

Assessment of Physio-Chemical Properties of Soil, of Hybrid Maize (*Zea mays L.*) as Influenced by Vermicompost and Biofertilizer

ABSTRACT

Field experiment was conducted at Soil Science Research Farm of SHUATS Prayagraj, (U.P.) on sandy loam soil to "Assessment of Physico-chemical properties of soil, growth and yield of hybrid maize as Influenced by Vermicompost and Biofertilizer" during kharif season of 2022. There are nine treatment combinations were comprised in randomized block design with three replications. The treatment combination are T₁-100% RDF Control, T₂-0% Vermicompost+50% PSB, T₃-0% Vermicompost+100% PSB, T₄. 50%Vermicompost+0 %PSB, T₅-50 % Vermicompost + 50 %PSB ,T₆-50 % Vermicompost + 100 %PSB, T₇-100 % Vermicompost + 0 %PSB ,T₈- 100 % Vermicompost + 50 %PSB ,T₉-100 % Vermicompost + 100 %PSB. Based on physico-chemical properties of soil the final optimized treatment was T₉ contains , BD (1.31Mgm⁻³), PD (2.40Mgm⁻³), Porespace (47.76%), WHC(45.27%), pH(6.98), EC(0.32 dSm⁻¹), Organic carbon (0.54 %), Available nitrogen (230.47kgha⁻¹), Available phosphorus (29.29kgha⁻¹) and Available Potassium (148.87kgha⁻¹).

Keywords: Soil parameters, Vermicompost, Biofertilizer, maize.

1. INTRODUCTION

Maize is also known as "Queen of cereals" and kind of fodder Maize has been usually considered as poor man's crop and occupying the place in the rich communities due to its multifarious use as industrial food and feed crops (Sukeet *al.*, 2011).

Maize belongs to family Gramineae and popularly known as corn, ranking third among the food crops, next to rice and wheat in the world and ranking fourth after rice, wheat and sorghum in India. The productivity of Maize is very high because of its C₄ nature of plants and it is very efficient in converting solar energy into production of dry matter. The crop has high genetic yield potential and hence, it is called as "Miracle crop". Among the Maize growing countries, India rank 4th in area and 7th in production, representing around 4% of the

world Maize area and 2% of total production. During 2018-19 in India, the Maize area has reached to 9.2 million ha (DACNET, 2020).

The application of vermicompost helps to improve and conserve the fertility of soil. Vermicompost imparts a dark colour of the soil and thereby help to maintain the temperature of soil. Vermicompost is one of the manures used by the farmer in growing crops because of early availability and presence of almost all the nutrient required by plants. The composition of vermicompost is 0.6-1.2%N, 0.13-0.22%P and 0.40-0.75%K. (Pawaret *et al.*, 2007).

Biofertilizers are low cost, renewable sources of plant nutrients which supplement chemical fertilizers. These are nothing but selected strains of beneficial soil microorganisms cultured in the laboratory and packed in a suitable carrier. They can be used either for seed treatment or soil application. Biofertilizers generate plant nutrients like nitrogen and phosphorus through their activities in the soil or rhizosphere and make available to plants in a gradual manner. Biofertilizers are also ideal input for reducing the cost of cultivation and for practicing organic farming (Perumalla *et al.*, 2020).

2. MATERIALS AND METHODS

The field experiment was conducted at Research Farm of Soil Science and Agricultural Chemistry at Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj. It is situated at 25°24'23" N latitude, 81°50'38" Longitude and at the altitude of 98 meter above the sea level. There are nine treatment combination were comprised in randomized block design with three replications. The treatment combination are T₁-100% RDF Control, T₂-0% Vermicompost+50% PSB, T₃-0% Vermicompost+100% PSB, T₄-50% Vermicompost+0% PSB, T₅-50% Vermicompost + 50% PSB, T₆-50% Vermicompost + 100% PSB, T₇-100% Vermicompost + 0% PSB, T₈-100% Vermicompost + 50% PSB, T₉-100% Vermicompost + 100% PSB. Healthy seeds of maize variety Moti were sown 50×20 cm spacing in sandy loam soil. The recommended doses of NPK were applied @ 120:60:40 kg ha⁻¹. The graded level of NPK were applied through Urea, Diammonium phosphate and Muriate of potash. Half dose of nitrogen and full dose of phosphorus and potassium were applied basally at the time of sowing. The soil samples were collected randomly from the experimental field to ascertain the nutrient status of each plot at 0-15 and 15-30 cm depth. The size of the soil sample was reduced by air-drying and crushing with the wooden hammer and then passed through a 2 mm sieve, coning and quartering to prepare the composite soil sample for physical and chemical analysis.

The soil analysis was done in laboratory of Soil Science, SHUATS, Prayagraj with following standard methods.

3. Result and Discussion

3.1 Soil Physical Properties

The interaction effect of VC and PSB on the bulk density of soil after crop harvest was also found significant. The maximum bulk density 1.34 and 1.37Mgm⁻³ of soil was revealed at 0-15 and 15-30 cm depth in VC₀PSB₀ and minimum bulk density 1.31 and 1.32 Mgm⁻³ of soil was found in VC₄PSB₂₀.The interaction effect/response of VC and PSB on the Particle density of soil after crop harvest was found significant. The maximum Particle density 2.56 and 2.62 Mgm⁻³ of soil was revealed at 0-15 and 15-30 cm depth in VC₀PSB₀ and minimum Particle density 2.40 and 2.44 Mgm⁻³ of soil was found in VC₄PSB₂₀. The interaction effect/response of VC and PSB on the Pore space of soil after crop harvest was found significant. The maximum Pore space 47.76 and 47.65 % of soil was revealed at 0-15 and 15-30 cm depth in VC₂₀PSB₂₀ and minimum Pore space 45.3 and 45.25 % of soil was found in VC₀PSB₀The interaction effect/response of VC and PSB on the Water Retaining Capacity of soil after crop harvest was found significant. The maximum Water Retaining Capacity45.27 and 45.01 % of soil was revealed at 0-15 and 15-30 cm depth in VC₂₀PSB₂₀ and minimum Water Retaining Capacity42.27 and 42.16 % of soil was found in VC₀PSB₀

Table 1: Physical Properties

Block	BD (Mg m ⁻³)		PD (Mg m ⁻³)		Pore space (%)		WRC (%)	
	0-15	15-30	0-15	15-30	0-15	15-30	0-15	15-30
VC ₀ PSB ₀	1.34	1.37	2.56	2.62	45.3	45.25	42.27	42.16
VC ₀ PSB ₁₀	1.34	1.34	2.51	2.58	45.55	45.53	43.24	43.16
VC ₀ PSB ₂₀	1.33	1.34	2.48	2.52	45.86	45.84	43.28	43.25
VC ₂ PSB ₀	1.33	1.34	2.46	2.49	46.07	46.05	44.27	44.24
VC ₂ PSB ₁₀	1.33	1.33	2.45	2.48	46.09	46.01	44.89	44.3
VC ₂ PSB ₂₀	1.32	1.33	2.45	2.47	46.2	46.00	44.94	44.75

VC₄PSB₀	1.32	1.34	2.44	2.46	46.3	46.25	44.98	44.8
VC₄PSB₁₀	1.32	1.32	2.42	2.44	46.76	46.74	45.01	44.94
VC₄PSB₂₀	1.31	1.32	2.40	2.45	47.76	47.65	45.27	45.01

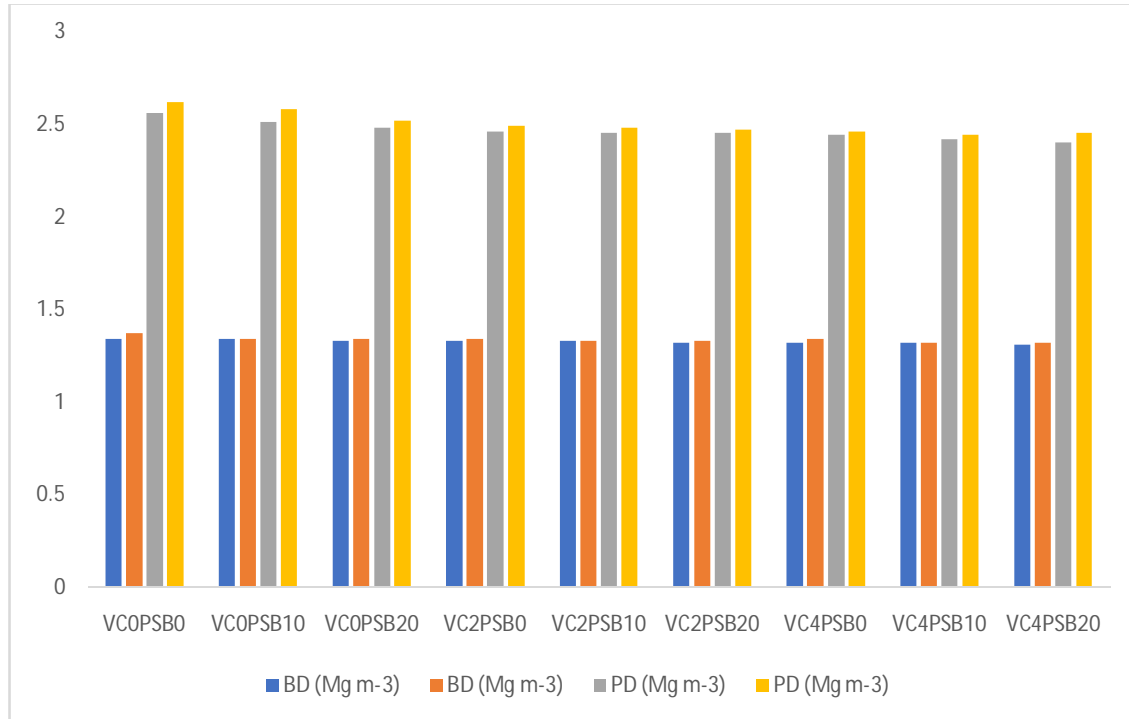


Fig 1: The effect of VC and PSB on the bulk density and particle density of soil after crop harvest.

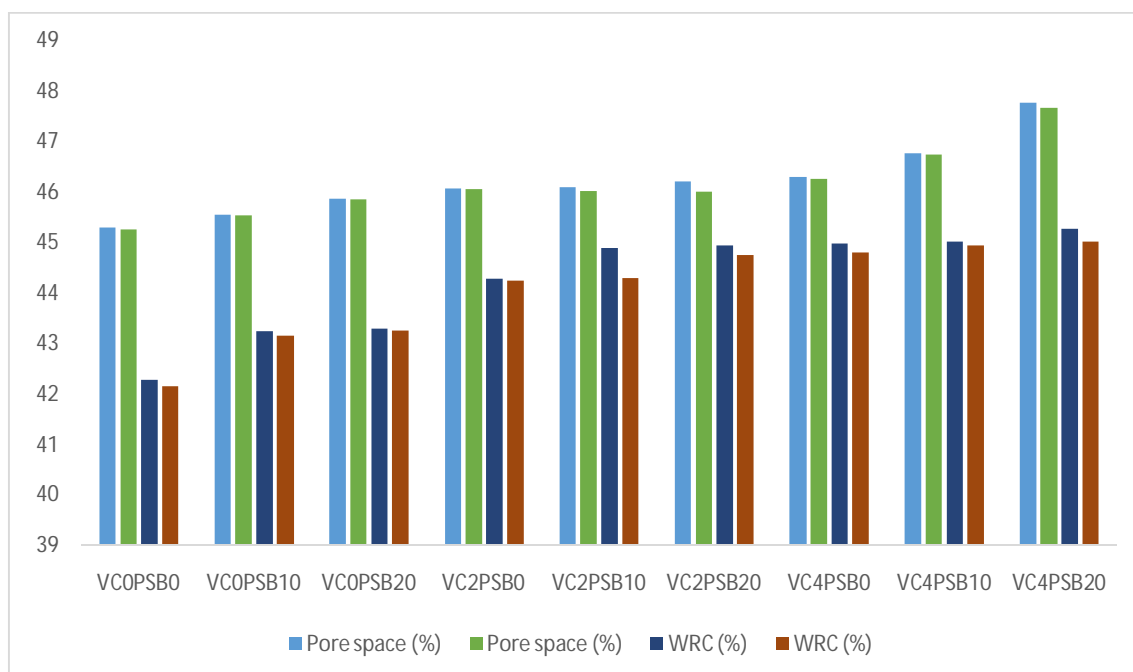


Fig 2: The effect of VC and PSB on Pore space and Water Retaining Capacity of soil after crop harvest.

3.2 Soil Chemical Properties

The interaction effect/response of VC and PSB on the pH of soil after crop harvest was found significant. The maximum pH 7.23 and 7.25 of soil was revealed at 0-15 and 15-30 cm depth in VC₀PSB₀ and minimum pH 6.98 and 7.01 of soil was found in VC₄PSB₂₀. The interaction effect/response of VC and PSB on the EC (dSm⁻¹) of soil after crop harvest was found significant. The maximum EC (dSm⁻¹) 0.45 and 0.41 of soil was revealed at 0-15 and 15-30 cm depth in VC₀PSB₀ and minimum EC (dSm⁻¹) 0.32 and 0.25 of soil was found in VC₄PSB₂₀. The interaction effect/response of VC and PSB on the % Organic carbon of soil after crop harvest was found significant. The maximum % Organic carbon 0.54 and 0.51 of soil was revealed at 0-15 and 15-30 cm depth in VC₄PSB₂₀ and minimum % Organic carbon 0.34 and 0.33 of soil was found in VC₀PSB₀. The interaction effect/response of VC and PSB on the Nitrogen (Kgha⁻¹) of soil after crop harvest was found significant. The maximum Nitrogen (Kgha⁻¹) 230.47 and 226.49 of soil was revealed at 0-15 and 15-30 cm depth in VC₄PSB₂₀ and minimum Nitrogen (Kgha⁻¹) 206.26 and 205.17 of soil was found in VC₀PSB₀. The interaction effect/response of VC and PSB on the Phosphorus (Kgha⁻¹) of soil after crop harvest was found significant. The maximum Phosphorus (Kgha⁻¹) 29.29 and 28.29 of soil was revealed at 0-15 and 15-30 cm depth in VC₄PSB₂₀ and minimum Phosphorus

(Kgha⁻¹) 16.87 and 16.26 of soil was found in VC₀PSB₀. The interaction effect/response of VC and PSB on the Potassium (Kgha⁻¹) of soil after crop harvest was found significant. The maximum Potassium (Kgha⁻¹)144.87 and 140.27 of soil was revealed at 0-15 and 15-30 cm depth in VC₄PSB₂₀ and minimum Potassium (Kgha⁻¹) 127.83 and 125.36 of soil was found in VC₀PSB₀.

Table 2: Chemical Properties

Block	Ph		EC (dSm ⁻¹)		OC (%)		N (Kgha ⁻¹)		P (Kgha ⁻¹)		K(Kgha ⁻¹)	
	0-15	15-30	0-15	15-30	0-15	15-30	0-15	15-30	0-15	15-30	0-15	15-30
VC ₀ PSB ₀	7.23	7.25	0.45	0.41	0.34	0.33	206.26	205.17	16.87	16.26	127.83	125.36
VC ₀ PSB ₁₀	7.21	7.23	0.44	0.42	0.37	0.35	211.59	211.19	17.36	17.26	136.37	134.29
VC ₀ PSB ₂₀	7.15	7.17	0.42	0.31	0.38	0.37	221.26	220.2	18.89	18.39	141.27	139.27
VC ₂ PSB ₀	7.12	7.15	0.43	0.32	0.41	0.38	209.36	207.16	17.26	17.01	131.11	130.11
VC ₂ PSB ₁₀	7.11	7.13	0.4	0.3	0.42	0.40	216.58	216.48	21.39	20.01	135.27	133.26
VC ₂ PSB ₂₀	7.02	7.11	0.37	0.25	0.44	0.41	226.29	225.29	25.36	24.46	143.27	141.39
VC ₄ PSB ₀	7.01	7.05	0.36	0.26	0.45	0.44	210.26	206.49	19.29	18.26	130.11	129.27
VC ₄ PSB ₁₀	6.99	7.03	0.34	0.26	0.50	0.46	220.29	217.39	23.49	22.26	140.34	138.29
VC ₄ PSB ₂₀	6.98	7.01	0.32	0.25	0.54	0.51	230.47	226.49	29.29	28.29	148.87	140.27

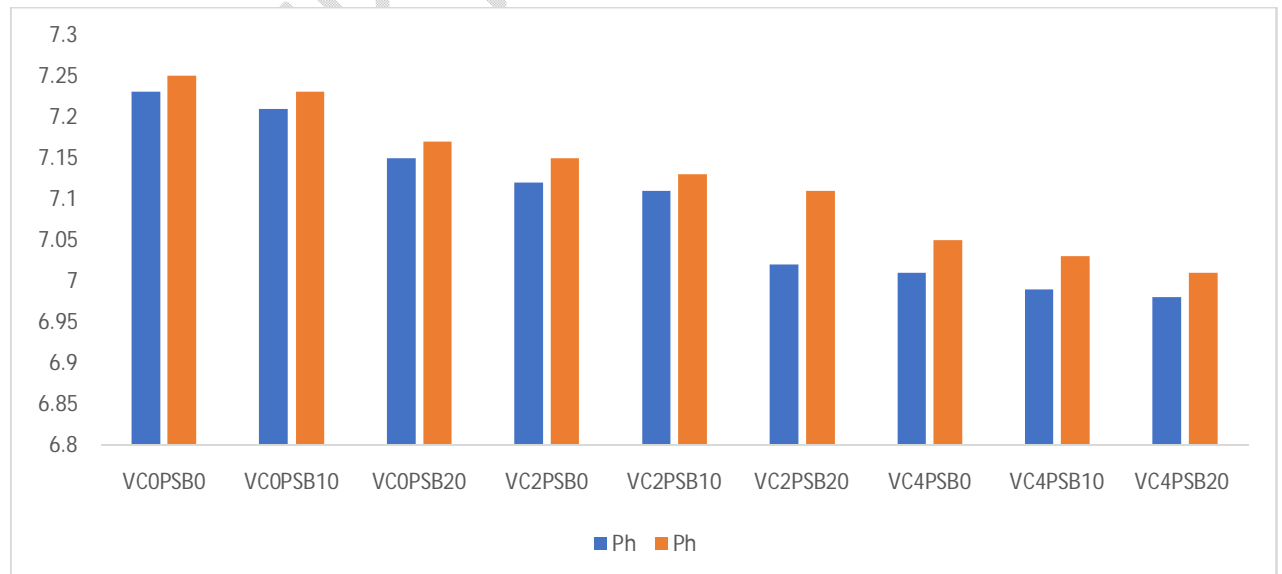


Fig 3: The effect of VC and PSB on pH of soil after crop harvest.

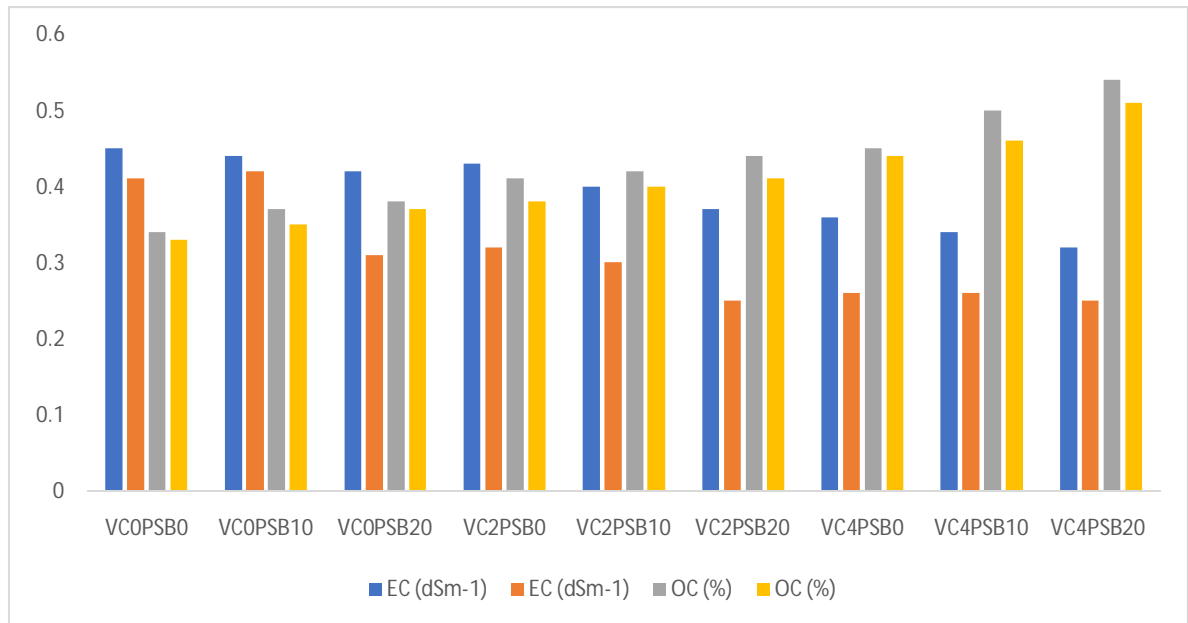


Fig 4: The effect of VC and PSB on EC and Organic Carbon of soil after crop harvest.

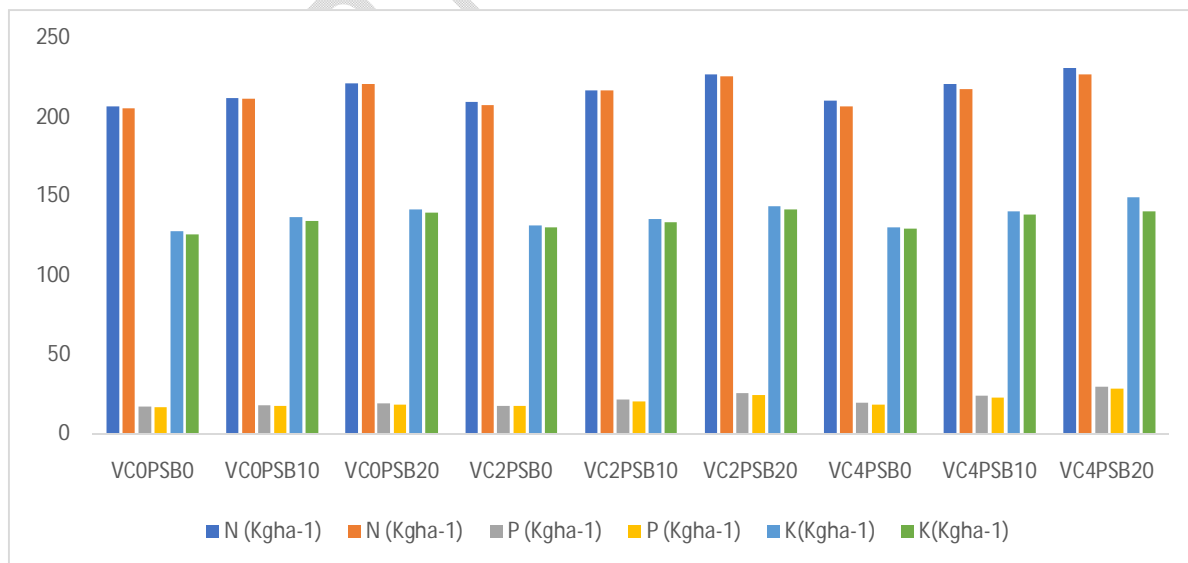


Fig 5: The effect of VC and PSB on NPK of soil after crop harvest

CONCLUSION

The results of experiment concluded as the application of Vermicompost and PSB in treatment T₉ (VC₄PSB₂₀) was found sample most effective in improving physico-chemical properties of soil as decrease in bulk density, particle density, pH, and electrical conductivity, an increase in Pore space, Water retaining capacity, organic carbon and Available Nitrogen, Phosphorus and Potassium. Similarly, the maximum plant height, number of leaves per plant, number of cobs per plant, number of grains per cobs, average cob weight, grain yield and Harvesting index was found in treatment T₉ (VC₄PSB₂₀). The economically of different treatment concerned, the treatment T₉ (VC₄PSB₂₀) provides maximum Gross Return ₹ 87475.00 ha⁻¹, Net Return of ₹ 31217.00 ha⁻¹ with Cost benefit ratio is 1:1.73 in VC₂PSB₀.

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