OriginalResearchArticle

InfluenceofFarmyardManureandbio-fertilizersongrowthandyieldofgreengram

Abstract

Astudywasconductedwiththeobjectiveto evaluatetheinfluence ofFarmyard Manureandbio-fertilizers on growth and yield ofgreen gram. The field experiment was conducted during Zaid season 2023 at Crop Research Farm, Department of Agronomy, Sam Higginbottom University of Agriculture, Technology And Sciences, Prayagraj, Uttar Pradesh, India. Thesoiloftheexperimentalfield wassandyloam intexture, slightlyalkaline in soilreaction(pH8),low leveloforganiccarbon (0.28%), availableN(219 kg/ha), P(11.6 kg/ha) and K (217.2 kg/ha). The experiment was conducted in Randomized Block Design consisting of9 treatments with3 different levels ofFYM 05t/ha, 10t/ha, 15t/ha and different biofertilizers Rhizobium 20g/kg seeds, PSB 20g/kg seedsandTrichoderma 4g/kg seeds with threereplicationsandthetreatmentswereallocated randomlyineachreplication. Theresults showed that treatment 7 with the application of FYM 15 tonnes/ha + Rhizobium 20g/kg seeds recorded significantly higher plant height (51.32cm), higher plant nodules (30.20), higher plant dry weight (13.69g), maximum crop growth rate (12.53g/m2 /day), maximum number ofpods/plant (19.47), higher seed yield (1513 kg/ha) compared to other treatments. The maximum gross returns (117257.00NR/ha) and maximum net returns (78577.50 INR/ha), whereas highest benefit ratio (2.86) was recorded in treatment 1 with the applicationofFYM15tonnes/ha+Rhizobium20g/kgseedsascompared toothertreatments.

Keywords:Greengram,FYM,bio-fertilizers,Growth,YieldandEconomics.

INTRODUCTION

“Green gram is one of the major pulse crops grown in India, cultivated in arid and semi-arid region, and it is also known as moong bean. It is originated in the Indo-Burma region and the areas of East Asia. Green gram is considered to be the hardiest of allpulse crops and belongs to the family Leguminosae. It is India's third most important pulse crop in area cultivated and production after chickpea and pigeonpea. In India, green gram is grown in a 3.38 m ha area with 474kg/ha average productivity. In Uttar Pradesh, it is grown on 25.9 thousand ha with a productivityof659kg/ha.Foroverhalfacentury,theworldhasreliedonincreasingcropyields to supplyanever-increasing demand for food. World pulse production increased significantly duringthelasttwodecades”. [15]Indiaisthelargestproducerandconsumerofpulseglobally,

accounting for 25% ofthe globaloutput and 15% consumption. India is producing 42.57 lakh hectares and production 20.09 lakh tons and yields 472 g/ha (Jharkhand accounts for the production of 637 kg per hectare green gram from an area of 16.1(t/ha) with the productivity of10.3t/ha. Farmyard manureplays a vitalrole in improving the fertilityand capacityofsoils through its positive effects on soil physical, volatility and biological properties and level of plant nutrition. More importantly FYM is known to improve the soil physical environment. Polysaccharidesproducedbymicrobeswhichareinvolvedindecompositionoforganicmanure are important in binding soil particles together and for creating a stable soil structure. With regularuseofFYM,soilerosionisminimizedandwaterretentioncharacteristicsareimproved.

Karnavat*et al.* (2018). Rhizobium is a soil habitat bacterium (which is able to colonize the legume roots and fixes the atmospheric nitrogen symbiotically). The morphology and physiology of Rhizobium varies from free- living condition. They are the most efficient biofertilizer as per the quantity of nitrogen fixed concerned. Rhizobium in the soil poor in Nitrogenmaybe helpfulinboostingupttheproductionthroughmorenitrogenfixation. **Gajera*et al.* (2014) "**Phosphate Solubulizing Bacteria (PSB) plays an important role in solubulization ofsoil P through secretion of various organic acids and helps to be available for plants by the use of PSB decreases the environmental pollution which is caused by the use of chemical fertilizers by the combination of Phosphorus and PSB, the plants uptake more Phosphorus". **Sumanth*et al.* (2021) "**Trichoderma is used as successful plant growth enhancers, bio stimulants,biofertilizers,andaseffectivebiocontrolagentsagainst variouspathogens.Someof these positive effects have been related to the microbial release of bioactive metabolites and elicitor proteins in the plant rhizosphere". **Sharma and Borah (2020)**

MATERIALSANDMETHODS

Afieldexperiment was conductedduring *Zaid*, 2023 atCropResearchFarm, DepartmentofAgronomy, SHUATS, Prayagraj(U.P) whichis locatedat 25^{o}24'42"Nlatitude, 81^{o}50'56"E longitude, and 98 maltitude above the meansea level. This area is situatedonthe rightside ofthe river Yamuna. The soilofthe experimental field constitutes a part ofcentral Genetic alluvium and is neutral and deep. The soil of the experimental plot was sandy loam in texture, nearly neutral in soilreaction (pH 7.2), organic carbon (0.48%), available N (108 kg/ha), available P (22.50 kg/ha), and available K (280 kg/ha). The experiment was laid out inRandomizedBlockDesignwith9treatmentseachreplicatedthrice.Theobservations were recordedondifferent growthparametersat harvest viz.plant height(cm),no.ofnodules,plant dryweight, test weight, seed per pod, pods per plant, seed yield, stover yield and harvest index. were analyzed statistically to test their significance and the experiment findings have been summarized and discussed below under each heading: -

RESULTANDDISCUSSION GROWTH

ATTRIBUTES

Plant Height: At 60 DAS, significantly higher plant height (51.32 cm) was observed in the treatment 7 with application of FYM 15t/ha + *Rhizobium* 20g/kg seeds. However, all the treatments except treatment 3 (FYM 5t/ha + Trichoderma 4g/kg seeds) were statistically at par withtreatmentFYM15t/ha+*Rhizobium*20g/kgseeds. "Thehigherplant height at maturitymaybe due to easily availability of macro and micro nutrient which may have helped in growth attribute ofGreen gram. Similar finding also confirmed" with **Meena*et al.* (2016).**

Nodules/Plant: At 60 DAS, significantly higher nodules/plant (23.00) was observed in the treatment FYM 15t/ha + *Rhizobium* 20g/kg seeds. However, treatment FYM 5t/ha + Trichoderma 4g/kgseeds,treatment FYM10t/ha+*Rhizobium*20g/kgseeds,treatment FYM15t/ha +PSB20g/kg seeds and treatment FYM 15t/ha +Trichoderma 4g/kg seeds were found to be statisticallyat par with treatment FYM 15t/ha + *Rhizobium* 20g/kg seeds. Significant and higher number of nodules/plant maybe duetobetter root development as levels of phosphorus increasedas phosphorus being a component of nucleic acids and various forms of proteins, which could have stimulated cell division, resulted with increased of nodules/plant. **Shete*et al*. (2011)**

Plant Dry Weight: At 60 DAS, significantly higher plant dryweight (13.69 g)was recorded in treatment 7 with the application of FYM 15t/ha + *Rhizobium* 20g/kg seeds. However, the treatment FYM 5t/ha + *Rhizobium* 20g/kg seeds, treatment FYM 15t/ha + PSB 20g/kg seeds and treatment FYM 15t/ha + Trichoderma 4g/kg seeds were found to be statistically at par with treatment FYM 15t/ha + *Rhizobium* 20g/kg seeds. "Rhizobium inoculation in conjunction with nitrogen might have helped in increased cell size and vegetative growthresulted in increased drymatter accumulationofgreengram. Similar results were" also reportedby **Pramanik and Singh (2003).**

YIELDATTRIBUTES

Pods/plant: The number of pods/plant was significantly maximum obtained (19.47) in treatment 7 (FYM 15 tonnes/ha + *Rhizobium* 20g/kg seeds). Whereas, minimum(16.13) was recorded with treatment 3 (FYM 5t/ha + Trichoderma 4g/kg seeds).

Numberof grains/pod: The number ofgrains/pod was maximum obtained (9.5) in treatment 7(FYM15tonnes/ha+*Rhizobium*20g/kg seeds).Whereas, minimum(8.4)wasrecordedwith treatment 3 (FYM 5t/ha + Trichoderma 4g/kg seeds).

TestWeight:Maximumtestweight(31.0)wasrecordedwithtreatment7(FYM15tonnes/ha +*Rhizobium*20g/kgseeds). Whereas, minimum(30.23)wasrecordedwithtreatment 5(FYM 10t/ha + PSB 20g/kg seeds).

SeedYield:Thesignificantlyhigherseed yield(1513kg/ha)wasobtainedwiththeapplication ofFYM15tonnes/ha+*Rhizobium*20g/kgseeds(treatment 7).Thissignificant increase inseed yield might be due to the bio-priming with Rhizobium which was significantly superior. Rhizobiuminoculationgenerallyinitiatedtheearlynodulesformationinthecrownrootsystem this might be probably due to effect of proliferation of nodule forming bacteria in the root system and enhance the N-fixation from atmosphere and results in better growth and development of plant **(Nandan et al., 2012).**

Stover Yield: The significantly higher stover yield (2550.45 Kg/ha) was obtained with the application ofFYM 5 tonnes/ha + *Rhizobium* 20g/kg seeds (treatment 1). Whereas, minimum (2406.45 Kg/ha) was recorded with treatment 8 (FYM 15t/ha + PSB 20g/kg seeds).

HarvestIndex: MaximumHarvest Index(34.89%) wasrecordedwiththeapplicationofFYM 15 tonnes/ha + *Rhizobium* 20g/kg seeds (treatment 7). Whereas, minimum (31.60%) was recorded with treatment 8 (FYM 15t/ha + PSB 20g/kg seeds).

Economics

The data on the economics of different treatments presented showed that the maximum gross return(₹ 1,17,257.50/ha)andnet return(₹ 78,577.50/ha)wasrecordedwithapplicationofFYM 15 tonnes/ha + *Rhizobium* 20g/kg seeds (treatment 7). However, maximum benefit-cost ratio was obtained in treatment 1 (2.86) due to low cost of cultivation. Minimum gross return (₹ 77,633.50/ha) and net return (₹ 43,687.50/ha) was observed with application of 05t/ha FYM + 4g/kg seeds Trichoderma (treatment 3) and lowest benefit-cost ratio (1.78) was recorded in treatment 9 (15t/ha FYM + 4g/kg seeds Trichoderma). This could be due to the concurrent rise in thequantityofpods/ plant and seeds/ pod,whichsurplusassimilates may havestored inthe leavesandthentranslocatedintoseedswhentheplantreachedsenescence,ultimatelyincreased higher benefit cost ratio. Similar result was reported by**Nawhal*et al.* (2021).**

Conclusion

Onthe basis ofone seasonexperimentation, the objective undertaken in the experiment, significantly higher Plant height (51.32cm), higher nodules/plant (31.50), higher plant dryweight (13.69 g), higher crop growthrate (12.53 g/m^2/day), higher number ofPods/Plant (19.47), higher number ofseeds/pod(9.5), higher test weight (31g),higherseed yield(1513kg/ha)wasrecordedwithtreatment 7(15t/haFYM+20g/kgseeds *Rhizobium*). Higher gross returns (117257.50 INR/ha) and net return (78577.50 INR/ha) wasalso recorded withtreatment 7.So, it canbeconcluded that applicationof (FYM5 tonnes/ha+ *Rhizobium* 20g/kg seeds)Treatment 7 inGreen gramhasrecorded highest seed yield, gross return and net return.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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Details of the AI usage are given below:

1.

2.

3.

Table1.GrowthParameters

S. No.	Treatment	AT60DAS		AT30DAS
		PlantHeight (cm)	**DryWeight (g/plant)**	**Number of nodulesper plant**
1.	FYM5tonnes/ha+*Rhizobium*20g/kg seeds	50.54	12.17	28.07
2.	FYM5tonnes/ha+PSB20g/kgseeds	49.96	11.86	28.90
3.	FYM5tonnes/ha+Trichoderma4g/kg seeds	49.38	11.78	29.87
4.	FYM10tonnes/ha+*Rhizobium*20g/kg seeds	50.84	12.96	29.93
5.	FYM10tonnes/ha+PSB20g/kgseeds	50.45	12.74	30.87
6.	FYM10tonnes/ha+Trichoderma4g/kg seeds	50.04	12.59	30.60
7.	FYM15tonnes/ha+*Rhizobium*20g/kg seeds	51.32	13.69	31.50
8.	FYM15tonnes/ha+ PSB20g/kg seeds	50.66	13.31	30.20
9.	FYM15tonnes/ha+Trichoderma4g/kg seeds	50.66	13.16	30.30
	F-test	S	S	S
	SEm(±)	0.50	0.30	0.43
	CD(p=0.05)	1.52	0.90	1.30

Table2.Seedyieldparametersandharvestindex

SNo	Treatments	Numberof podsper plant	Grains perpod	Test weight (g)	Seed yield (kg/ha)	Stover yield (kg/ha)	Harvest index (%)
1.	FYM5tonnes/ha+*Rhizobium* 20g/kgseeds	16.67	8.7	30.80	1179.33	2550.45	34.13
2.	FYM5tonnes/ha+PSB20g/kg seeds	16.43	8.5	30.60	1128.33	2460.25	34.37
3.	FYM5tonnes/ha+Trichoderma 4g/kgseeds	16.13	8.4	30.43	1087.33	2445.68	33.90
4.	FYM10tonnes/ha+*Rhizobium* 20g/kgseeds	17.90	9.2	30.61	1336.66	2505.62	33.94
5.	FYM10 tonnes/ha +PSB20g/kg seeds	17.47	8.9	30.23	1239.00	2430.28	33.75
6.	FYM10tonnes/ha+Trichoderma 4g/kg seeds	17.17	8.6	30.40	1184.33	2410.65	33.14
7.	FYM15 tonnes/ha +*Rhizobium* 20g/kgseeds	19.47	9.5	31.00	1513.00	2435.1	34.89
8.	FYM15tonnes/ha+PSB20g/kg seeds	19.13	9.3	30.80	1446.66	2406.45	31.60
9.	FYM15tonnes/ha+Trichoderma 4g/kg seeds	18.8	9.1	30.63	1382.66	2365.35	32.02
	F–Test	S	NS	NS	S	S	NS
	SEm(±)	0.47	0.36	0.55	23.04	14.94	72
	CD(p=0.05)	1.43	-	-	69.08	45.45	-

Table3.Costofcultivationandeconomic

	Treatments	Costofcultivation (₹/ha)	Grossreturn(₹ /ha)	Netreturn (₹/ha)	B:C Ratio
1.	05t/haFYM+20g/kgseeds*Rhizobium*	23680.00	91398.33	67718.33	2.86
2.	05t/haFYM+20g/kgseedsPSB	23680.00	87445.83	63765.33	2.69
3.	05t/haFYM+4g/kgseedsTrichoderma	23612.00	84268.33	60656.33	2.57
4.	10t/haFYM+20g/kgseeds*Rhizobium*	31180.00	103591.70	72411.67	2.32
5.	10t/haFYM+20g/kgseedsPSB	31180.00	96022.50	64842.50	2.08
6.	10t/haFYM+4g/kgseedsTrichoderma	31112.00	91785.33	60673.83	1.95
7.	15t/haFYM+20g/kgseeds*Rhizobium*	**38680.00**	**117257.50**	**78577.50**	**2.03**
8.	15t/haFYM+20g/kgseedsPSB	38680.00	112116.70	73436.67	1.90
9.	15t/haFYM+4g/kgseedsTrichoderma	38612.00	107156.70	68544.67	1.78

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