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Research Communication

Economics and fertility status of organic and inorganic fertilizer-applied soil in sweet corn (*Zea mays*) cultivation

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ABSTRACT

A rainfed field experiment was laid out during the rainy season of 2019 at the Research farm of Raj Mohini Devi College of Agriculture and Research Station, Ambikapur, Chhattisgarh, to study the effect of integrated nutrient management on economic viability and residual nutrient status of soil in sweet corn (*Zea mays* L. *saccharata*). The experiment comprised 2 sources of organic manures, viz. vermicompost and FYM together with no organic manure and 3 levels of fertilizers, viz. 50%, 75% and 100% recommended dose of fertilizer (RDF) (120, 60 & 40 kg N, P and K/ha respectively) and replicated trice. The result showed that, the application of 3 t vermicompost/ha resulted in the highest growth and yield attributes as well as cob and fodder yields, followed by 5 t FYM/ha and both these treatments proved significantly superior to no organic manure. However, 100% RDF recorded higher value of these parameters and was found significantly superior to 75% and 50% RDF. The highest dehusked cob yield (14.9 t/ha) and net returns (₹ 147,265.2/ha) were obtained with 3.0 t vermicompost/ha + 100% RDF. Different organic sources did not cause any significant effect on available N, P and K but significantly enhanced organic carbon content of the soil. Nutrient levels had significant effect on available N, P and K of the soil at harvesting.

Key words: FYM, Interactions, Sweet corn, Vermicompost

Sweet corn (*Zea mays* L. saccharata) is consumed as a human food as succulent grain in soft-dough stage. It is mostly grown for processing sector. Since sweet corn is a short-duration crop (65-70 days), it easily fits in rainfed cropping system and in addition to green cob, it provides green, nutritious, palatable felicitous fodder to cattle (Sahoo and Mahapatra, 2007). However, sweet corn is an exhaustive crop so it is necessary to economize its cultivation along with sustainability of soil health. When organic amendment is added, carbon (C) and other essential nutrients like major and micro nutrients are supplied, which are highly essential for growing crops to complete its life-cycle. Organic amendments are found effective to improve the physicochemical and microbiological properties of the soil, which are important in increasing the productivity and quality of soil (Canatoy and Daquiado, 2021).

An experiment was laid out during rainy season of 2019 at the Research farm of Raj Mohini Devi College of Agriculture and Research Station, Ambikapur, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh (23° 18' N, 83° 15' E, 611 m above mean sea-level). The experimental soil was sandy loam, acidic (pH 5.7), medium in organic carbon (0.56), available nitrogen (234 kg/ha), available phosphorus (8.4 kg/ha) and available potassium (268 kg/ha). The experiment was laid out in factorial randomized completely block design (FRCBD) with 3 repetitions. The treatment comprised 2 sources of organic manure, viz. vermicompost (3.0 t/ha) and FYM (5.0 t/ha) along with control and 3 fertilizers level 50%, 75% and 100% recommended dose of fertilizer (RDF, 120, 60 & 40 kg N, P and K/ha respectively). Sowing was done manually in the first week of July using Sugar 10 sweet corn cultivar. Organic manures were applied as per the treatments at the time of last field preparation. NPK were supplied as per the treatments through fertilizers mixture (12:32:16), urea and muriate of potash. The crop was sown in rows, 60 cm apart, with plant-to-plant distance of 15 cm by using 5 kg seed/ha.

The maximum plant height, leaf-area index, dry-matter accumulation/plant and crop-growth rate were recorded under 3.0 t vermicompost/ha, being at par with 5.0 t FYM/ha and both were significantly superior to control (Table 1).

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Table 1. Effect of organic sources and nutrient levels on growth, yield and economics of sweet corn and fertility status of the soil after harvesting of crop

Treatment	Growth attributes				Yield attributes				Yield (t/ha)			Economics			Fertility status of soil			
	Plant height (cm)	Leaf area index	DM/ plant (g)	CGR (g/m²/ day)	Cob length (cm)	Cob girth (cm)	kernel rows /cob	kernels /row	Husked cob yield	Dehus-ked cob yield	Green fodder yield	Gross returns (₹×10³/ha)	Net returns (₹×10³/ha)	Benefit: cost ratio	Organic carbon (%)	Available nitrogen (kg/ha)	Available phosphorus (kg/ha)	Available potassium (kg/ha)
Organic manure																		
No organic manure	250	3.2	146	54.2	17.9	15.4	13.6	34.7	14.4	9.6	18.1	153	94	1.61	0.23	198	8.1	128
Vermicompost (3.0 t/ha)	257	3.7	155	58.2	18.7	15.9	14.8	36.7	16.9	12.0	20.5	179	105	1.43	0.33	204	10.3	136
FYM (5.0 t/ha)	254	3.5	154	57.4	18.4	15.8	14.6	35.9	15.9	11.1	19.9	168	107	1.74	0.32	201	9.6	135
SEm±	1.2	1.1	0.08	0.9	0.8	0.06	0.13	0.32	0.3	0.3	0.3	3540.7	3540.7	0.06	0.02	2.3	0.9	2.7
CD (P=0.05)	3.7	3.3	0.2	2.8	2.3	0.18	0.39	0.96	1.03	0.8	0.8	10615.4	10615.4	0.17	0.06	NS	NS	NS
Nutrient level																		
50% RDF	239	2.6	140	51.2	17.3	15.1	12.9	33.6	12.9	8.8	16.6	137	74	1.20	0.27	187	7.9	119
75% RDF	251	3.4	153	57.6	18.4	15.8	14.5	35.9	15.5	10.7	19.4	164	100	1.56	0.30	201	8.7	130
100% RDF	270	4.5	162	61.0	19.4	16.3	15.6	37.8	18.7	13.4	22.5	198	132	2.01	0.31	213	12.5	148
SEm±	1.2	1.1	0.08	0.9	0.8	0.06	0.13	0.32	0.3	0.2	0.3	3540.7	3540.7	0.06	0.02	2.3	0.9	2.7
CD (P=0.05)	3.7	3.3	0.2	2.8	2.3	0.18	0.39	0.96	1.03	0.8	0.8	10615.4	10615.4	0.17	NS	6.9	2.8	8.0

RDF, 120, 60, 40 kg N, P, K/ha respectively; CGR, crop growth rate; DM, dry-matter

Among the nutrient levels, 100 % RDF resulted in the highest plant height, leaf-area index, dry-matter accumulation and crop-growth rate and was significantly superior to 75% and 50% RDF. Significantly higher cob length, cob girth, kernel rows/cob and kernels/row were obtained when 3.0 t vermicompost/ha was applied compared to no organic manure; however, it remained at par with 5.0 t FYM /ha. Application of 100% NPK produced significantly more cob length, cob girth, kernel rows/cob and kernels/row than 50 and 75% RDF. Better availability of nutrients under high nutrient levels improved the plant growth in terms of leaf-area and dry-matter accumulation which in turn might helped in increasing cob length and cob girth. These findings support the results of Paikra *et al.,* (2018) and Rathod *et al.,* (2018).

Crop fertilized with 3.0 t vermicompost/ha being at par with 5.0 t FYM/ha resulted in significantly more husked, dehusked cob yield and fodder yield than that grown without organic manure (Table 1). Crop nourished with 100% RDF gave significantly more husked, dehusked cob and green fodder yield than 50 and 75% RDF. A significant increase in green cob yield and green fodder yield was noted with combined application of inorganic fertilizers and organic manures (Table 2). The maximum cob and fodder yield were received when 3.0 t vermicompost/ha was applied with 100% RDF, which was significantly higher than remaining treatment combinations. The judicious use of inorganic fertilizers and organic manure, had the synergistic effect on availability of applied nutrients in soluble form that favoured better utilization of it thus, increased sink capacity through better nutrient uptake by crop. These findings are in accordance with Rathod *et al.,* (2018) and Rao *et al.,* (2020).

The maximum gross returns (₹ 179,033.2 /ha) were obtained under application of 3.0 t vermicompost/ha, whereas maximum net returns and B:C (₹ 107,359.1 /ha and 1.74) were obtained with 5.0 t FYM/ha. Among nutrient levels, the significantly maximum gross returns, net returns and B: C obtained with 100% NPK as compare to 50 and 75% RDF (Table 1). The maximum net returns (₹ 147,265.25 / ha) were accrued with addition of 3.0 t vermicompost/ha with 100% RDF followed by 5.0 t FYM/ ha + 100% RDF. Significantly the highest B:C (2.41) was obtained with 5.0 t FYM/ha + 100% of the RDF. The inorganic fertilizers are cheaper in comparison to vermicompost and farmyard manure and required in less quantity to supply recommended dose of nutrient which reduced the cost. The conjoined application of FYM and 100% RDF assured the maximum net return and benefit: cost owing to the higher production and lower cost of cultivation. These results confirm the findings of Paikra *et al.,* (2018), Rathod *et al.,* (2018) and Rao *et al.,* (2020).

Table 2. Interactive effect of organic sources and nutrient levels on yield and economics of sweet corn

Treatment	Organic manure											
Nutrient levels	Cob yield (husked) (t/ha)			Fodder yield (t/ha)			Net return (₹×10³/ha)			Benefit: cost ratio		
	No organic manure	Vermi-compost (3.0 t/ha)	FYM (5.0 t/ha)	No organic manure	Vermi-compost (3.0 t/ha)	FYM (5.0 t/ha)	No organic manure	Vermi-compost (3.0 t/ha)	FYM (5.0 t/ha)	No organic manure	Vermi-compost (3.0 t/ha)	FYM (5.0 t/ha)
50% RDF	11.8	13.7	13.4	15.2	17.6	17.0	73	79	88	1.43	1.19	1.62
75% RDF	14.3	16.5	15.8	18.1	20.1	20.1	98	1,06	1,11	1.86	1.57	1.99
100% RDF	17.2	20.5	18.5	21.0	23.9	22.5	1,28	1,47	1,38	2.35	2.12	2.41
SEm±	0.3			0.3			3,540.7			0.06		
CD (P=0.05)	1.02			0.8			10383.5			0.18		

RDF, 120 : 60 : 40 kg N : P : K/ha respectively.

Organic sources of nutrients did not cause significant effect on available N, P and K but significantly influenced the organic carbon content of the soil after harvesting. However, nutrient levels had significant effect on available N, P and K of soil. Highest nutrients level significantly enhanced the available N, P and K of soil over lower levels of nutrients (Table 1). The addition of organic amendment could gradually replenish plant-removed nutrients and improve important soil properties (Canatoy and Daquiado, 2021). With increase in the level of fertility (N, P and K) also assured the availability of these nutrients to the crop plants in adequate amount and remained in soil in substantial quantity after fulfilling the crop requirement that ultimately improved the soil fertility (Singh *et al*., 2010).

The combined application of 3.0 t vermicompost/ha and 100% recommended dose of fertilizer enhanced the yield indices, green cob, fodder yield and net returns of sweet corn, but could not increase the benefit: cost ratio accordingly because of its high cost. However, the findings of one year experimentation clearly showed that in sweet corn, organic manures such as vermicompost and FYM could be combined effectively with inorganic fertilizers to get higher return, benefit as well as to improve soil health.

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