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Influence of organic foliar nutrition on the growth and yield of rice-fallow blackgram (*Vigna mungo* L.)

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Abstract

A field experiment was conducted at Annamalai University during January to March, 2024 to assess the growth and yield response of rice-fallow black gram (*Vigna mungo* L.) to organic foliar nutrition. A Randomized Block Design was adopted to evaluate ten treatments comprising organic and inorganic foliar sprays. Among them, the foliar application of Vermiwash 2% on 30 DAS + Panchagavya 3% on 45 DAS (T₇) significantly improved growth and yield, recording the highest plant height (49.47 cm), leaf area index (2.43), dry matter production (2206 kg ha⁻¹) and CGR (5.10 g m⁻² day⁻¹) at harvest stage. This treatment also achieved the highest grain yield (579 kg ha⁻¹) and haulm yield (1773 kg ha⁻¹). The lowest performance in all aspects was recorded with control (T₁₀). The study highlights that organic foliar application, particularly the combined use of Vermiwash and Panchagavya, significantly enhances the growth parameters, grain yield, haulm yield and nutrient uptake of rice-fallow black gram, promoting a sustainable and eco-friendly approach to pulse cultivation.

Keywords: Black gram, growth, organic foliar, panchagavya, vermiwash, yield

1. Introduction

Pulses are an essential component of Indian agriculture, valued for their high nutritional content and role in sustainable farming systems. They serve as a primary protein source for the vegetarian population and are often referred to as the “Poor man's meat” due to their affordability. Among pulses, black gram (*Vigna mungo* L.) occupies a prominent position in India. Black gram is very nutritious as it contains 48.0 per cent carbohydrates, 22.3 per cent protein, 154 mg calcium, 9.1 mg iron, 1.4 g fat, 0.37 g riboflavin and 0.42 mg thiamine per 100 grams (Dhayal *et al.*, 2022) ^[1]. India is the largest producer and consumer of black gram in the world. In India, black gram occupies an area of 44.93 lakh ha with a production and productivity of 29.26 lakh tonnes and 651 kg ha⁻¹, respectively (Sunil *et al.*, 2023) ^[2]. In Tamil Nadu, black gram is one of the valuable pulse crop cultivated in an area of 4.07 lakh hectares with production of 2.69 lakh tonnes and productivity about 660 kg ha⁻¹ (Marimuthu *et al.*, 2024) ^[3]. Black gram is widely cultivated in tropical and subtropical regions and is particularly suited for cultivation under dryland and residual moisture conditions, making it ideal for rice-fallow systems. In Tamil Nadu, black gram is predominantly grown in rice-fallow fields, where it utilizes the residual soil moisture following paddy harvest. However, in such conditions, the impermeability of soil and lack of proper nutrient supply often limit crop growth and yield. Foliar application of nutrients is considered an effective approach to overcome these constraints. Unlike soil fertilization, foliar feeding enables nutrients to be directly absorbed through the stomata and cuticle of leaves, ensuring rapid and efficient utilization during critical crop stages. This technique becomes especially valuable in rice-fallow systems where conventional nutrient delivery methods are ineffective. Organic foliar sprays like Panchagavya, Vermiwash, Fish Amino Acid, and Seaweed Extract supply growth-promoting substances, micronutrients, and beneficial microbes that enhance germination, growth, photosynthesis, and yield, while also improving stress tolerance and reducing dependence on chemicals. Hence, the present study was undertaken to assess the growth and yield response of rice fallow black gram to organic foliar nutrition.

2. Materials and Methods

A field experiment was conducted at Experimental Farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalai Nagar during January to March, 2024 to study the “Influence of Organic Foliar Nutrition on the Growth and Yield Of Rice- Fallow Black gram”. The experimental field was located at 11° 24’ N latitude, 79°44’ E longitude and at an altitude of +5.79 m above mean sea level. The soil of the experimental field was clay loam in texture, moderately drained with pH of 7.7. The soil was low in nitrogen, medium in available phosphorus and high in available potassium. After the paddy harvest, the black gram variety ADT-3 was broadcasted across the field under suitable soil conditions. Each treatment plot size is 5.1 m × 4 m. The experimental field was laid out in Randomized Block Design with three replications and 11 treatments. The treatments consisted of: T₁ - DAP 2% on 30 and 45 DAS, T₂ - Panchagavya 3% on 30 DAS, T₃ - Vermiwash 2% on 30 DAS, T₄ - Fish Amino acid 0.5% on 30 DAS, T₅ - Seaweed Extract 2% on 30 DAS, T₆ - Panchagavya 3% on 30 and 45 DAS, T₇ - Vermiwash 2% on 30 DAS + Panchagavya 3% on 45 DAS, T₈ - Fish Amino acid 0.5% on 30 DAS + Panchagavya 3% on 45 DAS, T₉ - Seaweed Extract 2% on 30 DAS + Panchagavya 3% on 45 DAS and T₁₀ - Control. Observations on growth attributes viz., plant height, leaf area index, dry matter production, number of branches plant⁻¹, crop growth rate and yield were recorded at harvest stage.

3. Results and Discussion

3.1 Effect of organic foliar nutrition on growth parameters of black gram

Foliar nutrition significantly enhanced the growth performance of rice-fallow black gram (Table 1). Among the treatments, the foliar application of Vermiwash 2% on 30 DAS + Panchagavya 3% on 45 DAS (T₇) recorded superior values across all parameters. At harvest stage, the foliar application of Vermiwash 2% on 30 DAS + Panchagavya 3% on 45 DAS achieved the maximum plant height (49.47 cm), leaf area index (2.43), dry matter production (2206 kg ha⁻¹), number of branches plant⁻¹ (9.11) and crop growth rate (5.10 g m⁻² day⁻¹). This

improvement is attributed to the synergistic effect of Vermiwash and Panchagavya, both rich in beneficial microbes, growth hormones and micronutrients appears to have enhanced nutrient absorption and photosynthetic efficiency. The high LAI observed under the foliar application of Vermiwash 2% on 30 DAS + Panchagavya 3% on 45 DAS indicates better canopy development, which supports greater sunlight utilization and carbon assimilation. These findings align with Yogendra *et al.* (2024) ^[4], who reported that combined foliar application of organic inputs enhanced nutrient uptake and vegetative growth in black gram. The control (T₁₀) consistently recorded the lowest growth metrics, emphasizing the crucial role of timely foliar nutrition under rice-fallow conditions.

3.2 Effect of organic foliar nutrition on yield of black gram

The grain and haulm yield of rice-fallow black gram were significantly influenced by the foliar application of organic inputs (Table 1). Among all treatments, the foliar application of Vermiwash 2% on 30 DAS + Panchagavya 3% on 45 DAS (T₇) recorded the highest grain yield (579 kg ha⁻¹) and haulm yield (1773 kg ha⁻¹). The substantial yield advantage with this treatment can be attributed to enhanced nutrient uptake, increased leaf area index and improved crop growth rate observed during the vegetative phase. The combined application of Vermiwash and Panchagavya effectively supplied essential macro and micronutrients and bioactive compounds, which promoted better pod formation and seed development. The improved dry matter partitioning toward reproductive organs led to increased grain yield. These findings align with the observations of Prasath (2020) ^[5] who reported improved grain and biomass yield in black gram due to enhanced nutrient assimilation under organic foliar sprays. Kuttibai *et al.* (2022) ^[6] also highlighted the role of foliar-applied bio-stimulants in improving yield potential in pulses, especially with the combined application of vermiwash and panchagavya. In contrast, the control (T₁₀) registered the lowest grain (315 kg ha⁻¹) and haulm yields (978 kg ha⁻¹), highlighting the importance of foliar nutrition in low-input systems like rice-fallow cultivation.

Table 1: Growth & yield response of rice fallow black gram to organic foliar nutrition at harvest stage.

Treatments	Plant height (cm)	Leaf area index	Dry matter production (kg ha ⁻¹)	Number of branches plant ⁻¹	CGR (g m ⁻² day ⁻¹)	Grain yield ⁻¹	Haulm yield ⁻¹
T ₁ - DAP 2% on 30 and 45 DAS	46.14	2.17	1951	8.19	4.74	503	1638
T ₂ - Panchagavya 3% on 30 DAS	39.94	1.49	1492	6.52	2.08	406	1345
T ₃ - Vermiwash 2% on 30 DAS	40.11	1.51	1585	6.76	2.10	423	1380
T ₄ - Fish amino Acid 0.5% on 30 DAS	36.85	1.28	1719	7.40	4.47	344	1209
T ₅ - Sea weed extract 2% on 30 DAS	37.07	1.33	1830	7.54	4.52	357	1242
T ₆ - Panchagavya 3% on 30 and 45 DAS	49.01	2.36	2091	8.78	4.99	568	1745
T ₇ - Vermiwash 2% on 30 DAS + Panchagavya 3% on 45 DAS	49.47	2.43	2206	9.11	5.10	579	1773
T ₈ - Fish amino Acid 0.5% on 30 DAS + Panchagavya 3% on 45 DAS	43.09	1.76	1149	5.73	1.73	460	1512
T ₉ - Sea weed extract 2% on 30 DAS + Panchagavya 3% on 45 DAS	43.21	1.89	1266	5.95	1.83	469	1534
T ₁₀ - Control	28.15	1.03	895	4.82	1.06	251	924
S. Ed	1.33	0.07	57	0.24	0.11	15	48
CD (p=0.05)	2.80	0.14	120	0.51	0.23	32	101

4. Conclusion

The study clearly demonstrated that foliar nutrition significantly enhances the performance of rice-fallow black gram grown under residual soil moisture conditions. Among the evaluated treatments, the application of Vermiwash 2% on 30 DAS and Panchagavya 3% on 45 DAS (T₇) recorded superior growth,

maximum grain and haulm yield, along with enhanced physiological efficiency as indicated by the highest crop growth rate. Therefore, organic foliar nutrition, especially the combined use of Vermiwash and Panchagavya, offers a viable strategy to enhance productivity and profitability of black gram under rice - fallow conditions, while sustaining soil health and lowering

reliance on chemical fertilizers.

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