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Effect of Bio-NPK and different level of organic manures on growth, yield and quality of cauliflower (*Brassica oleracea* var. *botrytis* L.) var. Pusa Snowball K1

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Abstract
The present investigation was carried out on "Effect of Bio-NPK and organic manures on growth, yield and quality of cauliflower (*Brassica oleracea* var. *botrytis* L.) var. Pusa Snowball K 1" at Horticulture Research Farm, Department of Horticulture, B. A. College of Agriculture, Anand Agricultural University, Anand during *Rabi* season 2022-23. The experiment was laid out in Randomized Block Design with factorial concept with three replication and thirteen treatment combinations comprising of two level of Bio-NPK and six level of organic manures of total 12 combinations. The experiment result revealed that, treatment B_1 (Seedling dipping with Bio-NPK) was found the most effective treatment which recorded significantly maximum plant height (44.97, 51.74 and 58.16 cm), number of leaves at (10.65, 16.84 and 23.42), N-S plant spread (37.04, 50.67 and 63.88 cm) and E-W plant spread (34.78, 48.79 and 62.26 cm) at 40th, 60th and 80th DAT, respectively, weight of the curd (745.16 gm), diameter of the curd (16.99 cm) and yield per plot (13.46 kg). Treatment of organic manures significantly responded on growth and yield parameters *viz*., Among all treatment, treatment F_3 (100% RDN through VC) was the most effective treatment which recorded significantly maximum plant height (46.84, 54.42 and 61.00 cm), number of leaves (11.26, 17.66 and 24.19), plant spread N-S (37.58, 52.26 and 65.86 cm), E-W (35.40, 50.05 and 64.25 cm) at 40th, 60th and 80th DAT respectively, weight of the curd (802.41 gm), diameter of the curd (17.69 cm), yield per plot (14.72 kg), TSS (9.17 ^{o} Brix), total soluble sugar (2.46%), ascorbic acid (72.13 mg/100 g), compactness (23.76 kg/cm^2)and shelf life of cauliflower (7.41 days). However, it was remained at par with the treatment of F_5 (50% RDN through FYM + 50% RDN through VC) and F_6 (75% RDN through VC + 25% RDN through FYM).

Keywords: Bio-NPK, cauliflower, Pusa snowball K1, organic manures

Introduction
Cauliflower (*Brassica oleracea* var. *botrytis* L.) is one of the popular cruciferous vegetable crops grown in India. It belongs to the family *Cruciferae* and has 18 chromosome numbers (2n=18, x=9). The center of origin of cauliflower is the Mediterranean region. The word cauliflower derived from two Latin words '*caulis*' means cabbage and '*floris*' means flower. It is commonly known as *phool gobhi* in Hindi. According to the times of sowing and maturity, cauliflower is classified into different groups like early, mid-early, mid-late and late. In terms of climatic requirements, cauliflower is quite resistant to cold conditions making it well adapted to cool-season production. The plant is extremely sensitive to unfavorable conditions such as hot weather, drought or too low temperature, which often result into formation of premature heads or curds (Tiwari, 2006) [18]. Cauliflower can be grown on any good soil but a fairly deep loamy soil is desirable. The soil should be fertile, well supplied with organic matter and well-drained. India is the second largest producer of cauliflower in the world. In India, the area under cauliflower cultivation is 473.0 thousand hectares with an annual production of 9283 thousand tones (Anonymous, 2022a) [1]. FYM supplies all the essential plant nutrients, which improve the physio-chemical properties, increases water holding capacity and encourages the soil microbial activities. Vermicompost are products derived from the accelerated biological degradation of organic wastes by earthworms and microorganisms. Vermicompost are finely divided peat-like materials with high porosity, aeration, drainage, and water-holding capacity (Edwards and Burrows, 1988) [5]. Bio-NPK liquid biofertilizers which contains living organisms when applied to the soil, colonize the rhizosphere or interior of the plant and promote growth by increasing the supply or availability of primary nutrients to the

plant. It is an important component of plant nutrient management for sustainable agriculture. In recent years, biofertilizer NPK consortium are gaining much popularity. Bio-NPK consortium contain five strains of agriculturally beneficial microorganism (two Nitrogen fixer, two Phosphate solubilizers and one potash mobilizer) is the one time solution for all the macronutrient (N, P, K) requirement of crops.

Materials and Methods

The experiment was conducted at Horticultural Research Farm, Department of Horticulture, BA College of Agriculture, Anand Agricultural University, Anand, and Gujarat. The experiment was laid out in Randomized Block Design with factorial concept (FRBD) replicated thrice with two level of Bio-NPK and six level of organic manures application. The absolute control treatment was taken separately means without combination under experimentation. Treatment details given in (Table no. 1) and treatment combination is given in (Table no. 2). The Cauliflower (var. Pusa Snowball K 1) seeds were raised in nursery on 17th October, 2022 and transplanted in the main field on 24th November 2022 at a spacing of 60 cm × 45 cm. The gross plot size is 3.6 m x 4.5 m and net plot size is 2.4 m x 3.6 m. The soil of the experimental site was sandy loam, locally. Known as "Goradu" with the pH of soil is 7.85, organic carbon 0.34%, 254 kg/ha of available nitrogen, 30.90 kg/ha of available phosphorus, 278 kg/ha of available potassium. In this experiment two source of organic manures used *viz*., vermicompost, FYM. Bio- NPK used 1 l/ha. Applied Bio-NPK at seedling stage before transplanting and foliar spray at 30 DAT. Seedling was dipped in 0.5 (%) Bio-NPK solution for 20 minutes before transplanting. 10 t/ha FYM was given as blanket application at the time of soil preparation. Observations were recorded on growth and yield attributing parameters on five numbers of selected plants in each plot excluding the border rows. The data were statistically analysed by the method suggested by Panse and Sukhatme (1967) [2].

Table 1: Details of various treatments

Sr. No.	Symbol	Treatments
1.	B_1	Seedling dipping in Bio-NPK
2.	B_2	Foliar spray of Bio NPK at 30 DAT
1.	F_1	Control
2.	F_2	100% RDN through FYM
3.	F_3	100% RDN through VC
4.	F_4	75% RDN through FYM +25% RDN through VC
5.	F_5	50% RDN through FYM +50% RDN through VC
6.	F_6	75% RDN through VC +25% RDN through FYM
7.		Absolute control

Table 2: Treatment combinations

Treatments	Notation	Treatment combination
T_1	$B_1 F_1$	Seedling dipping in Bio NPK with control
T_2	$B_1 F_2$	Seedling dipping in Bio NPK with 100% RDN through FYM
T_3	$B_1 F_3$	Seedling dipping in Bio NPK with 100% RDN through VC
T_4	$B_1 F_4$	Seedling dipping in Bio NPK with 75% RDN through FYM + 25% RDN through VC
T_5	$B_1 F_5$	Seedling dipping in Bio NPK with 50% RDN through FYM + 50% RDN through VC
T_6	$B_1 F_6$	Seedling dipping in Bio NPK with 75% RDN through VC + 25% RDN through FYM
T_7	$B_2 F_1$	Foliar Spray of Bio NPK at 30 DAT with control
T_8	$B_2 F_2$	Foliar Spray of Bio NPK at 30 DAT with 100% RDN through FYM
T_9	$B_2 F_3$	Foliar Spray of Bio NPK at 30 DAT with 100% RDN through VC
T_{10}	$B_2 F_4$	Foliar Spray of Bio NPK at 30 DAT with 75% RDN through FYM + 25% RDN through VC
T_{11}	$B_2 F_5$	Foliar Spray of Bio NPK at 30 DAT with 50% RDN through FYM + 50% RDN through VC
T_{12}	$B_2 F_6$	Foliar Spray of Bio NPK at 30 DAT with 75% RDN through VC + 25% RDN through FYM
T_{13}	$B_0 F_0$	Absolute control

Results and Discussion

The results obtained from growth parameters of cauliflower experiment are presented in relevant Tables 3 and graphically illustrated in Fig.1. Plant height, number of leaves and plant spread N-S and E-W was significantly influenced by different treatment of Bio-NPK and different level of organic manures but their interaction effect was non-significant.

Plant height

Among different treatment of Bio-NPK treatment of seedling dipping was found most effective for increasing plant height at 40th, 60th and 80th days after transplanting. Similarly, among the different treatment of organic manures, treatment F_3 i.e. 100% RDN though vermicompost was found most effective which recorded maximum plant height at 40th, 60th and 80th days after transplanting i.e. 46.34, 54.42 and 61.00 cm respectively, followed by F_5 and F_6.

Reason of increased plant height may be assumed that the beneficial effects of vermicompost with the Bio-NPK consortium may be enhanced soil microorganism activities and increased soil humidification of both native and added nutrients, as shown by the significantly higher plant height in the treatment of 100% vermicompost when applied as a basal (Kale *et al.*, 1992 and Devi *et al.*, 2017) [3, 4].

Number of leaves

Treatment of seedling dipping in Bio -NPK was found most effective for increasing number of leaves at 40th, 60th and 80th days after transplanting. Similarly among different treatment of organic manures, treatment F_3 i.e., 100% RDN though vermicompost was found most effective which recorded maximum number of leaves at 40th, 60th and 80th days after transplanting i.e. 11.26, 17.66 and 24.19 respectively, followed by F_5 and F_6 than rest of the treatments.

The number of leaves was much higher in seedlings dipping with Bio-NPK for 20 minutes, which might have triggered an increase in the biological nitrogen fixation and availability of phosphorus required for vigorous vegetative growth. Consequently, it finally results in the growth of more leaves (Pawar & Barkule, 2017) [6]. And also found maximum in 100% Nitrogen through vermicompost, which showed better result than other organic manures due to larger soil availability of both naturally occurring and added nutrients resulted to increased vegetative growth and leaves of

cauliflower plant. Similar result was found by Meena *et al.* (2017) [7] and Atal *et al.* (2019) [8] in broccoli, Narayan *et al.* (2018) [9] and Ibrahim *et al.* (2018) [10] in Chinese cabbage.

Plant spread

Among different treatment of Bio-NPK treatment of seedling dipping was found most effective for increasing plant spread N-S and E-W at 40th, 60th and 80th days after transplanting. Similarly among application of different treatment of organic manures treatment F_3 i.e. 100% RDN though vermicompost was found most effective which was recorded maximum Plant spread N-S (37.58 cm, 52.26 cm and 65.86 cm) and E-W (35.40 cm, 50.05 cm and 64.25 cm) at 40th, 60th and 80th days after transplanting respectively, followed by F_5 and F_6 than rest of the treatments.

In the present experiment effect of organic manures on plant spread was found significantly effective in 100% RDN through vermicompost than the other organic manure treatment, which might be due to the vermicompost contains more mineral elements in their available forms and at higher amounts, which may have stimulated the growth of plants and increasing the number of leaves (Edwards *et al.*, 2011) [11]. Similar result was found by Atal *et al.* (2019) [8].

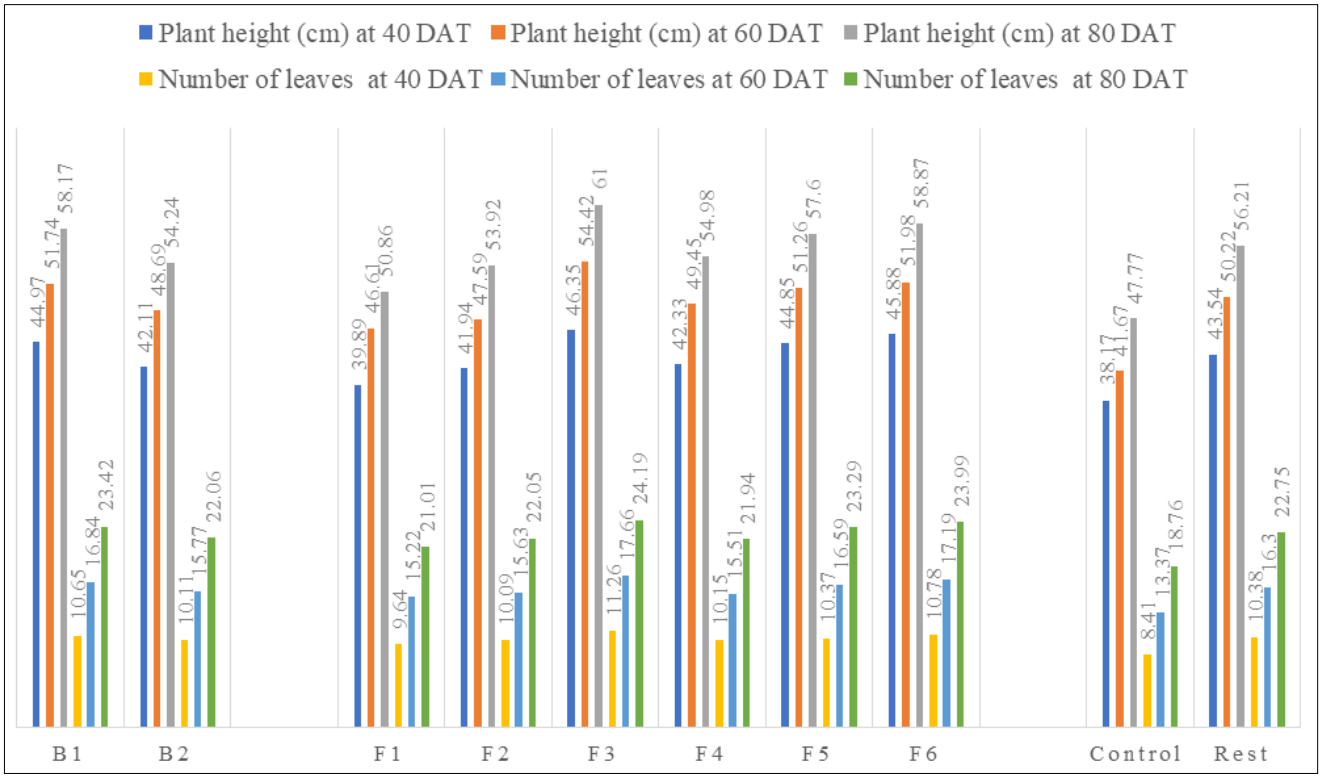

Fig 1: Effect of Bio-NPK and organic manures on growth parameters of cauliflower

Table 3: Effect of Bio-NPK and organic manures on plant height, number of leaves and plant spread

Treatments	Plant Height (cm)			No. of Leaves			Plant Spread (cm)					
	40th DAT	60th DAT	80th DAT	40th DAT	60th DAT	80th DAT	40th DAT (N-S)	40th DAT (E-W)	60th DAT (N-S)	60th DAT (E-W)	80th DAT (N-S)	80th DAT (E-W)
Factor A												
B_1 - Seedling dipping in Bio-NPK	44.97	51.74	58.16	10.65	16.84	23.42	37.04	34.78	50.67	48.79	63.88	62.26
B_2 - Foliar spray of Bio-NPK at 30 DAT	42.10	48.69	54.24	10.11	15.77	22.06	34.22	32.46	48.01	46.13	59.65	58.14
S.Em.±	0.76	1.02	1.13	0.18	0.32	0.41	0.63	0.61	0.78	0.80	1.13	1.14
CD at 5%	2.22	3.00	3.03	0.54	0.95	1.19	1.84	1.80	2.30	2.34	3.33	3.35
Factor B												
F_1 – Control	39.88	46.61	50.87	9.64	15.22	21.01	33.02	30.74	45.76	44.30	56.97	55.42
F_2 - 100% RDN through FYM	41.94	47.59	53.92	10.09	15.63	22.05	34.16	31.57	47.44	45.63	59.67	57.75
F_3 - 100% RDN through VC	46.34	54.42	61.00	11.26	17.66	24.19	37.58	35.40	52.26	50.05	65.86	64.25
F_4 - 75% RDN through FYM + 25% RDN through VC	42.33	49.45	54.98	10.15	15.51	21.94	34.32	32.08	47.69	45.67	59.89	58.27
F_5 - 50% RDN through FYM + 50% RDN through VC	44.85	51.26	57.60	10.36	16.59	23.29	37.01	34.97	51.22	49.14	63.64	62.59
F_6 - 75% RDN through VC + 25% RDN through FYM	45.88	51.98	58.86	10.77	17.19	23.99	37.27	35.25	51.65	49.97	64.58	62.95
S.Em.±	1.312	1.77	1.97	0.33	0.56	0.70	1.06	1.09	1.36	1.38	1.97	1.98
CD at 5%	3.85	5.20	5.65	0.97	1.65	2.06	3.10	3.18	3.99	4.05	5.78	5.81
Interaction	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Control vs Rest												
Absolute control	38.17	41.67	47.77	8.41	13.37	18.76	30.95	28.83	42.20	40.39	53.70	52.05

Rest treatments	43.53	50.22	56.20	10.38	16.30	22.75	35.93	33.62	49.34	47.46	61.76	60.21
S.Em.±	1.91	2.56	2.77	0.47	0.83	1.01	1.57	1.52	2.11	2.10	2.86	2.90
CD at 5%	3.94	5.29	5.72	0.98	1.71	2.11	3.24	3.14	4.36	4.34	5.90	5.99
CV%	7.33	8.57	8.28	7.7	8.56	7.54	7.39	8.09	7.18	7.44	7.76	8.08

Days taken curd initiation and harvesting

The results obtained from days taken for curd imitation and harvesting of cauliflower experiment are presented in relevant Tables 4 and graphically illustrated in Fig. 2.

Effect of Bio-NPK on days taken to curd initiation and harvesting was non-significant where in treatment of different organic nutrients it was significant. However their interaction was non-significant. Among different level of treatment of FYM and VC, treatment F3 (100% RDN through VC) recorded minimum days taken to curd initiation and harvesting i.e. 67.93 and 87.58 respectively, followed by F_5 and F_6. The maximum days taken for curd imitation and harvesting recorded in absolute control i.e. 77.26 and 99.30 days respectively.

The early curd initiation and harvesting could be due 100% RDN through vermicompost improve the physical condition of soil in respect of granulation, friability porosity which in term provided a balance nutritional environment to both soil rhizosphere and in plant system (Reddy *et al.*, 1998) [24].

Table 4: Effect of Bio-NPK and organic manures on days taken for curd initiation and curd harvesting

Treatments	Days taken for Curd Initiation	Days taken for Curd Harvesting
Factor A		
B_1 – Seedling dipping in Bio-NPK	70.22	90.04
B_2 – Foliar spray of Bio-NPK at 30 DAT	71.17	91.53
S. Em.±	0.83	1.07
CD at 5%	NS	NS
Factor B		
F_1 – Control	73.87	94.24
F_2 - 100% RDN through FYM	72.12	93.03
F_3 - 100% RDN through VC	67.93	87.58
F_4 - 75% RDN through FYM + 25% RDN through VC	72.18	92.92
F_5 - 50% RDN through FYM + 50% RDN through VC	69.30	89.01
F_6 - 75% RDN through VC + 25% RDN through FYM	68.74	87.94
S. Em.±	1.44	1.79
CD at 5%	4.22	5.24
Interaction	NS	NS
Control vs Rest		
Absolute control	77.26	99.30
Rest treatments	70.69	90.79
S.Em.±	2.07	2.65
CD at 5%	4.27	5.48
CV%	4.82	4.81

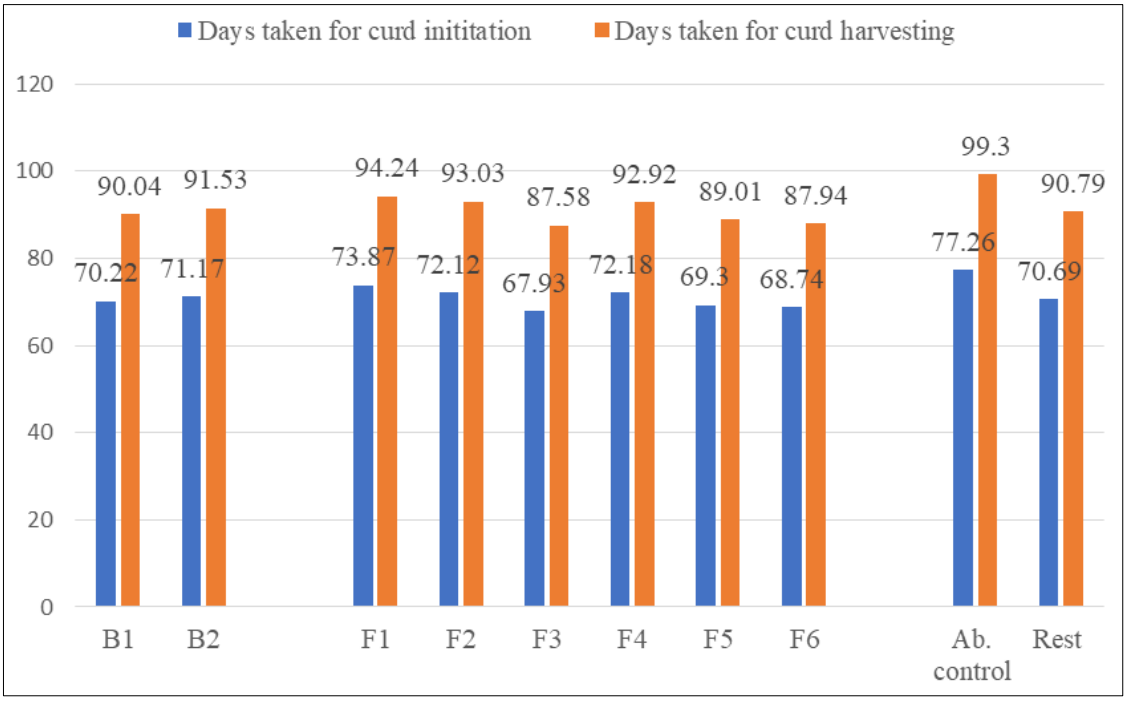

Fig 2: Effect of Bio-NPK and organic manures on days taken for curd initation and harvesting

Yield and yield attributing parameters

The results obtained from yield parameters of cauliflower experiment are presented in relevant Tables 5 and graphically illustrated in Fig 3. Weight of the curd and diameter of curd were significantly influenced by treatment of Bio-NPK and different level of organic manures but their interaction effect was non-significant.

Weight of the curd (gm) and diameter of the curd (cm)

Treatment of seedling dipping in Bio-NPK was found most effective for increasing weight of the curd and diameter of curd. Similarly among application of different treatment of organic manures, treatment, F_3 *i.e.* 100% RDN though vermicompost recorded maximum weight of the curd *i.e.* 802.41 gm followed by F_5 and F_6 than rest of the treatments. Among different treatment of Bio-NPK treatment of seedling dipping was found most effective for increasing diameter of the curd. Similarly among application of different treatment of organic manures treatment F_3 *i.e.* 100% RDN though vermicompost was found most effective which was recorded maximum diameter of the curd *i.e.* 17.69 cm followed by F_5 and F_6.

Increase in weight and diameter of curd might be due to higher and continuous nutrient availability from organic manure and biofertiliser at different stage of growth resulted in better translocation of carbohydrates to store organs, which influenced the diameter of head (Negi *et al.*, 2017) [13]. This findings also confirmed by Neupane *et al.*, 2020 [12]. Devi *et al.* (2017) [4] observed significantly increase in the diameter of head with treatment of vermicompost and *Azotobacter* and PSB in cabbage. These results are in line with the similar findings of Sharma (2020) [14] in cauliflower and Atal *et al.* (2019) [8] in broccoli.

Yield per plot (kg)

Yield per plot was significantly influenced by treatment of Bio-NPK and different level of organic manures but their interaction effect was non-significant. Among different treatment of Bio-NPK treatment of seedling dipping was found most effective for increasing yield per plot. Similarly among application of different treatment of organic manures treatment F_3 *i.e.* 100% RDN though vermicompost was found most effective which was recorded maximum yield per plot *i.e.* 14.72 kg followed by F_5 and F_6.

Significantly increased yield per plot was found in treatment of 100% vermicompost. Significantly increased leaf area, plant height, increased numbers of flowers, more fruits and greater overall yields in tomato by treatment of vermicompost (Edward *et al.* 2011) [11]. The availability of nutrients by direct addition and the solubility of the natural status nutrients present in the soil, enabling the enormous utilisation of nutrients and effective utilization may increase the yield by inoculating biofertilizer in vermicompost. (Devi *et al.*, 2017) [4]. The highest weight of curd in broccoli in vermicompost with biofertilizer treatment reported by Atal *et al.* (2019) [8]. Similar result was found by Gangadhar *et al.* (2020) [15] in chilli, Devi *et al.* (2017) [4], Chetterjee *et al.* (2012) [17] in cabbage, Suklabaidya *et al.* (2017) [17], Atal *et al.* (2019) [8], Meena *et al.* (2017) [7] in broccoli.

Quality parameters

The results obtained from quality parameters of cauliflower experiment are presented in relevant Tables 6 and graphically illustrated in Fig. 4.

TSS, total soluble sugar, ascorbic acid, curd compactness and shelf life of cauliflower was found significant in treatment of different organic manures but it was non-significant in case of treatment of Bio-NPK. However, their interaction was non-significant. Among different level of treatment of FYM and VC, treatment F_3 (100% RDN through VC) recorded maximum TSS (^{o} Brix), total soluble sugar (%), ascorbic acid (mg/100g), curd compactness (kg/cm^2) and shelf life of cauliflower *i.e.* 9.17 ^{o}Brix, 2.46%, 72.13 mg/100g, 23.76 kg/cm^2 and 7.41 days respectively, followed by F_5 and F_6.

In the above results, application of 100% vermicompost showed better result for quality parameters. Total sugar and TSS of of cauliflower higher than rest of treatments which might be possible due to the enhanced activities of the hydrolytic enzyme which converted the complex polysaccharides into simple sugar (Gangadhar *et al.* (2020) [15]. Ibrahim *et al.* (2018) [10] observed as a result of vermicompost and bio-fertilizers, which balance and improve nutrient uptake from the soil, there may be an increase in TSS in Chinese cabbage. Similar result found by Meena *et al.* (2017) [7] in broccoli and Chatterjee (2012) [16] in cabbage. Further ascorbic acid also recorded higher with application of 100% vermicompost might be due to there is a general observation that organically managed crop have usually higher vitamin C than the conventional fertilized crop. In case of organically managed soil, plants are generally exposed with comparatively lower amount of nitrogen and several plant nutrients are released slowly over time. Therefore, organic crop would be expected to maintain higher vitamin 'C' and carbohydrates and less protein as reported by Bahadur *et al.* (2003) [19] in broccoli. This is in confirmation with Sable and Bhamare (2007) [20] in cauliflower and Sharma (1997) [21] in cabbage. Results of 100 per cent of RDN application through vermicompost showed significant results in extension of shelf life of cauliflower which might be due to bio fertilizers and vermicompost which slow down the physiological process like respiration which leading to better retention of moisture and increased shelf life (Mohod *et al.* (2021) [22]. The similar trends of result was also reported by Gurav (2002) [23] in cabbage and Sable and Bhamare (2007) [20] in cauliflower who reported that the combination of organic manures and bio-fertilizers significantly increase the shelf life of the curd.

Table 5: Effect of Bio-NPK and organic manures on weight of the curd, diameter of the curd and curd yield per plot

Treatments	Weight of the curd (g)	Diameter of the curd (cm)	Curd yield per plot (kg)
Factor A			
B_1 – Seedling dipping in Bio-NPK	745.16	16.99	13.46
B_2 – Foliar spray of Bio-NPK at 30 DAT	682.14	16.32	12.40
S. Em.±	15.39	0.21	0.31
CD at 5%	45.15	0.63	0.91
Factor B			
F_1 - Control	635.52	15.92	10.91
F_2 - 100% RDN through FYM	685.06	16.00	11.62
F_3 - 100% RDN through VC	802.41	17.69	14.72
F_4 - 75% RDN through FYM + 25% RDN through VC	689.56	16.55	12.44
F_5 - 50% RDN through FYM + 50% RDN through VC	725.65	16.72	13.60
F_6 - 75% RDN through VC + 25% RDN through FYM	743.70	17.04	14.28
S.Em.±	26.66	0.37	0.54
CD at 5%	78.20	1.08	1.59
Interaction	NS	NS	NS
Control vs Rest			
Absolute control	596.08	14.00	9.46
Rest treatments	713.65	16.65	12.93
S.Em.±	41.80	0.55	0.79
CD at 5%	86.27	1.60	1.64
CV%	9.84	5.55	10.39

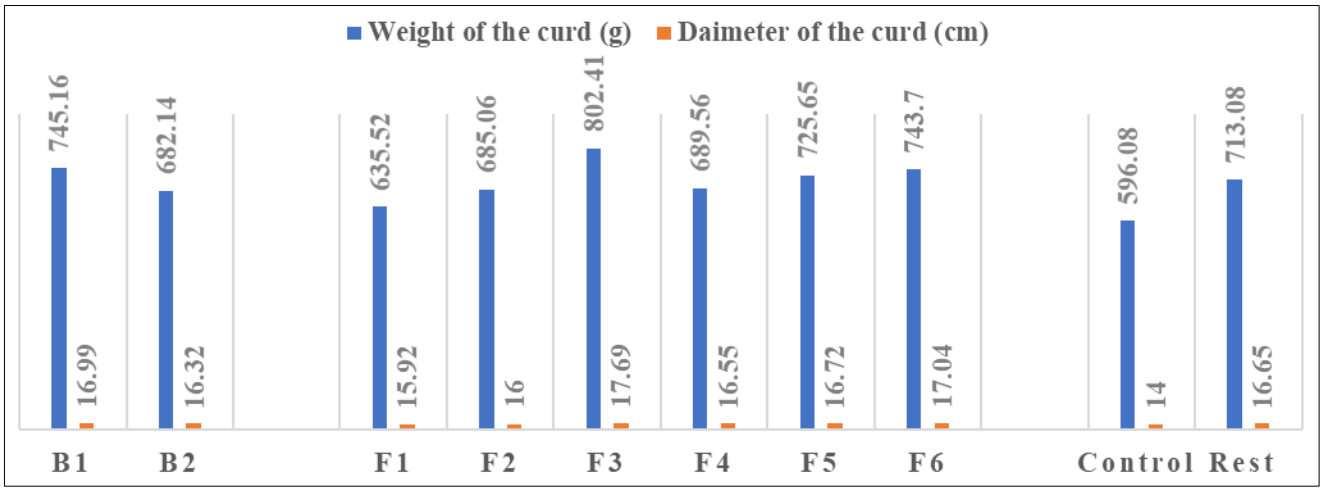

Fig 3: Effect of bio-NPK and organic manures on yield parameters of cauliflower

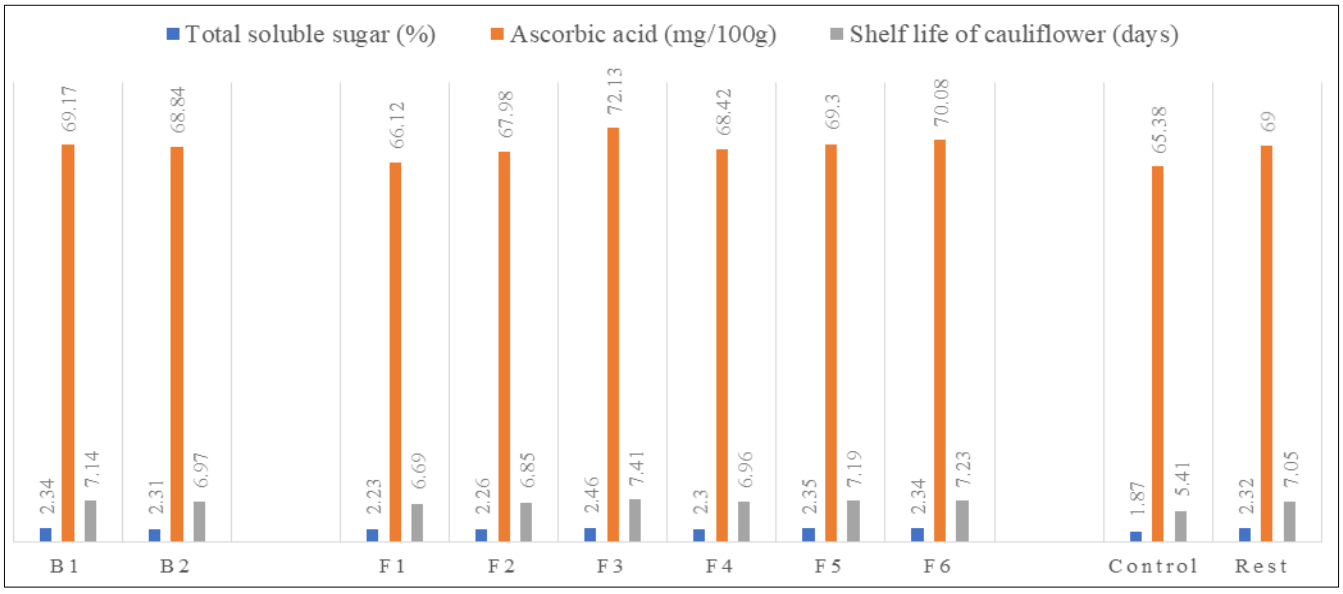

Fig 4: Effect of bio-NPK and organic manures on quality parameters of cauliflower

Table 6: Effect of Bio-NPK and organic manures on TSS, total soluble sugar, ascorbic acid, compactness and shelf life of cauliflower

Treatments	TSS (°Brix)	Total soluble sugar (%)	Ascorbic acid (mg/100g)	Compactness (kg/cm^2)	Shelf life of cauliflower (days)
Factor A					
B_1 – Seedling dipping in Bio-NPK	8.80	2.34	69.17	22.86	7.14
B_2 – Foliar spray of Bio-NPK at 30 DAT	8.72	2.31	68.84	22.53	6.97
S. Em.±	0.10	0.02	0.58	0.26	0.07
CD at 5%	NS	NS	NS	NS	NS
Factor B					
F_1 – Control	8.34	2.23	66.12	21.59	6.69
F_2 - 100% RDN through FYM	8.51	2.26	67.98	21.97	6.85
F_3 - 100% RDN through VC	9.17	2.46	72.13	23.76	7.41
F_4 - 75% RDN through FYM + 25% RDN through VC	8.60	2.30	68.42	22.24	6.96
F_5 - 50% RDN through FYM + 50% RDN through VC	8.94	2.35	69.30	23.23	7.19
F_6 - 75% RDN through VC + 25% RDN through FYM	9.02	2.34	70.08	23.39	7.23
S. Em.±	0.17	0.04	1.01	0.46	0.13
CD at 5%	0.52	0.12	2.99	1.37	0.39
Interaction	NS	NS	NS	NS	NS
Control vs Rest					
Absolute control	7.70	1.87	65.38	20.00	5.41
Rest treatments	8.76	2.32	69.00	22.70	7.05
S.Em.±	0.26	0.06	1.55	0.66	0.20
CD at 5%	0.53	0.13	3.21	1.37	0.41
CV%	4.94	4.54	3.75	4.88	4.79

Conclusion

In view of above discussion, it can be concluded that Bio-NPK and organic manures treatments have significant effect on growth, yield attributing character and quality parameters except in case of treatment of Bio-NPK was found non-significant for days taken for curd imitation, harvesting and quality parameters. While their interaction effect was found non-significant for all growth, yield and quality parameters. Seedling dipping with Bio-NPK or basal application of 100% RDN through vermicompost was found most effective for increasing growth, higher yield and improvement in quality.

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