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Effect of vermicompost and farmyard manure on performance of cauliflower (*Brassica oleracea* var. *botrytis* L.)

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ABSTRACT

The experiment was designed as one factor randomized block design with 8 replications and 5 treatments combination of vermicompost and farmyard manure to study the performance of cauliflower. Results revealed that maximum benefit cost ratio (3.20) was obtained from combined application of vermicompost (10 t ha^{-1}) and farmyard manure (5 t ha^{-1}). Highest number of leaves per plant (20.19), individual curd weight (971.45 g), whole plant weight (1260.82 g), yield (26.55 t ha^{-1}), dry matter percentage (11.09 %) and curd compactness (19.61 g cm^{-1}) was obtained through application of vermicompost @ 20 t ha^{-1} followed by combined application of vermicompost (10 t ha^{-1}) and farmyard manure (5 t ha^{-1}). Presence of adequate amount of growth nutrients, growth promoting substances and sufficient amount of organic matter in vermicompost were responsible for beneficial effect on cauliflower. However, with respect to economical viability combined application of 10 tonnes vermicompost with 5 tonnes farmyard manure per hectare could be recommended for highest economical return.

Keywords: Benefit-cost ratio, cauliflower, farmyard manure, vermicompost, yield

Cauliflower (*Brassica oleracea* var. *botrytis* L.) is an important crop in the world originated from wild cliff-cabbage (*Brassica oleracea* var. *sylvestris*) in Mediterranean region. Crops belonging to the Brassicaceae family have been given the focus for intense research based on their human health benefits (Traka and Mithen, 2009). Cultivation based on inorganic practices may hamper ecology as well as human health due to residual effect of harmful chemical. Sole application of inorganic fertilizers leads the soil into abnormal condition which is not suitable for long time cultivation. Sufficient amount of organic manures with optimum inorganic fertilizers help to maintained soil fertility for sustainable production. Presently more emphasis is given to the organic farming for quality and sustainable production without hampering soil as well as environmental health. Among the different organic manures, vermicompost and farmyard manure are the two important components of organic source of nutrient for plant life cycle. Due to unavailability of farmyard manure in desired quantity vermicompost become an alternative attractive organic source of nutrient leading to more yield and quality. Different sources of nutrient have an effective role on growth and development for a particular crop. Application of vermicompost along with biofertilizer as seedling inoculation gave a desirable growth, yield and quality attributes of offseason cauliflower under agro shade net condition (Chatterjee and Mahanta, 2013). There was a very little research regarding how much vermicompost singly and combined with farmyard manure affect the yield and quality of cauiliflower. Therefore, a field experiment was conducted to study the effect of vermicompost and farmyard manure on performance of cauliflower**.**

The experiment was conducted at farm of Dakshin Dinajpur KrishiVigyan Kendra, Uttar Banga Krishi Viswavidyalaya during *rabi* season 2016-17 and 2017-18. The trial was undertaken in one factor randomized block design with 8 replications and 5 treatments viz; T_1-control (No organic manure only inorganic fertilizer @ 120:60:60 kg ha^{-1} NPK), T_2-(T_1+20 t ha^{-1} FYM), T_3-(T1+10 t ha^{-1}FYM + 5 t ha^{-1} vermicompost), T_4- (T_1 + 5 t ha^{-1}FYM + 10 t ha^{-1}vermicompost) and T_5-(T_1 + 20 t ha^{-1}vermicompost). Soil of the experimental plot was sandy loam in nature having pH 6.5, organic carbon 0.84%, available nitrogen 172.68 kg ha^{-1}, available phosphorus 24.57 kg ha^{-1} and available potassium 210.87 kg ha^{-1}.Variety 'White Contessa' was cultivated under this experiment. Healthy seedlings of 27 days old were transplanted at 45 cm x 45 cm spacing in 2.25 m x 2.25 m plots area at afternoon. Vermicompost and farmyard manure of their respective treatment were applied at the time of transplanting. The recommended doses of inorganic fertilizers were applied in the form of urea, single super phosphate and muriate of potash. Full dose of phosphorus and half of potassium and nitrogen were applied as basal and rest potassium and nitrogen were top dressed in two equal splits at 25 and 45 days after transplanting.

Ten samples from each treatment were recorded for number of leaves plant^{-1}, whole plant weight, curd

Short communication

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weight (g), individual curd weight (g), yield (t ha^{-1}), dry matter content (%) and cost benefit ratio. Curd compactness was calculated as the average curd weight divided by average circumference (Nathoo, 2003).

a. Effect of vermicompost and farmyard manure on leaf no of cauliflower

The pooled data over two years (Table 1) revealed that significantly maximum number of leaves per plant (20.19) was obtained from application of vermicompost @ 20 t ha^{-1} (T_5) followed by combined treatment (T_4) of FYM @ 5 t ha^{-1}with vermicompost @ 10 t ha^{-1}(19.21) and combined application (T_3) of FYM @ 10 t ha^{-1} with vermicompost @ 5 t ha^{-1}(18.72). Vermicompost solely improved the growth of plant compared to application of conventional FYM so that number of leaves was found to be maximum with application of vermicompost alone. Vermicompost might have improved the soil physical properties like soil structure, porosity and water holding capacity of the soil which increased the soil microbial population leading to the increased availability of nutrients as well as production of plant growth promoting substances that actually improved the growth of plants by producing significantly maximum no. of leaves per plant. The result was also supported by Jahan *et al*. (2014).

b. Effect of vermicompost and farmyard manure on individual curd weight (g) and whole plant weight (g)

The pooled data of individual curd weight (g) and whole plant weight (g) from different treatment combinations of FYM and vermicompost or sole application of FYM and vermicompost indicated significant variation among the different treatments. Results represented that both the highest values of individual curd weight (971.45 g) and whole plant weight (1260.82 g) were produced from the application of vermicompost @ 20 t ha^{-1} (T_5) followed by 918.68 g of individual curd weight and 1196.00 g of whole plant weight from combined treatment of FYM @ 5 t ha^{-1}with vermicompost @ 10 t ha^{-1}(T_4) and 834.33 g of individual curd weight and 1051.09 g of whole plant weight from combined application of FYM @ 10 t ha^{-1} with vermicompost @ 5 t ha^{-1}(T_3), whereas lowest magnitude of both the parameters (648.03 g and 789.38 g) were found in control. The total plant weight is the combination of both the individual curd weight and total weight of all the leaves per plant. This way, the number of leaves per plant was positively correlated with the total plant weight. Vermicompost application was found to produce the best result in terms of maximum number of leaves per plant and highest individual curd weight which ultimately induced the total plant weight significantly. Variation in individual curd weight and total plant weight found in all the treatments might be attributed to variation in amount of availability of nutrients from different organic nutrient sources in different concentrations. Jahan *et al*. (2014) was also suggested the same trends.

c. Effect of vermicompost and farmyard manure on curd compactness (g cm^{-1})

Curd compactness is an important quality parameter of cauliflower which is directly related to the weight of the curd. More compactness donates more weight leading to higher yield. The pooled data (Table 2) revealed that maximum curd compactness (19.61 g cm^{-1}) was obtained from application of vermicompost @ 20 t ha^{-1}(T_5) followed by 18.82 g cm^{-1} and 17.74 g cm^{-1} from the treatment combination of FYM @ 5 t ha^{-1}with vermicompost @ 10 t ha^{-1}(T_4) and FYM @ 10 t ha^{-1}with vermicompost @ 5 t ha^{-1}(T_3), respectively. Presence of growth promoting substances in vermicompost might have trigger some specific enzymatic as well as hormonal activity for synthesis of some compounds that lead to better compactness of the curd. The results are in conformity with the findings of Tekasangla *et al.*, 2015.

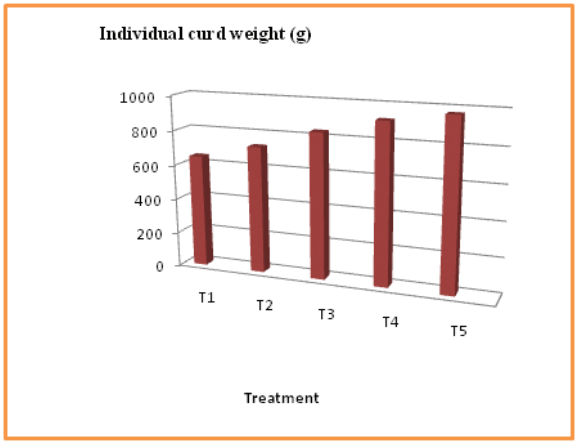

Fig. 1 : Individual curd weight(g) obtained from different treatments

d. Effect of vermicompost and farmyard manure on yield of cauliflower

The mean performance of cauliflower yield over two years as well as pooled data indicated that the each treatment combination involving FYM and vermicompost produced significantly different yield. The highest yield (26.55 t ha^{-1}) was obtained from the application of vermicompost @ 20 t ha^{-1}(T_5) followed by 25.29 t ha^{-1}, 23.89 t ha^{-1}and 21.56 t ha^{-1}from combined treatment of FYM @ 5 t ha^{-1}with vermicompost @ 10 t ha^{-1}(T_4), FYM @ 10 t ha^{-1}with vermicompost @ 5 t ha^{-1}(T_3) and only FYM @ 20 t ha^{-1}respectively. However lowest yield (17.30 t ha^{-1}) was found from control. Vermicompost application was found to be beneficial

Table 1: Effect of vermicompost and farmyard manure on different yield and quality attributes of cauliflower

Treatment	Leaf number plant^{-1}			Whole plant weight (g)			Individual curd weight (g)			Curd compactness (g cm^{-1})			Yield (t ha^{-1})			Dry matter (%)			Benefit : cost ratio
	Y1	Y2	Pooled	Y1	Y2	Pooled	Y1	Y2	Pooled	Y1	Y2	Pooled	Y1	Y2	Pooled	Y1	Y2	Pooled	Pooled
T1	16.70	16.46	16.58	792.14	786.62	789.38	655.80	640.25	648.03	12.23	12.11	12.17	17.34	17.26	17.30	7.68	7.48	7.58	1.61
T2	17.96	17.22	17.59	891.80	894.90	893.35	720.32	734.76	727.54	15.38	15.77	15.58	21.12	21.99	21.56	9.24	9.32	9.28	2.36
T3	18.57	18.88	18.72	1029.65	1072.53	1051.09	829.79	838.87	834.33	17.61	17.86	17.74	23.56	24.21	23.89	10.03	10.15	10.09	2.81
T4	18.91	19.50	19.21	1155.17	1236.82	1196	901.23	936.12	918.68	18.73	18.90	18.82	25.14	25.44	25.29	10.51	10.97	10.74	3.20
T5	20.04	20.34	20.19	1214.12	1307.51	1260.82	952.08	990.81	971.45	19.41	19.81	19.61	26.43	26.67	26.55	11.01	11.16	11.09	2.84
SEm±	**0.26**	**0.14**	**0.28**	**16.37**	**7.91**	**9.44**	**9.41**	**6.51**	**7.80**	**0.17**	**0.09**	**0.14**	**0.22**	**0.08**	**0.21**	**0.11**	**0.09**	**0.10**	-
LSD (0.05)	**0.75**	**0.41**	**0.61**	**47.66**	**23.03**	**26.75**	**27.41**	**18.96**	**22.09**	**0.49**	**0.26**	**0.40**	**0.65**	**0.24**	**0.59**	**0.32**	**0.26**	**0.27**	-

Y1-Ffirst year, Y2- Second year

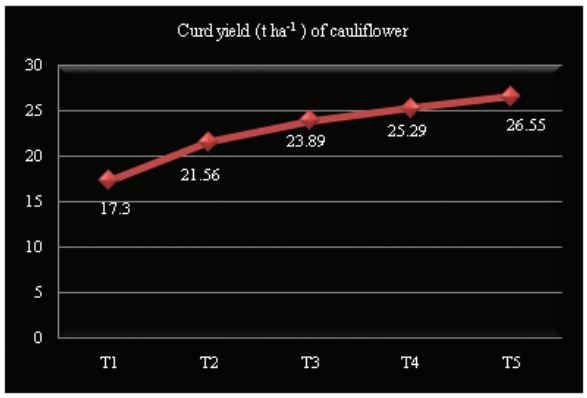

Fig. 2 : Curd yield (t ha^{-1}) obtained from different treatments

in terms of plant growth and yield compared to sole FYM application or combined application of FYM with vermicompost as additionally vermicompost acted as a good nutrient source which were easily available to the plant and also source of growth regulators, beneficial microorganism, humic acid etc. which directly improved the growth and development and ultimately yield of cauliflower. Increase of curd yield due to application of vermicompost was also reported by Jahan *et al.*(2014). Yadav *et al.*(2001) was also suggested that increased cabbage yield and head weight under integrated application of higher level of organic manure and lower level of inorganic fertilizer must be ascribed to better uptake of nutrients due to increased availability of them as a result of enhanced microbial population, in addition to that optimum utilization of the surplus available nutrients for better physiological activities, photosynthesis and translocation of nutrients from leaves to head.

e. Effect of vermicompost and farmyard manure on dry matter percentage of curd

The results of dry matter percentage of curd presented in Table 2 clearly revealed that maximum accumulation of dry matter percentage of curd (11.09 %) was recorded from the treatment of vermicompost application @ 20 t ha^{-1}(T_5) followed by 10.74% from combined treatment of FYM @ 5 t ha^{-1}along with vermicompost @ 10 t ha^{-1}(T_4) and lowest result (7.58 %) was found in control. As the individual curd weight and total curd yield per ha were recorded the maximum values from sole vermicompost application @ 20 t ha ^{1}(T_5), dry matter percentage was also found to be the highest in the same trend.

f. Benefit: cost ratio

The perusal of pooled data over two years performance represented on Table 2 revealed that the treatment of combined application of FYM @ 5

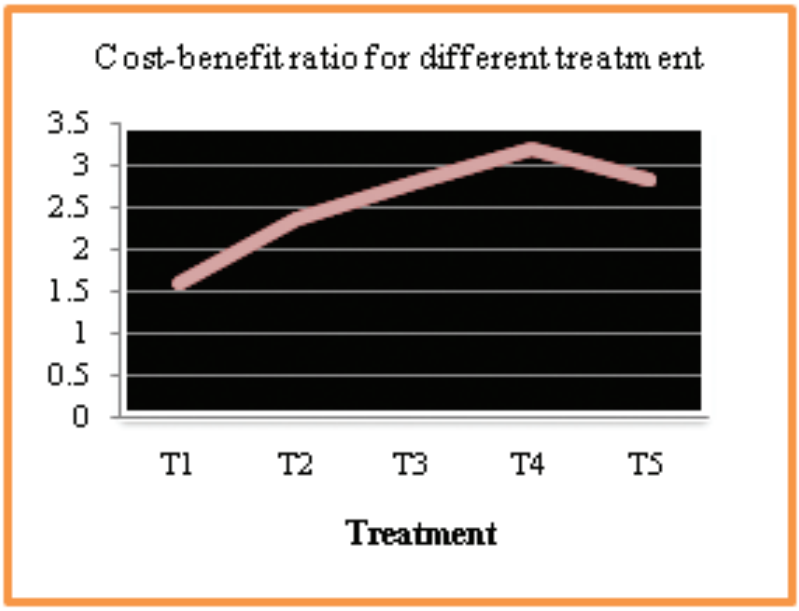

Fig. 3 : Cost benefit ratio obtained from different treatments

t ha^{-1} along with vermicompost @ 10 t ha^{-1} was found to be significantly profitable exhibiting the highest benefit: cost ratio of 3.20 followed by 2.84 and 2.81 from the treatment of only vermicompost @ 20 t ha^{-1}and combined application of FYM @ 10 t ha^{-1}along with vermicompost @ 5 t ha^{-1}, respectively, which were statistically at par. Though the highest result regarding yield and quality parameter was achieved from the application of 20 t ha^{-1}vermicompost it was not economically dominant due to more input cost and unavailability of vermicompost.

Application of vermicompost @ 20 t ha^{-1}(T_5) was found to be the best regarding growth parameters like number of leaves per plant (20.19), yield contributing parameters like individual curd weight (971.45 g) and whole plant weight (1260.82 g), total curd yield (26.55 tha^{-1}) and quality attributes like dry matter percentage (11.09 %) and curd compactness (19.61 g cm^{-1}). However, the highest benefit-cost ratio (3.20) was achieved through combined application of vermicompost (10 t ha^{-1}) and FYM (5 t ha^{-1}). Poor availability and higher market price of vermicompost led to lower benefit-cost ratio (2.84) as compared to combined application of vermicompost and farmyard manure. Pooled analysis also revealed that the solely application of farmyard manure did not give desirable results in respect to yield quality and benefit-cost ratio. The present study revealed that while application of FYM @ 5 t ha^{-1} along with vermicompost @ 10 t ha^{-1} could be recommended for higher benefit cost ratio, sole application of vermicompost @ 20 t ha^{-1}could result in higher yield and quality.

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