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Effect of Organic Sources of Nutrient Management on Growth, Yield and Economics of Greengram (*Vigna radiata* L.)

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ABSTRACT

A field experiment was conducted during *Zaid* season of 2021 at SHUATS Model Organic Farm, Department of Agronomy, SHUATS, Prayagraj (UP). The soil was sandy loam in texture, neutral in reaction (pH 7.0), low in available N (168.75 kg/ha), medium in available phosphorus (17.40 kg/ha), medium in available potassium (231.7 kg/ha), and low in available organic carbon (0.38%). The experiment was laid out in Randomized Block Design and having nine treatment consisted of three different manures farm yard manure, vermicompost, poultry manure and 3 different sources of spray panchagavya, vermiwash, fish amino acid which replicated thrice and effect was observed on Jawahar-1greengram variety.The result showed that growth parameters viz., plant height (45.09 cm), branch/plant (5.73), plant dry matter accumulation (351.33g/m^2) number of nodules (33.66/plant) and dry weight (14.05g/plant) yield attributes like effective seed/pod (13.10), pods/plant (35.45), test weight (37.08 g), seed yield (1433.33kg/ha), stover yield (3346kh/ha) were found to be significantly highest with T_5i.e.,vermicompost @ 3t/ha + panchagavya 3%. Similarly highest gross return (₹146679 /ha), net return (₹100226 /ha) and benefit: Cost ratio (2.16) were recorded superior with application T_5i.e.,vermicompost @ 3t/ha + panchgavya 3%

Keywords Greengram, Vermicompost, FYM, Poultry manure, Panchgavya.

INTRODUCTION

Greengram (*Vigna radiata* L.) is also known as mung, moong, mungo, golden gram, Chickasaw pea and Oregon pea. It's one of the important *Zaid* pulse crops of India which can be grown as catch crop between *zaid* and *kharif* seasons. Pulses are the main source of protein particularly for vegetarians and contribute about 14 % of the total protein of average Indian diet (Yadav *et al*. 2013). Green gram is the third important pulse crop cultivated throughout India for its multipurpose uses as vegetable, pulse, fodder and green manure crop. It belongs to the family Leguminaceae so it has the capacity to fix atmospheric nitrogen. It can be grown on a variety of soil and climatic condition, as it is tolerant to drought. It is mostly grown under dry land farming system (Malik *et al.* 2006). In India during 2019-20, about 31.15 lakh ha (76.97 lakh acres) area was covered under greengram. The

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states of Rajasthan 18.30 lakh ha (45.22 lakh acres), Karnataka 2.69 lakh ha (6.65 lakh acres), Maharashtra 3.28 lakh ha (8.11 lakh acres), Madhya Pradesh 1.82 lakh ha (4.50 lakh acres), Odisha 1.63 lakh ha (4.03 lakh acres) and Telangana 0.66 lakh ha (1.64 lakh acres) are the major producers of green gram in India (Directorate of Economics and Statistics 2019). In 2018-19, greengram production has increased from 19.25 to 20.26 lakh tonnes due to higher crop area by 7.41% to 34.36 lakh ha. With the import remaining same at 1.5 lakh tonnes, the total greengram supply has increased from 28.96 to 29.02 lakh tonnes including carryout stock of 7.26 lakh tonnes (Anonymous 2020).

The key variables influencing buyer interest for natural food is the well being cognizance and the readiness of people in general to pay for the extravagant produce or organic mean more value. Due to these secret advantages, conventional cultivators are going to natural cultivating. Use of organic manures alone or in combination with liquid organic manures will help to improve soil physico-chemical properties and effective utilization of applied organic manures for improved seed yield and seed quality. Organic manures provide a good substrate for the growth of microorganisms and maintain a favorable nutritional balance for productive soil ecosystem (Shariff 2017). Organic manures improves soil structure, increase organic matter content, promotes nutrient mobilization, increase water holding capacity of the soil, promotes formation of soil aggregates, suppresses certain plant diseases and soil borne pathogens and encourage the growth of beneficial microorganisms. Organic manures like FYM, vermi-compost, poultry manure. helps in the improvement of soil structure, aeration and water holding capacity of soil. Further, they increase the availability of macro and micro nutrients to the plants through enhanced biological processes, increases solubility of nutrients and soil salinity, sodicity and pH. Panch gavya and vermiwash an organic products have potential to play the role in prompting growth and providing immunity in plant system by Gopinath *et al*. (2010). The use of panchagavya and vermiwash not only provides the nutrients but also hydrates the leaf cells, improves the chlorophyll content thus increase the photosynthetic activity. Fish amino acid for growth promotion is a common practice. This can be easily prepared using fish waste from fish market with country black sugar. Though this amino acid does lot of good to the plant, its sustainable effect is very less compared to chemical growth promoters. Hence different ways and means were experimented to reduce the use of chemical through organic growth promoters. It helps to improve plant metabolism and actively take part in plant process by Priyanka *et al*. (2019). Keeping in view the above facts the present investigation was conducted to study the effect of organic sources of nutrient management on greengram growth, yield and economics under eastern Uttar Pradesh condition.

MATERIALS AND METHODS

Experiment site

The experiment was carried out during *Zaid* season of 2021 at the SMOF (SHUATS Model Organic Farm), Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh. SHUATS Model Organic Farm, developed under the National Project on Organic Farming (NPOF) is situated at 25º24‘41.27” N latitude, 81°50‘56” E longitude (Google 2021) and 98 m altitude above the mean sea level. This area is situated on the right side of the river Yamuna and south east side of Prayagraj city. The treatment comprised of two different factors first factor manures (farm yard manure, poultry manure, vermicompost) and second factor sprays (panchAgavya, vermicompost, fish amino acid).The experiment was laid out in Randomized Block Design, replicated thrice, details of possible treatment combination given in Table 1.

Table 1.. Treatment combination.

Treatments	Treatment combination
T_1	FYM @ 12.5 t/ha + Vermiwash 3%
T_2	FYM @ 12.5 t/ha + Panchagavya 3%
T_3	FYM @ 12.5 t/ha +Fish amino acid 1%
T_4	Vermicompost @ 3 t/ha+ Vermiwash 3%
T_5	Vermicompost @ 3 t /ha + Panchagavya 3%
T_6	Vermicompost @ 3 t/ha+ Fish amino acid 1%
T_7	Poultry manure @ 2.5 t/ha + Vermiwash 3%
T_8	Poultry manure @ 2.5 t/ha + Panchagavya3%
T_9	Poultry manure @ 2.5 t/ha + Fish amino acid 1%
T_{10}	Control (No application of nutrient)

Climate

Prayagraj belongs to sub-tropical and semi-arid climatic conditions, with both extremes of temperature, i.e., winter and summer. It receives southwest monsoon rains which commence in the month of July and withdraws by the end of September. During the growing season, the mean weekly maximum and minimum temperature, relative humidity and rainfall were 42.60°C, 31.71°C, 87.57 %, 29.0 % and 4.9 mm, respectively.

Soil chemical status

The field was uniformly irrigated one day before sowing on each of the treatment combinations. The soil of experimental plot was sandy loam in texture, neutral in soil reaction (pH 7.0), low organic carbon (0.37%), low available N (168.75 kg/ha), low available P (17.40 kg/ha) and medium available K (231.7 kg/ha).

Observations

Observations on growth parameters viz.,m plant height (cm), Dry weight (g/plant), Number of branches/plant, Dry matter accumulation (g/m^2) and nodules/plant, yield attributes viz., Pods/plants, Seeds/pods and test weight (g) and yield of Greengram viz., Seed yield (kg/ha) and Stover yield (kg/ha) was recorded and their significance was tested by the variance ratio and the level of significance used in F-test was P=0.05. Critical difference values were calculated wherever F-test was found significant (Gomez and Gomez 1984).

RESULTS AND DISCUSSION

Growth parameter

Growth parameters of Greengram, viz., plant height (cm), dry weight (g), dry matter accumulation (g/m^2), number of branches/plant and nodules/plant varied due to different organic manures and organic spray are presented in Table 2. The treatment T_5 i.e., application of Vermicompost @ 3 t /ha + Panch gavya 3% resulted significantly higher plant height (45.09cm), dry weight (8.62 g), number of nodules/plant (33.66), number of branches/plant (5.73) and contribute maximum dry matter accumulation (351.33 g/m^2) whereas, T_8 i.e., application of Poultry Manure @ 2.5 t/ha + Panch gavya 3% was found to be statistically at par and comparatively followed with highest in growth attributes like plant height (43.91 cm), dry weight (8.29 g) and dry matter accumulation (343.83 g/m^2). Vermicompost and panch gavya encourage formation of new cells, promote plant vigoursly and hastens leaf development, which help in harvesting more solar energy and better utilization of nitrogen, which help towards higher growth attributes. Similar results also found by Kumar *et al*. (2017) and Bhadu *et al.* (2018).

Yield and yield attributes

Yield attributes such as number of pods/plants, seeds/

Table 2. Effect of organic nutrient management on growth attributes of green gram.

Sl. No.	Treatment combinations	Plant height (cm)	Dry weight (g/plant)	No. of nodules / plant	No. of branches/ plant	Dry matter accumulation (g/m^2)
T_1	FYM @ 12.5 t/ha + Vermiwash 3%	40.22	6.72	29.60	4.00	281.00
T_2	FYM @ 12.5 t/ha +Panchagavya 3%	40.94	6.86	30.13	4.26	296.17
T_3	FYM @ 12.5 t/ha + Fish amino acid 1%	40.46	6.41	28.66	4.66	278.33
T_4	Vermicompost @ 3 t/ha + Vermiwash 3%	41.78	7.74	31.86	4.93	319.83
T_5	Vermicompost @ 3 t /ha + Panch gavya 3%	45.09	8.62	33.66	5.73	351.33
T_6	Vermicompost @ 3 t/ha + Fish amino acid 1%	42.58	7.84	32.33	5.13	325.33
T_7	Poultry manure @ 2.5 t/ha + Vermiwash 3%	41.52	7.21	31.40	4.73	308.67
T_8	Poultry manure @ 2.5 t/ha + Panchgavya3%	43.91	8.29	32.73	5.26	343.83
T_9	Poultry manure @ 2.5 t/ha + Fish amino acid 1%	40.81	6.94	30.80	4.53	300.50
T_{10}	Control	38.24	6.11	27.93	3.73	252.67
	SEm (±)	0.44	0.12	0.23	0.18	0.63
	CD (5%)	1.32	0.36	0.70	0.56	1.89

Table 3. Effect of organic nutrient management on yield and yield attributes of greengram.

Sl. No.	Treatment combination	Seeds/pod (no.)	Pods/plant (no.)	Test weight (g)	Seed yield (kg/ha)	Stover yield (kg/ha)
T_1	FYM @ 12.5 t/ha + Vermiwash 3%	8.93	27.30	35.64	926.66	2162.00
T_2	FYM @ 12.5 t/ha + Panchagavya 3%	9.60	28.63	34.59	933.33	2177.33
T_3	FYM @ 12.5 t/ha + Fish amino acid 1%	8.50	27.08	35.90	886.66	2068.66
T_4	Vermicompost @ 3 t/ha+ Vermiwash 3%	11.20	33.90	36.27	1113.66	2598.00
T_5	Vermicompost @ 3 t /ha + Panchagavya 3%	13.10	35.45	37.08	1433.33	3346.00
T_6	Vermicompost @ 3 t/ha+ Fish amino acid 1%	12.13	32.50	35.05	1117.66	2607.33
T_7	Poultry manure @ 2.5 t/ha + Vermiwash 3%	10.28	31.00	34.97	1090.00	2543.00
T_8	Poultry manure @ 2.5 t/ha + Panchagavya3%	12.26	34.10	36.06	1148.33	2679.00
T_9	Poultry manure @ 2.5 t/ha + Fish amino acid 1%	9.76	30.44	34.66	1008.33	2352.33
T_{10}	Control	8.13	26.56	33.38	623.33	1450.33
	SEm±	0.09	0.43	0.67	56.66	129.91
	CD (P = 0.05)	0.27	1.29	1.99	165.37	385.98

pods and test weight (g) exhibited significant variation during the experimental period varied due to different organic manures and organic spray are presented in Table 3. The treatment T_5 i.e, application of Vermicompost @ 3 t /ha + Panch agavya 3% resulted in significantly higher number of seeds/pod (13.10), number of pods/plant (35.45), test weight (37.08,) seed yield (1433.33 kg/ha) and stover yield (3346 kg/ha).The increase in seed yield due to vermicompost and panchagavya application is attributed to source and sink relationship. It appears that greater translocation of photo synthates from Source to sink might have increased seed yield as reported by Rambuatsaha *et al.* (2017).Vermicompost and panchagavya increases yield due to its effect on plant activity i.e., well-developed root system, increased N fixation and its availability to the plants and favorable en-vironments in the rhizosphere reported by Shariff *et al*. (2017). The results revealed that combined application of manure along with panchagavya 3% spray increase yield of summer green gram. Similar result also reported by Bhargavi *et al.*(2018).

Economics

Data represented in Table 4 shows that the economics performance of different treatment combination based on cost of cultivation (₹/ha), gross return (₹/ha), net return (₹/ha) and benefit cost ratio (B:C). Highest cost of cultivation (₹46453/ha), gross return (₹146679/ha), net return (₹100226/ha) and benefit cost ratio (2.16) were found with the application of T_5 i.e.,Vermicompost @ 3 t /ha + Panchgavya 3%. Increased in economic performance of greengramwas due to the positive effect to Vermicompost and Panchagavya combination on plants at higher levels which were responsible for higher marketable seed and stover yield.The application of Vermicompost @

Table 4. Effect of organic nutrient management on economics return of greengram.

Treatments no.	Treatment details	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C ratio
T_1	FYM @ 12.5 t/ha + Vermiwash 3%	36465	94828	58363	1.60
T_2	FYM @ 12.5 t/ha +Panchagavya 3%	37953	95510	57557	1.52
T_3	FYM @ 12.5 t/ha +Fish amino acid 1%	36465	90735	54270	1.49
T_4	Vermicompost @ 3 t/ha+ Vermiwash 3%	44965	113964	68999	1.53
T_5	Vermicompost @ 3 t /ha + Panchagavya 3%	46453	146679	100226	2.16
T_6	Vermicompost @ 3 t/ha+ Fish amino acid 1%	44965	114374	69409	1.54
T_7	Poultry manure @ 2.5 t/ha + Vermiwash 3%	36465	111543	75078	2.06
T_8	Poultry manure @ 2.5 t/ha + Panchagavya3%	37953	117512	79559	2.10
T_9	Poultry manure @ 2.5 t/ha + Fish amino acid 1%	36465	103185	66720	1.83
T_{10}	Control	21025	63783	42758	2.03

3 t /ha +Panchagavya 3% gave highest gross return (INR146679/ha), net return (INR100226/ha) and also maximum B: C Ratio (2.16). Application of organic fertilizer on long term basis increase yield and reduced cost of cultivation. Due to quality produce through organically had more monetary return as compare to chemically cultivate greengram. Similar results also reported by Tyagi and Upadhyay (2015), Naeem *et al*. (2006).

CONCLUSION

On the basis of one year experimentation it can be concluded that the application of vermicompost @ 3t/ha + panchagavya 3% (T_5) among the other treatments has proved to be a better treatment for getting higher productivity in greengram and is more productive economically as well.

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