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Role of vermiwash foliar spray combined with fertilizer levels on insect pest incidence in greengram

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Abstract
To evaluate the effect of fertilizers and foliar spray of vermiwash on pest population in greengram, a field experiment was conducted at the College Farm, College of Agriculture, Rajendranagar, Hyderabad during the *rabi* season of 2023-2024. The experiment was laid out in a randomized block design with three replications. The results revealed that the treatments did not show a statistically significant effect; however, numerically lower populations of nymphs and adults of whitefly (*Bemisia tabaci*) and bean pod borer (*Maruca vitrata*) were observed with the application of Foliar spray of 3% vermiwash at vegetative, preflowering stage and pod formation stage, higher pest population was observed in the application of 100% RDF.

Keywords: Vermiwash, greengram, pest population, whitefly

Introduction
Greengram (*Vigna radiata* L.) is an important short-duration leguminous crop widely cultivated in India due to its drought tolerance, easy digestibility, and suitability for intensive cropping systems. It is used for human consumption, fodder, and green manure. Greengram seeds are highly nutritious, containing about 23.8% protein, 1.22% fat, 5.2% fiber, and 78.2% carbohydrates, along with essential minerals, vitamins, and amino acids such as lysine and tryptophan (Dahiya *et al*., 2015) [1]. India is the leading producer of greengram, cultivating it over an area of 55.50 lakh ha with a production of 31.65 lakh tonnes and an average productivity of 570 kg ha^{-1}. In Telangana, during 2021-22, the crop occupied 0.51 lakh ha with a production of 0.35 lakh tonnes and productivity of 704 kg ha^{-1} (Indiastat, 2022) [2].

Excessive use of chemical fertilizers has led to deterioration of soil health and fertility, necessitating the adoption of sustainable nutrient management practices. Integrated use of organic and inorganic fertilizers has gained attention as a viable approach to enhance crop productivity while maintaining soil quality. Vermiwash, a liquid organic extract obtained from vermicomposting, is a rich source of macro- and micronutrients, beneficial microorganisms, plant growth regulators, enzymes, vitamins, and amino acids (Tripathi and Bhardwaj, 2004; Jandaik *et al*., 2015; Nayak *et al*., 2019) [5, 3, 4].

Application of vermiwash as a foliar spray, particularly in combination with recommended doses of fertilizers (RDF), improves nutrient availability, promotes plant growth, and enhances yield and quality of crops (Bezboruah and Dutta, 2021; Kumar *et al*., 2022) [6, 7]. In addition, vermiwash acts as a biopesticide and offers an eco-friendly, cost-effective alternative to chemical inputs.

In addition to improving plant nutrition, integrated nutrient management practices influence pest incidence and crop health. Balanced fertilization enhances plant vigor and tolerance to insect pests, whereas excessive or imbalanced use of chemical fertilizers may increase pest populations by creating favorable conditions for their multiplication. Organic inputs such as vermiwash have been reported to induce systemic resistance in plants and reduce the incidence of sucking and pod-boring pests due to the presence of bioactive compounds and beneficial microorganisms. Foliar application of vermiwash not only improves crop growth but also contributes to sustainable pest management, reducing dependence on chemical pesticides and promoting environmentally safe crop production.

Therefore, the present study was undertaken to evaluate the effect of vermiwash application along with recommended doses of fertilizers on the population of major insect pests of greengram, particularly whitefly (*Bemisia tabaci*) and bean pod borer (*Maruca vitrata*).

Materials and Methods

The field experiment was conducted during the rabi season of 2023-2024 on sandy loam soils at the College Farm, College of Agriculture, Professor Jayashankar Telangana State Agricultural University (PJTSAU), Rajendranagar, Hyderabad, Telangana, India. The experimental site is located at 17°19′18″ N latitude and 78°24′31″ E longitude and falls under the Southern Telangana Agro-Climatic Zone of Telangana State. The soil of the experimental field was low in available nitrogen (166.2 kg N ha^{-1}), medium in available phosphorus (26.4 kg P_2O_5 ha^{-1}), and high in available potassium (316.5 kg K_2O ha^{-1}), with a pH of 7.28 and organic carbon content of 0.35%.

Greengram variety MGG 295 was sown at a spacing of 30 cm × 10 cm. The recommended dose of fertilizers (RDF) comprising 20 kg N and 50 kg P_2O_5 ha^{-1} was applied as a basal dose using urea and diammonium phosphate (DAP) as sources of nitrogen and phosphorus, respectively. During the crop growth period, a total rainfall of 14.4 mm was received, with mean weekly maximum and minimum temperatures of 33.1°C and 15.5°C, respectively.

The experiment consisted of nine treatments laid out in a randomized block design with three replications. The treatments included: 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 stages), T_8 (foliar spray of 3% vermiwash at pre-flowering and pod formation stages), and T_9 (foliar spray of 3% vermiwash at vegetative, pre-flowering, and pod formation stages).

The vermiwash used in the experiment was obtained from the College Farm, College of Agriculture, Rajendranagar, Hyderabad. Foliar sprays were applied as per the treatment schedule using a knapsack sprayer, while RDF was applied uniformly as a basal soil application.

The population of major insect pests of greengram, namely whitefly (*Bemisia tabaci*) and bean pod borer (*Maruca vitrata*), was recorded at different vermiwash sprays. For whitefly, observations were taken by randomly selecting five plants from each plot. Adult whiteflies were counted early in the morning by observing three leaves per plant (one each from the top, middle, and bottom canopy), and the mean population per plant was calculated.

The incidence of bean pod borer was assessed by counting the number of larvae present on five randomly selected plants per plot at flowering and pod formation stages. All observations were recorded at regular intervals, and the mean values were used for statistical analysis.

Statistical Analysis

Insect count data do not always conform to normal distribution, the observed pest population data were subjected to square root transformation $\sqrt{(X+0.5)}$ prior to analysis to stabilize the variance. The transformed values were used for statistical analysis, while the original values are presented in parentheses in the tables for clarity and interpretation.

Results and Discussion

Effect of Vermiwash and Fertilizer Treatments on Whitefly and Bean Pod Borer Population

The whitefly (*Bemisia tabaci*) population recorded across the three foliar sprays showed consistent numerical trends (Table 1& 2). Pre-spray observations for all sprays indicated no significant differences among treatments, confirming uniform initial infestations across plots.

After each spray, treatments involving foliar application of vermiwash in combination with recommended doses of fertilizers, particularly T_7 (75% RDF + foliar spray at pre-flowering and pod formation stages) and T_9 (foliar spray at vegetative, pre-flowering, and pod formation stages), recorded numerically lower whitefly populations compared to the control (T_1). For example, after the third spray, post-treatment whitefly population was 1.85 in T_9, compared to 1.95 in the control. Treatments with multiple-stage vermiwash sprays consistently maintained lower populations, while plots receiving RDF alone (T_2) recorded slightly higher populations than the vermiwash treatments but lower than the control. Despite these trends, differences were statistically non-significant.

Similarly, the population of bean pod borer (*Maruca vitrata*) larvae was numerically lower in vermiwash-treated plots than in the control during all sprays. The third spray showed the lowest larval populations in T_9 (1.34), followed by T_8 (1.36) and T_7 (1.37), whereas the control recorded 1.51 larvae per plant. Pre-spray counts were uniform across treatments, and reductions after spraying indicate the potential suppressive effect of vermiwash applications.

The observed numerical reduction in pest populations with vermiwash treatments can be attributed to its bioactive compounds, plant growth hormones, and beneficial microorganisms that may deter feeding, reduce oviposition, or enhance plant resistance (Jandaik *et al*., 2015; Nayak *et al*., 2019) [3, 4]. Foliar application ensures direct contact with pest populations, while integration with RDF improves plant vigor and tolerance to pest attack.

Although statistical significance was not observed, the trends indicate that foliar application of vermiwash, especially when applied at multiple crop stages (vegetative, pre-flowering, and pod formation), can contribute to eco-friendly pest management in greengram. These findings align with previous reports highlighting vermiwash as a biopesticide and plant growth enhancer, providing a sustainable alternative to chemical pesticides (Bezboruah and Dutta, 2021; Shiromiya and Niranjana 2023; Haralu *et al*. 2018; Kumaran (2016) [6, 8, 9, 10].

Table 1: Pest count (whitefly nymphs and adults $plant^{-1}$) of greengram as influenced by application of fertilizers and foliar spray of vermiwash

Treatments	Whitefly nymph and adult $plant^{-1}$			
	1st spray		2nd spray	
	Before	After	Before	After
T_1	(2.31)1.68	(2.31)1.74	(2.98)1.86	(3.01)1.87
T_2	(2.58)1.75	(2.58)1.81	(3.25)1.93	(3.33)1.95
T_3	(2.91)1.85	(2.92)1.90	(3.25)1.94	(2.85)1.83
T_4	(2.31)1.67	(2.31)1.73	(2.98)1.86	(3.07)1.89
T_5	(2.75)1.80	(2.74)1.85	(3.08)1.89	(2.78)1.81
T_6	(2.31)1.68	(2.31)1.74	(2.98)1.86	(3.05)1.88
T_7	(2.26)1.66	(2.26)1.72	(2.96)1.86	(2.68)1.78
T_8	(2.58)1.75	(2.58)1.80	(3.18)1.92	(2.83)1.82
T_9	(2.33)1.68	(1.89)1.61	(2.93)1.85	(2.62)1.77
	0.05	0.05	0.06	0.05
	NS	NS	NS	NS

*Values in the parenthesis are original and ($\sqrt{X+0.5}$) transformed

Table 2: Pest count (whitefly nymphs, adults plant^{-1} and bean pod borer plant^{-1}) of greengram as influenced by application of fertilizers and foliar spray of vermiwash

Treatments	Whitefly nymph and adult plant^{-1}		Bean pod borer larvae plant^{-1}	
	3rd spray		3rd spray	
	Before	After	Before	After
T_1	(3.22)1.93	(3.31)1.95	(1.59)1.44	(1.78)1.51
T_2	(3.44)1.98	(3.53)2.00	(1.65)1.46	(1.83)1.53
T_3	(3.40)1.97	(3.51)2.00	(1.47)1.40	(1.57)1.44
T_4	(3.14)1.90	(2.98)1.86	(1.54)1.43	(1.44)1.39
T_5	(3.32)1.95	(3.38)1.96	(1.41)1.38	(1.47)1.40
T_6	(3.19)1.92	(3.07)1.89	(1.54)1.43	(1.46)1.40
T_7	(3.22)1.93	(3.10)1.90	(1.40)1.38	(1.37)1.37
T_8	(3.08)1.89	(2.97)1.86	(1.40)1.37	(1.34)1.36
T_9	(3.05)1.88	(2.93)1.85	(1.39)1.37	(1.30)1.34
	0.22	0.22	0.13	0.13
	NS	NS	NS	NS

Values in the parenthesis are original and ($\sqrt{X+0.5}$) transformed

Conclusion

Based on the above results, it can be concluded that the foliar application of 3% vermiwash at vegetative, pre-flowering, and pod formation stages, particularly in combination with 100% RDF, resulted in numerically lower populations of whitefly (*Bemisia tabaci*) and bean pod borer (*Maruca vitrata*). Treatments with vermiwash consistently suppressed pest incidence compared to RDF alone or the control, while the control recorded the highest pest populations.

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