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**Simranpreet Sandhu**
Department of Horticulture, University College of Agriculture, Guru Kashi University, Talwandi Sabo Bathinda, Punjab, India

**Navdeep Singh**
Department of Horticulture, University College of Agriculture, Guru Kashi University, Talwandi Sabo Bathinda, Punjab, India

**Gurdeep Singh**
Department of Horticulture, University College of Agriculture, Guru Kashi University, Talwandi Sabo Bathinda, Punjab, India

**Khushveer Singh**
Department of Horticulture, University College of Agriculture, Guru Kashi University, Talwandi Sabo Bathinda, Punjab, India

**Corresponding Author:**
**Simranpreet Sandhu**
Department of Horticulture, University College of Agriculture, Guru Kashi University, Talwandi Sabo Bathinda, Punjab, India

# Correlation coefficient and path analysis in early cauliflower genotypes (*Brassica oleracea* var. *botrytis*)

**Simranpreet Sandhu, Navdeep Singh, Gurdeep Singh and Khushveer Singh**

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**Abstract**
The current study, titled "Evaluation of Cauliflower Varieties," was conducted in the winter of 2023–2024 at the University College of Agriculture, Vegetable Research Farm, Guru Kashi University, Talwandi Sabo (Bathia). Three replications of the experiment were set up in RBD. For horticultural qualities, a total of 13 genotypes were assessed, along with one check genotype (Pusa Katki). The analysis of variance showed significant variation among different genotypes for all the traits under study. The observation of various characters recorded revealed that the genotypic correlation coefficients among 12 characters showed that yield per hectare had positive and significant association with Self Blanching leaves, Yield per plant and the phenotypic correlation coefficients showed that Yield per hectare had positive and significant association with Yield per plant. The path analysis estimates indicated that Yield per hectare has positive direct effect on Length of leaves, Days to curd initiation and Yield per plant.

**Keywords:** Cauliflower, genotypes, correlation coefficient, path coefficient

## Introduction
Cauliflower (*Brassica oleracea* L. var. *botrytis*) is a thermo sensitive crop belonging to the Cruciferae family, and it is commonly referred to as "Phul gobhi." Dr. Jemson introduced cauliflower to India in 1822 from England. Domestication of cauliflower dates back to Mediterranean Sea coast. Cauliflower has 2n = 18 chromosomes. The Latin words "Caulis," which means stem, and "Floris," which means flower, are the origin of the name "cauliflower." In terms of cauliflower production, India leads the world. Cauliflower's ancestor was *Brassica cretica* C. Indian cauliflower cultivars are the result of hybridizing European and Cornish varieties (Muthukumar and Selvakumar 2017) [12].

Cauliflower indeed prefers a cool, moist climate, and extreme temperatures, both too low and too high, are not favourable for its growth. The optimal temperature range of 10 to 15 °C is crucial for the development of cauliflower curds. The classification of Indian cauliflower varieties into early, mid, and late types based on temperature requirements highlights the importance of specific temperature conditions for successful curd formation. (Seshadri and Chatterjee, 1996) [14].

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) [11]. 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 optimal sowing time for cauliflower varies based on the variety and agro-climatic conditions, as highlighted by Gill and Sharma (1996) [6]. In North Indian plains, early cauliflower is typically sown from late May to mid-July, mid-season varieties from July to the end of August, and snowball types from September to October.

Availability in the market spans from September to May. The timing of curd initiation, influenced by transplanting dates, is a crucial factor affecting yield and maturity. Ara *et al*. (2009) [1] reported significant effects on vegetative growth parameters, such as plant height, number of leaves, whole plant weight, marketable curd weight, and yield, based on both the variety and planting date.

## Materials and Methods

The current study was carried out in the winter of 2023–2024 at the Talwandi Sabo (Bathinda) experimental site of the Guru Kashi University Research Farm. The farm is situated 213 meters above sea level at 29°57'N latitude and 75°7'E longitude, according to the Goggle map. The research material included thirteen genotypes of *Brassica oleracea* var. *botrytis* cauliflower, one of which is a commercial cultivar known as Pusa katki (check). These were gathered for the study from several sources. There were three replications of each genotype in the Randomized Block Design experiment. On August 14, 2023, the seedlings were moved. Plants were spaced 45 centimetres apart. The standard cultivar practices were followed to raise the cauliflower crop. The observations were recorded on three randomly selected plants per replications *viz*. Height of plant (cm), Length of leaves (cm), Breadth of leaves (cm), No of leaves per plant (No), Days to curd initiation (no), 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 pooled data were statistically analysed to determine the correlation co-efficient and path coefficients as per method suggested by Al-Jibouri *et al*. (1958) [2] and Dewey and Lu (1959) [4], respectively.

## Results and Discussion

Significant variations were found for every genotype for every characteristic that was being studied. Table 1 displays the information related to the correlation coefficient. Since yield is a significant result of numerous connected features, it is crucial to understand the correlation between various traits. Correlation coefficients have been worked out at genotypic and phenotypic levels. The genotypic correlation coefficients among 12 characters showed that yield per hectare had positive and significant association with Self Blanching leaves (0.461), Yield per plant (0.445) and negative correlation with Days to curd initiation (-0.334) and Equatorial diameter of curd (-0.413). The phenotypic correlation coefficients showed that Yield per hectare had positive and significant association with Yield per plant (0.461). Days to first harvest had negative correlation with No of leaves per plants (-0.333). Yield per plant had positive correlation with Days to first harvest (0.695). These results support the findings of Kumar *et al* (2010) [10] Kumar *et al*. (2005) [9], Garg and Lal (2004) [7], Radhakrishnan and Korla (1995) [13] and Dutta *et al*. (1992) [5].

**Table 1:** Phenotypic and Genotypic correlation coefficient

| | | 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Height of plant (cm) | G | | 1.000** | 0.201 | 0.242 | 0.030 | 0.332* | 0.176 | 0.229 | 0.222 | -0.637** | -0.636** | -0.213 |
| | P | | 1.000** | 0.090 | 0.102 | 0.115 | -0.016 | -0.002 | 0.218 | 0.136 | -0.232 | -0.450 | -0.148 |
| Length of leaves (cm) | G | | | 0.201 | 0.242 | 0.030 | 0.332* | 0.176 | 0.229 | 0.222 | -0.637** | -0.636** | 0.213 |
| | P | | | 0.090 | 0.102 | 0.115 | -0.016 | -0.002 | 0.218 | 0.136 | -0.232 | -0.450 | -0.148 |
| Breadth of leaves (cm) | G | | | | 0.137 | 0.011 | 0.738** | -0.444** | 0.784 | 0.139* | 0.301 | 0.249 | 0.223 |
| | P | | | | 0.035 | -0.066 | 0.395* | -0.259 | 0.763** | 0.282 | -0.151 | 0.022 | 0.097 |
| No of leaves per plant (no) | G | | | | | 0.750** | -0.493** | -0.862** | -0.164 | 0.581** | -0.256 | -0.157 | -0.010 |
| | P | | | | | 0.384* | -0.192 | -0.338* | -0.048 | 0.199 | -0.333* | -0.159 | -0.044 |
| Days to curd Initiation (no) | G | | | | | | -0.444** | -0.343* | -0.223 | 0.113 | -0.848** | -0.641** | -0.334* |
| | P | | | | | | -0.470** | -0.191 | 0.057 | 0.128 | -0.256 | -0.278 | -0.162 |
| Polar diameter of curd (cm) | G | | | | | | | 0.045 | 0.241 | -0.009 | 0.670** | 0.279 | 0.020 |
| | P | | | | | | | 0.036 | 0.121 | 0.006 | 0.033 | 0.185 | -0.034 |
| Equatorial diameter of curd (cm) | G | | | | | | | | -0.167 | -0.310* | -0.110 | -0.413 | -0.413** |
| | P | | | | | | | | -0.086 | -0.302 | -0.153 | -0.257 | -0.254 |
| Self blanching leaves (cm) | G | | | | | | | | | 0.263 | 0.129 | 0.176 | 0.461** |
| | P | | | | | | | | | 0.221 | 0.095 | 0.068 | 0.270 |
| Stalk length (cm) | G | | | | | | | | | | 0.183 | 0.219 | 0.286 |
| | P | | | | | | | | | | 0.151 | 0.135 | 0.246 |
| Days to first harvest (no) | G | | | | | | | | | | | 0.866 | 0.166 |
| | P | | | | | | | | | | | 0.695** | 0.240 |
| Yield per plant ( kg) | G | | | | | | | | | | | | 0.445** |
| | P | | | | | | | | | | | | 0.461** |

**Table 2:** Path Analysis

| | 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Height of plant (cm) | -0.219 | 0.370 | -0.524 | 0.022 | -0.320 | 0.405 | -0.239 | -0.209 | -0.712 | 1.127 | -0.625 | -0.213 |
| Length of leaves (cm) | -0.218 | 0.370 | -0.524 | 0.022 | -0.321 | 0.406 | -0.248 | -0.219 | -0.720 | 1.150 | -0.637 | 0.213 |
| Breadth of leaves (cm) | -0.218 | 0.370 | -0.524 | 0.022 | -0.321 | 0.406 | -0.246 | -0.217 | -0.719 | 1.146 | -0.634 | 0.223 |
| No of leaves per plant (no) | 0.218 | -0.369 | 0.523 | -0.022 | 0.318 | -0.404 | 0.231 | 0.201 | 0.705 | -1.109 | 0.616 | -0.010 |
| Days to curd Initiation (no) | 0.217 | -0.369 | 0.522 | -0.022 | 0.322 | -0.405 | 0.264 | 0.235 | 0.730 | -1.183 | 0.653 | -0.334 |
| Polar diameter of curd (cm) | 0.218 | -0.370 | 0.524 | -0.022 | 0.322 | -0.406 | 0.252 | 0.223 | 0.723 | -1.158 | 0.641 | 0.020 |
| Equatorial diameter of curd (cm) | -0.165 | 0.291 | -0.409 | 0.016 | -0.269 | 0.324 | -0.316 | -0.298 | -0.659 | 1.176 | -0.639 | -0.413 |
| Self-blanching leaves (cm) | -0.153 | 0.272 | -0.381 | 0.015 | -0.254 | 0.303 | -0.315 | -0.299 | -0.630 | 1.142 | -0.619 | 0.461 |
| Stalk length (cm) | -0.212 | 0.363 | -0.512 | 0.021 | -0.320 | 0.399 | -0.283 | -0.256 | -0.736 | 1.215 | -0.669 | 0.286 |
| Days to first harvest (no) | 0.200 | -0.346 | 0.488 | -0.020 | 0.310 | -0.382 | 0.302 | 0.277 | 0.726 | -1.231 | 0.679 | 0.166 |
| Yield per plant ( kg) | 0.202 | -0.349 | 0.493 | -0.206 | 0.312 | -0.385 | 0.299 | 0.274 | 0.729 | -1.231 | 0.675 | 0.445 |

The path coefficient analysis allows partitions of correlation coefficients into direct and indirect effects of various traits towards dependent variable and thus, helps in proficient selection approach. The path analysis estimates indicated that Yield per hectare has positive direct effect on Length of leaves (0.370), Days to curd initiation (0.322) and Yield per plant (0.675) whereas Height of plant (-0.219), Breadth of leaves (-0.524), No of leaves per plant (-0.022), Polar diameter of curd (-0.406), Equatorial diameter of curd (-0.316), Self-blanching leaves (-0.299), Stalk length (0.736) and Days to first harvest (-1.231) had negative direct effect on curd yield per hectare. These results were obtained in studies conducted by Khar (1995) [8] and Chand *et al*. (1984) [3].

## Conclusion

The correlation coefficients, calculated at both genotypic and phenotypic levels, highlighted important relationships between traits. Genotypically, yield per hectare showed positive associations with self-blanching leaves and yield per plant, while it had negative correlations with days to curd initiation and equatorial diameter of curd. Phenotypically, yield per hectare was positively correlated with yield per plant, and days to first harvest negatively correlated with the number of leaves per plant. These findings are consistent with previous studies by Kumar *et al*. (2010, 2005) [9-10], Garg and Lal (2004) [7], Radhakrishnan and Korla (1995) [13], and Dutta *et al*. (1992) [5].

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