in cauliflower (Dhaliwal 2017) <sup>[19]</sup>. Vegetables belonging to family Brassicaceae contains a substance indole-3-carbinol that helps to prevent various types of cancers. According to Indians council of medical research on an average 200-300 g of vegetable should be consumed per capita.

The distinctive inflorescence that the cauliflower plant forms is made up of thick, meaty, heavily ramified flower stalks that compact into a nearly spherical "curd." The cauliflower curd is characterized as a pre-floral, fleshy apical meristem, with elongated, highly branched lateral buds from the shoot meristem. The apices of these branches constitute the curd's structure, and over 90% of curds fail before flowering. Among the Cole crops, cauliflower is the only one where the curding stage is transitional, occurring between the vegetative and reproductive stages (Nieuwhof, 1969) <sup>[7]</sup>. Roughly 45% of the plant is what can be eaten, according to Rai and Yadav (2005) <sup>[9]</sup>.

The portion of the curd that is consumed by humans can grow to be more than twenty centimetres in diameter. When it comes to the development of curd, this crop requires a particular climate in contrast to other vegetables in the brassicaceous family. Extreme temperatures and droughts, for example, might cause cauliflower to react negatively and produce pre-mature curd, which can have a negative economic impact (Singh *et al.*, 2014) <sup>[13]</sup>.

Crop improvement mainly depends on the presence of large genetic variability in the germplasm and the subsequent introduction of an appropriate breeding method. If there is great variability, attempts can be made to improve the harvest through mere selection; otherwise, variability may need to be created through hybridization, mutation, or germplasm collection prior to selection. Germplasm collection and assessment of genetic variability are of great importance in any crop improvement program.

#### The objectives outlined for the cauliflower study in the south-western region of Punjab are as follows

1. To evaluate cauliflower hybrids for economic characters specific to the region.
2. To identify early-season cauliflower genotypes with desirable curd quality.
3. Estimate genetic variability and heritability for both quantitative and qualitative characters, contributing to a comprehensive characterization of cauliflower traits in the specified area.

#### Materials and Methods

The present research was conducted at the experimental site of Guru Kashi University Research Farm, Talwandi Sabo (Bathinda) during winter 2023-24. According to the Google map, the farm is located at 29°57'N latitude and 75°7'E longitude and at an altitude of 213 meters above sea level. The material used in the research work consisted of thirteen genotypes of cauliflower (*Brassica Oleracea var botrytis*) out of which one is commercially grown cultivar *viz.*, Pusa katki (Check). These are obtained from different sources for undertaking the study. The experiment was laid out in Randomized Block Design with three replications of each genotype. The seedlings were transplanted on 14 Aug. 2023. The plant to plant spacing was 45 cm and were recorded on three randomly selected plants per replication *viz.* Height of plant (cm), Length of leaves (cm), Breadth of leaves (cm), No of leaves per plant (No), Days to curd initiation, Days to first harvest (days), Polar diameter of curd (cm), Equatorial diameter of curd (cm), No of self-blanching leaves (no), Stalk length (cm), Days to first harvest (days), Curd weight (kg) and Yield per hectare (q). The analysis of variance was carried out as suggested by Panse and Sukhatme (1985) <sup>[20]</sup>. The data were analysed to estimate genotypic and phenotypic coefficient of variations (Burton and De – Vane, 1953) <sup>[21]</sup>, heritability in broad sense and genetic advance (Allard, 1960) <sup>[22]</sup>.

#### Results and Discussion

The analysis of variance revealed significant differences across all twelve characters, indicating substantial genetic variability for growth and yield attributes among the

cauliflower genotypes. Various statistical measures, such as range, coefficient of variation, genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), broad sense heritability, and genetic advance (GA), were used to quantify this variability. The mean performances of the traits in the thirteen cauliflower genotypes are detailed in Table 1, highlighting significant differences among all the genotypes for the studied characters.

A wide range of variations existing for various quantitative traits has also been reported in cauliflower by various workers (Thakur, 1998; Kumar *et al.*, 2002; Dubey *et al.*, 2003; Singh *et al.*, 2013; Chittora and Singh, 2015; Aditya *et al.*, 1989; Pandey and Naik, 1991; Sharma. *et al.*, 1988; Singh and Thakur, 1990; Mehara and Singh, 2013 <sup>[16, 2, 3, 13, 2, 1, 8, 14, 15, 6]</sup>.

The maximum plant height was observed in Selection 6 (58.00) cm. Length of leaf was maximum in Selection 4 (57.00) cm. Maximum Breadth of leaves was observed in Selection 1 (26.00) cm. Number of leaves per plant was maximum in Selection 6 (23.00). Maximum days to curd initiation was observed in Pusa katki (Check) (64.00). Polar diameter of curd was maximum in Selection 2 (20.00) cm. Maximum equatorial diameter of curd was observed in Selection 7 (24.33). Maximum Self blanching leaves were observed in Selection 9 (6.33). Stalk length was maximum in Selection 5 (8.21) cm. Maximum days to harvest were recorded in Selection 7 (76.33). Maximum curd weight was observed Selection 11 (1.08) kg and maximum curd yield per hectare was recorded in Selection 11 (543.3) q.

The components of variance, genetic advance value, heritability and coefficient of variation for twelve horticultural traits are represented in Table 2. For every character in the study, the phenotypic coefficient of variation (PCV) was substantially greater than the matching genotypic coefficient of variation (GCV), suggesting that the environment had a major impact on the expression of each character. High magnitude of PCV and GCV (>30%) were recorded in self blanching leaves and height of plants. Rest of the characters recorded moderate coefficient of variation except for Days to curd initiation and Days to first harvest.

The magnitude of heritability ranged from 32.59 – 90.48. Heritability estimates were high (50%) for height of plant. Moderate heritability (50-80%) were recorded in Length of leaves, No of leaves per plants, days to first harvest, Yield per plant and Yield per hectare. Low heritability (<50%) were recorded in Breadth of leaves, Days to curd initiation, Polar diameter of curd, Equatorial diameter of curd, self-blanching leaves and stalk length. These findings were in accordance with by Singh *et al.*, (2013) <sup>[13]</sup>, Chittora and Singh (2015) <sup>[2]</sup> in cauliflower.

The genetic gain (genetic advance expressed as percentage of population mean) was ranged from 7.33 to 45.56% (Table 2). Moderate values of genetic gain (25-50%) were recorded for Height of plant, Length of leaves, Breadth of leaves, No of leaves per plant, Polar diameter of curd, Yield per plant and Yield per hectare. Low range of genetic gain (<25%) was recorded for the characters like Days to curd initiation, Equatorial diameter of curd, Self-blanching leaves, Stalk length and Days to first harvest.

**Table 1:** Mean performance of thirteen genotypes for the characters under study in cauliflower.

	Height of plant (cm)	Length of leaves (cm)	Breadth of leaves (cm)	No of leaves per plant (no)	Days to curd Initiation (no)	Polar diameter of curd (cm)	Equatorial diameter of curd (cm)	Self-blanching leaves (cm)	Stalk length (cm)	Days to first harvest (no)	Yield per plant (kg)	Yield per hectare (q)
Selection -1	36.33	37.66	26.00	19.00	57.66	16.66	21.83	3.33	5.46	71.33	0.58	290
Selection -2	40.33	33.00	16.33	20.00	49.33	20.00	20.33	4.00	6.14	62.00	0.65	325
Selection -3	37.00	24.66	14.33	19.00	56.33	17.00	22.50	2.66	7.12	70.66	1.07	508.3
Selection -4	57.00	38.00	19.00	19.66	59.66	9.33	22.00	3.66	6.33	71.33	0.89	446.6
Selection -5	35.66	28.00	14.33	20.33	58.00	12.80	13.86	6.00	8.21	69.00	0.70	354.1
Selection -6	58.00	27.66	16.33	23.00	58.00	13.66	20.66	5.00	7.18	72.33	0.68	343.1
Selection -7	34.00	25.66	15.00	18.33	63.33	19.16	24.33	4.33	5.13	76.33	1.01	507.5
Selection -8	32.33	28.66	12.33	18.00	54.33	12.66	21.56	6.00	6.53	70.33	0.73	366.6
Selection -9	36.66	23.66	13.00	18.66	60.00	16.66	20.50	6.33	7.13	72.00	0.94	473.3
Selection -10	42.33	25.00	14.00	19.33	53.66	14.83	18.00	5.66	8.03	67.00	0.88	440
Selection -11	31.33	21.33	13.00	20.00	53.66	18.50	17.16	5.33	6.37	62.33	1.08	543.3
Selection -12	38.00	25.33	13.66	4.33	53.33	19.00	19.00	4.00	5.43	64.00	0.66	333.3
Pusa Kartiki (Check)	57.66	31.33	14.33	20.00	64.00	18.66	17.50	4.00	7.10	69.00	0.79	398.3
Overall mean	41.30	28.46	15.51	18.43	57.02	16.07	19.94	4.641	6.484	69.05	0.820	409.98
CD 5%	5.281	4.641	5.412	4.756	6.845	4.711	5.207	2.054	0.487	6.120	0.142	70.830

**Table 2:** Estimates of Phenotypic and genotypic coefficient of variation, heritability, genetic advance and genetic gain for different traits in cauliflower.

Characters	Heritability (%)	Genetic advance	Genetic gain (%)	Coefficient of variation	
				Phenotypic	Genotypic
Height of plant (cm)	90.48	18.82	45.56	24.44	23.25
Length of leaves (cm)	76.53	8.909	31.30	19.85	17.36
Breadth of leaves (cm)	48.58	4.457	28.72	28.70	20.00
No of leaves per plant (no)	68.18	6.986	37.89	26.97	22.27
Days to curd Initiation (no)	42.46	4.657	8.167	9.336	6.084
Polar diameter of curd (cm)	49.79	4.023	25.02	24.39	17.21
Equatorial diameter of curd (cm)	32.59	2.512	12.59	18.76	10.71
Self-blanching leaves (cm)	36.74	1.153	24.84	32.82	19.89
Stalk length (cm)	37.99	0.824	12.70	16.23	10.00
Days to first harvest (no)	50.51	5.340	7.733	7.432	5.282
Yield per plant (kg)	77.77	0.284	34.63	21.61	19.06
Yield per hectare (q)	77.77	142.0	34.63	21.61	19.06

## Conclusion

It is concluded from the present investigation that the genotypes Selection 11 have maximum value of plant yield (1.08) kg and height of plant (31.33) cm. So this selection is suitable for commercial use. Selection 2 took minimum days to curd initiation (49.33) and days to first harvest (62.00). This selection also have good quality curds so it can be used in cauliflower breeding programme and suitable for growing in south western region of Punjab for early season crop. Out of thirteen genotypes these two genotypes Selection 2 and Selection 11 were the promising genotypes for yield and quality characters.

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