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Effect of Organic and Inorganic Nutrients Sources on Growth, Yield and Quality of Cauliflower In Mid Hills of Himachal Pradesh

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Abstract: Plant growth parameters and leaf nutrient content of plant were significantly influenced by the combined application of vermicompost and jeevamrit. The application of 100 percent recommended dose of nutrients through vermicompost + jeevamrit @ 1.5 l plot^{-1} registered a significant increase in plant growth parameters i.e. plant height, polar and equatorial diameter, dry biomass production, gross and net curd weight, curd yield, ascorbic acid content, number of days required for curd initiation and maturity. Thus, 100 percent application of vermicompost along with jeevamrit (1.5l/4.32 m^2) is a nutrient module suggested for the farmers which showed a positive effect on plant growth parameters and leaf nutrient content of the plant.

Keywords: Organic and inorganic nutrients, Recommended dose of nutrients, Vermicompost, Jeevamrit

Cauliflower is a member of the Cruciferae family and curd is the edible part of cauliflower that prevents cancer due to the high concentration of glucothiocyanate (Abd El-Rheemkh et al 2019). In India, the total area under cauliflower was about 453 thousand ha with a production of 8668 thousand MT and in Himachal Pradesh, the total area under cauliflower was about 5.5 thousand ha with a production of 131 thousand MT (Anonymous 2018). Soil organic matter is the organic substances present in the soil which arise from the decomposition of plant and animal residues. The organic matter content in soil is closely related to soil's productivity and fertility, as it governs the soil's physical, chemical and biological properties. The well decomposed organic manure is considered to be as good as lime to buffer soil acidity as it improves soil's physical and chemical properties. The presence of a large population of bacteria, actinomycetes and fungi in organic manure increases the microbiological activity, which leads to enhanced organic nitrogen mineralization and therefore nutrients becoming available to the plants (Shrestha 2008). The application of chemical fertilizers may increase the yield of crops initially however there is no sustainability of yield in long run. The productivity of cauliflower is slowly declining by the continuous use of chemical fertilizers resulting in deterioration in soil fertility. With the continuously growing demand for limited land resources to feed an increasing population, it is necessary to maintain soil health as well as environmental degradation at an optimum level for sustaining the productivity of agricultural soils. Loss of soil fertility is due to imbalanced use of chemical fertilizers which adversely impact soil fertility as well as agriculture productivity. The incorporation of organic inputs along with liquid manures is going to reduce the dependence on chemical inputs without any significant reduction in yield (Giraddi 2000 and Patil et al 2004). Therefore, it is necessary to use various nutrient sources (VC, FYM, jeevamrit, and green manure) to maintain the fertility of the soil.

Modern agriculture practices based on the utilization of organic inputs play an important role in obtaining a higher yield and good quality of cauliflower (Sharma et al 2007). Organic farming is a sustainable production system, which includes the use of organic wastes such as crop residues, green manures, animal manures, legumes and fermented liquid inputs. Organic farming maintains soil fertility, and ecological balance and reduces the cost of market-driven farm inputs. Various fermented organic inputs such as panchagavya, jeevamrit, beejamrit and vermiwash are prepared from animal origin mainly by using cow dung, cow urine, pulse flour, jaggery, live soil and local vegetation extracts, etc. These products are effective in promoting the growth and yield of different crops. These manures may not provide direct nutrients in the area of application, but they hasten the soil micro-flora and fauna activity which maintains the fertility of the soil (Yadav and Mowade 2004).

MATERIAL AND METHODS

The experiment was conducted during the year 2018-19 at the experimental farm of the Department of Soil Science and Water Management, Dr. Y S Parmar University of

Horticulture and Forestry, Nauni, Solan. The initial physico-chemical and microbiological properties of the experimental trial are presented in Table 1. The cauliflower variety "Sweta" was planted in a plot size of 2.40m×1.8m with a spacing of 60cm×45cm. There were seven treatments *i.e.* T_1- 100 per cent RDN (Recommended Dose of Nutrients) through VC, T_2- 100 per cent RDN through FYM, T_3- 100 per cent RDN through VC + jeevamrit @ 1.5 l/plot, T_4- 100 per cent RDN through FYM + jeevamrit @ 1.5 l/plot, T_5- 75 per cent RDN through VC + jeevamrit @ 3.0 l/plot, T_6- 75 per cent RDN through FYM + jeevamrit @ 3.0 l/plot, T_7- 100 per cent RD through chemical fertilizers. The RDN was calculated based on N equivalence in VC and farm yard manure. Recommended dose of nutrients N: P: K- 125:76:72 kg ha^{-1} and FYM @ 250 q ha^{-1}. A full amount of VC and FYM was applied and mixed with soil before the transplanting of seedlings. The concentrated jeevamrit was applied at 15 days intervals after transplanting as per treatment. The experimental plants were given uniform recommended cultural practices during the entire course of investigations. The Jeevamrit was prepared by adding fresh cow dung (10kg) along with cow urine (10l). After that, mixed the jaggery (2kg), pulse flour (1kg) and live soil (1kg) in 200 l of water. The solution was mixed and stir properly in the morning and evening for 4 days for 5-10 minutes. On the fifth day filter, the solution and filtrate were ready for soil drenching/spray.

RESULTS AND DISCUSSION

Growth and yield attributes: The, maximum (46.56 cm) plant height was in T_3(100% RDN through VC + Jeevamrit @ 1.5 l/ 4.32 m^2) which was statistically at par with T_5 and the lowest (39.0 cm) was in T_2 (100% RDN through FYM) (Table 2). The maximum plant height may be due to the use of vermicompost and jeevamrit which contain a large amount of nitrogen, phosphorus, and potassium. These results are in line with those of Joshi and Pal (2010) and Ramesh et al (2015). The highest (14.28 cm, 17.23 cm) polar and equatorial diameter was in T_3 (100 percent RDN through VC + Jeevamrit @ 1.5 l/ 4.32 m^2) which was statistically at par with T_5 and the lowest (8.88 cm, 9.70 cm) was in T_2 (100% RDN through FYM). Gupta and Samnotra (2004) reported that vermicompost application increased head diameter in cabbage. Arancon et al (2004) also observed that application of vermicompost increased head diameter in cabbage.

Maximum (50.09 q ha^{-1}) dry biomass production was recorded under T_3 (100 percent RDN through VC + Jeevamrit @ 1.5 l/ 4.32 m^2) was statistically at par with T_5. The lowest (27.36 q ha^{-1}) dry biomass production was recorded under T_2 (100% RDN through FYM). Joshi and Pal (2010) also recorded that the application of vermicompost significantly increases the plant biomass of tomatoes. Significantly highest (1051.67 and 469.59g) gross and curd weight was in T_3 and the lowest (814.00 g, 375.49 g) was in T_2. Maximum curd yield was highest (151.13 q/ha) under T_3 which was found statistically at par with T_5 and lowest (123.36 q/ha) curd yield was reported under T_2. The increase in gross weight, curd weight and yield may be due to the beneficial role of vermicompost and Jeevamrit. The application of vermicompost and Jeevamrit increases the activity of beneficial microorganisms in the rhizosphere and growth-promoting substances which increases the soil biomass thereby maintaining the availability and uptake of applied inputs as well as native soil nutrients resulting in better growth and yield. Earlier researchers also repoted similar findings (Arancon et al 2003, Arancon et al 2005, Natesh et al 2005, Joshi and Pal 2010Ramesh et al 2015 and Kumar 2016).

Table 1. Nutrient contents of manures

Manures	N (%)	P (%)	K (%)
Vermicompost	1.35	0.45	0.61
Farm yard manure	0.51	0.26	0.51
Jeevamrit	1.39	0.88	0.04

Table 2. Effect of different nutrient sources on growth and yield attributes of cauliflower

Treatments	Plant height (cm)	Polar diameter (cm)	Equatorial diameter (cm)	Dry biomass production (q ha^{-1})	Net curd weight (g)	Gross curd weight (g)	Curd yield (q ha^{-1})
T_1	39.66	9.30	10.70	30.50	399.38	861.00	130.27
T_2	39.00	8.88	9.70	27.36	375.49	814.00	123.36
T_3	46.56	14.28	17.23	50.09	469.59	1051.67	151.13
T_4	42.03	11.62	12.77	39.09	440.23	979.33	142.31
T_5	45.62	14.03	17.03	48.38	467.08	1041.00	148.98
T_6	41.00	10.62	11.80	35.43	434.59	954.00	141.04
T_7	44.05	12.11	14.00	42.41	443.23	991.67	144.10
CD (p=0.05)	1.35	0.28	0.25	2.57	2.84	10.35	3.52

Curd initiation, maturity and quality parameter: There was significant variation in the days required for curd initiation and curd maturity (Table 3). Significantly, the minimum (95 days,102 days) required for curd initiation and maturity were under T_3 (100% RDN through VC + Jeevamrit @ 1.5 l/ 4.32 m^2) which was statistically at par with T_5 while the maximum (104 days, 114 days) number of days required for curd initiation and maturity was under T_2 (100% RDN through FYM). The results showed that the increasing level of nutrients hastens the reproductive phase of growth whereas at a lower rate of nutrients reproductive phases were drastically delayed. Chaubey et al (2006) in cabbagealso reported that higher fertility levels favored the maturity time whereas the process of growth and development was slower at lower fertility levels. The maximum (69.33 mg $100g^{-1}$) ascorbic acid content was under T_3 (100% RDN through VC + Jeevamrit @ 1.5 l/ 4.32 m^2) which was statistically at par with T_5 and minimum (55.00 mg $100g^{-1}$) observed under T_2 (100% RDN through FYM). There were non significant effect on non wrapper leaves Sharma et al (2014) vermicompost increased the spinach 14.42 percent more ascorbic acid content than chemically grown spinach. Theunissen et al (2010**)** organic manures treated plants yielded higher vitamin C content as compared to conventional ones.

Nutrient content in leaves, curd and roots: The significantly, highest (2.63%) nitrogen content was in T_3 and the minimum (2.08%) under T_2 (100% RDN through FYM). The P and K content also showed the same trend. The increased leaf nutrient content might be due to the beneficial effect of vermicompost brought about by the presence of macro and micronutrients and vital plant-promoting substances in vermicompost (Arancon et al 2006). The maximum NPK content in curd (3.43%, 0.79%, 2.13%) was recorded under T_3 (100% RDN through VC + Jeevamrit @ 1.5 l/ 4.32 m^2) and the minimum NPK content (2.84, 0.45 and 1.94%) was in T_2 (100% RDN through FYM). Weber et al (2007) observed that application of vermicompost significantly increased NPK content and also affect soil properties. The , maximum NPK in root was in T_3 and the minimum in T_2 Chander et al (2010) also reported an increase in nutrient content by the application of organic manures. This might be due to the beneficial effect of organic manures on nutrient availability in soil and improvement in soil's physical and microbiological properties.

Table 3. Effect of different nutrient sources on curd initiation, maturity and quality parameter

Treatments	No. of days required for curd initiation	No. of days required for curd maturity	Ascorbic acid (mg/100g)	No. of non-wrapper leaves
T_1	102.00	110.00	58.00	6.33
T_2	104.00	114.00	55.00	7.00
T_3	95.00	102.00	69.33	7.33
T_4	101.00	108.00	63.00	6.66
T_5	97.00	104.00	68.00	7.33
T_6	102.00	110.00	61.33	7.33
T_7	99.00	107.00	65.00	6.66
CD (p=0.05)	2.64	2.82	3.07	NS

Table 4. Effect of different nutrient sources on nitrogen, phosphorus potassium content of leaves, curd and root (%)

Treatments	Leaf			Curd			Root		
	N	P	K	N	P	K	N	P	K
T_1	2.16	0.50	1.64	2.91	0.48	1.97	1.19	0.26	1.12
T_2	2.08	0.47	1.56	2.84	0.45	1.94	1.15	0.25	1.07
T_3	2.63	0.64	1.99	3.43	0.79	2.13	1.54	0.39	1.30
T_4	2.39	0.56	1.77	3.22	0.73	2.03	1.43	0.33	1.20
T_5	2.63	0.62	1.93	3.36	0.76	2.07	1.48	0.36	1.27
T_6	2.19	0.53	1.72	3.11	0.68	2.02	1.31	0.30	1.16
T_7	2.48	0.59	1.86	3.28	0.62	2.06	1.43	0.33	1.22
CD (p=0.05)	0.08	0.02	0.03	0.04	0.02	0.02	0.06	0.02	0.01

CONCLUSION

Application of 100 percent RDN through vermicompost + Jeevamrit @ 2800 l ha^{-1} showed greater plant height, polar and equatorial diameter, dry biomass production, gross and net curd weight, curd yield, ascorbic acid content and number of days required for curd initiation and curd maturity. Thus, vermicompost along with jeevamrit can be used for sustainable yield for cauliflower without deteriorating soil health.

REFERENCES

Abd El-RheemKh M, Entsar M, Essa Neama MM and El-Tanahy AMM. 2019. Effect of vermicompost and foliar application of methanol on cauliflower plants grown in sandy soil. *Journal of Horticultural Science and Ornamental Plants* **11**: 152-158.

Anonymous. 2018. *Indian Horticulture Database*. National Horticulture Board, Gurgaon, Haryana. pp. 142-44.

Arancon NQ Edward CA, Biermanb P, Metzgerc JD and Lucht C 2005. Effects of vermicompost produced from cattle manure, food waste and paper waste on the growth and yield of peppers in the field. *Pedobiologia* **49**: 297-306.

Arancon NQ, Edwards CA, Bierman P, James DM, Stephen L and Christie W 2003. Effect of vermicomposts on growth and marketable fruits of field-grown tomatoes, peppers and strawberries. *Pedobiologia* **47**: 731-735.

Arancon NQ, Edwards CA, Bierman P, Welch C and Metzger JD 2004. Influences of vermicomposts on field strawberries: Part 1. Effects on growth and yields. *Bioresource Technology* **93**: 145-153.

Chaubey T, Srivastava BK, Singh M, Chaubey PK and Rai M 2006. Influence of fertility levels and seasons on maturity and morphological traits of cabbage. *Vegetable Science* **33**: 29-33.

Chander G, Verma TS and Sharma S 2010. Nutrient content of cauliflower (*Brassica oleracea* var. *botrytis*) as influenced by boron and farm yard manure in north west Himalyan alfisols. *Journal of Indian Society of Soil Science* **58**: 248-251.

Giraddi RS 2000. Influencing vermicomposting methods on the biodegradation of organic wastes. *Indian Journal of Agricultural Sciences* **70**: 663-666.

Gupta AK and Samnotra RK 2004. Effect of biofertilizers and nitrogen on growth, quality and yield of cabbage cv. Golden Acre. *Ecology and Environment* **22**: 551-553.

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Joshi R and Pal VA 2010. Effect of vermicompost on growth, yield and quality of tomato (*Lycopersicum esculentum* L). *African Journal of Basic and Applied Sciences* **2**: 117-123.

Kumar BM 2016. Effect of vermicompost on germination, growth and yield of vegetable plants. *Scrutiny International Research Journal of Agriculture, Plant Biotechnology and Bio Products* **3**: 07-13.

Natesh N, Vyakaranahal BS, Shekhargouda M and Deshpande VK 2005. Effect of micronutrients and organics on growth, seed yield and quality of chilli. *Karnataka Journal of Agricultural Sciences* **18**: 334-337.

Patil MB, Mohammad RG and Ghadge PM 2004. Effect of organic and inorganic fertilizers on growth, yield and quality of tomato. *Journal of Maharashtra Agricultural Universities* **29**: 124-127.

Ramesh G, Ajithkumar K, Savitha AS and Patil SG 2015. Integrated influence of organic manures in addition to inorganic fertilizers on growth, yield parameters and early blight disease of tomato (*Lycopersicon esculentum* L.). *International Journal of Biological & Pharmaceutical Research* **6**: 478-483.

Sharma A, Pathania NK, Singh Y and Sharma RP 2007. Substitution of synthetic fertilizers through vermicompost and bio-inoculant in cauliflower (*Brassica oleracea* var. *botrytis* L.) under wet temperate conditions of Himachal Pradesh. In: *Proceedings of National Seminar on Policy interventions for promotions of balanced fertilization and integrated nutrient management*, held at CSKHPKV, Palampur. pp.1-2.

Sharma J and Agarwal S 2014. Impact of organic fertilizers on growth, yield and quality of spinach. *Indian Journal of Plant Sciences* **3**: 37-43.

Shrestha YM 2008. *Response of nasabike manure and agri-medicine in relation to organic cabbage production in Ilam, Nepal.* Masters thesis submitted to Institute of Agriculture and Animal Science (IAAS), Agriculture (Ecology), Rampur, Chitwan.

Theunissen J, Ndakidemi PA and Laubscher CP 2010. Potential of vermicompost produced from plant waste on the growth and nutrient status in vegetable. *International Journal of the Physical Sciences* **5**: 1964-1973.

Weber J, Karczewska A, Drozd J, Licznar S, Jemroj E and Kocowicz A 2007. Agricultural and ecological aspects of a sandy soil as affected by the application of municipal solid waste composts. *Soil Biology and Biochemistry* **39**: 1294-1302.

Yadav AK and Mowade SM. 2004. Organic manures and compost. In: *Organic Farming- A Ray of Hope for Indian Farmer*. National Center of Organic farming, Ghaziabad, Utter Pradesh, India. pp. 14-19.