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YIELD PARAMETERS, YIELD AND ECONOMICS OF GREENGRAM (*VIGNA RADIATA* L.) AS INFLUENCED BY APPLICATION OF FERTILIZERS AND FOLIAR SPRAY OF VERMIWASH

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ABSTRACT

A field experiment was carried out at College Farm, College of Agriculture, Rajendranagar, Hyderabad during *rabi* season of 2023-2024. The experiment was laid out in randomized block design with three replications. From the study results, it was found that an application of 100 % RDF + foliar spray of 3% vermiwash at pod formation stage resulted in significantly higher no. of pods plant^{-1} (26.1), grain yield (1262.5 kg ha^{-1}) and haulm yield (3146.3 kg ha^{-1}). This treatment also resulted in the highest gross returns (Rs.1,10,458 ha),Net returns (Rs. 65508 ha) and BC ratio (2.46), which was statistically on par with the application of 100 % RDF with foliar spray of vermiwash 3% at pre-flowering stage. Based on the findings, it was concluded that, application of 100% RDF with foliar spray of vermiwash 3 % at pod formation or 100 % RDF with foliar spray of vermiwash 3% at pre-flowering stage was found to be the most viable option for getting higher yield in greengram.

Key words : Vermiwash, Greengram, Foliar spray, Yield, Pod formation.

Introduction

Greengram (*Vigna radiata* L.), an ancient and extensively cultivated leguminous crop in India, is renowned for its short duration and ability to thrive in drought conditions. Its easy digestibility makes it preferred among consumers and it also serves as valuable fodder and green manure. Due to its short growth cycle, it fits well into various intensive crop rotations. Greengram seeds are nutritionally dense, comprising 23.8% protein, 1.22% fat, 5.2% fiber and 78.2% carbohydrates (Dahiya *et al.*, 2015). They also contain substantial amounts of minerals (ca, petc), vitamins and amino acids (lysine and tryphtophan).

India is the major producer of greengram in the world and grown in almost all the states. It is grown in about 55.50 lakh ha^{-1} with the total production of about 31.65 lakh tons of seed with a productivity of about 570 kg ha^{-1}, while in Telangana greengram production in 2021-22 is raised in an area 0.35 lakh tons from 0.51 lakh ha^{-1} with productivity of 704 Kg ha^{-1} (Indiastat, 2022).

In recent years, the use of chemical fertilizers in agriculture has been steadily rising, which has led to a concerning decline in soil quality and fertility. To address this issue and mitigate the excessive reliance on synthetic chemicals, there has been a growing emphasis on organic alternatives. One such innovative solution is vermiwash, a natural liquid fertilizer derived from the process of vermicomposting. Integration of organic and inorganic fertilizers can able to enhance the crop performance. Chemical fertilizers increase nutrient availability in the soil during the early stages of crop growth. When used together with recommended dose of fertilizers and organic sources as foliar spray of vermiwash, which enhance nutrient availability and provide plants with immediate

nutrition (Bezboruah and Dutta, 2021)

Vermiwash is a honey brown coloured liquid extract of organic composts, constituting the slime layer of earth worms and the extract of vermicompost in the liquid form. (Nayak *et al.*, 2019). Majorly it comprises of mucus, excretory by-products of worms and a diverse mix of macro and micro nutrients, along with beneficial microorganisms (Jandaik *et al.*, 2015) growth hormones, vitamins, enzymes (Tripathi and Bhardwaj, 2004) and amino acids, contribute significantly to the growth and development of plants vermiwash is highly beneficial for foliar spray on crops, effectively distributing nutrients to the leaves, shoots, and other plant components.

The foliar application of vermiwash notably enhances crop growth, productivity and quality (Kumar *et al.*, 2023). Vermiwash plays a crucial role in fostering plant growth and development, facilitating root initiation, growth, and overall plant development. It also increases soil organic matter and enriches nutrient content readily accessible to plants, thereby leading to higher yields. Vermiwash has excellent growth promoting effects besides serving as biopesticide. Thus, vermiwash presents a more cost-effective alternative to chemical fertilizers and easy to produce. This eco-friendly organic liquid fertilizer which can be employed as a foliar spray on a variety of crops (Jandaik *et al.*, 2015).

Therefore, the present study aimed to investigate the effect of vermiwash on the yield and economics of greengram production.

Materials and Methods

The experiment was conducted in rabi season of 2023-2024 on sandy loam soils at College farm, College of Agriculture, Rajendranagar, Professor Jayashankar Telangana State Agricultural University, Hyderabad, Telanagana, India. The experimental site was located at 17° 19' 18" N latitude and 78° 24' 31" E longitude, within the Southern Telangana Agro Climatic Zone of Telangana State. The soil at the site was low in available nitrogen (166.2 kg N ha^{-1}), medium in phosphorus (26.4 kg P_2O_5 ha^{-1}) and high in potassium (316.5 kg K_2O ha^{-1}), pH (7.28) and OC (0.35%). The variety used in the experiment is MGG 295. Throughout the crop growth period, there was 14.4 mm of rainfall and the mean weekly maximum and minimum temperatures were recorded as 33.1°C and 15.5°C, respectively. The experimental layout includes nine treatments, arranged in a randomized block design with three replications.

Vermiwash used in this experiment was obtained from College farm, College of Agriculture, Rajendranagar, Hyderabad. Urea and diammonium phosphate (DAP) were used to supply nitrogen (N) and phosphorus (P), respectively, through soil application. The entire recommended dose of fertilizers (RDF) was applied as a basal application.

The observations were taken from five plants, randomly selected and tagged from each net plot and yield-attributing parameters *viz.*, number of pods per plant, number of seeds per pod, 100 seed weight, seed and haulm yield, harvest index and economics were estimated.

Table 1 : Treatment details of experiment.

Treatment Details	
T_1	Control (no N, P, K)
T_2	100% RDF
T_3	100 % RDF + foliar spray of 3% vermiwash at pre flowering stage
T_4	100 % RDF + foliar spray of 3% vermiwash at pod formation stage
T_5	75% RDF + foliar spray of 3% vermiwash at pre flowering stage
T_6	75 % RDF + foliar spray of 3% vermiwash at pod formation stage
T_7	75% RDF + foliar spray of 3% vermiwash at pre flowering and pod formation stage
T_8	Foliar spray of 3% vermiwash at pre flowering and pod formation stage
T_9	Foliar spray of 3% vermiwash at vegetative, pre flowering and pod formation stage

Note: Recommended dose of fertilizer: 20:50:0 (N P K kg ha^{-1}) (RDF)

Statistical analysis

The data collected from different parameters was subjected to analysis using the method of analysis of variance (ANOVA), as outlined by Gomez and Gomez (1984). A significance level of 5% was employed in the "F" test and in cases where the effects were found to be significant, the critical difference was computed.

Results and Discussion

Yield parameters and yield

The yield and yield attributes recorded are presented in the Table 2. The results observed that yield parameters *viz.*, no. of pods $plant^{-1}$ at harvest significantly influenced by the different treatments. Among the treatments, the highest number of pods $plant^{-1}$ (26.1) was observed with the application of 100% RDF along with foliar spray of vermiwash at pod formation stage (T_4), which was

Table 2 : Yield parameters yeild of greengram as influenced by application of fertilizers and foliar spray of vermiwash.

Treatments		No. of pods plant^{-1}	No. of seeds Pod^{-1}	100 seed weight (g)	Seed yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Harvest index (%)
T_1	Control (no N, P, K)	15.4	10.3	3.20	761	1961	27.9
T_2	100% RDF	23.1	11.2	3.58	1131	2849	28.4
T_3	100 % RDF + foliar spray of 3% vermiwash at pre flowering stage	25.6	11.4	3.62	1247	3133	28.5
T_4	100 % RDF + foliar spray of 3% vermiwash at pod formation stage	26.1	11.5	3.73	1262	3146	28.7
T_5	75% RDF + foliar spray of 3% vermiwash at pre flowering stage	20.5	10.7	3.45	1001	2537	28.3
T_6	75 % RDF + foliar spray of 3% vermiwash at pod formation stage	20.5	10.8	3.55	1007	2553	28.3
T_7	75% RDF + foliar spray of 3% vermiwash at pre flowering and pod formation stage	20.7	11.0	3.57	1024	2583	28.4
T_8	Foliar spray of 3% vermiwash at pre flowering and pod formation stage	17.8	10.4	3.33	877	2250	28.1
T_9	Foliar spray of 3% vermiwash at vegetative, pre flowering and pod formation stage	18.1	10.6	3.38	890	2271	28.2
S Em (±)		0.8	0.45	0.14	34.9	88.0	0.6
CD (5%)		2.3	NS	NS	104.5	263.8	NS

statistically on par with T_3(25.6)**,** the next best treatment T_2 *i.e.*, 100% basal application of RDF (23.1). It was observed that T_5, T_6, T_7 all are statistically similar, followed by T_8, T_9 and the lowest was recorded with the control T_1 (15.4). The fertilizer application and foliar spray of vermiwash treatments did not have a significant effect on No. of seeds pod^{-1} and 100 seed weight (g) of greengram.

The increased number of pods per plant observed with foliar application of vermiwash can be attributed to improved nutrient availability. The nitrogen in vermiwash, which comes from mucus, enzymes, nitrogenous excretory materials from worms, and plant growth hormones, likely, enhanced the transfer of photosynthates to the developing pods, thereby improving the quality of grain filling. The findings reported by Rao *et al*. (2018), Machhar *et al*. (2021), Yalagar *et al*. (2021) and Negi *et al*. (2023) are in close conformity with the present study.

Higher seed yield (1262 kg ha^{-1}) and haulm yield (3146kg ha^{-1}) was found under the treatment T_4 (application of 100% RDF along with foliar spray of vermiwash at pod formation stage) which was statistically on par with the (T_3) 100% RDF with vermiwash applied at 3% concentration during pre-flowering stage seed yield (1247kg ha^{-1}) and haulm yield (3133 kg ha^{-1}). Next best treatment 100 % RDF. It was observed that T_5, T_6, T_7 all are on par, which was followed by T_9, T_8 and lowest was recorded with the control T_1 seed yield (761kg ha^{-1}) and haulm yield (1961kg ha^{-1}). The fertilizer application and foliar spray of vermiwash treatments did not have a significant effect on harvest index (%) significantly higher grain yield was observed in T_4 which might be due to its direct association of grain yield with growth and yield characteristics, which can be attributed to the additional nutrients provided by the foliar application of vermiwash and the prescribed doses of fertilizers. This enhanced nutrient availability enabled the crop to assimilate and utilize resources more effectively, resulting in increased photosynthate production and improved partitioning of dry matter from source to sink. These findings are closely associated with the Saranraj and Thiruppathi (2015), Rao *et al*. (2018), Yasmin *et al*. (2021) and Joshi *et al*. (2023).

The improvement in haulm yield can be attributed to the application of vermiwash and RDF, which might enhanced the chlorophyll concentration and supported necessary growth and development. This enhancement

Table 3 : Cost of cultivation, gross returns, net returns, BC ratio of greengram as influenced by application of fertilizers and foliar spray of vermiwash.

	Treatments	COC	Gross returns	Net returns	B:C ratio
T_1	Control (no N, P, K)	41550	66725	25175	1.61
T_2	100% RDF	44500	99002	54502	2.22
T_3	100 % RDF + foliar spray of 3% vermiwash at pre flowering stage	44950	109176	64226	2.43
T_4	100 % RDF + foliar spray of 3% vermiwash at pod formation stage	44950	110458	65508	2.46
T_5	75% RDF + foliar spray of 3% vermiwash at pre flowering stage	44250	87628	43378	1.98
T_6	75 % RDF + foliar spray of 3% vermiwash at pod formation stage	44250	88165	43915	1.99
T_7	75% RDF + foliar spray of 3% vermiwash at pre flowering and pod formation stage	44700	89685	44985	2.01
T_8	Foliar spray of 3% vermiwash at pre flowering and pod formation stage	42450	76854	34404	1.81
T_9	Foliar spray of 3% vermiwash at vegetative, preflowering and pod formation stage	42900	77953	35053	1.82

in chlorophyll levels boosted photosynthetic activity, leading to greater dry matter production and, subsequently, an increase in haulm yield. The result was also affirmed by the findings of Bezboruah and Dutta (2021), Machhar *et al*. (2021), Joshi *et al*. (2023) and Kotadiya *et al*. (2023).

Economics

The use of fertilizers and foliar spray of vermiwash had a significant impact on the economics of greengram production. The highest cost of cultivation (COC) was observed for treatments T_4 and T_3, followed by T_2 (100% RDF). However, despite of increased costs in T_4 and T_3, which were justified by the significant yield improvements, as reflected in the higher economic indicators such as gross returns (Rs. 1,10,458 ha and Rs. 1,09,176 ha), net returns (Rs. 65508 ha and Rs. 64226 ha) and the B:C ratio (2.46 and 2.43), respectively. Similar results are in line with the findings of Latha *et al.* (2014), Verma *et al*. (2018) and Selvarani *et al*. (2021).

Conclusion

The results of the study showed that the application of foliar spray of vermiwash @ 3% at pod formation or pre-flowering stage along with the integration of chemical fertilizers at recommended dose can enhance the yield attribute, yield and economics of Telangana. Hence, vermiwash proved to be the most effective liquid organic fertilizer and economically beneficial technology for boosting grain yield in greengram production.

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Competing interests

Authors have declared that no competing interests exist.

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