Original Research Article

~~Enhance of Soil Health Parameters by using~~ Integrated Nutrient Management in Green ~~gram~~ gram (*Vignaradiata* L.) ~~var. Samrat~~for Enhancing Soil Health

ABSTRACT

Integrated nutrient management (INM) is a holistic approach that involves the application of organic and inorganic fertilizers to improve soil health and crop productivity. The research study was conducted ~~with an objective~~ to ~~show~~ demonstratethe effective use of INM on soil health in ~~green~~ Green gram. ~~The design was for study is~~We used a randomized block design(RBD)~~having~~ withfour levels of poultry manure (~~@ 0~~zero, 50, 75, and 100% ha^{-1}),~~,~~ four levels of nitrogen, phosphorus, and potassium; N.P.K (~~@ 0~~zero, 50, 75, and 100% ha^{-1}), ~~respectively~~ and rhizobium seed treatment. The result~~sobtained with~~revealed that treatment T_9 ($N_{20}P_{40}K_{40}$ kg ha^{-1} + PM @ 5 t ha^{-1} and *Rhi*~~@~~ at200g.10 kg^{-1} Seed) ~~that showed poultry manure and N:P: K in combination~~ resulted in a slight change in soil pHup to 6.82, electrical conductivity (EC)to 0.198 $dS.m^{-1}$. In post-harvest soil of fertilizers, observations ~~were resulted in~~showed a significant (P < 0.05) increase in pore space (49.20%), water holding capacity (47.59%), organic carbon (0.49%), and available N (334.23 $kg.ha^{-1}$), P (34.58 $kg.ha^{-1}$),~~,~~and K (202.83 $kg.ha^{-1}$). ~~Increase~~ The increase in ~~case of~~ NPK was found to be significant (P < 0.05) among other treatments in ~~green~~ Green gram cultivation and soil quality improvement. ~~It was also revealed that t~~The application of NPK with poultry manure was a magnificent source ~~for of~~fertilization.

Keywords:*Green gram, INM, Poultry manures, Rhizobium,~~and~~ Soil health parameters.*

Introduction:

Soil health refers to the capacity of soil to function. ~~A h~~Healthy soil is vital for farm profitability, sustainable crop production, nutrient and water cycling, and climate regulation. Soil health assessment is designed to evaluate soil quality in supporting land productivity, as well as management sustainability in the context of soil functions. Several soil properties have been identified as indicators ~~for of~~soil health. Scientists have been conducting extensive studies on measuring soil health in research plots under various soil health management treatments.

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Green gram is popularly known as “Moong Dal”.~~and one of the main pulse crops in India.~~ It is widely cultivated throughout ~~the~~ Asia, including India.Pulses are the main source of protein particularly for vegetarians and contribute about 14% of the total protein of the average Indian diet. The per capita availability of pulses in India has been continuously decreasing ~~which is~~to 32.52 g.day^{-1} against the minimum requirement of 80 g.day^{-1} per capita prescribed by the Indian Council of Medical Research (ICMR). Therefore, ~~it is necessary for agricultural scientists to~~agricultural scientists must evolve a strategy to ~~increasing~~ increasethe production of pulses to meet the protein requirements of the increasing population of the country.

Poultry manure is relatively resistant to microbial degradation. However, it is essential for establishing and maintaining the optimum soil physical condition for plant growth. It is a good source of N for sustainable crop production, but its availability remains an important issue due to its bulky nature, while inorganic fertilizer is no longer affordable to poor farmers due to its high cost**.** Poultry Manure contains high amounts of nutrients especially nitrogen that are easily taken up by plants for fast growth. These manures provide a source of all necessary macro and micro-nutrients in available forms, thereby improving the physical and biological properties of the soil **Muhammad *et al*., (2020).**

Methodology:

The detailed treatment combinations~~was shown~~are listed in ~~table~~Table~~.~~1 and the field experiment has been conducted during the ~~Zaid~~ summer~~season~~ of 2022 in the central researchfarm of the ~~department~~ Department of ~~soil~~ Soil ~~science~~ Science and ~~agricultural~~ Agricultural ~~chemistry~~Chemistry,NainiAgricultural Institute, Prayagraj (Allahabad) 211 007, (U.P.), located at 25°24’30’’ North latitude 81°51’10’’ East longitude and 98m above mean sea level. ~~Representing~~ The study area representsthe Agro**-**ecologicalsubregion [North Alluvium plain zone (0-1% slop)] and Agro-climatic zone (Upper ~~gangetic~~ Gangeticplain region).Argo climatically, Prayagraj district represents the subtropical belt of the South East of (U.P.)~~,~~ and is endowed with extremely hot summers and fairly cold winters. The maximum temperature ~~of the location~~ ranges between 46°C and ~~seldom falls below~~ 4°C-5°C. The relative humidity ranges between 20-94%. The average rainfall ~~of this area~~ is around 1100mm annually.The soil samples ~~will be~~were randomly collected from one site in the experiment plot ~~prior to~~beforethe tillage operation from a depth of 0-15 cm. The volume of the soil samples~~will be~~was reduced by conning and quartering the composites.~~soil~~ Soil samples~~will be~~were~~air~~ air-dried and passed through a 2 mm sieve ~~by way of preparing the~~

~~sample for physical and chemical analyses~~.Soil physical analysis ~~is done~~was carriedout after post-harvest operation. After 60 days, crop harvest soil sample was collected from the field. Physical properties textural class **(Bouyoucos,1927),** soil colo~~u~~r**(Albert, 1971),** bulk density(Mg.m^{-3}), particle density(Mg.m^{-3}), pore space (%)~~%~~, water holding capacity (%)~~%~~**(Muthuvel*et al.*, 1992)** were ~~analysed~~analyzed. Soil chemical analysis ~~is done~~was carriedout ~~after~~ post-harvest ~~operation were~~ following, pH **(Jackson, 1958)**, EC (dS.m^{-1})**(Wilcox, 1950)**, organic carbon (%)~~%~~**(Walkleyand Black, 1947)**, ~~available~~ N (kg.ha^{-1})**(Subbaihand Asija, 1956)**, P (kg.ha^{-1})**(Olsen *et al.*, 1954)**, and K (kg.ha^{-1})**(Toth and Price, 1949).**

Result and Discussion:

The ~~detailed significant~~ results ~~was~~ ~~were~~~~shown~~ illustratedin ~~table~~Table~~.~~2 where a composition of NPK and poultry manure ~~have~~ hada significant (P< 0.05) incr~~eas~~ement on the soil health parameters. The incr~~eas~~ement of pore space (%)~~%~~, water holding capacity (%)~~%~~, organic carbon (%), available nitrogen (kg.ha^{-1}), phosphorus (kg.ha^{-1}), and potassium (kg.ha^{-1}) with the improvement of soil parameters~~,~~ ~~–~~ as shown inT~~t~~able 2. ~~revealed that~~ The application of different levels of NPK and poultry manure ~~have~~ hada significant (P < 0.05) ~~roll~~role, on soil health. In treatment T_1, the lowest data observed~~,~~ ~~–~~ such aspore space (42.41%), water holding capacity (40.80%), organic carbon (0.37%), nitrogen(295.50 kg.ha^{-1}), phosphorus (23.60 kg.ha^{-1}), and potassium (130.11 kg.ha^{-1}), while~~and~~ T_9 ~~shows~~ showedthe highest pore space (49.20%), water holding capacity (47.59%), organic carbon (0.49%), nitrogen (334.23 kg.ha^{-1}), phosphorus (34.58 kg.ha^{-1}), and potassium (202.83 kg.ha^{-1}). ~~As depicted in fig.~~ Figures 1~~.~~ and ~~fig.~~ 2~~.~~ ~~–~~ revealedthat the treatment T_9 ~~is~~ hasthe maximum potential ~~of~~ forsoil health that improves the soil parameters followed ~~to~~ byT_8. It ~~eventually shows~~ showedthat the N P K and poultry manure application ~~is~~ had~~the~~ abeneficial effect on the soil, that maintained the soil parameters. ~~T_1 shows that lowest effect on the soil parameters.~~

Conclusion

In conclusion, the use of INM practices such as the application of organic manures, the use of chemical fertilizers, and the use of biofertilizers can improve the soil health parameters in ~~green~~ Green gram and increase crop productivity. ~~The t~~Treatment ~~combination~~ T_9 ~~was concluded from trial that the~~revealed that ~~various level of~~ NPK, poultry manure, and rhizobium combination is the best for a significant increase of soil physical ~~and o~~chemical properties. These practices can also help in the sustainable management of soil fertility and the conservation of soil resources.

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Comment [es1]: MUST BE UPDATED as 8.3% (1 out of 12) of the listed references were published in the past five years. The percentage has to increase to 30-40%. The old reference indicates less interest in the study field.

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Table 1. Treatment combinationfor study to enhance soil parameters in green gram var. Samrat

S.No.	Treatment combination	Symbol
T_1	**Absolute Control,**	$L_1P_1R_1$
T_2	**($N_0P_0K_0$ kg.ha^{-1} + PM @ (2.5 t.ha^{-1}) and *Rhi*@ (200g)/ 10kg^{-1} Seed),**	$L_1P_2R_2$
T_3	**($N_0P_0K_0$ kg.ha^{-1}+ PM @ (5 t.ha^{-1}) and *Rhi*@ (200g)/ 10 kg^{-1} Seed),**	$L_1P_3R_1$
T_4	**($N_{10}P_{20}K_{20}$ kg.ha^{-1} + PM $_0$ and *Rhi*@ (200g)/ 10 kg^{-1} Seed),**	$L_2P_1R_2$
T_5	**($N_{10}P_{20}K_{20}$ Kg.ha^{-1} + PM @ (2.5 t ha^{-1}) and *Rhi*@ (200g)/10 kg^{-1} Seed),**	$L_2P_2R_2$
T_6	**($N_{15}P_{30}K_{30}$ kg.ha^{-1} + PM @ 5 t ha^{-1} and *Rhi*@ (200)/g 10 kg^{-1} Seed),**	$L_3P_3R_2$
T_7	**($N_{15}P_{30}K_{30}$ kg.ha^{-1} + PM $_0$ and *Rhi*@ (200g)/ 10 kg^{-1} Seed),**	$L_3P_1R_2$
T_8	**($N_{20}P_{40}K_{40}$ kg.ha^{-1} + PM @ 2.5 t ha^{-1} and *Rhi*@ (200 g)/g 10 kg^{-1} Seed),**	$L_4P_2R_2$
T_9	**($N_{20}P_{40}K_{40}$ kg.ha^{-1} + PM @ 5 t ha^{-1} and *Rhi*@ (200g)/ 10 kg^{-1} Seed).**	$L_4P_3R_2$

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Treatments	Pore space (%)	Water holding capacity (%)	Organic Carbon (%)	Nitrogen ($kg.ha^{-1}$)	Phosphorus ($kg.ha^{-1}$)	Potassium ($kg.ha^{-1}$)
T_1	42.41	40.80	0.37	295.50	23.60	130.11
T_2	43.73	40.42	0.41	303.83	25.59	149.30
T_3	44.00	42.44	0.44	309.88	26.19	154.43
T_4	45.91	43.45	0.42	313.31	27.79	156.27
T_5	46.65	44.35	0.45	314.32	28.81	167.40
T_6	45.00	46.09	0.47	319.10	30.38	172.14
T_7	46.60	45.00	0.45	320.65	31.27	183.73
T_8	48.60	46.27	0.47	326..98	33.68	197.27
T_9	49.20	47.59	0.49	334.23	34.58	202.83

Table 2.Significanteffect of different levels of NPK, poultry manure, and rhizobium on soil health parameters