

Original Research Article

Assessment of Physico-chemical Properties of Soil, Growth and Yield of Potato (*Solanum tuberosum* L.) as Influenced by Integrated Nutrient Management at Prayagraj District.

ABSTRACT

An experiment was conducted on “Assessment of Physico-chemical Properties of Soil, Growth and Yield of Potato (*Solanum tuberosum* L.) as Influenced by Integrated Nutrient Management Prayagraj District.” during Rabi season 2022 at the Research farm Department of Soil science and Agricultural chemistry, NAINI, SHUATS, Prayagraj. The design applied was 3x3 RBD having three levels of Poultry-manure @0t,4t,8t h⁻¹ and NPK @ 0, 50and 100%. The result obtained with treatment T₉ [NPK @ 100% + poultry manure @ 8t ha⁻¹] that showed Poultry manurer in combination resulted in a slight change in soil pH at 0-15 cm and 15-30 cm were found 7.21 and 7.28 and EC 0.37 and 0.28 dS m⁻¹ respectively. In post soil of fertilizers observations were resulted in non-significant increase in two depth 0-15 cm and 15-30 cm, Bulk density 1.33 and 1.30 Mg m⁻³, Particle density 2.54 and 2.56 Mg m⁻³ and significant in Pore space 47.57 and 47.24 %, Water holding capacity 42.57 and 42.24 %, Organic Carbon 0.44 %, 0.42 %, and Available N 278.49 kg ha⁻¹, 256.66 kg ha⁻¹, P 31.26 kg ha⁻¹, 29.93 kg ha⁻¹, K 208.58 kg ha⁻¹, 202.18 kg ha⁻¹, in case of Nitrogen (kg ha⁻¹), Phosphorus (kg ha⁻¹) and Potassium (kg ha⁻¹) was found to be significant among other treatments in Potato cultivation and soil quality improvement. The maximum yield regarding, gave the best results with respect to plant height 46.78cm, number of leaves plant⁻¹ 129.60. It gave highest yield 37.31 t ha⁻¹. It was also revealed that the application with organic manures was excellent source for fertilization than fertilizers.

Keywords: Potato, Poultry manure, NPK, Soil health, Morphological parameters etc.

INTRODUCTION

Soil plays a key role in many ecological processes, including nutrient cycling, water infiltration, carbon sequestration, and habitat creation. Soil quality is influenced by various factors such as climate, topography, vegetation, and human activities. Degradation of soil quality can lead to reduced crop productivity, loss of biodiversity, and increased susceptibility to erosion and desertification Lal (2014). Potato (*Solanum tuberosum* L) native to tropical South America and one of the most efficient food

crops which produces more dry matter, dietary fiber, quality protein, minerals, vitamins and richest source of energy. The area and production of potato in the country is estimated around 20.85 lakhs hectares and 480 96 lakh million tonnes, respectively with the productivity of 23.07 tonnes per hectare **Anon, (2015)**. In order of importance for food production in comparison to other major food crops on the fresh weight basis, potato ranks 6th in developing countries, 4th in developed countries and 3rd in India (**Khurana and Naik, 2003**). The protein in potato is of good quality with regard to essential amino acids in human nutrition. It also has the substantial number of vitamins, minerals and traces of other nutrients. With all these characters, potato undoubtedly a very important crop for countries with the high human population density like India where adequate protein and calories can be supplied cheaply for the nutritional needs calling it as "Poor man's crop". **Bugarcić, (2000)**. Potato is an important crop for solving food and nutritional security problems of growing population of India with its high potential for the growth and yield. Potato is the fourth most important food crop after rice, wheat and maize in the North-East plains of India. India is the second largest potato producing country in the world after China, with annual production of 42.48 million tonnes from area of 1.93 million hectare, while in Uttar Pradesh area, production and productivity of potato is 0.55 m ha, 13.57 m tonnes and 24.67 tonnes ha', respectively **Anon, (2022)**. Potassium is one of the three major nutrient elements (N, P and K) required by plants. Potassium imparts pest and disease resistance to the plant and plays an important role in crop productivity. Potassium contributes to stem growth, tuber growth and the synthesis of protein **Ginindza et al., (2015)**. It is always involved in the movement of carbohydrates, therefore accumulation carbohydrates and soluble nitrogen compound points to diminish protein synthesis in case of potassium deficiency. In the event of luxury consumption during the process. It is also regulating the transpiration process through opening and closing the stomata by affecting the activities of guard cells. In these organelles potassium activates the fat produces enzyme and enhances the oil content **Singh et al., (2013)**

MATERIAL AND METHODS

The investigation on “**Assessment of Physico-chemical Properties of Soil, Growth and Yield of Potato (*Solanum tuberosum* L.) as Influenced by Integrated Nutrient Management Prayagraj District.**” comprise of a field experiment which was carried out at the Soil Science Research Farm, Sam Higginbottom University of Agriculture Technology, Prayagraj during Rabi season 2022. The details about the experiment site, soil and climate are described in this chapter together with the experimental design, layout plan, cultural practice, particulars of treatments, planting material and techniques employed for the parameters.

The experiment was conducted at research Farm of Soil Science at Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, the area is situated on the south of Prayagraj on the right side of the river Yamuna on the South of Rewa Road at a distance of about 6 km

from Prayagraj city. It is situated at 25°57" N latitude, 81°59" E longitude and at the altitude of 98 meter above the sea level, comes under subtropical belt in the South east of Uttar Pradesh, which experience extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46°C – 48°C and seldom falls as low as 4°C – 5°C. The relative humidity ranged between 20 to 94 percent. The average rainfall in this area is around 1100 mm annually.

The soil samples will be randomly collected from one site in the experiment plot prior to tillage operation from a depth of 0-15 cm and 15-30 cm. The volume of the soil sample will be reduced by conning and quartering the composites soil sample will be air dried and passed through a 2 mm sieve by way of preparing the sample for physical and chemical analyses.

Table 1. Treatment combination of Potato

Treatments	Treatment combinations
T ₁	Absolute control
T ₂	(NPK@0%+PM@4t ha ⁻¹)
T ₃	(NPK@0%+PM@8t ha ⁻¹)
T ₄	(NPK@50%+PM@0t ha ⁻¹)
T ₅	(NPK@50%+PM@4t ha ⁻¹)
T ₆	(NPK@50%+PM@8t ha ⁻¹)
T ₇	(NPK@100%+PM@0t ha ⁻¹)
T ₈	(NPK@100%+PM@4t ha ⁻¹)
T ₉	(NPK@100%+PM@8t ha ⁻¹)

RESULT AND DISCUSSION

Soil parameters

The composition of NPK and Poultry manure have significant increasement on the soil parameters. The increasement of pore space %, water holding capacity %, organic carbon, available nitrogen, phosphorus and potassium with the improvement of soil parameters, table 2. shown that application of different levels of NPK and Poultry manure have significant role on soil. In treatment T₁ lowest data observed, pore space 40.55 and 39.21%, water holding capacity 35.55 and 34.21%, organic carbon 0.36 and 0.34%, nitrogen 219.30 and 204.30 kg ha⁻¹, phosphorus 21.02 and 18.62 kg ha⁻¹, potassium 152.54 and 150.21 kg ha⁻¹ and T₉ shows the highest pore space 47.57 and 47.24%, water holding capacity 42.57 and 42.24%, organic carbon 0.44 and 0.42%, nitrogen 278.49 and 256.66 kg ha⁻¹, phosphorus 31.26 and 29.93 kg ha⁻¹ and potassium 208.58 and 202.18 kg ha⁻¹, respectively in 0-15cm and 15-30cm depth of soil.

In fig 1. and 2. the treatment T₉ is the maximum potential of soil parameters that improve the soil followed by T₈. It eventually shows that the NPK and poultry manure application is the beneficial effect on the soil, that will maintain the soil. T₁ shows that lowest effect on the soil.

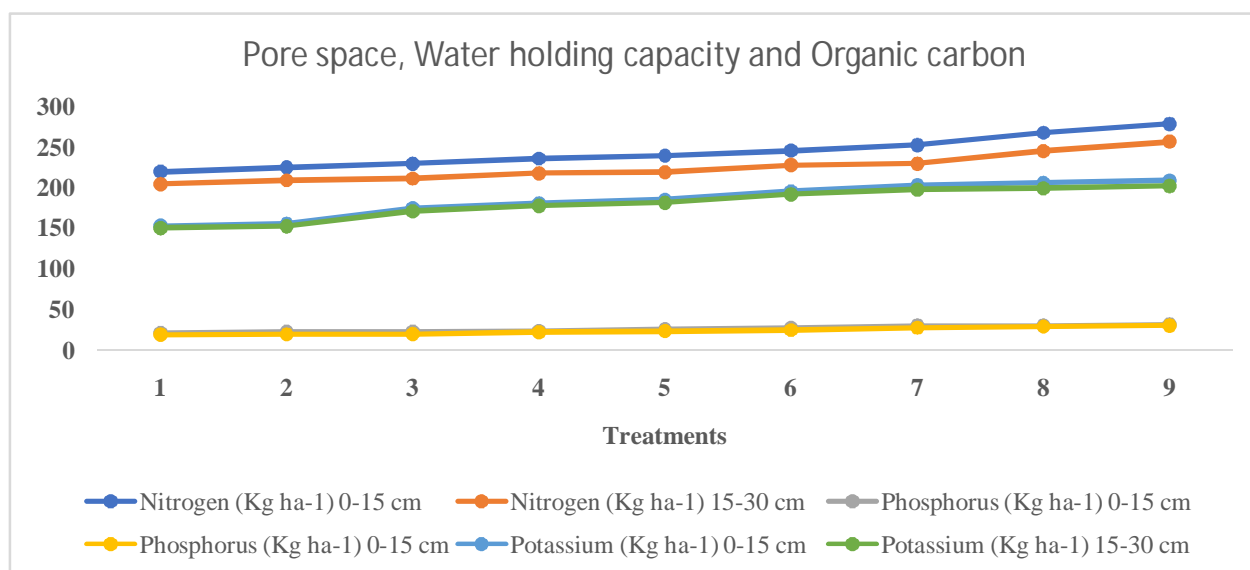


Fig. 1. Effect of different levels of NPK and Poultry manure on pore space, water holding capacity and organic carbon

Table 2. Effect of different levels of NPK and Poultry manure on soil parameters

Treatments	Pore space (%)		Water holding capacity (%)		Organic carbon (%)		Nitrogen (Kg ha ⁻¹)		Phosphorus (Kg ha ⁻¹)		Potassium (Kg ha ⁻¹)	
	0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm
T ₁	40.55	39.21	35.55	34.21	0.36	0.34	219.30	204.30	21.02	18.62	152.54	150.21
T ₂	42.63	41.29	37.63	36.29	0.36	0.35	224.43	209.10	22.35	19.02	155.27	152.60
T ₃	44.46	43.15	39.46	38.15	0.37	0.36	229.31	211.31	22.70	19.36	174.58	171.25
T ₄	44.58	43.22	39.58	38.22	0.38	0.36	235.54	217.54	23.29	21.96	180.33	177.67
T ₅	44.64	44.31	39.64	39.31	0.38	0.37	239.31	219.31	25.40	23.07	184.81	181.48
T ₆	45.57	45.23	40.57	40.23	0.39	0.38	245.50	227.84	26.56	24.30	195.33	192.00
T ₇	46.49	45.16	41.49	40.16	0.41	0.40	252.48	229.48	29.96	27.23	202.51	197.85
T ₈	46.55	46.21	41.55	41.21	0.43	0.42	267.66	245.16	30.08	28.75	205.52	198.91
T ₉	47.57	47.24	42.57	42.24	0.44	0.42	278.49	256.66	31.26	29.93	208.58	202.18

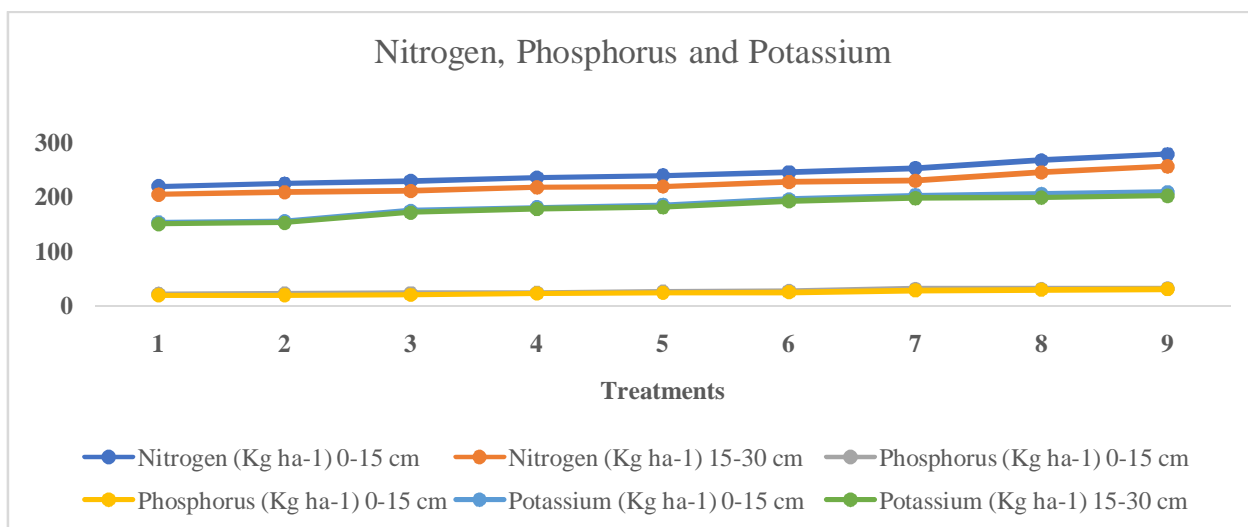


Fig. 2. Effect of different levels of NPK and poultry manure on nitrogen, phosphorus and potassium

Table 3. Yield of Potato

Treatment	Treatment Combination	Tuber yield (t ha ⁻¹)
T ₁	Absolute control	30.32
T ₂	(NPK@0%+PM@4t ha ⁻¹)	31.67
T ₃	(NPK@0%+PM@8t ha ⁻¹)	32.91
T ₄	(NPK@50%+PM@0t ha ⁻¹)	32.06
T ₅	(NPK@50%+PM@4t ha ⁻¹)	33.03
T ₆	(NPK@50%+PM@8t ha ⁻¹)	34.95
T ₇	(NPK@100%+PM@0t ha ⁻¹)	34.27
T ₈	(NPK@100%+PM@4t ha ⁻¹)	35.20
T ₉	(NPK@100%+PM@8t ha ⁻¹)	37.31

The result on table 3. depicted that the maximum tuber yield (t ha⁻¹) of Potato was (37.31) found in T₉ [NPK@100%+PM@8t ha⁻¹] followed by T₈ [NPK@100%+PM@4t ha⁻¹] and the minimum tuber yield (t ha⁻¹) was found in T₁ (control) which was (30.32 t ha⁻¹) respectively.

CONCLUSION

On the basis of above findings, it concluded that the treatment combinations of T₉ [NPK@100%+PM@8t ha⁻¹] shows best results with respect to in comparison to other treatment combinations. It gives highest yield 37.31 t ha⁻¹. So, we can recommend farmer to apply NPK and Poultry manure for profitable production of Potato and for good soil Health.

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