

## The Promotive Effect of Vermicompost and Compost for Improving Vegetative Growth and Nutrients Status of Cauliflower Plants

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**Abstract:** Field experiments were conducted during two successive season of 2017 and 2018 at the Experimental Station of the National Research Centre in Nubaria region, Egypt. In order to investigate the effect of vermicompost and compost at different rates alone or in combination to improve both vegetative growth and nutrients status of cauliflower plants. Vegetative growth parameters (plant height, number of leaves/plant, leaf area /plant, girth of stem, fresh weight of plants, head height, fresh weight of head, head diameter, head yields) as well as leaf and shoots mineral content (N, P, K, Mg and Ca) were determined. Results showed that vermicompost amendment combined with compost tended to increase all growth parameters, yield in comparison with application of each of them and the control. The highest value were obtained integrated treatment of 60% vermicompost and 40% compost. Most treatments of cauliflower plants in the present study significantly increased most leaves and head mineral content. Treatment with (60% vermicompost + 40% compost) is important for inducing an increase in all leaves and head.

**Key words:** Cauliflower plants • Vermicompost and compost • Vegetative growth • Mineral contents

### INTRODUCTION

Vegetables are an integral part of the daily diet of all classes of the society in most country of the World. Cauliflower (*Brassica oleracea*) is considered to be as the second crop after cabbage in Egypt, which is belongs to the family Brassicaceae. It is rich in of vitamin C, B and K, protein, amounts of minerals and phytochemicals such as isothiocyanates and glucosinolates. [1-4]. Rising in the prices of chemical fertilizers, environmental safety concerns and growing awareness and inclination among the sections of the society towards organic foods are of great concern now. Organic fertilizer are eco-friendly and gives cheapest source of nutrients for growth of plants and improve build and quality soil to grow healthy crops, which in turn, are better able to resist insects [5, 6].

Vermicompost not only makes crops healthy and productive, but it is also controls plant development with humic acid and hormones. More importantly, it adds to soil fertility and quality by enhancing microbial activity and microbial biomass concentrations and N accessibility in the soil [7-9]. In addition, application vermicompost as

biofertilizer for the productivity of cauliflower they found that Vermicompost encourage increased yield of cauliflower plants [10]. Using vermicompost at the rate of three t ha<sup>-1</sup> gave greater uptake of NPK compared to FYM at the level of three ton ha<sup>-1</sup> on yield of cauliflower [11]. Therefore, the present investigation aimed to improve vegetative growth, yield and chemical composition of cauliflower plants by using different single dose alone or in combination of vermicompost and compost.

### MATERIALS AND METHODS

Field experiments were conducted during successive season of 2017 and 2018 at the Experimental Station of the National Research Centre in Nubaria region, Egypt in order to study the effect of vermicompost and compost at different rates alone or in combination to improve both vegetative growth and nutrients status of cauliflower plants. Soil sample was air dried and passed through a 2-mm sieve and stored for laboratory analysis. The investigated soil characterized by pH 7.68, EC 1.35 dSm<sup>-1</sup>, available N 34.44 (mg/kg), available P 9.78 (mg/kg)

and K 4.22 (mg/kg), Sand 82.17 %, Silt 12.5 %, Clay 5.28 %, 2.78 %, Fe 3.41 ppm, Mn 5.96 ppm and Zn 0.25 ppm. The physical and chemical properties of the soil were determined according to [12, 13]. The experiments were laid in Complete Randomized Block Design with five replicates. The seedlings of Cauliflower plants were kindly obtained provided by the Vegetable Department, Ministry of Agriculture. After five weeks from sowing, the transplants were planted under the open field conditions. Cauliflower seedlings were cultivated in rows; the final spacing was 80cm and the distance among the plants in row was 50cm. The recommended dose of NPK chemical fertilizers used in this experiment according to the Ministry of Agriculture, Egypt as control treatment, was 200 kg fed<sup>-1</sup> ammonium sulphate N, 75 kg fed<sup>-1</sup> super phosphate 15.5% P<sub>2</sub>O<sub>5</sub> and 100 kg potassium sulphate 48% K<sub>2</sub>O. The organic manure residue (compost and vermicompost) mixed with 0-20 cm soil surface layer before transplantation at the rates of 4-ton fed<sup>-1</sup>. The experimental design included six treatments, which were as follows:

- Control(recommended dose)
- Compost 100%
- Vermicompost 100%
- Vermicompost 80% + compost 20%
- Vermicompost 60% + compost 40%
- Compost 40% + Vermicompost 60%
- Compost 80% + Vermicompost 20%

All agriculture practices operation other than experimental treatments necessary for growth and development as cultivation, irrigation and pest control were followed whenever it was necessary.

**Vegetative Growth:** When plants reached suitable maturity, the following data were taken to determine: plant height (cm), number of leaves/plant, Leaf area /plant (cm<sup>2</sup>), girth of stem (cm), fresh matter of plants (g plant<sup>-1</sup>), head height (cm), fresh matter of head (g plant<sup>-1</sup>) head diameter (cm), Head yields (ton/ fed<sup>1</sup> and Vitamin C (mg/100gm F. W).

**Leaves and Had Mineral Content:** The percentage of N, P, K, Mg and Ca in leaves and shoots were determined according to the methods of the [14]. Zinc, manganese, iron and copper content were determined using atomic absorption spectrophotometer to method described by [14]. Vitamin C was estimated in cauliflower heads according to the method reported in [15].

**Statistical Analysis:** All data obtained during each season were subjected to analysis of variance according to. [16]. the least significant differences (LSD) at P= 0.05 level was to verify the difference between means of the treatments.

## RESULTS AND DISCUSSION

**Growth Parameters and Yield:** Data in Table (1) that the effect of different rates and ratios of organic residues (vermicompost and compost) on vegetative growth, yield of cauliflower plants. It is clear that all combined treatment with vermicompost compost significantly produce heaviest vegetative parts for the characters under study as compared with that in compost or vermicompost treatment alone and control. Data also, show that using vermicompost fertilizers or compost as s sole amendment increased growth parameters and yield of cauliflower plants as compared inorganic treatment (control), [17, 18]. These beneficial impacts could be ascribed to organic fertilizer addition, which has solubilizing impacts on soil nutrients as well as chelating impacts on metal ions and improved root development and hence enhanced increased availability of the nutrients to the plants. Meanwhile, growth of cauliflower plants grown in of 60% vermicompost and 40% compost gave maximum plant height (66.05), number of leaves (14), leaf area /plant (563.2 cm<sup>2</sup>), girth of stem (4.55cm), fresh matter of leaves (346.7g plant<sup>-1</sup>), dry matter of leaves (117.89g plant<sup>-1</sup>) fresh matter of total plants (1739.9g plant<sup>-1</sup>) head height (19.8cm),fresh weight of head (1149g plant<sup>-1</sup>), dry matter of head (191.38g plant<sup>-1</sup>), head diameter (20.9cm) and head yields (7.85ton/ fed<sup>1</sup>) as compared with the other treatments used and the control. While, the lowest increase was obtained from compost treatment and control. These results may be due to the influence of combined effect of various ingredients of vermicompost such as macro and micronutrients and micro flora associated with vermicomposting that induce hormone-like activity on the production of metabolites. Similar results were obtained by [19-21]. In general, vermicompost fertilizer combined treatment tended to increase all growth parameters and yield in comparison with the application of both and the control. The highest value were obtained integrated treatment of 60% vermicompost and 40% compost [22, 23]. They concluded that vermicompost fertilizer with compost increased maximum vegetative growth parameters, has led to a reduced the use of chemical fertilizers and has provided high quality products free of harmful.

Table 1: Effect of different rates and ratios of organic residues (vermicompost and compost) on vegetative growth of Cauliflower plants (Average of two seasons)

Treatments	Plant length (cm)	Leaves number / plant	Leaf area /plant (cm <sup>2</sup> )	Fresh matter of Leaves g plant <sup>-1</sup>	Dry matter of leaves g plant <sup>-1</sup>	Fresh matter of total plants g plant <sup>-1</sup>	Girth of stem (cm)
Control	40.12	7	377.8	218.0	55.6	955.2	3.42
100% compost	47.75	8	401.9	246.4	61.7	1034.7	3.63
100 % vermicompost	54.4	11	433.4	265.1	74.5	1197.1	3.81
80% Verm.+20compost	63.7	12	471.6	280.7	88.9	1476.3	4.21
60%Verm+40%compost	66.05	14	563.2	346.7	117.8	1739.9	4.55
40Verm%+60%compost	63.45	11	510.7	330.2	101.2	1645.1	4.30
80%compost+20%Verm	61.2	12	455.0	268.6	88.6	1456.9	4.03
LSD 0.5%	4.99	3.48	76.17	88.72	6.79	95.17	0.85

B)

Treatments	Fresh matter of head g plant	Dry matter of head g plant	Head height (cm)	Head diameter (cm)	Head yields (ton/ feddan)
Control	631.1	101.30	14.8	13.2	3.61
100% compost	679.85	122.84	16.4	14.3	3.88
100 % vermicompost	830.5	134.63	17	16.45	4.55
80% Verm.+20compost	969.9	165.30	19	20.4	5.75
60%Verm+40%compost	1149.8	191.38	19.8	20.9	7.85
40Verm%+60%compost	1084.3	176.76	18.7	18.5	6.25
80%compost+20%Verm	910.5	153.45	18.0	19.15	5.05
LSD 0.5%	64.11	12.61	2.61	2.65	1.14

Table 2: Impact of different rates of vermicompost and compost on N, P, K, Ca and Mg content (%) in leaves and head of Cauliflower plants(Average of two seasons).

Treatments	Leaves					Head				
	N	P	K	Ca	Mg	N	P	K	Ca	Mg
Control	1.66	0.37	2.11	0.89	0.25	2.58	0.51	2.30	0.46	0.19
100% compost	1.81	0.42	2.18	0.63	0.26	2.77	0.59	2.45	0.30	0.22
100 % vermicompost	2.16	0.48	2.36	0.6	0.30	2.92	0.66	2.60	0.25	0.27
80% Verm.+20compost	2.28	0.55	2.44	0.5	0.35	3.33	0.70	3.18	0.25	0.25
60%Verm+40%compost	2.35	0.50	2.74	0.41	0.44	3.24	0.87	3.42	0.27	0.35
40Verm%+60%compost	2.29	0.49	2.57	0.45	0.38	3.18	0.79	3.31	0.28	0.30
80%compost+20%Verm	2.04	0.47	2.48	0.53	0.30	3.11	0.70	3.11	0.26	0.27

**Chemical Composition:** Data in Table (2) indicate that the combined treatments of 40% vermicompost and 60% compost statistically the richest with the table leaves and head N % (2.29% and 3.18%). However, combined treatments of 80% vermicompost and 20% compost gave the highest increase percentage of P content of leaves (0.55). While the treatment of (60% vermicompost and 40% compost) gave the highest percentage of P content of head (0.87). As for the leaf and head K content of cauliflower plants. The data in Table (2) indicated that all treatments succeeded increasing leaf and head K content significantly as compared with those of the control. This may be due to that cauliflower heads needed these elements to induce heads formation. Treatments with (60% vermicompost and 40% compost) had higher K content leaves and head (2.74% and 3.42%). Regarding the response of leaf and head of cauliflower plants table (2) it is clear that all treatments gave the

lowest significant percentage of Ca in leaves and head content as compared with control. As for the leaf and head Mg % of cauliflower plants the data indicated that all treatments results in increase Mg % over the control in addition treatments with (60% vermicompost and 40% compost) increased leaf and head Mg % (0.44 and 0.35) as compared with all treatments and the control. In general, all treatments of vermicompost or compost alone or in combination in the present study significantly increased in most leaf and head mineral content under study except Ca content as compared with that of the control. Organic fertilizer may have a positive effect owing to the slow and constant supply of nutrients from organic fertilizer throughout the growing season. Treatments with (60% vermicompost and 40% compost) is important for inducing increase in most leaf and head nutrient content. Figures (1&2) indicate that all treatments of cauliflower plants in the present study increased N, P,

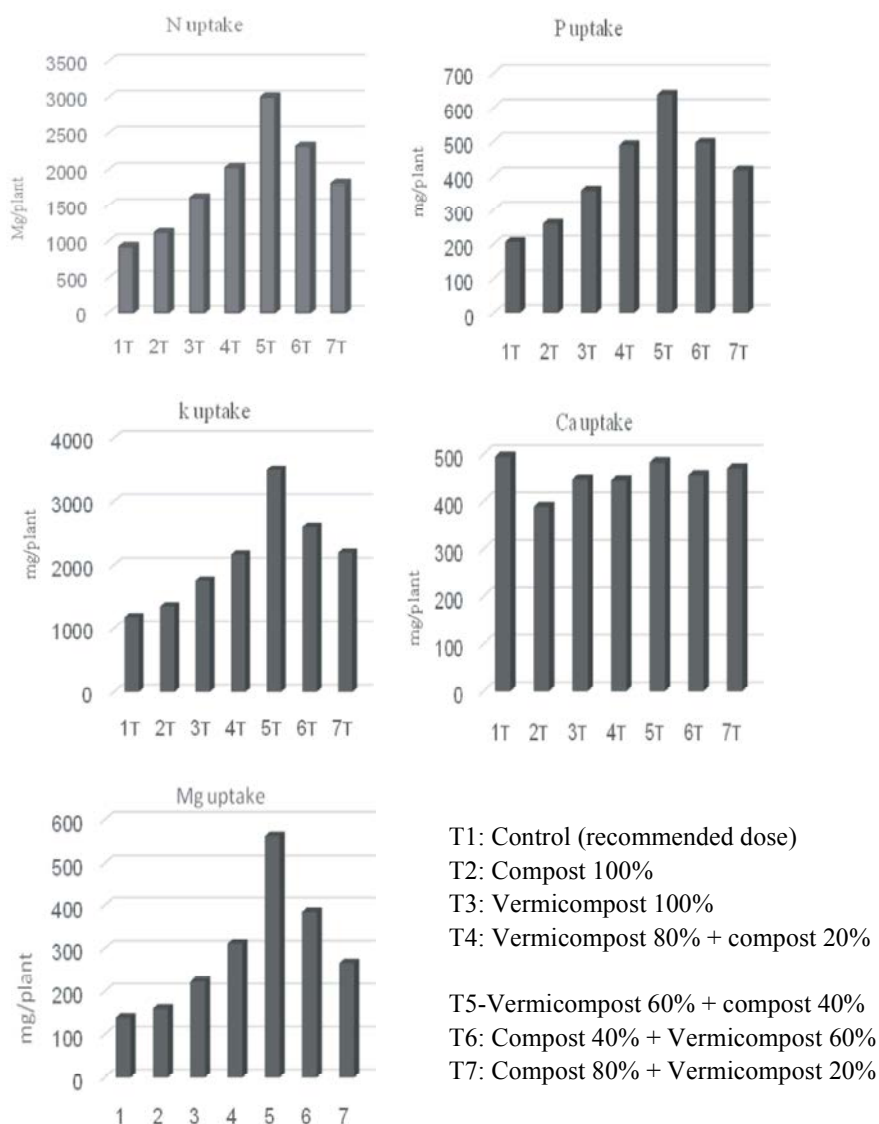


Fig. 1: Influence of organic residues (vermicompost and compost) on N, P, K, Ca and Mg uptake mg/plant in leaves of Cauliflower plants

Table 3: Impact of different rates of vermicompost and compost on Fe, Zn, Mn, Cu(ppm) and Vitamin C (mg/100gm F. W) head of Cauliflower plants(Average of two seasons)

Treatments	Head				Vitamin C (mg/100gm F. W)
	Fe	Zn	Mn	Cu	
Control	116.4	11.70	7.73	1.26	59.8
100% compost	125.8	13.10	8.30	1.55	69.8
100 % vermicompost	137.4	14.33	11.98	1.62	75.9
80% Verm.+20compost	157.5	19.40	14.14	2.28	85.5
60%Verm+40%compost	177.1	21.76	13.85	2.39	82.3
40Verm%+60%compost	195.0	25.88	16.75	2.42	84.6
80%compost+20%Verm	165.0	19.66	10.1	2.59	70.2

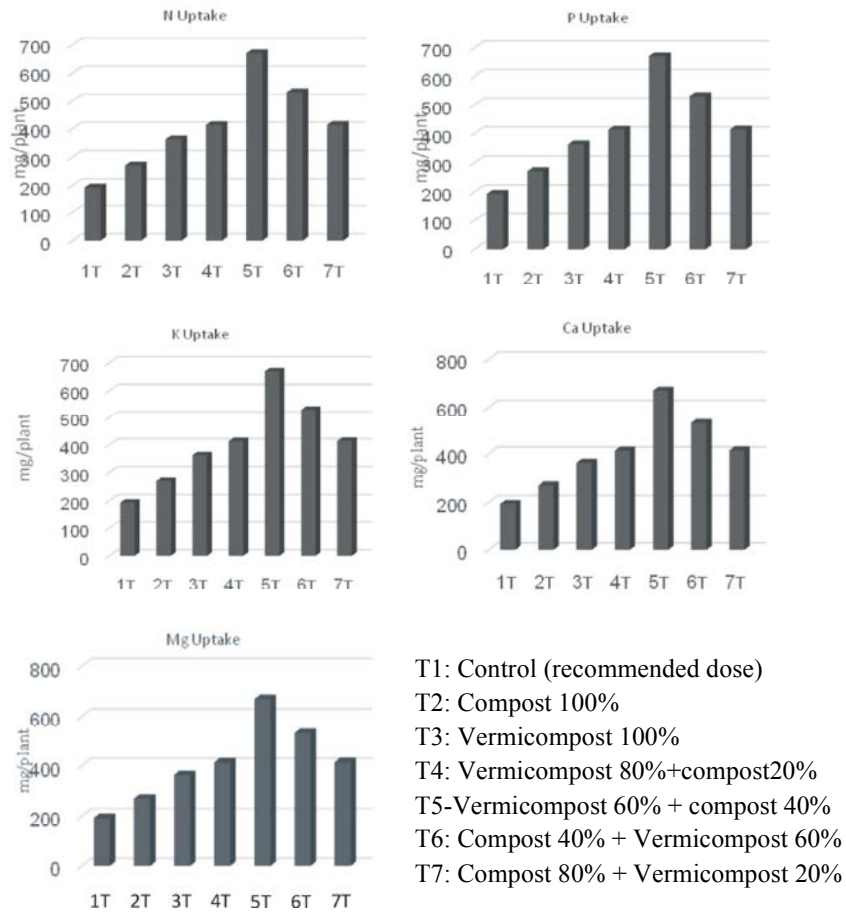


Fig. 2: Influence of organic residues (vermicompost and compost) on N, P, K, Ca and Mg uptake mg/plant in head of Cauliflower plants

K, Ca and Mg uptake mg/plant in leaves and head as compared with that of the control. In addition, of combination treatments consisted of (60% vermicompost and 40% compost) are important for inducing an increase in all leaf and head nutrient contents under study as compared with that of the control. These results partially agreed with the findings of Al-Nasir, 2002 [24] on cauliflower plants, Preusch *et al.* [25] on strawberry plants and [26] they found that application of vermicompost fertilizer induced the highest leaf N, P, K and micronutrients, which is beneficial to increase soil microbes activity and solubility of the phosphate. Data in Table (3) showed that combined treatments with 40% vermicompost+60% compost gave increase Fe, Zn, Mn, Cu contents and Vitamin C in head of cauliflower plants, (Fe177.1, Zn21.76, Mn 16.75,, Cu2.42 ppm Vitamin C 84.6 mg/100gm)by60% vermicompost + 40% treatment. The lowest value occurred with adding vermicompost and compost as sole [27-29].

## CONCLUSION

In general, these results concluded that involving different combined application with vermicompost and compost significantly produce heaviest vegetative parts for the characters and gave the highest yield, high nutrient content and uptake and good residual effect which not only improved productivity but also improved the fertility status of the soil.

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