*International Journal of Plant & Soil Science*

***Volume 35, Issue 23, Page 431-440, 2023; Article no.IJPSS.110964***
***ISSN: 2320-7035***

# Effect of Bio-NPK and Organic Manures on Growth, Yield and Economics of Cauliflower (*Brassica oleracea* var. *botrytis* l.) var. Pusa Snowball K 1

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***Authors' contributions***

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

***Article Information***

DOI: 10.9734/IJPSS/2023/v35i234259

**Open Peer Review History:**
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/110964

***Original Research Article***

***Received: 15/10/2023***
***Accepted: 19/12/2023***
***Published: 21/12/2023***

## ABSTRACT

The present investigation was carried out on "Effect of Bio-NPK and organic manures on growth, yield and economics 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

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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 40$^{th}$, 60$^{th}$ and 80$^{th}$ 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), E-W (35.40, 50.05 and 64.25 cm) at 40$^{th}$, 60$^{th}$ and 80$^{th}$ DAT respectively, weight of the curd (802.41 gm), diameter of the curd (17.69 cm) and yield per plot (14.72 kg). However, based on economics, treatments 75 % RDN through VC + 25 % RDN through FYM gave maximum net realization (197168 ₹ /ha).

*Keywords: Bio-NPK, cauliflower; pusa snowball K1; organic manures; economics.*

## 1. 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 [1]. 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 tonnes. Major cauliflower growing states in India are West Bengal, Bihar, Odisha, Haryana, Gujarat, Jharkhand, Assam, Chhattisgarh, Madhya Pradesh and Uttar Pradesh [2]. Farm yard manure (FYM) is maintaining soil health. It supplies all the essential plant nutrients, which improve the physio-chemical properties, increases water holding capacity, and encourages the soil microbial activities. Vermicomposts 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 [3]. 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.

Novelty of this research is the Conventional agriculture has made an adverse impact on soil and plant health. This eventually, leads to high demand for organic farming to protect soil and plant health. Organic farming in recent years is gaining impetus due to realization of inherent advantages as it confers in sustaining crop production and also in maintaining dynamic soil nutrient status and safe environment [4]. In view of maintain soil health and getting sustainable production, the ecofriendly treatments of experiment were selected.

## 2. MATERIALS AND METHODS

The experiment was conducted at Horticultural Research Farm, Department of Horticulture, B. A. College of Agriculture, Anand Agricultural

University, Anand, 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 Details of various treatment) and treatment combination is given in (Table no. 2 Treatment combinations). 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. The economic parameters like cost of cultivation, net return and benefit: cost (B:C) ratio were worked out based on prevailing market prices of inputs, outputs and labour daily wages. Input cost like vermicompost and FYM purchasing price is 6 ₹ /kg and 1 ₹ /kg respectively. Selling price of cauliflower curd is 20 ₹ /kg. The data were statistically analyzed by the method suggested by Panse and Sukhatme [5].

**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 Table 2: Treatment combinations |
| $T_4$ | $B_1$ $F_4$ | 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 |

**Table 3. 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 |

## 3. RESULTS AND DISCUSSION

### 3.1 Effect on Growth

The results obtained from growth parameters of cauliflower experiment are presented in relevant Tables 4 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.

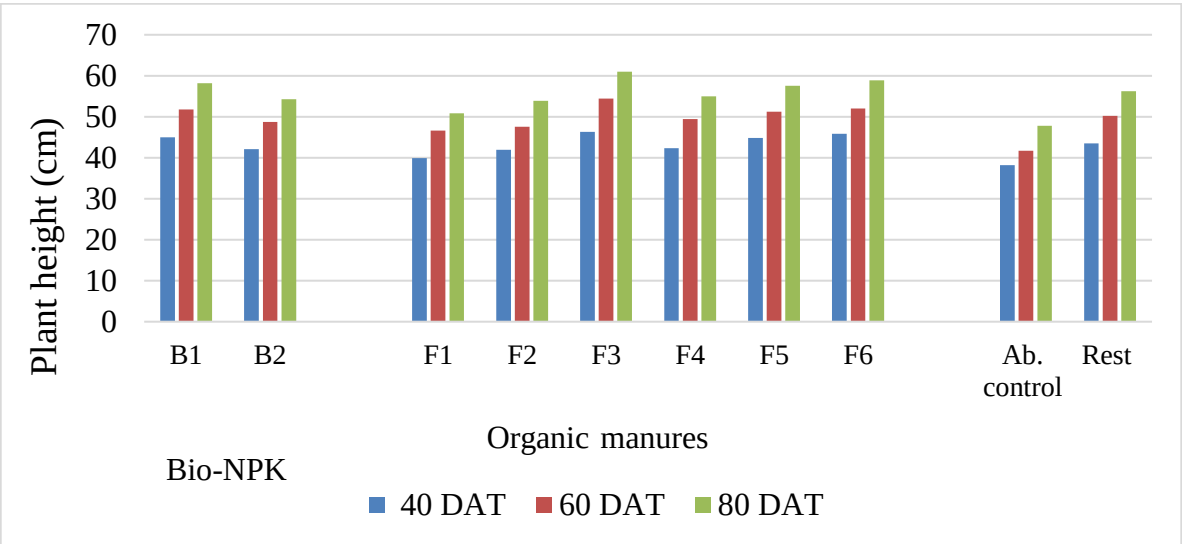


**Fig. 1. Effect of Bio-NPK and organic manures on plant height at 40, 60 and 80 DAT**

### 3.2 Plant Height

Plant height 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 plant height at 40$^{th}$, 60$^{th}$ and 80$^{th}$ days after transplanting. Similarly, different treatment of organic manures treatment $F_3$ i.e. 100 % RDN though vermicompost was found most effective which recorded maximum plant height at 40$^{th}$, 60$^{th}$ and 80$^{th}$ days after transplanting i.e 46.34, 54.42 and 61.00 cm respectively, followed by $F_5$ and $F_6$.

Increased plant height it can 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 [6,7].

### 3.3 Number of Leaves

Number of leaves 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 number of leaves at 40$^{th}$, 60$^{th}$ and 80$^{th}$ days after transplanting. Similarly 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 40$^{th}$, 60$^{th}$ and 80$^{th}$ days after transplanting i.e. 11.26, 17.66 and 24.19 respectively, followed by $F_5$ and $F_6$.

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 [8]. 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 in Meena et al. [9] and Atal et al. [10] in broccoli, Narayan et al. [11] and Ibrahim et al. [12] in chinese cabbage.

### 3.4 Plant spread

Plant spread N-S and E-W 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 plant spread N-S and E-W at 40$^{th}$, 60$^{th}$ and 80$^{th}$ 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 40$^{th}$, 60$^{th}$ and 80$^{th}$ days after transplanting respectively, followed by $F_5$ and $F_6$.

In the present experiment effect of organic manures on plant spread was found significantly 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 [13]. Similar result was found by Atal et al. [10].

### 3.5 Yield and its Attributing Parameters

The results obtained from yield parameters of cauliflower experiment are presented in relevant Tables 3 and graphically illustrated in Fig. 2. 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.

### 3.6 Weight of the Curd (gm)

Weight of the curd 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 weight 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 weight of the curd *i.e.* 802.41 gm followed by $F_5$ and $F_6$.

**Table 4. 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 |

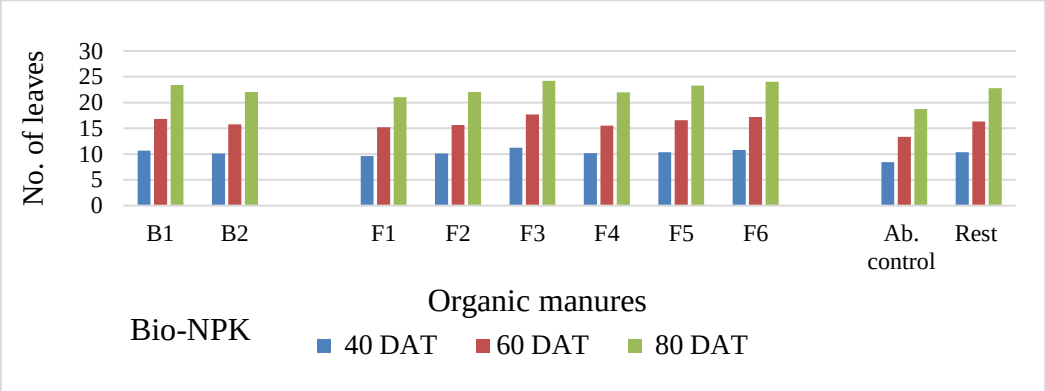


**Fig. 2. Effect of Bio-NPK and organic manures on number of leaves at 40, 60 and 80 DAT**

The increase in curd size in Bio-NPK treatment with vermicompost might be due to improved nutritional atmosphere in the root zone to encourage plant growth and development which help in supply of nutrients and proliferous root system enabling better absorption of water and nutrient along with the physical environment [14]. And also Nitrogen fixation through *Azotobacter* supported by additional use of 100 % vermicompost leads to increase the curd weight of cauliflower.

### 3.7 Diameter of the curd (cm)

Diameter of the curd 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 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 diameter of curd might be due to higher and continuous nutrient availability from organic manure and biofertilizer at different stage of growth resulted in better translocation of carbohydrates to store organs, which influenced the diameter of head [15]. It was observed that an increasing application nitrogen through 100 % vermicompost, bio-fertilizer increased the curd diameter. Devi et al. [7] 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 [16] in cauliflower and Atal et al. [10] in broccoli.

### 3.8 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 the yield per plot was found in 100 % vermicompost. 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 [7]. The highest weight of curd in broccoli in vermicompost with biofertilizer treatment reported by Atal et al. [10]. Similar result was found by Gangadhar et al. [17] in chilli, Devi et al. [7], Chetterjee et al. [18] in cabbage, Suklabaidya et al. [19], Atal et al. [10], Meena et al. [9] in broccoli.

### 3.9 Economics

Data presented in Table 5 showed that a significantly maximum net return of Rs. (197168 ₹ /ha) and benefit cost ratio of 2.48 were recorded with $F_6$ – 75 % RDN through VC + 25 % RDN through FYM followed by 50 % RDN through FYM + 50 % RDN through VC (194485 ₹ /ha and 2.61 net return and benefit cost ratio, respectively). The lowest net return (180543 ₹ /ha) in absolute control treatment.

**Table 5. Economics of cauliflower as influenced by Bio-NPK and organic manures treatments**

| Treatments | Yield/ hectare (kg) | Gross returns (₹/ha) | Cost of cultivation (₹/ha) | Net returns (₹ /ha) | B:C ratio |
|---|---|---|---|---|---|
| **Factor A** | | | | | |
| $B_1$ - Seedling dipping in Bio-NPK | 15578 | 311572 | 107508 | 204063 | 2.90 |
| $B_2$ - Foliar spray of Bio-NPK at 30 DAT | 14351 | 287035 | 111273 | 175761 | 2.58 |
| **Factor B** | | | | | |
| $F_1$ – Control | 12627 | 252544 | 63011 | 189533 | 4.00 |
| $F_2$ - 100 % RDN through FYM | 13448 | 268979 | 94211 | 174768 | 2.85 |
| $F_3$ - 100 % RDN through VC | 17036 | 340738 | 146442 | 194296 | 2.33 |
| $F_4$ – 75 % RDN through FYM + 25 % RDN through VC | 14398 | 287961 | 107269 | 180691 | 2.68 |
| $F_5$ – 50 % RDN through FYM + 50 % RDN through VC | 15740 | 314812 | 120327 | 194485 | 2.61 |
| $F_6$ – 75 % RDN through VC + 25 % RDN through FYM | 16527 | 330553 | 133384 | 197168 | 2.48 |
| Absolute Control | 10949 | 218980 | 38436 | 180543 | 5.70 |

*@ Selling price of cauliflower curd is 20 ₹ /kg.*

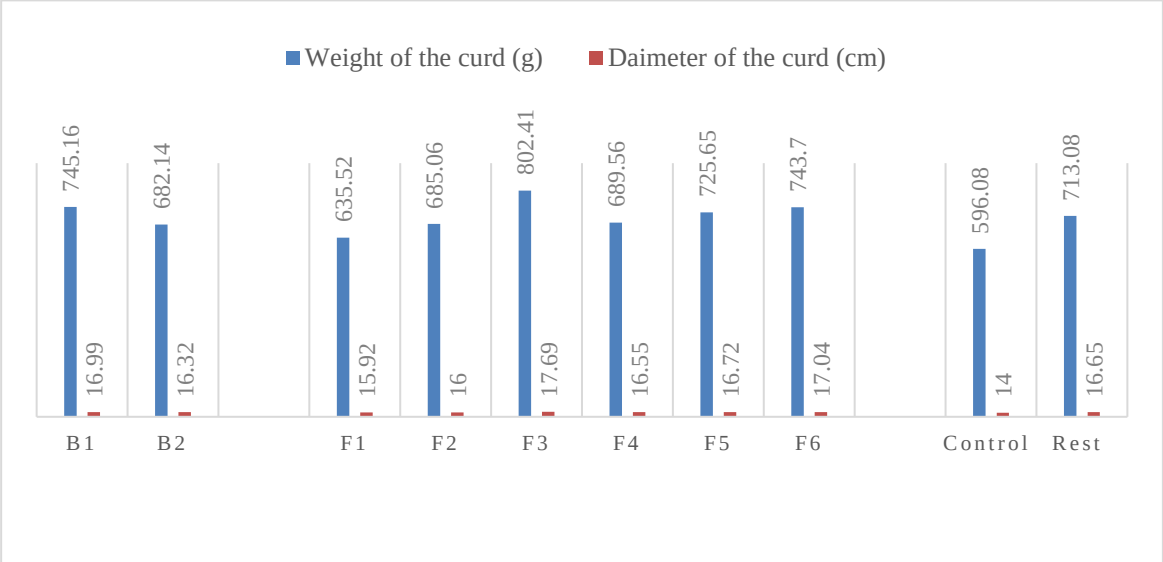


**Fig. 3. Effect of Bio-NPK and organic manures on yield parameters of cauliflower**

## 4. CONCLUSION

In view of above discussion, it can be concluded that Bio-NPK and organic manures treatments have significant effect on growth and yield attributing character. 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 significantly most effective for growth and yield attributing characters. Application of 75 % RDN through VC + 25 % RDN through FYM produced maximum net return with 2.48 B:C ratio. Thus, it may be recommended to the farmers of middle Gujarat For cultivation of cauliflower.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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