



e-ISSN: 2456-6632

This content is available online at AESA

Archives of Agriculture and Environmental Science

Journal homepage: journals.aesacademy.org/index.php/aaes



ORIGINAL RESEARCH ARTICLE



Effect of foliar spray of micronutrients and hormones on cauliflower (*Brassica oleracea* var. *botrytis* L.)

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ARTICLE HISTORY

Received: 22 October 2021

Revised received: 01 December 2021

Accepted: 19 December 2021

Keywords

Cauliflower
Foliar spray
Micro-nutrition
Hormones
Yield

ABSTRACT

In order to achieve optimal plant growth and production, essential nutrients must be readily available in adequate quantities and in a balanced proportion to give a good yield, especially cauliflower which has health benefits that may not be found in many other plants. For this purpose, this experiment was carried out during the seasons 2020-2021 in the on station of Bangladesh Agricultural Research Institute, Khulna under Smallholder Agricultural competitiveness project. Although the treatments showed a positive effect on yield, quality and economics but, T₁ revealed most significant influence on all parameters under study as compared to T₀ (control). For micronutrients and hormone, T₁ treatment produced the highest curd yield (29.99 t ha⁻¹) and the lowest (17.04 t ha⁻¹) was control from the varietal effect the highest curd yield was (35.14 t ha⁻¹) from V₄ (It Amazuku 33) and the lowest was (16.21 t ha⁻¹) from V₅ (BARI Fulcopi-1). In case of combined effect, the highest curd yield (45.16 t ha⁻¹) was obtained from T₁V₄ and the lowest curd yield (10.27 t ha⁻¹) from T₀V₁. Therefore, it can be suggested that the highest curd yield and good shape cauliflower curd can be obtained application of Zn 8.83 kg/ha, B 3.5 kg/ha, Ma 8.43 kg/ha and Flora (Hormone) 2 ml/1 L of water. Therefore, foliar application of micronutrients and hormone is suitable way to feed the cauliflower crop to enhance the marketable yield and quality.

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Citation of this article: Rahman, M., Shahadat, M.K., Rashid, M.H., & Nasim, F.A. (2021). Effect of foliar spray of micronutrients and hormones on cauliflower (*Brassica oleracea* var. *botrytis* L.). *Archives of Agriculture and Environmental Science*, 6(4), 548-555, https://dx.doi.org/10.26832/24566632.2021.0604018

INTRODUCTION

Cauliflower (*Brassica oleracea* var. *botrytis* L.), which belongs to family Brassicaceae and genus Brassica, is a fast-growing annual and herbaceous vegetable crop (Anonymous, 2020). It is one of the most popular cruciferous vegetable crops. The edible part, i.e., curd is a prefloral fleshy apical meristem and it is generally white in color and may be enclosed by inner leaves before its exposure (Dixit *et al.*, 2020). Cauliflower has high quality protein. It is being grown round the year for its white and tender curd vegetables and thrives best in a cool, moist climate and it does not withstand very low temperature or too much heat (Din *et al.*, 2007). Although Bangladesh is producing a good amount of

cauliflower and it is using for the preparation of different delicious food but the average yield of cauliflower is low in Bangladesh compared to other countries. In Bangladesh total production of cauliflower was 283157 MT from 54205 acre of land (BBS, 2020). It is well known that plants need various inorganic nutrients in addition to carbon dioxide (CO₂) and water for their growth and production. Inherent in soil, most of these nutrients are reduced and can be used for various purposes. Adopting various improved agro-techniques can enhance the productivity of cauliflower. Micronutrients and other plant growth regulator are prerequisite for increasing the production of cauliflower in Bangladesh (Kannan *et al.*, 2016). In addition, micronutrients are essential elements for normal plant growth, development and

productivity of plants as they play important roles in the meristematic development, chlorophyll formation, photosynthesis and transpiration as well as tannin and phenolic compound development (Tripathi *et al.*, 2015). Like other crops, plant nutrition is one of the key principals for getting high yield of cauliflower. It is well known to be a heavy feeder crop and has the capacity to absorb high number of macronutrients, particularly nitrogen, Magnesium, Zinc and Boron (Abdel-Razzak *et al.*, 2008; Bianco *et al.*, 2015).

Magnesium (Mg) is recognized as an essential nutrient for various living organisms including, plant species, and animals and as well as human beings and thereby its deficiency may cause the reduction in productivity and quality in agriculture (Hermans *et al.*, 2004). Magnesium is integral part of chlorophyll, photosynthesis, enzymes activator, building of nucleic acids, carbohydrate metabolism and stimulates phosphorus uptake and transport (Nguyen *et al.*, 2016). Magnesium deficiency proved negative effects on plants in an experiment performed by (Tewari *et al.*, 2006). Thus, it's an important task to maintain the quantity of Mg in agricultural products within sufficient amount. Magnesium is considered important nutrients for growth, production and fruit quality (Nguyen *et al.*, 2016). Zinc is an indispensable micronutrient for crop growth, an important component of carbonic anhydrase and a stimulator of aldolase, which are involved in carbon metabolism (Tsoney and Lidon 2012). Zn is also an integral component of several biomolecules such as lipids, proteins and co-factor of auxins, and, therefore, it plays an important role in plant nucleic acid metabolism (Mengel *et al.*, 2001). Zn application has been proved beneficial in improving crop yield and quality (Chattha *et al.*, 2017 and Hassan *et al.*, 2019), while its deficiency reduces yield and deteriorates crop quality (Mousavia *et al.*, 2007; Kumar *et al.*, 2019).

Several previous studies reported that B an important element in attributes of cauliflower productivity and quality (Thapa *et al.*, 2016; Hossain *et al.*, 2018; Sarker *et al.*, 2018). Boron (B) is very important for growth and development of crops as it is involved in cell division, root elongation, calcium metabolism, auxin synthesis, sugar metabolism translocation of solutes and protein synthesis (Camacho-Cristobal *et al.*, 2018). Unfortunately, B deficiency has been reported very frequently in cauliflower and caused several anatomical, physiological, and biological changes, such as browning of curd and hollow stem as well as whiptail disorders, sword like leaves, malformation of growing tip and delaying curd formation (Sharma, 2002). In addition, the affected heads become irregular in shape, smaller in size, and bitter in taste, which adversely affects the market demand of the crop. Nevertheless, several researchers reported that B deficiency could be overcome by application of B, either as soil application or as foliar spray, and enhanced the cauliflower growth and productivity (Ningawale *et al.*, 2016; Farooq *et al.*, 2018). Plant growth regulators (Hormones) are defined as an organic chemical other than nutrients which in small amount promote, inhibit or otherwise modify the plant physiological processes. It increases the yield and improves the quality by alerting the behavior of plant and number of physiological processes in plant sys-

tems. They help in synthesis of metabolites and translocation of nutrients and assimilation of these into different plant parts which ultimately resulting higher yields and improve the quality (Dixit *et al.*, 2020). Considering the above all perspective, the present study was undertaken to investigate the effect magnesium, zinc, boron and hormone on cauliflower to find out the growth and yield attributes of cauliflower.

MATERIALS AND METHODS

Experimental design

This experiment was conducted during 28 October, 2019 to 25 February, 2020 in the experimental field of Bangladesh Agricultural Research Institute, Khulna. The location of the experimental site was AEZ of High Ganges River Flood Plain (22.8875 N latitude and 89.5167 E longitudes). The soil of the experimental field was silt loam-clay of dark grey soil color. The soil contained pH of 6.8 and organic matter 2.1 %. There were five varieties viz., V₁ (High Top), V₂ (Snow Crown), V₃ (Shira Giku), V₄ (It Amazuku 33), V₅ (BARI Fulcopi-1). V₁, V₂, V₃ and V₄ were collected from the market of Dhaka and V₅ was collected from Bangladesh Agricultural Research Institute, Gazipur. Two treatments were used on this experiment one treatment was T₁ (Zn 8.83 kg/ha + B 3.5 kg/ha + Ma 8.43 kg/ha + Flora (Hormone) 2 ml/1 L of water) and other T₀ (Control). Flora (Nitrobenzin 20% W) was collected from ACI crop Care limited. Flora is very popular and are used as a plant growth regulator (Hormone) on a commercial scale in various crops, including cauliflower which increases the yield by 20-40%. The field experiment was laid out in a factorial Randomized Complete Block Design with three replications. The unit plot size was 4 m x 1.5 m. The land was manured and fertilized with N, P, K and Molybdenum as Cow dung, Urea, TSP, MoP and Molybdenum @ 1500, 210, 120, 100 and 1 kg/ha, respectively. The entire amount of Cow dung, TSP, MoP and Molybdenum were applied at the time of final land preparation and the entire urea was applied as top dressing in two equal splits at 15 and 30 days after transplanting (DAP). The seeds were soaked overnight in the water prior to sowing. Seeds were treated by provax. Two to three seeds were sown in each pit. Then the seeds were covered with loose soil by hand. After germination, the weaker seedlings were removed keeping the healthier one in each pit to grow properly. Seeds were sown on seedling bed 04 October 2020. Healthy and uniform 30 days old seedlings were transplanted 03 November 2020 in the main field at each date of planting maintaining a spacing of 50 cm x 50 cm. simultaneously any damage or dead seedlings were replaced by healthy seedling. The first foliar spray was done at 30 days after planting 14 December 2020 in the morning hours. The second application at 60 days after planting 14 January 2021 was done after the wetting agent. The uniform spraying was carried out with the help of the knapsack sprayer; the leaves on both sides were completely wet with the spray solution. The total amount of solution required to be sprayed on experimental plants was decided by representative cauliflower plants. Weeding was done 6 times to keep the plots free from weeds and the

soil was mulched by breaking the soil crust for easy aeration and conservation of soil moisture. The plots were watered four times at regular interval during the growth season to keep the field moist for better growth and development of plant. Three cauliflower plants from each plot were selected randomly for collecting data. The plants of the outer rows and the extreme end of the middle rows were excluded from data collection. The data was analyzed using the program R (4.0.2) for variance analysis (Table 1).

Measurements

At maturity stage, three plants were randomly selected from each experimental unit (plot) and data were recorded for number of leaves, leaves fresh weight (g), stem weight (g), root weight (g), curd fresh weight (g), curd length (cm), curd diameter (cm), curd yield ($t\ ha^{-1}$) following standard methods (Figures 1 and 2).

RESULTS AND DISCUSSION

Number of leaves plant⁻¹

The number of leaves per plant of cauliflower was non-significant among the treatments (Table 2). From the foliar treatment T₁ was (23.27) and control T₀ was (23.20). Eimon et al. (2019) found significant variation of result and this result was similar with my result among the treatment where the highest number of leaves per plant (21.16) was recorded from T₄ treatment at harvest time and the lowest number of leaves per plant (12.9) was found from T₁. Ali et al. (2019) observed that number of leaves per plant of cauliflower varied from 19.33 to 22.66 among the treatments. Significant variation in number of leaves was observed due to different varieties (Table 3). The highest number of leaves obtained from V₃ (26.33) which was statistically similar to V₂ (24.17). The lowest number of leaves was recorded from V₅ (20.83). Eimon et al. (2019) obtained non-significant result among the varieties where snow white was 17.1 and White angel was 17.52. The interaction effect between varieties and treatments was non-significant (Table 4). The highest number of leaves (26.67) was recorded from the genotype T₁V₃ (Foliar spray on Shira Giku) and the lowest number of

leaves (20.67) was obtained from T₀V₅ (No spray on BARI Fulcopi-1). The higher number of leaf production per plant may be accounted for higher vegetative growth due to optimum vegetative growth and optimum nutrient supply. But the minimum number of leaves was counted from control (T₀) treatment. Eimon et al. (2019) obtained non-significant variation of among the interaction as like as my result where the highest number of leaves per plant (20.27) was recorded from V₂T₄ whereas the lowest number of leaves per plant (12.77) was found from V₂T₀ treatment combination. Thakur et al. (1991) reported that application of boron increased the number of leaves per plant of cauliflower. Sharmin et al. (2002) in cauliflower, who stated that the probable reasons for enhanced plant height and the number of leaves, may be due to promoting effects of molybdenum on vegetative growth which ultimately led to more photosynthetic activities.

Fresh weight of leaves

There were significant differences among the treatments in respect of fresh weight of leaves (Table 2). The maximum fresh weight of leaves was recorded from T₁ (952.33 g) and lowest was T₀ (792.47 g). Leaf fresh weight represents leaf biomass. Getachew (2016) also observed significant variation fresh weight of leaves of broccoli where highest T₁ was (832.12 g) and lowest result T₃ was (204.14 g) this result was more or less similar with my results. Fresh weight of leaves of cauliflower varied significantly with varieties (Table 3). The maximum fresh weight of leaves was V₃ (1177.00 g) which was statistically similar with V₄ (1162.67 g). The minimum fresh weight of leaves was V₅ (470.67 g) which was statistically similar with V₁ (569.67 g). Rahman et al. (2020) also reported Japan-1 (830.77 g) was the highest fresh weight of leaves and lowest was BARI Broccoli-1 (395.56 g) this result was similar with my findings. The combined effect of genotypes and planting dates was found significant in respect of fresh weight of leaves (Table 4). The maximum fresh weight of leaves was obtained from T₁V₄ (Foliar spray with It Amazuku 33) (1446.33 g). The minimum fresh weight of leaves was obtained from T₀V₅ (No spray with BARI Fulcopi-1) (385.33 g) which was statistically similar with T₀V₅, T_{a1}V₅ and T₁V₁. Rahman et al. (2020) recorded highest interaction result was V₄T₁

Table 1. Treatments used during the study.

Month	Weekly rainfall (mm)				Monthly rainfall (mm)	Temperature °C (monthly average)	
	1st week	2nd week	3rd week	4th week		Max.	Min.
Jun-20	51	2	13	15	81	36.2	34.1
Jul-20	89	110	20	110	329	37.6	35.4
Aug-20	258	70	210	52	590	36.1	35.2
Sep-20	104	145	50	41	340	33.4	30.6
Oct-20	68	45	18	99	230	32.3	28.8
Nov-20	0	44.1	0	0.3	44.4	26.02	19.86
Dec-20	0	0	0	0.3	0.3	21.38	16.13
Jan-21	0.3	0	0.3	0.6	1.2	20.56	15.48
Feb-21	0.9	0	0.3	0.3	1.5	22.56	16.66
Mar-21	0	0	0	0	0	29.45	22.10
Apr-21	0	0	9	16	25	32.5	31.4
May-21	0	64	10	15	89	34.6	32.5



Figure 1. Pictorial view of micronutrient with hormone and control effect of different varieties of cauliflower.

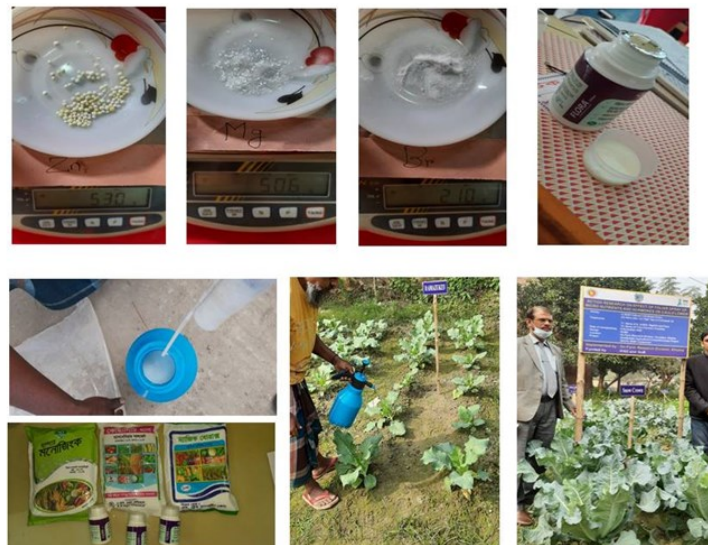


Figure 2. Some pictorial view during study period.

(1566.46 g) and the minimum fresh weight of leaves was obtained from V3T3 (267.59 g) this result was similar with my findings. As micronutrients and hormones in treated seedlings, which stimulated the cell division and enlargement, As well as the role of amino acids and vitamins in stimulating the metabolic processes and their effects in activating the photosynthesis through the release of CO₂ of treated plants.

Curd weight plant⁻¹

Statistically significant variation was recorded for foliar micronutrients and hormone in terms of weight of curd per plant of cauliflower (Table 2). The highest weight of curd per plant (809.86 g) was found from T₁ treatment whereas the lowest weight (460.27 g) from T₀ treatment). Eimon et al. (2019) re-

vealed that the Curd weight plant⁻¹ were 0.7258 g to 1420 g. Thakur et al. (1991) reported that the application of boron increased the curd yield of cauliflower. Sani et al. (2018) found similar result where the highest weight of curd per plant (1.05 kg) was found from T₂ treatment whereas the lowest weight (0.53 kg) from T₀ treatment. Weight of curd per plant of cauliflower showed significant differences due to different plant varieties (Table 3). The highest weight of curd per plant (948.83 g) was observed from V₁ which was closely followed (774.83 g) to V₂, while the lowest weight of curd per plant (437.83 g) was found from V₅ treatment which was statistically similar with V₄ (471.50 g) and V₃ (542.33 g) (Table 3). Similar observation was also found in previous report investigated by Eimon et al. (2019). In case of combined effect of variety and micronutrients, statis-

Table 2. Effect of treatment on yield contributing characters and yield of cauliflower.

Treatment	Number of leaves plant ⁻¹	Leaf weight (g)	Curd weight plant ⁻¹ (g)	Curd length (cm)	Curd diameter (cm)	Fresh weight of stem (g)	Fresh weight of Root (g)	Curd yield (t ha ⁻¹)
T ₁	23.27	952.33 a	809.86 a	11.79 a	18.68 a	108.13 a	46.60	29.99 a
T ₀	23.20	795.47 b	460.27 b	8.86 b	14.16 b	91.13 b	41.66	17.04 b
CV(%)	7.94	15.92	19.83	10.40	10.16	17.48	30.69	19.84
Level of significance	NS	**	***	***	***	*	NS	***

T₁ (Foliar spray), T₀ (Control), * = Significant at 1% level, ** = Significant at 0.1% level, *** = Significant at 0% level, NS= Non-significant, CV= Coefficient of variation.

Table 3. Effect of varieties on yield contributing characters and yield of cauliflower.

Variety	Number of leaves plant ⁻¹	Leaf weight (g)	Curd weight plant ⁻¹ (g)	Curd length (cm)	Curd diameter (cm)	Fresh weight of stem (g)	Fresh weight of Root (g)	Curd yield (t ha ⁻¹)
V ₁	21.50 cd	569.67 c	948.83 a	11.17 a	15.17 b	48.17 c	41.67 b	17.46 c
V ₂	24.17 ab	989.50 b	774.83 b	7.58 b	15.72 b	118.50 b	41.33 b	20.08 c
V ₃	26.33 a	1,177.00 a	542.33 c	10.90 a	19.65 a	135.50 ab	63.50 a	28.69 b
V ₄	23.33 bc	1,162.67 a	471.50 c	11.17 a	16.00 b	151.50 a	57.17 ab	35.14 a
V ₅	20.83 d	470.67 c	437.83 c	10.83 a	15.57 b	44.50 c	17.00 c	16.21 c
CV(%)	7.94	15.92	19.83	10.40	10.16	17.48	30.69	19.84
Level of significance	***	***	***	***	**	***	***	***

V₁ (High Top), V₂ (Snow Crown), V₃ (Shira Giku), V₄ (It Amazuku 33), V₅ (BARI Fulcopi-1). ** = Significant at 0.1% level, *** = Significant at 0% level, CV= Coefficient of variation.

Table 4. Interaction effect of treatment and varieties on yield contributing characters and yield of cauliflower.

Treatment X Variety	Number of leaves plant ⁻¹	Leaf weight (g)	Curd weight plant ⁻¹ (g)	Curd length (cm)	Curd diameter (cm)	Fresh weight of stem (g)	Fresh weight of Root (g)	Curd yield (t ha ⁻¹)	
T ₁	V ₁	21.00	598.67 d	665.67	13.33	18.67 b	188.33 a	38.00 cd	24.65
	V ₂	23.33	893.67 c	642.00	8.93	17.17 bcd	141.00 b	31.67 cde	23.77
	V ₃	26.67	1,267.00 ab	933.33	12.03	24.10 a	133.33 bc	73.33 a	34.56
	V ₄	24.33	1,446.33 a	1,219.33	12.67	18.00 bc	130.00 bc	68.33 ab	45.16
	V ₅	21.00	556.00 d	589.00	12.00	15.47 cd	114.67 bc	21.67 de	21.81
T ₀	V ₁	22.00	540.67 d	277.33	9.00	11.67 e	103.67 c	45.33 bcd	10.27
	V ₂	25.00	1,085.33 bc	442.67	6.23	14.27 de	54.33 d	51.00 abc	16.39
	V ₃	26.00	1,087.00 bc	616.33	9.77	15.20 cd	53.33 d	53.67 abc	22.82
	V ₄	22.33	879.00 c	678.33	9.67	14.00 de	42.00 d	46.00 bcd	25.12
	V ₅	20.67	385.33 d	286.67	9.67	15.67 bcd	35.67 d	12.33 e	10.61
CV%	7.94	15.92	19.83	10.40	10.16	17.48	30.69	19.84	
Level of significance	NS	**	NS	NS	**	**	.	NS	

T₁ (Foliar spray), T₀ (Control), V₁ (High Top), V₂ (Snow Crown), V₃ (Shira Giku), V₄ (It Amazuku 33), V₅ (BARI Fulcopi-1). ** = Significant at 0.1% level, . = Significant at 5% level, NS= Non-significant, CV= Coefficient of variation.

tically non-significant variation on curd weight per plant of cauliflower was found (Table 4). The highest weight of curd per plant (1219.33 g) was recorded from T₁V₄, while the lowest weight of curd per plant (286.67 g) was observed from T₀V₅ treatment combination (Table 3). Eimon *et al.* (2019) had found much variation among the interaction whose result were 0.692 g to 1510 g. Increase in curd weight might be due to the combined application of boron and molybdenum at optimum levels under deficient condition increased uptake of major nutrients which re-

sulted in sturdy plant growth and increased yield and quality. Present result confirms findings of Singh (2003) who found maximum yield with the combined foliar application of boron and molybdenum in cauliflower.

Diameter of curd

The diameter of curd of cauliflower showed significant differences due to foliar spray of micronutrients and hormone (Table 2). The highest diameter of curd (18.68 cm) was observed from

T₁ treatment, while the lowest diameter of curd (14.16 cm) was found from T₀ treatment. Kumar and Choudhary (2002) reported that B and Mo application significantly increased curd diameter of cauliflower. Sani et al. (2018) recorded similar result where the highest diameter of curd (9.00 cm) was found from T₂ treatment whereas the lowest diameter of curd (7.56 cm) from T₀ treatment. Statistically, significant variation was recorded from different varieties of cauliflower (Table 3). The highest diameter of curd (19.65 cm) was found from V₃ treatment whereas the lowest diameter of curd (15.17 cm) from V₁ which was statistically similar with V₅, V₂ and V₄ (Table 3). Eimon et al. (2019) had obtained much variation compare to the present study whose varietal diameter ranges were 43.45 cm to 45.36 cm. Combined effect of different plant spacing and micronutrients showed statistically significant variation on diameter of curd of cauliflower (Table 4). The highest diameter of curd (24.10 cm) was recorded from T₁V₃ treatment combination while the lowest diameter of curd (11.67 cm) was observed from T₀V₁ treatment combination. The formation of bigger curd with the application of higher levels of micronutrients might be done to higher synthesis of carbohydrate and their translocation to the curd, which subsequently helped in the formation of higher curd of cauliflower. Eimon et al. (2019) also reported that there was much variation among the interaction 34.57 cm to 51.60 cm. Similar results have been reported by Kumar and Choudhary (2002) reported that highest curd diameter was Borax @10 kg+ Amm. Moly. @1 kg/ha (T9) was 18.41 cm and lowest Control T0 was (15.52 cm).

Curd length (cm)

There were significant differences among the treatments in respect of curd length (Table 2). The maximum curd length was recorded from T₁ (11.79 cm) and lowest was T₀ (8.86 cm). Eimon et al. (2019) obtained significant variation among the treatment and similar result was found. Curd length of cauliflower varied significantly with varieties (Table 3). The maximum fresh weight of leaves was V₁ (11.17 cm) which was statistically similar with V₄ (11.17 cm), V₃ (10.90 cm) and V₅ (10.83 cm). The minimum fresh weight of leaves was V₂ (7.58 cm). Eimon et al. (2019) found non-significant variation among the varieties where Snow white was 13.42 cm and White Angel was 13.24 cm. The combined effect of treatment and varieties was found non-significant in respect of curd length (Table 4). The maximum curd length was obtained from T₁V₁ (Foliar spray with High Top) (13.33 cm). The minimum curd length was obtained from T₀V₂ (No spray with Snow crown) (6.23 cm). Eimon et al. (2019) obtained significant variation among the interaction where highest interaction was V₂T₄ (16.12) and lowest was V₁T₀ (Snow White x no fertilizer) was (10.28).

Fresh weight of stem (g)

Fresh weight of stem per plant of cauliflower was significant variation among the treatments (Table 2). From the foliar treatment the highest stem weight was T₁ (108.13 g) and lowest stem weight was T₀ (91.13 g). Eimon et al. (2019) obtained significant

variation among the treatment where height T₄ was 40.4 and lowest T₀ was 21.37 this result was less similar with me. Rana et al. (2019) reported that fresh weight of stem per plant of cauliflower was varied from 16.20 to 19.13. Significant variation in Fresh weight of stem was observed due to different varieties (Table 3). The highest Fresh weight of stem obtained from V₄ (151.50) which was statistically similar to V₃ (135.50). The lowest Fresh weight of stem was recorded from V₅ (44.50) followed by V₁ (48.17). Eimon et al. (2019) found Snow white was significantly highest (41 g) than that of White angel F1 (22.29 g) in this experiment similar result with me. The interaction effect between varieties and treatments was significant (Table 4). The highest Fresh weight of stem (26.67) was recorded from T₁V₁ (Foliar spray with High Top) and the lowest Fresh weight of stem (35.67) was obtained from T₀V₅ (No spray on BARI Fulcopi-1) followed by T₀V₄, T₀V₃ and T₀V₂. The variation in weight of fresh stem was found due to the variation in genotypic variation of the experimented varieties while similar observation was also found in previous report investigated by Islam et al. (2014).

Fresh weight of root (g)

Among the treatments non-significant differences found in respect of fresh weight of root (Table 2). The highest fresh weight of root (46.60 g) was recorded from T₁ (Foliar micronutrients with hormone) and the lowest weight was (41.66 g) from T₀ (control). Eimon et al. (2019) obtained significant variation among the treatment result from 52.56 g to 21.93 g this result was similar with my findings. Significant variation in fresh weight of root was observed due to different varieties (Table 3). The highest fresh weight of root obtained from V₃ (63.50 g) which was statistically similar to V₄ (57.17 g). The lowest fresh weight of root was recorded from V₅ (17.00 g). Eimon et al. (2019) found non-significant that result where the root weight of the variety Snow white (V1) was 36.3 g and White angel F1 (V2) was 36.87 g this finding more or less similar with me. Rana et al. 2019 recorded fresh weight of root was 7.00 to 9.50 g. In case of combined effect of variety and micronutrients, significant variation fresh weight of root of cauliflower was found (Table 4). The highest fresh weight of root (73.33 g) was recorded from T₁V₃ (Foliar spray with Shira Giku) and the lowest Fresh weight of stem (12.33 g) was obtained from T₀V₅ (No spray on BARI Fulcopi-1). The higher weight of fresh root was found under higher rates of N, P, K, Zn & B fertilizers which might be due to the macro and micro nutrients of the studies soil were highly utilize by this application while similar observation was also found in previous report investigated by Eimon et al. (2019) whose result was 18.08 g to 56.94 g.

Curd yield (t ha⁻¹)

Statistically significant variation was recorded for micronutrients in terms of curd yield per hectare of cauliflower (Table 2). The highest curd yield (29.99 t/ha) was found from T₁ treatment whereas the lowest curd yield (17.04 t/ha) was recorded from T₀ treatment. Kumar and Choudhary (2002) reported that B and

Mo application significantly increased curd diameter, weight and yield of cauliflower. Khadka et al. (2005) reported the better cauliflower curd from the application of boron. Curd yield per hectare of cauliflower showed significantly significant differences due to different plant varieties (Table 3). The highest curd yield per hectare (35.14 t/ha) was observed from V₃ (It Amazuku 33), while the lowest curd yield per hectare (16.21 t/ha) was found from V₅ followed by V₁ (17.46 t/ha) and V₂ (20.08 t/ha). Eimon et al. (2019) found It was found the highest (36.48 ton ha⁻¹) in White Angel F1 compared to Snow White (31.51 ton ha⁻¹). There was no significant variation has been found for the curd yield of Cauliflower due to the effects of interaction of varieties and fertilizers at the 5% level of significance (Table 4). The highest yield (45.16 t/ha) was recorded from T₁V₄, while the lowest curd yield (10.61 t/ha) was observed from T₀V₅ combination. These findings are in confirmation with the non-significant combination findings of Eimon et al. (2019) whose curd yield was 16.79 to 50.5 t ha⁻¹.

Conclusion

This study enlightened us with the further conclusion that the cultivation of the variety It Amazuku 33 (V₄) with the application of Zn 8.83 kg/ha, B 3.5 kg/ha, Ma 8.43 kg/ha and flora (Hormone) 2 ml/1 L of water (T₁) was more satisfied combination (T₁V₄) of Zn+ B+Mg+ Flora fertilizers for the noteworthy production of cauliflower under the agro-climatic circumstance. So that, it could be suggested by reviewing the concluded observations of this experiment that the farmer(s) can be applied the combined treatment of Zn 8.83 kg/ha + B 3.5 kg/ha + Ma 8.43 kg/ha + Flora (Hormone) 2 ml/1 L for tremendous production of Cauliflower in Bangladesh. Considering the all resolved results and facts of this study, the successive solicitations may be suggested. Superfluous and advance experiment may be ameliorated to ascertain the studied achievements in another agro-ecological region of our country for regarding conformation. Diversified types of Cauliflower varieties along with excessive proportions and forms of fertilizers are required for further analysis to justify the current outcomes of this experiment.

Conflict of interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

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