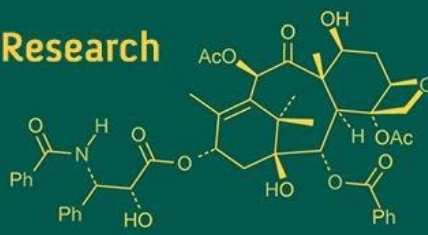


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To work out the integrated nutrient management on growth, yield nutrient uptake and soil nutrient status of summer green gram (*Vigna radiata* L.)

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Abstract

Summer green gram (*Vigna radiata* L.) is a vital legume crop in many tropical regions, but its production is often limited by inadequate nutrient management. This study investigates the impact of integrated nutrient management (INM) on summer green gram's growth, yield, nutrient uptake, and soil nutrient status in Chittorgarh Rajasthan. The presented experiment consisting of ten treatment combinations was carried out in Randomized Block Design (RBD). The results showed that INM significantly the highest numbers of pods plant⁻¹ (11.21) were observed under treatment 75% RDF + Vermicompost @ 1 t ha⁻¹ + PSB + Rhizobium (T₁₀), maximum yield, seed yield and straw yield and the lowest numbers of pods (8.77) were found in treatment T₀ compared to the control. Plant height 30 and 60 DAS. Additionally, INM improved nutrient uptake, with increases of 15% for nitrogen, 20% for phosphorus, and 18% for potassium. Soil nutrient status also improved, with significant increases in organic carbon, available phosphorus, and exchangeable potassium. The study demonstrates that INM can optimize summer green gram production while maintaining soil fertility, making it a sustainable and effective approach for farmers.

Keywords: *Vigna radiata*, INM, nutrient

Introduction

Summer green gram (*Vigna radiata* L.) is a warm-season legume crop widely cultivated in tropical and subtropical regions for its high protein content, nutritional value, and adaptability to diverse environments. As a vital component of sustainable agriculture, summer green gram plays a crucial role in maintaining soil fertility, reducing soil erosion, and supporting biodiversity. However, its production is often constrained by inadequate nutrient management, leading to reduced yields, poor soil health, and decreased crop resilience. Numerous studies have highlighted the importance of balanced nutrient management for optimal summer green gram production. For instance, Singh *et al.* (2017) [5] demonstrated that nitrogen and phosphorus application significantly enhanced summer green gram yields. Similarly, found that organic amendments like compost and green manure improved soil fertility and summer green gram productivity. Integrated Nutrient Management (INM) has emerged as a promising approach to optimize nutrient use efficiency, minimize environmental degradation, and enhance crop productivity. INM involves the judicious combination of organic and inorganic nutrient sources, conservation tillage, and crop rotation to create a balanced nutrient cycle. However, the effects of INM on summer green gram production have not been extensively explored. A few studies have investigated the impact of INM on legume crops, including green gram. For example, a study found that INM significantly improved soil organic carbon, available phosphorus, and potassium in a green gram-wheat cropping system. Similarly, reported increased green gram yields and improved soil nutrient status under INM. Despite these findings, there is a need for further research on the specific effects of INM on summer green gram production, particularly in tropical regions. This study aims to investigate the impact of INM on summer green gram's growth, yield, nutrient uptake, and soil nutrient status, providing insights into the feasibility of INM as a sustainable approach to optimize summer green gram production and maintain soil fertility.

Review of Literature

Yield attributes and yields: Studied the effect of inorganic and biofertilizers on growth and yield of cowpea. They found that application of 125% RDF showed significantly higher growth and yield contributing characters viz. plant height (92.8 cm), dry matter/ plant (23.6 g) and no. of seeds/plant (66.1), no. of pods/plant (8.6), pod yield/plant (7.98 g), seed yield kg/ha (1564), straw yield (3881 kg/ha) and seed index (8.7 g) over the application of 75% RDF.

Singh *et al.* (2017) ^[5] studied the integrated nutrient management for high productivity and net returns in lentil crop. They revealed that pods/plant were highest in RDF + Rhizobium + PSB. Combination of different organic sources with RDF resulted in significantly higher grain yield than RDF alone.

Sushil *et al.* (2015) ^[6] conducted a field experiment at Allahabad (U.P.) on green gram [*Vigna radiate* (L.)]. Results indicated that the application of 100% RDF + vermicompost @ 1.25 t/ha + Azatobactor @ 375 g/ha recorded significantly higher number of seeds/pod (14.77), number of seeds per plant (342.74), seed yield per plant (14.80 g), seed yield per ha (1139.46 kg), thousand seed weight (42.52 g), Number of pods/plant (24.77) germination (99.90%)

Materials and Methods

Study Area: The experiment was conducted during Rabi 2023-24 at Research Farm, Mewar University, Chittorgarh. Geographically, the study area is located at 075° 08' 99" E longitude and 26° 01' 17" N latitude and this region falls

under agro-climatic zone IV A of Rajasthan. 3.2 Climate and weather conditions the region has typically semi-arid climate characterized by dryness of atmosphere. The annual rainfall of the zone varies between 350 and 450 mm. In which most of received from July to September. The temperature may go as high as 48 °C during summer and it may fall below freezing point during winter. Weather acts as input, influencing the growth, yield and quality of crops as well as biotic phase of soil during season. Hence, it is important to present climatic variable in this context. The mean weekly data for temperature, relative humidity and rainfall recorded of the crop season

Experimental details (Design and layout): The presented experiment consisting of 10 treatment combinations was carried out in Randomized Block Design (RBD).

Characteristics of variety: Chickpea variety Pratap Urd-1 was used for sowing. This variety released by MPUAT, Udaipur for Rajasthan, Punjab, Haryana and Delhi. The variety average yield is 2000-2200 kg ha⁻¹. This variety is suitable for rainfed areas and moderately resistant to wilt and root rot. 3.8 Treatment application

Application of inorganic fertilizer (RDF): RDF of green gram are 20-40 (N-P) which applied by DAP and urea.

Application of FYM

FYM was applied as per treatments before sowing and thoroughly incorporated with the help of spade in soil.

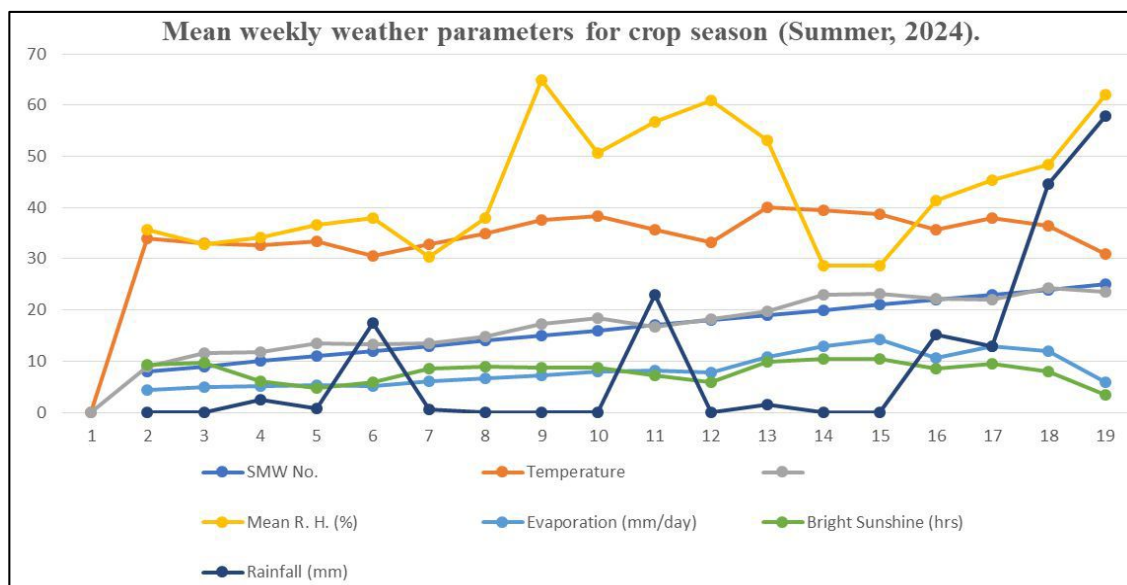


Fig 1: weakly weather parameters for crop season (summer 2024)

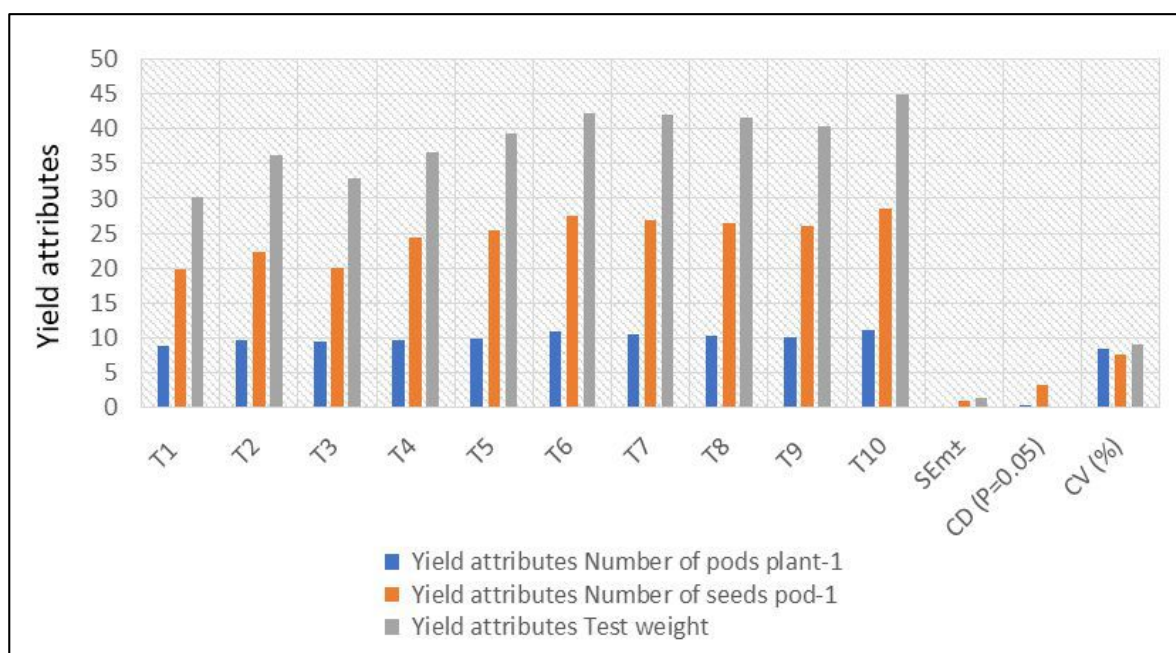
4.2 Result and Discussion

1. Yield attributes - Number of pods plant-1 A perusal of data (Table 1 and fig. 2) indicated that integrated nutrient management significantly improved numbers of pods plant-1 of cowpea. The highest numbers of pods plant-1 (11.21) were observed under treatment 75% RDF + Vermicompost @ 1 t ha⁻¹ + PSB + Rhizobium (T₁₀) to rest of the treatments and which was found to be statistically at par with 50% RDF +1 t/ha Vermicompost + PSB + Rhizobium (T₆). The lowest numbers of pods (8.77) were found in treatment T₀ (Control). Number of seeds pod-1 The data presented in and fig. 1) revealed that significantly numbers of seeds pod-1 of

cowpea. The numbers of seeds pod-1 (14.80) at 40 DAS were observed in treatment 75% RDF + Vermicompost @ 1 t ha⁻¹ + PSB + Rhizobium (T₁₀) to rest of the treatments and which was found to be statistically at par with 50% RDF +1 t/ha Vermicompost + PSB + Rhizobium (T₆). Significantly lowest numbers of seed pods-1 were found in treatment T₁ (Control). Test weight (g): The Data pertaining to test weight of green gram as affected by different nutrient management presented in table- 2 and depicted in fig.- 1. Test weight fails to crate It is clear from the data that different nutrient management did not cause significant influence on test weight of green gram.

Table 2: Effect of integrated nutrient management treatments on yield attributes of green gram

Treatments	Yield attributes		
	Number of pods plant ⁻¹	Number of seeds pod ⁻¹	Test weight
T ₁	8.77	19.8	30.3
T ₂	9.6	22.23	36.3
T ₃	9.4	20.07	33
T ₄	9.77	24.3	36.7
T ₅	9.93	25.43	39.3
T ₆	10.9	27.5	42.3
T ₇	10.5	26.87	42
T ₈	10.3	26.4	41.7
T ₉	10.13	26.07	40.3
T ₁₀	11.21	28.6	45
SEm±	0.14	1.07	1.39
CD (P=0.05)	0.43	3.19	NS
CV (%)	8.48	7.53	8.99

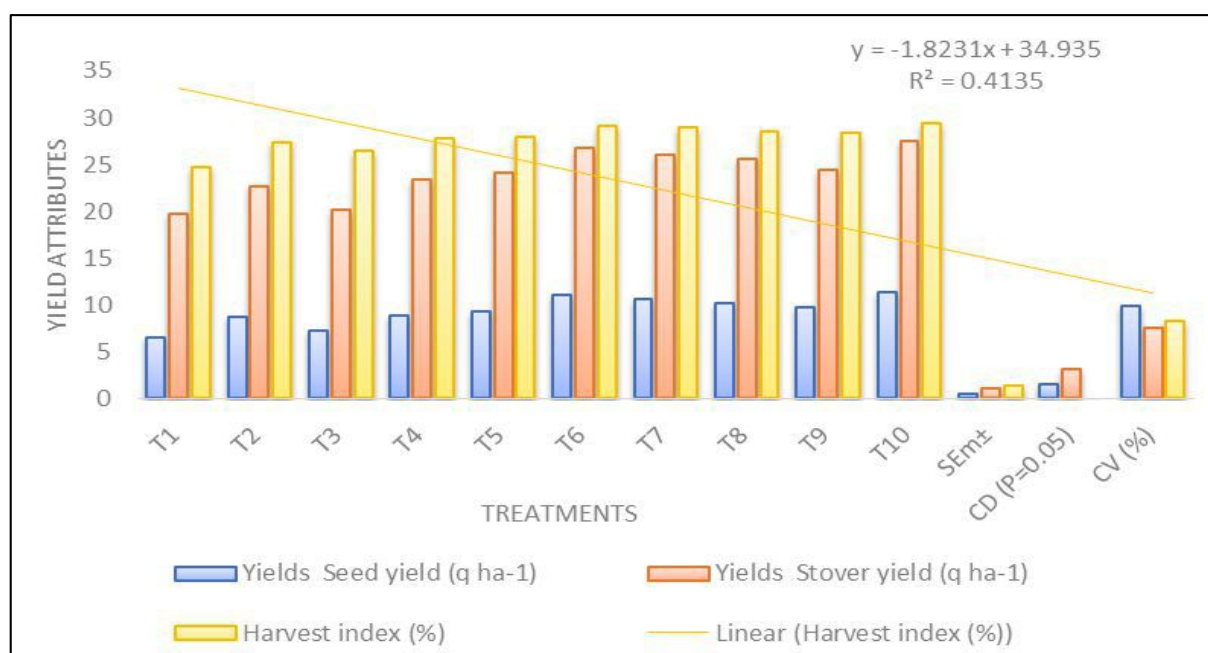
**Fig 2:** Bar diagram Effect of integrated nutrient management treatments on yield attributes of green gram

4.2.4 Seed yield ($q\ ha^{-1}$) - Data presented in (Table 3 and fig. 2) regarding yields of cowpea. that significantly highest seed yield ($1280.91\ kg\ ha^{-1}$) was observed under the application of 75% RDF + Vermicompost @ $1\ t\ ha^{-1}$ + PSB + Rhizobium (T₁₀) to rest of the treatments and which was found to be statistically at par with 50% RDF +1 t/ha Vermicompost + PSB + Rhizobium (T₆). Significantly lowest numbers of seed pods-1 ($1051.24\ kg\ ha^{-1}$) were found in treatment T₁ (Control). 4.2.5 Straw yield Perusal of data (Table 3 and fig. 2) revealed that significantly highest straw yield ($2471.96\ kg\ ha^{-1}$) was observed due to application of 75% RDF + Vermicompost @ $1\ t\ ha^{-1}$ + PSB + Rhizobium (T₁₀) to rest of the treatments and which was found to be statistically at par with 50% RDF +1 t/ha Vermicompost +

PSB + Rhizobium (T₆). Significantly lowest numbers of seed pods-1 ($2824.32\ kg\ ha^{-1}$) were found in treatment T₁ (Control). 4.2.6 Biological yield Data (Table 3 and fig. 2) showed that significantly highest biological yield ($3751\ kg\ ha^{-1}$) was found with the treatment of 75% RDF + Vermicompost @ $1\ t\ ha^{-1}$ + PSB + Rhizobium (T₁₀) to rest of the treatments and which was found to be statistically at par with 50% RDF +1 t/ha Vermicompost + PSB + Rhizobium (T₆). Significantly lowest biological yield ($1773.32\ kg\ ha^{-1}$) was recorded under treatment T₀ (Control). 4.2.7 Harvest index (%) Data presented in (Table 3 and Fig. 2) pertaining to harvest index did not show significant difference among different nutrient sources.

Table 3: Effect of integrated nutrient management treatments on yields and harvest index green gram.

Treatments	Yields			Harvest index (%)
	Seed yield (q ha ⁻¹)	Stover yield (q ha ⁻¹)	Biological yield (q ha ⁻¹)	
T ₁	6.48	19.72	26.2	24.77
T ₂	8.68	22.65	31.34	27.39
T ₃	7.23	20.15	27.38	26.48
T ₄	8.85	23.4	32.25	27.8
T ₅	9.32	24.11	33.43	27.87
T ₆	11.03	26.8	37.83	29.18
T ₇	10.57	25.99	36.56	28.95
T ₈	10.16	25.58	35.57	28.54
T ₉	9.73	24.4	34.31	28.36
T ₁₀	11.41	27.45	38.86	29.36
SEm±	0.54	1.04	1.3	1.32
CD (P=0.05)	1.6	3.1	3.86	NS
CV (%)	9.96	7.53	7.75	8.23

**Fig 3:** Effect of integrated nutrient management treatments on yields and harvest index of green gram

Discussion

Yield attributes, yields and economics

Results presented in table 3 and figure 3 showed that yield attributes viz., number of pods plant⁻¹, number of seeds pod⁻¹ and test weight improved by application of 75% RDF + Vermicompost @ 1 t ha⁻¹ + PSB + Rhizobium (T₁₀) as 53 compared to other treatments but statistically remained at par with 50% RDF + Vermicompost @ 1 t ha⁻¹ + PSB + Rhizobium (T₆). This could mainly be associated with the increased growth of the crop in terms of plant height, dry matter accumulation and higher number of branches recorded under these treatments due to greater availability of most of the macro and micro nutrients in appropriate amounts and balanced proportion that led to higher uptake of the nutrients. The increased growth provided greater site for photosynthesis and diversion of photosynthates towards sink. The beneficial effect on yield attributes might also be due to the increased supply of all the essential nutrients by inorganic fertilizer, vermicompost, biofertilizer and FYM that might have resulted in higher manufacture of food and its subsequent partitioning towards sink. The findings of present investigation are supported by Muindi *et al.* (2019) [2]. Significantly higher seed yield was obtained by the application of 75% RDF + Vermicompost @ 1 t ha⁻¹ + PSB

+ Rhizobium (T₁₀) as compared to other treatments except 50% RDF + Vermicompost @ 1 t ha⁻¹ + PSB + Rhizobium (T₆). (Table 3). The higher values of yield attributes like number of pods plant⁻¹, number of seeds pod⁻¹ and test weight coupled with the higher crop dry matter observed with these treatments might have been the most probable reason of higher seed and straw yield. The increase in seed yield of green gram with these treatments was also largely due to high harvest index that showed high partitioning of the plant assimilates towards the sink (Table 3). Since, application of 75% RDF + Vermicompost @ 1 t ha⁻¹ + PSB + Rhizobium (T₁₀) significantly increased the growth parameters viz., plant height, dry matter accumulation and number of branches plant⁻¹, the resultant effect of these parameters might have also produced higher straw yield. Since, biological yield is a sum of seed and straw yields, the improvement in these parameters as discussed above also enhanced the biological yield significantly due to these treatments. Significantly higher net returns achieved with the application of 10075% RDF + Vermicompost @ 1 t ha⁻¹ + PSB + Rhizobium (T₁₀) which are directly correlated with the considerably higher seed and straw yields corresponding to 54 these treatments. Slightly lower net returns and B:C ratio recorded under the treatment involving 75% RDF +

Vermicompost @ 1 t ha⁻¹ + PSB + Rhizobium (T₁₀) than the corresponding levels of FYM and biofertilizer could be explained with the fact that vermicompost is comparatively costlier than FYM. Similar results were also obtained by Patil *et al.* (2018) [3].

Summary and Conclusion

Based on the results of one year experimentation, it is concluded that the treatments 75% RDF + Vermicompost @ 1 t ha⁻¹ + PSB + Rhizobium (T₁₀) which at par with 50% RDF + Vermicompost @ 1 t ha⁻¹ + PSB + Rhizobium (T₆) were equally effective in increasing seed and straw yield of green gram. These treatments were also observed equally remunerative. These most effective treatments for integrated nutrient management in green gram under loamy sand in semi-arid region of Rajasthan, However, these results are only indicative and require further experimentation to arrive at more consistent and final conclusion.

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