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Integrated nutrient management on growth, yield and quality of green gram (*Vigna radiata* L.)

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Abstract
An experiment was conducted at Research Farm, Department of Agronomy, Faculty of Agriculture, AKS University, Sherganj, Satna (M.P.) during *Kharif* season of 2021-22. The experiment consisted of randomize block design three replications. In this experiment, 12 treatment combinations *viz*., RDF (NPK @ 20: 60: 20 kg/ha) – T_1, 100% nitrogen through FYM – T_2, 100% nitrogen through vermicompost –T_3, 100% nitrogen through poultry manure - T_4, 75% nitrogen through FYM + 25% nitrogen through vermicompost – T_5, 75% nitrogen through vermicompost + 25% nitrogen through poultry manure – T_6, 75% nitrogen through poultry manure + 25% nitrogen through FYM – T_7, 50% nitrogen through FYM + 50% nitrogen through poultry manure – T_8, 50% nitrogen through vermicompost + 50% nitrogen through poultry manure – T_9, 50% nitrogen through FYM + 50% nitrogen through vermicompost – T_{10}, 33% nitrogen through FYM + 33% nitrogen through vermicompost + 33% nitrogen through poultry manure – T_{11} & 25% nitrogen through FYM + 25% nitrogen through poultry manure + 50% nitrogen through vermicompost – T_{12}. The plant growth parameters were taken at 30, 45 and 60 days after sowing. Plant height, no. of leaves & pod form, no. of branches, root nodules yield of grain and stoves were maximum found in T1 followed by T4 than T3.

Keywords: Green gram, PSB, FYM, vermicompost, plant, grains/pod, grain weight, stover yield

Introduction
Green gram (*Vigna radiata* L.) is an important pulse crop believed to be originated from India. Green gram commonly known as mung, is also known as “golden gram” and it contains 20-25% protein. It is cultivated in variety of soils from red lateritic to black cotton soil. More than 70% of world’s green gram production comes from India. It is also used as green manuring crop, being a leguminous crop, it has the capacity to fix atmospheric nitrogen. It also helps in preventing soil erosion. Being a short duration crop and adaptability to off season, it fits well in many intensive crop rotations. It is a good source of protein (20-24%), carbohydrates (60-62%), water (10%), fat (1.0%), fiber (4.0%) and ash (3.0%). Green gram protein is deficient in methionin and cystein but rich in lysine making it an excellent complement to rice. It is a good source of mineral, pro-vitamin A, B complex and ascorbic acid.
Integrated plant nutrient management enhances the crop productivity and improves the soil physical, chemical as well as biological properties. The physical properties *viz*., water stable aggregates, mean weight diameter, available water holding capacity and hydraulic conductivity increase with the application of crop residues along with fertilizers whereas bulk density decreases. The chemical properties namely organic carbon content and available nutrients enhance with the application of crop residues supplemented with chemical fertilizers.
The nutrient needs of Indian agriculture are so large that no single plant sources, be it fertilizer, organic manure, green manure or biofertilizer, is in a position to meet the entire plant nutrient demand. The complementary use of fertilizer, organic manure and biofertilizers referred to integrated nutrient management (INM) is an ideal approach to supply nutrient need of plants and solve the problem of nutrient mining and sustain soil health.
The basic concept underlying the principles of Integrated Nutrient Management (INM) is the maintenance and possibly improvement of soil fertility for sustaining crop productivity on long-term basis. This may be achieved through combined use of all possible sources of nutrients and their scientific management for optimum growth, yield and quality of different crops and cropping systems. Integrated nutrient management is not a new concept but an age-old practice. Its importance was, however, not realized earlier due to low nutrient turn over in soil plant system and almost all the nutrient needs were met through organic sources, which supplied secondary and micronutrients besides major nutrients.

Incorporation of organic sources i.e. green manure, FYM, vermicompost, poultry manure, compost, crop residues along with NPK fertilizer is effective in alleviating the nutrient deficiency in soil, improving physical properties of soil and its organic carbon status. Managing organic source of plant nutrients with mineral fertilizer and their incorporation into the soil in a cropping system has certain favourable and augmenting effects on soil physical and biological properties for sustainability and high productivity of crops.

Materials and Methods

Experiment was carried out at the Research Farm, Faculty of Agriculture, AKS University, Sherganj, Satna (M.P.) during *Kharif* season 2021-22. The experiment was conducted in randomize block design with three replications. different Fertility levels *viz*., RDF (NPK @ 20: 60: 20 kg/ha) – T_1, 100% nitrogen through FYM – T_2, 100% nitrogen through vermicompost –T_3, 100% nitrogen through poultry manure - T_4, 75% nitrogen through FYM + 25% nitrogen through vermicompost – T_5, 75% nitrogen through vermicompost + 25% nitrogen through poultry manure – T_6, 75% nitrogen through poultry manure + 25% nitrogen through FYM – T_7, 50% nitrogen through FYM + 50% nitrogen through poultry manure – T_8, 50% nitrogen through vermicompost + 50% nitrogen through poultry manure – T_9, 50% nitrogen through FYM + 50% nitrogen through vermicompost – T_{10}, 33% nitrogen through FYM + 33% nitrogen through vermicompost + 33% nitrogen through poultry manure – T_{11} & 25% nitrogen through FYM + 25% nitrogen through poultry manure + 50% nitrogen through vermicompost – T_{12}. The gross and net plot size was 5 m x 3 m, respectively. The experimental plots were fertilizers as per recommended dose.

Results and Discussion

The result shows that plant height, number of branches per plant, number of grains/pod, thousand grains weight, grain and Stover yield was influenced significantly due to INM.

The highest plant height (61.06 cm) was recorded with the application of treatment, T_1 (NPK @ 20: 50: 20 kg/ha) which was significantly better than T_2 of 52.12 cm (100% nitrogen through FYM). Treatment of T_1 was found statistically at par with 100% nitrogen through PM (T_4) and 100% nitrogen through vermicompost (T_3) with the respective values of 58.07 cm and 57.59 cm, respectively.

An examination of data showed positive effect of different levels of INM treatments application on number of branches per plant of green gram. The highest number of branches per plant (11.80) was recorded with the application of treatment, T_1 (NPK @ 20: 50: 20 kg/ha) which was significantly better than T_2 of 6.20 (100% nitrogen through FYM). Treatment of T_1 was found statistically at par with 100% nitrogen through PM (T_4) and 100% nitrogen through vermicompost (T_3) with the respective values of 8.53 and 8.27, respectively.

An examination of data showed positive effect of different levels of INM treatments application on number of leaves per plant of green gram. The highest number of leaves per plant (24.87) was recorded with the application of treatment, T_1 (NPK @ 20: 50: 20 kg/ha) which was significantly better than T_2 of 13.80 (100% nitrogen through FYM). Treatment of T_1 was found statistically at par with 100% nitrogen through PM (T_4) and 100% nitrogen through vermicompost (T_3) with the respective values of 24.40 and 22.33, respectively.

The results revealed that the growth characters *viz*., plant height, number of nodules per plant, dry weight of nodules per plant and number of branches per plant showed significant improvement with application of 100% nitrogen through PM. However, it also remained at par with the application of 100% nitrogen through vermicompost in terms of plant growth. It might be due to basal application of poultry manure supplied all essential nutrients, growth hormones and enzymes to plant, which favours rapid cell division and ultimately results into better growth of plant. These results are in collaborated with research findings reported by Prajapati (2014) [3], Kachariya (2015) [2], Singh *et al*. (2017) [6] and Subrata *et al*. (2020) [7] in green gram crop.

An examination of data showed positive effect of different levels of INM treatments application on number of pods per plant of green gram. The highest number of pods per plant (22.40) was recorded with the application of treatment, T_1 (NPK @ 20: 50: 20 kg/ha) which was significantly better than T_2 of 10.33 (100% nitrogen through FYM). Treatment of T_1 was found statistically at par with 100% nitrogen through PM (T_4) and 100% nitrogen through vermicompost (T_3) with the respective values of 19.53 and 18.80, respectively.

An examination of data showed positive effect of different levels of INM treatments application on test weight of green gram. The highest test weight (39.06 g) was recorded with the application of treatment, T_1 (NPK @ 20: 50: 20 kg/ha) which was significantly better than T_2 of 28.20 g (100% nitrogen through FYM). Treatment of T_1 was found statistically at par with 100% nitrogen through PM (T_4) and 100% nitrogen through vermicompost (T_3) with the respective values of 37.01 g and 35.59 g, respectively.

An examination of data showed positive effect of different levels of INM treatments application on grain yield per plot of green gram. The highest grain yield per plot (1.49 kg) was recorded with the application of treatment, T_1 (NPK @ 20: 50: 20 kg/ha) which was significantly better than T_2 of 0.52 kg (100% nitrogen through FYM). Treatment of T_1 was found statistically at par with 100% nitrogen through PM (T_4) and 100% nitrogen through vermicompost (T_3) with the respective values of 1.46 kg and 1.31 kg, respectively.

An examination of data showed positive effect of different levels of INM treatments application on grain yield per hectare of green gram. The highest grain yield per hectare (12.42 q/ha) was recorded with the application of treatment, T_1 (NPK @ 20: 50: 20 kg/ha) which was significantly better than T_2 of 4.31 q/ha (100% nitrogen through FYM). Treatment of T_1 was found statistically at par with 100% nitrogen through PM (T_4) and 100% nitrogen through vermicompost (T_3) with the respective values of 12.19 q/ha and 10.89 q/ha, respectively.

As a consequence of higher value of yield parameters, grain and straw yield of green gram also increase significantly. Similar report has been recorded by Qureshi and Bashir (2016) [4], and Bhadu *et al*. (2018) [1]. Application of 100% nitrogen through PM significantly increased number of pods per plant, number of seeds per pod, grain, straw and biological yields, harvest index and test weight increased of green gram over control. Flocculation of soil and availability of all macro and micronutrients making the soil and crop production sustainable one (Rajkhowa *et al*., 2003) [5].

Summary and Conclusion

Based upon this experiment it is concluded that application of 100% RDF prove best treatment. Among the INM treatment,

application of 100% nitrogen through poultry manure recorded the maximum and significantly higher grain yield (12.19q/ha), gross returns (₹ 100083.00/ ha), net returns (₹ 79320.00/ ha) and highest B: C ratio of 3.82:1.

Hence, it can be concluded that application of 100% nitrogen through poultry manure obtained B: C ratio >3.8.0, can be used as a remunerative strategy and can be adopted in semi-arid eastern plain zone of Madhya Pradesh.

Table 1: Integrated nutrient management on growth, yield and quality of green gram (*Vigna radiata* L.)

Treatment	Plant height (cm)	Number of branches / Plant	Number of leaves per plant	Seed yield per plant (g)	Grain yield per plot (kg)	Grain yield per hectare (q/ha)	Stover Seed yield (q/ha)
RDF (NPK @ 20: 50: 20 kg/ha)	55.20	8.53	24.87	8.78	1.49	12.42	25.49
100% nitrogen through FYM	48.00	3.73	13.80	2.78	0.52	4.31	9.85
100% nitrogen through vermicompost	54.04	6.20	22.33	6.74	1.31	10.89	25.10
100% nitrogen through PM	54.78	6.60	24.40	8.02	1.46	12.19	25.28
75% nitrogen through FYM + 25% nitrogen through vermicompost	48.41	4.13	14.47	2.90	0.58	4.81	10.84
75% nitrogen through vermicompost + 25% nitrogen through PM	51.66	5.93	19.20	6.14	1.08	9.00	23.61
75% nitrogen through PM + 25% nitrogen through FYM	53.31	6.07	20.73	6.29	1.19	9.92	24.79
50% nitrogen through FYM + 50% nitrogen through poultry manure	51.25	5.27	16.80	5.33	0.90	7.53	21.40
50% nitrogen through vermicompost + 50% nitrogen through PM	51.60	5.60	17.33	5.90	0.95	7.94	21.76
50% nitrogen through FYM + 50% nitrogen through vermicompost	48.87	4.60	15.60	4.77	0.81	6.78	19.60
33% nitrogen through FYM + 33% nitrogen through vermicompost + 33% nitrogen through PM	48.82	4.40	15.40	3.79	0.62	5.17	11.66
25% nitrogen through FYM + 25% nitrogen through PM + 50% nitrogen through vermicompost	50.56	4.80	15.80	5.14	0.89	7.42	20.63
S Em±	0.32	0.30	0.63	0.38	0.08	0.66	0.80
C.D. (P+=0.05)	0.94	0.88	1.82	1.12	0.23	1.91	2.33

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