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S Indhu Pavithra
Research Scholar, Department of Soil Science and Agricultural Chemistry, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh. India

Narendra Swaroop
Associate Professor, Department of Soil Science and Agricultural Chemistry, [Naini Agricultural Institute], Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh. India

Jadhav Ravindra
Ph.D., Scholar, Department of Soil Science and Agricultural Chemistry, [Naini Agricultural Institute], Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh. India

Tarence Thomas
Professor and Head, Department of Soil Science and Agricultural Chemistry, [Naini Agricultural Institute], Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh. India

Corresponding Author:
S Indhu Pavithra
Research Scholar, Department of Soil Science and Agricultural Chemistry, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh. India

Effect of organic and inorganic sources of nutrients on soil health and yield of baby corn (*Zea mays* L.) Var. *Vl 42*

S Indhu Pavithra, Narendra Swaroop, Jadhav Ravindra and Tarence Thomas

Abstract
An experiment was conducted during *Kharif* season (July – October) 2021 to study the "Effect of organic and inorganic sources of nutrient on soil health and Yield of Baby Corn (*Zea Mays.* L) Var VL 42" on crop research farm department of Soil Science & Agricultural chemistry. The experiment was laid out in Randomized block Design having three levels of NPK @ 0%, 50%, 100% ha^{-1} and three levels of Vermicompost @ 0%, 50%, 100% ha^{-1} respectively. The treatment combinations were replicated three times and were allocated at random in each replication. The result shows that the application of different levels combination of Organic and Inorganic fertilizer increased growth, yield of baby corn and improved soil chemical properties, however, some parameter of soil physical properties decreased. It was recorded from the application of NPK and Vermicompost fertilizer in treatment T_9- L_0+ V_0 [@ 100% NPK ha^{-1} + @ 100% Vermicompost ha^{-1}] maximum Bulk density 1.327 Mg m^{-3} in 0-15 cm and 1.329 in 15-30 cm, Particle density 2.438 Mg m^{-3} in 0-15 cm and 2.439 in 15-30 cm, % pore space 51.31 in 0-15 cm and 50.34 in 15-30 cm, Water holding Capacity 59.10% in 0-15 cm and 59.40 in 15-30 cm, pH 7.69 in 0-15 cm and 7.71 in 15-30 cm, EC dSm^{-1}0.48 in 0-15cm and 0.49 in 15-30 cm, % Organic Carbon 0.297% in 0-15 cm and 0.298% in 15-30 cm, Available N 263.99 Kg ha^{-1} in 0-15 cm and 265.98 Kg ha^{-1}in 15-30 cm, Available P 27.67 in 0-15 cm Kg $ha^{-1}$and 26.62 in 15-30 cm, Available K 157.89 kg ha^{-1} in 0-15 cm and 155.42 kg ha^{-1} in 15-30 cm. It was also revealed that the application of NPK with Vermicompost was excellent source for fertilization than fertilizers. The economy of different treatment concerned, the treatment T_9 (L_2 + V_2) provides highest net profit of Rs. 39377 with cost Benefit Cost ratio (1:1.76).

Keywords: Physico-chemical properties of soil, NPK, Vermicompost, Yield

Introduction
Maize (*Zea mays* L.) the Queen of cereals, is considered as one of the most important cereal crops in the world. It serves as a staple food than any of the other cereal crops. Maize ranks 3rd as a food-grain crop after wheat and rice and it is not only a cereal but is also used as a vegetable and fodder crop. Maize, which was originated in America, was domesticated almost 7000 years ago, and it provides nutrients to human and as well as animals. It is also used as a source of raw material for the production of oil, protein, starch, food sweeteners, alcoholic beverages and fuel source. Maize cobs used for vegetable known as baby corn. Baby corns are unfertilized young cobs harvested 2 or 3 days after silk emergence. Baby corn is an immature dehusked, unfertilized maize ear, harvested 1–2 days after silking at 2–3 cm-long silk stage and consumed as vegetables owing to its sweet flavour. High-nutritive value, eco-friendly and crispy nature of baby corn has made it a special choice for various traditional and continental dishes apart from canning in the elite society. After harvest of baby corns, economic potential is further enhanced, since it supplies green, soft, succulent, nutritious, palatable fodder with higher digestibility. 100 grams of baby corn contain 89.1% moisture, 0.2 g fat, 1.9 g protein, 8.2 mg carbohydrate, 0.06 g ash, 28.0 mg calcium, 86.0 mg Phosphorus, and 11.0 mg of ascorbic acid. (Pandey *et al*., 2002). Baby corn has high nutrient content, a good source of foliate, vitamin B6, riboflavin, vitamin A, C, rich in Potassium, Phosphorus and fibre content and low in fat content, free from saturated fat and cholesterol, very low in sodium. (Paroda and Sashi, 2005).

Nitrogen plays an important role in essential constituent of protein and chlorophyll and is present in many other compounds of great physiological importance in plant metabolism such as nucleotide. Phosphate, alkaloid, enzymes, hormones, vitamins etc and imparts dark green colour to plants, Promotes leaf, stem and other vegetative growth but retains small root system and governs to a considerable degree, the utilization of Potassium, Phosphorous and other elements.Nitrogen is a mobile element. The tendency of young upper leaves to remain green and the lower leaves tum yellow of die is a visual indication of the mobility of Nitrogen in the plant. When the roots are unable to absorb sufficient amounts of this element to meet the growing requirement, Nitrogen compounds in the older plant parts will undergo lysis.

Phosphorus is a key element in the formation of high energy compounds such as ATP and ADP, which plays an essential role in photosynthesis and respiration. It is a vital component of nucleic acids and phospholipids. Plants take up Phosphorus in the inorganic form (Hussain *et al*., 2012) as it has beneficial effect on early root development, plant growth and quality of produce (Brady, 1947).

Potassium plays a vital role in the translocation of essential nutrients, water and other substances from the roots through stems and leaves. It helps in regulation of plants responses to light through opening and closing of stomata. Potassium is required for improving the yield and quality of different crops because of its effect on photosynthesis, water use efficiency and plant tolerance to disease, drought and cold as well for making the balance between protein and carbohydrates (Singh *et al*., 2012) [14].

Vermicompost is a nutritive organic fertilizer enriched microbiologically-active peat-like material, and is commonly used for management of organic wastes by decomposition and humification of biodegradable organic wastes carried out by microbes present in the soil and gut of earthworms. Vermicompost improve plant growth and development beyond that normally observed from just soil nutrient transformation and availability. These increases in plant productivity have been attributed to improved soil structure and soil microbial populations that have higher levels of activity and greater production of biological metabolites, such as plant growth regulators. The composition of NPK in Vermicompost is 0.6-1.2% N, 0.13-0.22% P and 0.40-0.75% K (Pawar, 2007) [11].

Materials and Methods

Two different factors were considered: (i) NPK levels (0%, 50%, 100%) ha^{-1}. (ii) Vermicompost (0%, 50% and 100%) ha^{-1}. The experiment consists of 9 treatments and the field was laid out in a Randomized Block Design with three replications and treatments were assigned accordingly. Size of each plot was 2m x 2m. The seeds were sowing into the plots at a spacing of 50 cm x 20cm. Standard recommended doses of Nitrogen as Urea, Phosphorus as SSP (Single Super Phosphate), Potassium as Muriate of Potash and Vermicompost was applied according to the treatment combinations which then applied as a basal dose before sowing of seed.

Nitrogen was applied at split doses, first after 35 days of sowing and the second dose after 42 days after sowing. Various intercultural operations such as irrigation, weeding, pest control etc. were done uniformly as required. The total yield were recorded from each individual plots after harvest. The soil at depth of 0-15cm and 15-30cm were taken both before and after crop harvest to analysis soil parameters. The various parameters analysed were Bulk density, particle density, % Pore space, pH, E.C, % Organic Carbon, Nitrogen, Phosphorus and Potassium.

Table 1: Initial status of the soil before sowing of baby corn.

Particulars	Scientists (Year)	Methods	Results
Physical Properties			
Bulk Density (Mg m^{-3})	Muthuval *et al*., (1992) [6]	Graduated Measuring Cylinder	1.320
Particle Density (Mg m^{-3})	Muthuval *et al*., (1992) [6]	Graduated Measuring Cylinder	2.430
Pore Space (%)	Muthuval *et al*., (1992) [6]	Graduated Measuring Cylinder	42.31
Soil Colour	Munsell, (1971)	Munsell colour chart	Dry- Light yellow, wet- Olive Brown
Soil Texture (Sand %, Silt %, Clay %)	Bouyoucos, (1927) [3]	Bouyoucos Hydrometer	Sandy loam- 59.09%,26%, 14%
Chemical Properties			
Soil pH	M.L. Jackson, (1958) [4]	pH meter	7.6
EC (dSm^{-1})	Wilcox, (1950) [19]	Digital Conductivity meter	0.41
% Organic Carbon	Walkley and Black, (1947)	Walkley and black wet oxidation method	0.289
Nitrogen (Kg ha^{-1})	Subbiah and Asija, (1956) [15]	Alkaline Permanganate oxidation method	260.14
Phosphorus (Kg ha^{-1})	Olsen *et al*., (1954) [9]	Spectrophotometric method	20.91
Potassium (Kg ha^{-1})	Toth and Prince, (1949) [17]	Flame photometric method	145.23

Table 2: Treatment Combinations

Treatments	Treatment Description
T_1	Control
T_2	0 kg NPK ha^{-1} + V 2.5 t ha^{-1}
T_3	0 kg NPK ha^{-1} + 5 t ha^{-1}
T_4	60:25:20 kg NPK ha^{-1} + 0 kg ha^{-1}
T_5	60:25:20 kg NPK ha^{-1} + 2.5 t ha^{-1}
T_6	60:25:20 kg NPK ha^{-1} + 5 t ha^{-1}
T_7	120:50:40 kg NPK ha^{-1} + 0 t ha^{-1}
T_8	120:50:40 kg NPK ha^{-1} + 2.5 t ha^{-1}
T_9	120:50:40 kg NPK ha^{-1} + 5 t ha^{-1}

Results and Discussion

Soil Properties: The results revealed that the respect to depth the maximum bulk density of soil was found in T_9 (1.327), (1.329) and minimum bulk density of soil was found in T_1 (1.320), (1.321) respectively. The maximum particle density of soil (Mg m^{-3}) was found in T_9 (2.438), (2.439) and the minimum particle density of soil was found in T_1 (2.430), (2.431). These findings are similar to Silva *et al.*, (2005) [12]. The maximum (%) pore space of soil was found in T_9 (51.31), (50.34) and minimum (%) pore space values result was found in T_1 (42.31), (41.56).These findings are similar to Bhattacharya (2004). The maximum (%) water holding capacity of soil was found in T_9 (59.10), (59.40) and minimum was found in T_1 (50.03), (50.72).These improvement in physical properties of soil in treatment in T_9 might be due to the application of 100% NPK and 100% Vermicompost. These findings are similar to Szmigiel *et al.*, (2006) [16].

Table 3: Effect of Organic and Inorganic Sources of nutrients on Bulk density (Mg m^{-3}), Particle density (Mg m^{-3}), % Pore Space and % Water holding capacity

Treatments	Bulk Density (Mg m^{-3})		Particle Density (Mg m^{-3})		Pore Space (%)		Water Holding Capacity (%)	
	0-15cm	15-30cm	0-15cm	15-30 cm	0-15cm	15-30cm	0-15cm	15-30cm
T_1	1.320	1.321	2.430	2.431	42.31	41.56	50.03	50.72
T_2	1.323	1.324	2.432	2.433	42.32	41.58	49.46	51.00
T_3	1.321	1.322	2.431	2.432	44.12	43.32	51.73	52.80
T_4	1.324	1.325	2.433	2.434	46.32	44.32	53.00	53.46
T_5	1.322	1.323	2.432	2.433	47.32	45.00	54.78	55.16
T_6	1.321	1.322	2.434	2.435	46.32	44.32	51.92	52.96
T_7	1.323	1.325	2.436	2.437	49.75	48.32	55.25	56.24
T_8	1.323	1.324	2.435	2.436	51.29	50.30	58.26	58.32
T_9	1.327	1.329	2.438	2.439	51.31	50.34	59.10	59.40
F test	NS	NS	NS	NS	S	S	S	S
S.Em ±	-	-	-	-	0.54	0.51	0.54	0.67
C.D @ 5%	-	-	-	-	1.09	1.98	2.05	2.43

Chemical Properties: The results observed that the respect to depth. The Maximum pH of soil after crop harvest was found in T_9 (7.69), (7.71) and the minimum pH (1:2.5) of soil after crop harvest was found in T_1 (7.60), (7.61) and respectively. Similar finding also reported by Opala (2011) [10]. The maximum EC (dSm^{-1}) of soil after crop harvest was found in T_9 (0.48), (0.49) and minimum EC (dSm^{-1}) of soil after crop harvest was found in T_1 (0.41), (0.43) respectively. Similar finding also reported by Wyngaard *et al.*, (2012) [20]. The maximum (%) Organic carbon of soil was found in T_9 (0.297), (0.298) and minimum (%) Organic carbon was found in T_1 (0.289), (0.290) respectively. Similar results have also been recorded by Kumar *et al.*, (2010) [7]. The maximum Nitrogen (kg ha^{-1}) of soil was found in T_9 (263.99), (265.98) and minimum Nitrogen (kg ha^{-1}) values result was found in T_1 (260.14), (262.40). Similar results have also been recorded by Singh *et al.*, (2003).The maximum Phosphorus (kg ha^{-1})of soil was found in T_9 (27.69), (26.62) and minimum Phosphorus (kg ha^{-1})values result was found in T_1 (20.91), (19.64) respectively. Similar results have also been recorded by Singh *et al.*, (2003) [13]. The maximum available Potassium (kg ha^{-1}) in soil was found in T_9 (157.89), (155.42) and minimum available Potassium (kg ha^{-1}) of soil was found in T_1 (148.97), (145.23) respectively. Similar finding also reported by Singh *et al.*, (2003) [13].

Table 4: Effect of Organic and Inorganic Sources of nutrients on pH (1:2.5), EC (dS m^{-1}), % Organic Carbon, N (kg ha^{-1}), P (kg ha^{-1}) and K (kg ha^{-1}).

Treatments	pH		EC		% Organic Carbon		N (kg ha^{-1})		P (kg ha^{-1})		K (kg ha^{-1})	
	0-15cm	15-30cm	0-15 cm	15-30cm	0-15cm	15-30cm	0-15cm	15-30cm	0-15cm	15-30cm	0-15cm	15-30cm
T_1	7.60	7.61	0.41	0.43	0.289	0.290	260.14	262.40	20.91	19.64	148.97	145.23
T_2	7.61	7.62	0.43	0.44	0.291	0.292	260.95	262.74	22.67	21.23	147.89	145.30
T_3	7.62	7.65	0.42	0.43	0.290	0.291	263.81	263.80	21.00	20.55	150.76	148.67
T_4	7.62	7.64	0.45	0.46	0.292	0.293	262.99	263.00	24.67	22.78	148.00	146.00
T_5	7.63	7.65	0.44	0.45	0.294	0.295	260.87	264.00	23.33	22.45	152.50	150.60
T_6	7.65	7.68	0.47	0.48	0.293	0.294	261.00	263.70	23.00	22.00	151.78	149.10
T_7	7.68	7.69	0.46	0.47	0.296	0.297	261.48	265.47	25.00	23.50	155.67	152.10
T_8	7.67	7.68	0.47	0.48	0.295	0.296	261.64	263.63	26.67	25.39	154.97	151.83
T_9	7.69	7.71	0.48	0.49	0.297	0.298	263.99	265.98	27.67	26.62	157.89	155.42
F test	NS	NS	S	S	S	S	S	S	S	S	S	S
S.Em ±	-	-	0.05	0.04	0.331	0.332	0.466	0.453	0.763	0.568	0.873	0.871
C.D @ 5%	-	-	0.14	0.13	0.154	0.155	0.218	0.200	1.992	0.02	1.961	1.860

Conclusion
Based on this study, it is concluded that, the present paper highlights the positive effect of NPK and Vermicompost on the soil properties of growing baby corn. Combined application of 100% NPK [N (120 kg ha^{-1}), P (50 kg ha^{-1}), K (40 kg ha^{-1})]and 100% Vermicompost [5 t ha^{-1}] is an optimum nutrient for enhancing growth, increasing yield attributes and probability of baby corn as compared to other treatment combinations.

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