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Growth and Yield Performance of Colored Cauliflower Cultivars (*Brassica Oleracea* var. *botrytis* L.) Under Different Fertilizers Management Practices

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Abstract: Cauliflower is esteemed for its nutritional benefits and health-enhancing attributes. An experiment was conducted at the field laboratory of the School of Agriculture and Rural Development of Bangladesh Open University, Gazipur, Bangladesh during the period from October 2024 to March 2025 to evaluate the growth and yield performance of three colored cauliflowers under different fertilizer management practices. The experiment consisted of three F_1-hybrid cauliflower varieties, viz., V_1: White colored (Hamazuki 33), V_2: Yellow colored (Yellow Harmony), V_3: Purple colored (Purple Harmony) and six fertilizer treatments, viz., T_1: Control (No fertilizer), T_2: Cow-dung (10 tha^{-1}), T_3: Poultry litter (10 tha^{-1}), T_4: 100% recommended chemical fertilizers (N P K S Zn B), T_5: Cow-dung (5 tha^{-1}) + 50% recommended chemical fertilizers, and T_6: Poultry litter (5 tha^{-1}) + 50% recommended chemical fertilizers. The doses of recommended chemical fertilizers for nitrogen (N), phosphorus (P), potassium (K), sulfur (S), zinc (Zn), and boron (B) were @ 250-35-65-40-5-1 $kgha^{-1}$**.** The experiment was designed as a randomized complete block design with 3 replications and each replication was considered as a block. The white cauliflower variety (V_1) performed better compared to the yellow cauliflower variety (V_2) and purple cauliflower variety (V_3) in relation to yield under local agroclimatic conditions. The highest curd yield was recorded in the white-colored cauliflower variety (31.09 tha^{-1}), followed by the purple-colored cauliflower variety (27.99 tha^{-1}) and the yellow-colored cauliflower variety (26.30 tha^{-1}) irrespective of fertilizer treatments. The highest curd yield (31.27 tha^{-1}) was obtained from T_3 (poultry litter @ 10 tha^{-1}), which was statistically similar to T_5 and T_6 treatment irrespective of variety. The lowest curd yield (20.84 tha^{-1}) was obtained from the T_1 treatment (no fertilizers). The interaction between variety and fertilizer had a significant impact on yield and other traits of cauliflower. The highest average yield per hectare (34.91 tha^{-1}) was observed in the white-colored cauliflower under poultry litter @10 tha^{-1} treatment (V_1T_3), which was statistically similar to V_1T_5 and V_1T_6. So, the application of poultry litter @10 tha^{-1} or poultry litter @ 5 tha^{-1} + 50% recommended chemical fertilizer or cow-dung @ 5 tha^{-1} + 50% recommended chemical fertilizers is suggested to get higher yield in cauliflower irrespective of variety.

Keywords: Cauliflower; Color cultivars; Fertilization; Growth; Curd yield.

INTRODUCTION

Vegetables are rich in numerous health-enhancing chemical compounds. Colored vegetables are essential for human nutrition (Kar et al., 2021). Cauliflower (B*rassica oleracea* var. *botrytis* L.) is a worldwide cultivated herbaceous vegetable crop belonging to the family Brassicaceae. The foremost countries in the world for cauliflower production include India, China, France, Italy, Spain, the United States of America, and the United Kingdom (FAO, 2020). It is one of the vital winter vegetables among the Cole crops grown in Bangladesh. The edible part of cauliflower is botanically known as pre-floral fleshy apical meristem or flowering primordial or immature inflorescence and is known as curd (Nath et al., 1994; Vincent et al., 2017). It has a specific climatic requirement for curd development (Vanlalneihi et al., 2017). The curd of cauliflower is exceptionally nutritious, providing a substantial quantity of protein, dietary fiber, riboflavin, potassium, phosphorus, manganese, vitamin B_6, vitamin C, vitamin K, folate, and pantothenic acid (Khanam et al., 2022). Cauliflower is characterized by its low fat and carbohydrate content, while being rich in dietary fiber, water, and vitamin C, thus exhibiting a high nutritional density (Parajuli S. and Adhikari, 2019; Teshome and Ioyew, 2021). Beyond basic nutrition, cauliflower contains an array of phytochemicals and bioactive compounds, including glucosinolates, flavonoids, and antioxidants, which have been linked to reduced risks of several chronic diseases (Park et al., 2013).

Cauliflower can be eaten in raw, cooked, and pickled forms (Noor et al., 2014). The hue of curd is a significant attribute that influences consumer preference for cauliflower. Typically, the curd is white, although its color can differ based on the variety. It may appear in shades such as white, cream-white, yellow, purple, green, red, and so forth (Kindo and Singh, 2018; Saha et al., 2015). Some imported colored varieties of cauliflower seeds are now available in the local markets. Recently, the Department of Agricultural Extension (DAE) of Bangladesh has succeeded in growing colored cauliflower on an experimental basis in the farmers' fields in different districts. Local vegetable farmers are showing interest in the cultivation of colored cauliflower due to increasing consumer demand for a lucrative color and higher prices than the existing white variety. Buyers are paying farmers a good price for colored cauliflower (Shakil, 2023). The chemical composition of cauliflower can vary widely among varieties, influenced by genetic, environmental, and cultivation factors (Grand and Hermann, 2024).

In Bangladesh, the area dedicated to cauliflower cultivation spans approximately 21.677 thousand hectares, yielding a total production of 3.05 million tons (BBS, 2019). The average yield of cauliflower in Bangladesh is significantly lower than that of other countries (Hossain et al., 2021). The productivity of cauliflower in Bangladesh is 11.41 metric tha^{-1}, whereas cauliflower productivity for varieties is 40 metric tha^{-1} in India (Reddy, 2019). The production of cauliflower has seen a notable rise; however, its productivity remains low in comparison to India, primarily due to traditional farming practices and the absence of modern, high-yield varieties (Hoque et al., 2021). Additionally, there is a significant demand for colored varieties of cauliflower. To enhance the current state of cauliflower cultivation in Bangladesh, it is crucial to encourage the adoption of superior varieties among Bangladeshi growers (Yeasmin et al., 2021). At present, the productivity of available cauliflower varieties is not satisfactory due to low soil fertility and the use of imbalanced fertilization in Bangladesh (Siddique et al. 2017; Sultana et al. 2015; Siddique et al. 2014).

Using a minimum effective dose of organic and inorganic fertilizers is becoming a very promising practice not only for maintaining higher productivity but also for greater crop production stability (Sharma et al., 2022). Cauliflower yield can be significantly impacted by nutrient sources (Farahzetya et al., 2013). The objective of this study is to evaluate the yield performance of three newly introduced colored cauliflower varieties (F_1-Hybrid) under different fertilizer management practices, particularly within the context of local environmental adaptation.

MATERIALS AND METHODS

Experimental site

A field experiment was conducted during the winter (October 2024 to March 2025) at the Agricultural Field Research Center of Bangladesh Open University to evaluate the yield performance of three cultivated color varieties under six different fertilizer management practices in the agroclimatic condition of Gazipur. The geographical location of the experimental site with the coordinates of latitude 23.9443ºN and longitude 90.3819ºE (Figure 1). The experimental area belongs to the Madhupur Tract Agroecological Zone (AEZ-28) (UNDP and FAO, 1988). The experimental site was in Madhupur Tract (AEZ-28).

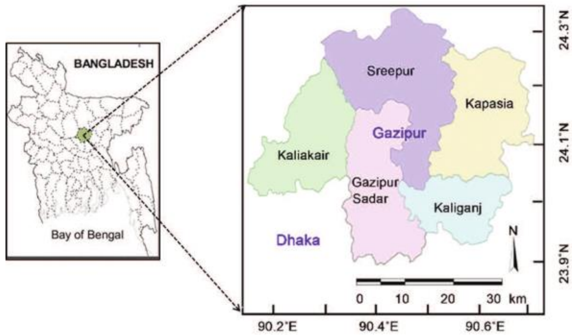

Figure 1. Location map of Gazipur District, Bangladesh (Rony et al., 2021)

Table 1 illustrates the average monthly maximum and minimum air temperatures, mean temperatures, rainfall, humidity, and hours of sunshine recorded at the experimental site during the study period. The soil in the experimental field had a pH of 6.95 and an organic matter content of 1.21%. The initial levels of other significant soil elements were 0.054% N, 26.541% P, 0.132% K, 10.718% S, 0.891% Zn, and 0.244% B. The cow dung used had an organic matter content of 34.88%, along with 1.44% N and 0.561% K. In contrast, the chicken manure had an organic matter content of 50.98%, with 1.757% N and 0.592% K (BRAC-Lab, 2022).

Treatments and experimental design

The experiment consisted of three colored cauliflower F_1 hybrid varieties viz., V_1: White color cauliflower (Hamazuki 33), V_2: Yellow color cauliflower (Yellow Harmony), V_3: Purple color cauliflower (Purple Harmony) and six fertilizer treatments, viz., T_1: Control (No fertilizer), T_2: Cow-dung (10 tha^{-1}), T_3: Poultry litter (10 tha^{-1}), T_4: 100% recommended chemical fertilizers doses (N P K S Zn B), T_5: Cow-dung (5 tha^{-1}) + 50% recommended chemical fertilizers doses, T_6: Poultry litter (5 tha^{-1}) + 50% recommended chemical fertilizers doses. The experiment was designed as a randomized complete block design with 3 replications and each replication was considered as a block. The doses of

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recommended chemical fertilizers for nitrogen (N), phosphorus (P), potassium (K), sulfur (S), zinc (Zn), and boron (B) were N, P, K, S, Zn and B were @ 250-35-65-40-5-1 $kgha^{-1}$ (BARC, 2005) applied in the form of urea, triple super phosphate, muriate of potash, gypsum, zinc sulphate and boric acid respectively. Poultry manure and cow dung were collected from local poultry and dairy farm respectively.

Table 1. Monthly average air maximum temperature, minimum temperature, mean temperature, rainfall, humidity, and sunshine hours of the experimental site during the study period (November 2023 to March 2024)

Month	Air temperature (°C)			Rainfall (mm)	Humidity (%)	Sunshine (h)
	Maximum	Minimum	Mean			
Nov, 2023	31.09	20.03	25.56	28	85.93	7.55
Dec, 2023	26.67	16.24	21.46	45	86.20	4.56
Jan, 2024	22.72	12.73	17.72	00	84.42	3.70
Feb, 2024	27.84	15.73	21.78	18	73.59	6.15
Mar, 2024	31.72	18.87	25.29	58	75.47	7.15

Source: Weather Station, Gazipur

Land preparation and transplanting

Seeds were collected from local seed markets of Dhaka and Gazipur city in Bangladesh**.** Seeds were sown in the well-prepared nursery beds on 15 October 2024. All the experimental plots were fertilized as per treatments (T_2, T_3, T_4, T_5, T_6), but control plots (T_1) did not be treated with any amounts of N, P, K, S, Zn and B or any other organic and inorganic manures. The whole amount of P, K, S, Zn, B and one third of N fertilizer were broadcast and thoroughly incorporated into the soil at the time of final land preparation. The remaining two third of N fertilizer was top dressed in two equal installments at 15 and 30 days after transplanting (DAT). Seedbeds were watered in the morning before uprooting the seedlings to avoid damage to the roots. The seedlings were uprooted carefully from the seedbed to ensure minimal injury to the root system. Thirty-day-old seedlings were transplanted into each plot by maintaining a 50 cm row-to-row distance and 50 cm plant-to-plant distance. The unit plot size was 2.0 × 2.0 m. Transplanting was done in the afternoon and watered lightly with a watering can immediately after transplanting for better establishment.

Intercultural operations and harvesting

Irrigation was administered daily during the initial week to facilitate the establishment of seedlings in the field. Subsequently, irrigation occurred approximately once a week. Earthing up and hoeing were performed 30 days post-transplanting using a hand hoe. Initially, weeding was conducted concurrently with earthing up and hoeing. A second round of weeding took place 30 days after the first weeding. Harvesting was executed on a plot-by-plot basis on various dates, ranging from February 5 to March 8, 2025, once the crops reached harvest maturity. Prior to harvesting, the maturity of the crops was confirmed by assessing the color and size of the curds. For data collection, five plants were randomly selected from each plot, predominantly from the middle rows. Only the compact, mature curds were harvested using a sharp knife. The curds were collected in a compact state before the flower buds had the chance to open. Before the harvesting of the cauliflower curd, the compactness of the curd was evaluated by applying pressure with the thumbs.

Data collection and statistical analysis

The morphological data were collected from five randomly chosen plants for each treatment, focusing on various parameters such as plant height, canopy spread, leaf count per plant, dimensions of the largest leaf, fresh weight of the largest leaf, curd initiation time, harvesting time, untrimmed curd weight, individual curd weight, length and diameter of the curd, and trimmed curd yield of cauliflower. Plant height was recorded using a measuring tape at the initial harvesting stage, measured from the soil level to the tip of the shoot, and expressed in centimeters. The canopy spread of the plant was assessed by measuring the horizontal distance from one side of the canopy to the other with a measuring tape, also expressed in centimeters. This involved measuring the crown's diameter in two perpendicular directions and calculating the average of these two measurements. The total number of leaves produced by the plant was counted from five randomly selected plants at the curd initiation stage, and the average number of leaves per plant was determined. Leaf length was measured from the base to the tip of the leaf, while the width was measured at the broadest part of the same leaf. The dimensions of the large leaf, including length and breadth, were measured using a measuring tape and expressed in centimeters.

Figure 2. Curd harvesting stage of white, yellow & purple colored cauliflower

The leaves were detached from the selected plant and the individual fresh large leaf was weighed by electronic balance and expressed in grams (g). The individual untrimmed (whole plant with curd) and trimmed curd (only mature curd) weights were measured by digital balance and expressed in kg and grams respectively. Every harvested curd weight was recorded and averaged after the final harvest of five selected

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plants. The total yield per hectare in tons was calculated by multiplying the individual curd weight of each treatment with the number of plants (per hectare). Curd diameter and height were measured on a centimeter scale. Data were analyzed with 2-way ANOVA between variety and fertilizer dose using R statistical software. Mean separation was performed using Duncan's Multiple Range Test (DMRT) at a 5% significance level.

RESULTS AND DISCUSSION

Varietal performances

Irrespective of fertilizer treatment, varieties had significant effects on plant height, canopy spread, number of leaves per plant, length of the largest leaf, breadth of the largest leaf, fresh weight of large leaf, untrimmed curd weight, individual curd weight, height of curd, diameter of curd, trimmed curd yield of cauliflower. But no significant effect was observed on curd initiation time and harvesting time (Table 2).

The highest plant height (62.88 cm), canopy spread (72.71 cm), number of leaves per plant (15.88), length of the largest leaf (51.03 cm), breadth of the largest leaf (21.73 cm), fresh large leaf weight (85.43g), untrimmed curd weight (2.92 kg), curd diameter (17.22 cm), curd height (9.21 cm), individual curd weight (777.17 g), trimmed curd yield (31.09 tha^{-1}) were recorded from white cauliflower cultivar (V_1). The lower plant height (59.44 cm), leaves per plant (15.00), length of the largest leaf (47.37cm), breadth of the largest leaf (18.93 cm), curd diameter (15.89 cm), curd height (8.78 cm), individual curd weight (657.61 g), untrimmed curd weight (2.13kg) and trimmed curd yield (26.30 tha^{-1}) were recorded from yellow color cauliflower variety (V_2). The fresh large leaf weight of the white-colored cauliflower variety was significantly higher than yellow colored-cauliflower cultivar (61.09g) and purple-colored cauliflower (75.29g) in this experiment**.** The observed differences in plant height, canopy spread, number of leaves per plant, length of the largest leaf, breadth of the largest leaf, fresh large leaf weight, diameter of curd, curd height, individual curd weight, untrimmed curd weight and trimmed curd yield per hectare of cauliflower cultivars might be due to the genotypic character of each variety and this character might be genetically controlled. Similar findings were reported in cauliflower by Sharma et al. (2001); Thakur and Singh (2001) and Kumar (2002). They studied the genetic variation and divergence in nine cauliflower cultivars and found significant differences in all the growth and yield contributing traits. Chittora and Singh (2015) observed genetic variability for eighteen quantitative characters and five qualitative characters in forty genotypes of early cauliflower. They found significant differences among the genotypes for all the characters.

Effect of fertilizers

Irrespective of variety, fertilizers had a significant influence on all the growth and yield of contributing characteristics of cauliflower under the study except curd initiation and harvesting time (Table 3). The highest plant height (63.82 cm) was observed under T_3 treatment (poultry litter @ 10 tha^{-1}), which was statistically similar to T_2, T_4, T_5 and T_6. The lowest plant height (54.20 cm) was found in T_1 treatment (control). The highest canopy spread (73.64 cm), large leaf length (54.73 cm), large leaf breadth (24.21 cm) and fresh leaf weight (78.54 g) were found under T_6 treatment (Poultry litter @ 5 tha^{-1} + 50% recommended chemical fertilizers). Whereas the lowest canopy spread (52.89 cm), large leaf length (14.33 cm), large leaf breadth (14.92 cm) and fresh leaf weight (60.30g) were recorded under control treatment (T_1). The variations in the total number of leaves per plant under different doses of fertilizer treatments over control treatment were found statistically significant at the curd initiation stage. The length of the biggest leaf varied significantly at curd initiation stage due to the application of different levels of manure and combined fertilizers. T_6 gave the highest length of the largest leaf (54.73 cm) and T_1 gave the lowest length (40.34 cm) of a large leaf**.** The highest untrimmed curd weight (3.08 kg) was found in the T_3 treatment, which was statistically similar to the T_6 treatment. The highest curd yield per hectare (31.27 tha^{-1}) was found in the T_3 treatment and that was statistically the same as the T_5 (30.31 tha^{-1}) and T_6 (30.79 tha^{-1}) treatments. The lowest curd yield per hectare (20.84 tha^{-1}) was observed in T_1 treatment (control). A higher curd diameter (18.62 cm) was found in T_3, which was statistically similar to T_5 and T_6, but higher curd height (10.62 cm) was found under T_3 treatment. Individual curd weight was found higher (781.78g) in T_3 treatment, and it was statistically similar to T_5 and T_6. The highest curd yield value was observed in T_3 due to the highest individual curd weight. The significant enhancement in the vegetative development of cauliflower resulting from these treatments is attributed to nitrogen availability, particularly from poultry litter, which promotes the production of amino acids. This effect could be a result of a gradual and consistent supply of nutrients, which aids in energy storage, cell division, and cell expansion. The application of poultry litter @10 tha^{-1} or poultry litter @ 5tha^{-1} with 50% recommended chemical fertilizer or cow-dung @ 5tha^{-1} with 50% recommended chemical fertilizer performed better due to sufficient organic matter and higher N availability. Manures such as poultry litter and cow-dung enhance plant growth and development by improving soil health through the release of nutrients. This conclusion aligns with the findings of various studies on cauliflower (Simarmata et al., 2017). Hashi et al. (2023) reported that the optimal combination of various organic and inorganic nutrient sources can significantly enhance cauliflower growth and yield. Khanam et al. (2022) stated that the use of organic fertilizers in conjunction with the recommended dosage of inorganic fertilizers had notably positive effects on growth parameters, yield attributes, and the overall yield of cauliflower.

Combined effects of variety and fertilizers

The interaction effect of variety and fertilizer had a significant influence on all the growth and yield parameters of cauliflower was observed in the study except cur initiation

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Table 2. Effect of variety on the yield and yield contributing characteristics of cauliflower

Treatment	Studied parameters values at curd initiation stage							Studied parameters values after harvest					
Variety	**Plant height (cm)**	**Canopy spread (cm)**	**No. of leaf/plant**	**Large leaf length (cm)**	**Large leaf breadth (cm)**	**Fresh large leaf weight (g)**	**Average curd initiation time (DAT)**	**Average curd harvesting time (DAT)**	**Untrimmed curd weight after harvest (kg)**	**Individual curd weight (g)**	**Curd diameter (cm)**	**Curd height (cm)**	**Curd yield (t/ha)**
V_1	62.88a	72.71a	15.88a	51.03a	21.73a	85.43a	67.56	84.33	2.92a	777.17a	17.22a	9.21a	31.09a
V_2	59.44b	62.61c	15.00b	47.37b	18.93b	61.09c	64.94	81.22	2.13c	657.61c	15.89b	8.78b	26.30c
V_3	60.88ab	65.45b	15.50ab	48.51b	20.51a	75.29b	66.78	83.33	2.59b	699.78b	17.06a	9.56a	27.99b
L. Significant	**	**	*	**	**	**	NS	NS	**	**	**	**	**
CV (%)	4.91	3.67	6.46	6.32	9.22	3.58	6.50	6.50	10.10	5.96	5.75	5.64	5.96

Note: A column with a similar letter(s) are statistically similar and those with a dissimilar letter(s) differ significantly at a 5% probability level as per DMRT. *=significant at 5% level of probability, **=significant at 1% level of probability, NS=Not significant. [V_1: White-colored cauliflower, V_2: Yellow-colored cauliflower, V_3: Purple-colored cauliflower].

Table 3. Effect of fertilizer treatments on the yield and yield contributing characteristics of cauliflower

Treatment	Studied parameters values at curd initiation stage							Studied parameters values after harvest					
Fertilizer doses	**Plant height (cm)**	**Canopy spread (cm)**	**No. of leaf/plant**	**Large leaf length (cm)**	**Large leaf breadth (cm)**	**Fresh large leaf weight (g)**	**Average curd initiation time (DAT)**	**Average curd harvesting time (DAT)**	**Untrimmed curd weight after harvest (kg)**	**Individual curd weight (g)**	**Curd diameter (cm)**	**Curd height (cm)**	**Curd yield (t/ha)**
T_1	54.20b	52.89e	14.33b	40.34d	14.92c	60.30d	63.78	78.89	1.74e	521.00d	11.16d	5.49d	20.84d
T_2	61.14a	66.17d	15.33a	47.56c	19.90b	75.98bc	67.33	83.78	2.46cd	726.67bc	17.31bc	9.53c	29.06bc
T_3	63.82a	70.22bc	15.56a	50.57b	20.69b	76.55abc	67.00	83.89	3.08a	781.78a	18.62a	10.62a	31.27a
T_4	61.40a	68.07cd	15.67a	49.30bc	20.98b	74.80c	66.22	83.89	2.37d	712.11c	16.91c	9.59bc	28.48c
T_5	62.47a	70.61b	15.89a	51.33b	21.66b	77.45ab	67.11	83.44	2.69bc	757.67ab	18.06ab	9.83bc	30.31ab
T_6	63.39a	73.64a	16.00a	54.73a	24.21a	78.54a	67.11	83.89	2.91ab	769.89a	18.28a	10.03b	30.79a
L. Significant.	**	**	*	**	**	**	NS	NS	**	**	**	**	**
CV (%)	4.91	3.67	6.46	6.32	9.22	3.58	8.10	6.50	10.10	5.96	5.75	5.64	5.96

Note: A column with a similar letter(s) are statistically similar and those with a dissimilar letter(s) differ significantly at a 5% probability level as per DMRT. *Significant at 5% level of probability, **Significant at 1% level of probability, NS=Not significant. [T_1: Control (No fertilizer), T_2: Cow-dung @10 tha^{-1}, T_3: Poultry litter @10 tha^{-1}, T_4: 100% recommended chemical fertilizers, T_5: Cow-dung @ 5tha^{-1} + 50% recommended chemical fertilizers, T_6: Poultry litter @5 tha^{-1} + 50% recommended chemical fertilizers].

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Table 4. Combined effect of variety and fertilizers on the yield and yield contributing characteristics of cauliflower

Treatment	**Studied parameters at curd initiation stage**							**Studied parameters after harvest**					
Variety	**Plant height (cm)**	**Canopy spread (cm)**	**No. of leaf/plant**	**Large leaf length (cm)**	**Large leaf breadth (cm)**	**Fresh large leaf weight (g)**	**Average curd initiation time (DAT)**	**Average curd harvesting time (DAT)**	**Untrimmed curd weight after harvest (kg)**	**Individual curd weight (g)**	**Curd diameter (cm)**	**Curd height (cm)**	**Curd yield (t/ha)**
V_1T_1	56.13def	58.50i	14.33d	41.97gh	16.50fg	64.47de	64.67	80.00	2.24fg	567.67g	11.20g	5.77g	22.71g
V_1T_2	64.87ab	71.05cd	16.00abc	51.37a-d	20.97cde	88.98a	68.33	85.33	2.87bcd	776.33bc	17.77b-f	9.70cde	31.05bc
V_1T_3	65.33a	73.79bc	16.33ab	52.50a-d	21.90bcd	90.41a	69.00	86.00	3.43a	872.67a	19.53a	10.40abc	34.91a
V_1T_4	62.83abc	74.10bc	16.00abc	50.37b-f	22.50a-d	87.85a	66.33	84.67	2.70cde	755.33cd	17.57b-f	9.30def	30.21cd
V_1T_5	63.67ab	77.67ab	16.33ab	53.90abc	23.10abc	90.85a	69.33	85.33	2.97bcd	840.66ab	18.30a-e	9.80b-e	33.63ab
V_1T_6	64.47ab	80.69a	16.33ab	56.10a	25.43a	90.01a	67.67	84.67	3.29ab	850.33a	18.93abc	10.30abc	34.01a
V_2T_1	52.57f	47.33k	47.33k	39.10h	13.53g	46.65f	61.33	76.67	1.35i	455.33h	10.87g	4.87h	18.21h
V_2T_2	58.47cde	60.22hi	60.22hi	45.40fg	18.47ef	63.04de	66.00	81.67	1.88gh	682.00ef	16.73ef	8.83f	27.28ef
V_2T_3	62.33abc	68.43def	68.43def	48.43def	18.73ef	62.80e	65.33	81.67	2.74cde	724.33c-f	17.30def	10.73a	28.97c-f
V_2T_4	60.27bcd	64.00gh	64.00gh	48.77c-f	19.67de	61.95e	66.00	83.33	1.86gh	668.67f	16.30f	9.73b-e	26.75f
V_2T_5	60.90a-d	66.07fg	66.07fg	49.40c-f	20.73cde	64.67de	65.33	81.67	2.38ef	699.33def	16.93ef	9.13ef	27.97def
V_2T_6	62.13abc	69.63def	69.63def	53.13a-d	22.47a-d	67.41cd	65.67	82.33	2.56def	716.00c-f	17.20def	9.37def	28.64c-f
V_3T_1	53.90ef	52.85j	52.85j	39.95h	14.73g	69.78c	65.33	80.00	1.63hi	540.00g	11.40g	5.83g	21.60g
V_3T_2	60.10bcd	66.80efg	66.80efg	45.90efg	20.27cde	75.91b	67.67	84.33	2.64c-f	721.67c-f	17.43c-f	10.07a-d	28.87c-f
V_3T_3	63.80ab	68.43def	68.43def	50.77b-e	21.43cde	76.43b	66.67	84.00	3.06abc	748.33cde	19.03b	10.73a	29.93cde
V_3T_4	61.10a-d	66.10fg	66.10fg	48.77c-f	20.77cde	74.60b	66.33	83.67	2.55def	712.33c-f	16.87ef	9.73b-e	28.49cdef
V_3T_5	62.83abc	68.09def	68.09def	50.68b-e	21.13cde	76.83b	66.67	83.33	2.75cde	733.00c-f	18.93abc	10.57ab	29.32c-f
V_3T_6	63.57ab	70.60cde	70.60cde	54.97ab	24.73ab	78.20b	68.00	84.67	2.89bcd	743.33cde	18.70a-d	10.43abc	29.73cde
L. Significa	*	*	*	*	*	**	NS	NS	*	*	*	*	*
CV (%)	4.91	3.67	3.67	6.32	9.22	3.58	8.10	6.50	10.10	5.96	5.75	5.64	5.96

Note: A column with a similar letter(s) are statistically similar and those with a dissimilar letter(s) differ significantly at a 5% probability level as per DMRT. *Significant at 5% level of probability, **Significant at 1% level of probability, NS=Not significant. [V_1: White-colored cauliflower, V_2: Yellow-colored cauliflower, V_3: Purple-colored cauliflower; T_1: Control (No fertilizer), T_2: Cow-dung @10tha^{-1}, T_3: Poultry litter @10 tha^{-1}, T_4: 100% recommended chemical fertilizers, T_5: Cow-dung @5tha^{-1} + 50% recommended chemical fertilizers, T_6: Poultry litter @ 5tha^{-1} + 50% recommended chemical fertilizers].

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and harvesting time (Table 4). The highest plant height at (65.33cm) was observed in V_1T_3, which was statistically similar to V_1T_2, V_1T_4, V_1T_5, V_1T_6, V_2T_3, V_2T_5, V_2T_6, V_3T_3, V_3T_4, V_3T_5 and V_3T_6. The highest individual curd weight (872.67g) and curd yield per hectare (34.91 tha^{-1}) were observed in white-colored cauliflower under poultry litter application @ 10 tha^{-1} (V_1T_3), which was statistically similar to V_1T_5 and V_1T_6 treatments. The lowest plant height (52.57 cm), canopy spread (47.33 cm), large leaf length (39.10 cm), large leaf breadth (13.53 cm), fresh large leaf weight (46.65g), curd diameter (10.87 cm), curd height (4.87 cm), individual curd weight (455.33g) and curd yield per hectare (18.21 tha^{-1}) were observed in V_2T_1 treatment. This happens due to the lack of availability of the required plant nutrients. Nitrogen is one of the major determining nutrients for the growth and development of cauliflower. El-Saady and Omar (2018) stated that curds yield had been significantly influenced by NPK fertilizer ratios, rates and their interactions. Dhakal et al. (2019) indicated that applying a suitable quantity of nitrogen to the soil can significantly enhance both the qualitative and quantitative growth parameters of cauliflower. Devkota et al. (2021) found that the combined use of organic and inorganic fertilizers improved the growth, development, and yield of cauliflower, along with enhancing soil properties. Such an improvement in yield parameters may be due to better availability of nutrients through judicious supply of both organic manures and inorganic fertilizers. Similar results were found in poultry manure fertilization as well, which added the supply of nutrients and proliferous root system, enabling better absorption of water as well as nutrients (Singh et al., 1970). Ghimirey et al. (2025) reported that the application of poultry manure can be recommended for sandy loam soil to improve cauliflower performance and the overall health of the soil. Additionally, improved soil fertility brought about by its organic content encourages root growth and nutrient uptake, both of which increase cauliflower yields (Rayne and Aulat, 2020). A similar kind of result was found in the study of vegetables (Al-Gaadi et al., 2019). Poultry manure not only enhances growth and yield but also contributes to soil health, which is essential for sustainable crop production (Shanta et al., 2018).

CONCLUSION

Results indicated that variety, fertilizer dose and their interaction effects had significant effects on the growth and yield of cauliflower. Higher curd yield was obtained from the white-colored cauliflower F_1 hybrid variety (Hamazuki 33) with the application of poultry litter @ 10tha^{-1}. On the other hand, the combined application of poultry litter @ 5tha^{-1} + 50% recommended chemical fertilizers and cow-dung @ 5tha^{-1} + 50% recommended chemical fertilizers give a statistically similar yield. So, the application of poultry litter @10 tha^{-1} or poultry litter @ 5 tha^{-1} + 50% recommended chemical fertilizers or cow-dung @ 5tha^{-1} + 50% recommended chemical fertilizers can be recommended to get a higher yield of cauliflower, particularly within the context of local environmental adaptation and sources of manures. More location-based research will be needed to select a suitable variety and fertilizer doses for cauliflower cultivation under different climatic conditions.

Conflict of Interest

The authors indicate no conflict of interest in this work.

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REFERENCES

Al-Gaadi, K.A., Madugundu, R. and Tola, E. 2019. Investigating the response of soil and vegetable crops to poultry and cow manure using ground and satellite data. Saudi J. Biol. Sci. 26:1392-9.

BARC (Bangladesh Agricultural Research Council). 2005. Fertilizer Recommendation Bangladesh Guide. BARC Soils Publication No. 45, BARC, Dhaka, 1-254.

BBS (Bangladesh Bureau of Statistics). 2019. Year Book of Agricultural Statistics of Bangladesh. Ministry of Planning, Dhaka, Bangladesh.

BRAC-Lab. 2022. Soil-testing laboratory. BRAC-Seed and Agro-Enterprise (SAE), CERDI Road, 1701 Gazipur, Bangladesh.

Chittora, A. and Singh, D.K. 2015. Genetic variability studies in early cauliflower (*Brassica oleracea* var. *botrytis* L.). Electronic Journal of Plant Breeding. 6(3):842-84.

Devkota, S., Rayamajhi, K., Yadav, D.R. and Shrestha, J. 2021. Effects of different doses of organic and inorganic fertilizers on cauliflower yield and soil properties. Journal of Agriculture and Natural Resources. (2): 11-20.

Dhakal, N., Shrestha, R.K., Subedi, S. and Burlakoti, D. 2019. Performance of Different Varieties of Cauliflower (Brassica Oleracea Var. Botrytis) Under Different Level of Nitrogen Application in Ultisols of Lamjung Nepal. World J. Agri. & Soil Sci. 1(2):1-4.

El-Saady, W. A. and Omar, G.F. 2018. Effect of some Inorganic NPK Fertilization Treatments on Cauliflower. J. Plant Production, Mansoura Univ. 9(12):1215-1222.

FAO. 2020. World Food and Agriculture-Statistical Yearbook 2020. Food and Agriculture Organization of the United Nations, Rome, Italy.

Farahzetya, A.B., Illias, M.K. and Aishah, H.S. 2013. Nutritional Quality and Yield of Cauliflower (*Brassica oleracea* var. *botrytis*) as Affected by Fertilizer Sources. Acta Hort. 1012:265-269.

Ghimirey, V., Chaurasia, J., Dhungana, R. and Poude, l B. 2025. Organic fertilizers and their efficacy on soil characteristics, growth and yield of cauliflower (*Brassica oleraceae* var. *botrytis*) in sandy loam soil of Nepal. Front. Soil Sci. 5:1556283.

DOI: https://doi.org/10.55706/jae1814

Grand, T. L. and Hermann, M. 2024. Chemical profiling of diverse cauliflower (*Brassica oleracea* var. *botrytis*) varieties. Journal of Research in Chemistry. 5(1): 64-66.

Hashi, S.N., Mostarin, T., Khatun, K., Kabir, S., Akter, S., Banu, K., Roy, S., Ahmed, A., and Samad, M.A. 2023. Effect of Integrated Nutrient Management on Growth and Yield of Cauliflower. European Journal of Nutrition & Food Safety. 15 (1): 44-51.

Hoque, F., Afrin, S., Akter, A., Khatun, M., Beg, T.H., Afrin, T. and Yoezer, K. 2021. Measuring technical efficiency of the cauliflower cultivation in Bangladesh: A case study on Dhaka district. Journal of Applied Horticulture. 23(1): 54-58.

Hossain, M.F., Azam, M.G., Islam, M.R., Uddin, M.R. and Islam, M.S. 2021. Response of boron and molybdenum on growth and curd yield of cauliflower (*Brassica oleracea* L.). Thai J. Agric. Sci. 54(3): 198−211.

Kar, S., Kundu, S. and Mal, D. 2021. Nutritional Quality of Colored Vegetables: A review. J. Nutraceuticals Food Sci. 6(9):37.

Khanam, M., Alam, M. S., Kamal, M. U., Akter, M., Binte, B.I. and Alam, M.A. 2022. Efficacy of Organic and Inorganic Fertilizers on Growth, Yield and Nutrient Uptake of Cauliflower in Acidic Soil of Bangladesh. European Journal of Agriculture and Food Sciences. 4(3): 24-29.

Kindo, S.S. and Singh, D. 2018. Varietal Evaluation of Cauliflower [*Brassica oleracea* var. *botrytis* L] Under Agro-climatic Condition of Allahabad, Int. J. Pure App. Biosci. 6(1): 672-677.

Kumar, A. 2002. Genetic evaluation of some genotypes of cauliflower (*Brassica oleracea* var. *botrytis* L.). MSc. Thesis, Department of Vegetable Science, Dr. Y.S. Parmar University of Horticulture and Forestry, Solan, H.P., India.

Nath, P., Velayudhan, S. and Singh, D.P. 1994. Vegetables for the tropical region. ICAR, New Delhi, India. 147-163.

Noor, F., Aktar, T., Mahomud, M.S. and Islam, M.M. 2014. Impact of processing methods on quality of cauliflower pickle. Journal of Science and Technology. 12: 48-53.

Parajuli, S. and Adhikari, S. 2019. A Project work on production of Cauliflower (*Brassica oleracea* var. *Botrytis*) variety "Pusa Kartiki" under Treatment by FYM, Vermicompost, Bio Fertilizer and NPK at IAAS Paklihawa. Acta Scientific Agriculture. 3 (1): 139-145.

Park, S.Y., Lim, S.H., Ha, S.H., Yeo, Y., Park, W.T. and Kwon, D.Y. 2013. Metabolite profiling approach reveals the interface of primary and secondary metabolism in colored cauliflowers (*Brassica oleracea* L. ssp. *botrytis*). Journal of agricultural and food chemistry. 61(28):6999-7007.

Rayne, N and Aula, L. 2020. Livestock manure and the impacts on soil health: A review. Soil Systems. 4:64.

Reddy, J. 2019. Cauliflower cultivation income (Gobi), cost and project report in India.

Saha, P., Kalia, P., Joshi, S. and Vinod. 2015. Genetic analysis of yield components and curd color of midseason heat tolerant Indian cauliflower (*Brassica oleracea* var. *Botrytis* L.). SABRAO Journal of Breeding and Genetics. 47 (2):124-132.

Shakil, M. 2023. Colored cauliflower showing bright prospects. The Daily Star (Published on 27 Jan, 2023).

Shanta, U.K., Howlader, M.H., Hasan, M.M., Nabi, A. and Ratna, S.A. 2018. Effect of fertilizers and manures on the growth and yield of cauliflower. Intl J. Chem. Stud. 8:1196 200.

Sharma, S.R., Singh, R, & Gill, H.S. 2001. Pusa Sharad-a mid-early maturity cauliflower. Vegetable Science. 28(1): 69.

Sharma, D., Dutta, I. and Choudhary, P. 2022. Growth, Yield and Quality of Cauliflower (*Brassica oleracea* var. *botrytis*) as Affected by Integrated Nutrient Management under Low Hill Region of Himachal Pradesh. Biological Forum-An International Journal. 14(1): 508-512.

Siddique, M. N. A., Islam, M. M., Sultana, J., Kamaruzzaman, M. and Halim, M. A. 2014. Potential of soil sensor EM38 measurements for soil fertility mapping in the Terrace soil of Bangladesh. Journal of Science, Technology and Environment Informatics. 1(1): 01-15.

Siddique, M. N. A., Sultana, J. and Abdullah, M. R. 2017. Aggregate stability: an indicator of quality and resistivity of arable Soil. Asian Journal of Soil Science and Plant Nutrition. 1(2): 1-7.

Simarmata, M., Susantia, L. and Setyowati, N. 2016. Utilization of manures and green organic composts as alternative fertilizers foe cauliflower production. Journal of Agricultural Technology. 12: 311-319.

Singh K., Gill I. S. and Verma, O.P. 1970. Studies on poultry manure in relation to vegetable production-cauliflower. Indian Journal of Horticulture. 27: 41-47.

Sultana, J., Siddique, M. N. A. and Abdullah, M. R. 2015. Fertilizer recommendation for agriculture: practice, practicalities and adaptation in Bangladesh and Netherlands. International Journal of Business, Management and Social Research. 1(1): 21-40.

Teshome, Y. and loyew, A. 2021. Agronomic management status in cauliflower cultural practices in Ethiopia for vegetable crop production technology. International Journal of Agriculture and Food Science. 3(1):10-13.

Thakur, P.C. and Singh, V. 2001. Assessment of cauliflower (*Brassica oleracea* var. *botrytis* L.) varieties for summer production in temperate climate. Cruciferae Newsletter. 3:85-86.

UNDP and FAO. 1988. Land Resources Appraisal of Bangladesh for Agricultural Development. Report 2. Agroecological Regions of 53 Bangladesh. United Nations Development Programme and Food and Agriculture Organization. pp. 212-221.

Vanlalneihi, B., Saha, P. and Srivastava, M.2017. Assessment of Genetic Variability and Character Association for Yield and Its Contributing Components in Mid Maturing Indian Cauliflower. International journal of current microbiology and applied sciences. 6(11):2907-2913.

Vincent, A.F., Carl, J.R., Michelle, A.G., William, D.H., Roger, L.B., Cindy, T., Jerry, A.W. and Terry, T.N. 2017.

DOI: https://doi.org/10.55706/jae1814

Growing broccoli, cabbage and cauliflower in Minnesota. University of Minnesota Extension, Garden-Growing Vegetables.

Yeasmin, N., Rashid, M.H.A. and Rahman, M.H. 2021. Effects of varieties and organic manures on growth and yield of cauliflower. Fundamental and Applied Agriculture. 6(3):257-264.