



International Journal of Research in Agronomy

E-ISSN: 2618-0618
P-ISSN: 2618-060X
© Agronomy
NAAS Rating (2026): 5.20
www.agronomyjournals.com
2026; 9(4): 148-151
Received: 02-01-2026
Accepted: 09-02-2026

K Susanna Grace
Department of Agronomy,
Acharya N. G. Ranga Agricultural
University, Agricultural College,
Bapatla, Andhra Pradesh, India

NVenkata Lakshmi
Department of Agronomy,
Acharya N. G. Ranga Agricultural
University, Agricultural College,
Bapatla, Andhra Pradesh, India

S Jafar Basha
Department of Agronomy,
Acharya N. G. Ranga Agricultural
University, Agricultural College,
Bapatla, Andhra Pradesh, India

V Sailaja
Department of Agronomy,
Acharya N. G. Ranga Agricultural
University, Agricultural College,
Bapatla, Andhra Pradesh, India

Corresponding Author:
K Susanna Grace
Department of Agronomy,
Acharya N. G. Ranga Agricultural
University, Agricultural College,
Bapatla, Andhra Pradesh, India

Nutrient content and uptake of newly released blackgram varieties at different nutrient levels and liquid biofertilizers

K Susanna Grace, N Venkata Lakshmi, S Jafar Basha and V Sailaja

DOI: <https://www.doi.org/10.33545/2618060X.2026.v9.i4c.5343>

Abstract

A field experiment was carried out on clay loam soils during *rabi*, 2024-2025 at Regional Agricultural Research Station, Lam, Guntur to study the response of newly released blackgram varieties to liquid biofertilizers at graded nutrient levels. The experiment was laid out in randomised block design with factorial concept with 3 varieties viz., LBG-884, LBG-904 and LBG-752(check variety) as factor - I and nutrient levels – Absolute control, *Rhizobium* seed treatment + soil application of PSB & KRB alone, 100% RDF, 75% RDF + *Rhizobium* seed treatment + PSB+ KRB and 50% RDF + *Rhizobium* seed treatment + PSB+ KRB as factor - II, in three replications. The results of the investigation revealed that among the varieties, LBG-904 (M₂) recorded the highest Nitrogen, Phosphorous and Potassium content in both seed and haulm. Application of 100% RDF registered higher nutrient content in both seed and haulm. Highest nutrient uptake among the varieties tested was noticed with LBG-904 (M₂). Among the nutrient levels tested Application of 100% RDF resulted in higher nutrient uptake in both seed and haulm.

Keywords: Blackgram, liquid biofertilizers, PSB, KRB, *rhizobium*, nutrient levels, varieties, nutrient uptake and nutrient content

Introduction

Legumes are an essential source of plant based protein and play a vital role in improving and sustaining soil health. They provide protein levels that are nearly three times higher than those found in cereal grains. Across many regions of the world, people depend on legumes as a staple food, frequently combining them with cereals to meet their daily protein requirements. In addition, legumes and the by-products left after harvest offer valuable and nutrient rich fodder for livestock.

Blackgram (*Vigna mungo* L.) is regarded as one of the most important pulse crop among grain legumes. Commonly known as urdbean, it is widely cultivated and valued for its nutritional and agronomic benefits. The dried mature seeds contain approximately 24–26% protein and around 60% carbohydrates, along with several essential amino acids. It is consumed either as whole grains or split seeds (dal) and its flour is used in both fermented and unfermented food preparations (Khan *et al.*, 2021) ^[7]. Beyond its role as a food crop, blackgram is also an excellent forage plant, producing dense vegetative growth that provides effective ground cover and reduces soil erosion. It is suitable for silage making and can be incorporated into the soil as green manure. Furthermore, the crop enhances soil fertility through atmospheric nitrogen fixation and demonstrates good tolerance to adverse environmental conditions.

Biofertilizers consist of beneficial microorganisms such as bacteria, algae and fungi that improve soil fertility by transforming nutrients into forms readily available for plants. Applied to seeds, roots, or soil they provide an environmentally friendly and economical alternative to chemical fertilizers. In pulse crops, biofertilizers support nitrogen fixation, phosphorus solubilization, and efficient nutrient uptake. Their use enhances crop productivity, maintains soil health, and reduces dependence on synthetic inputs (Gupta *et al.*, 2021) ^[5]. In blackgram, seed treatment with biofertilizers improves NPK uptake, increases seed protein content, and boosts yield (Murtaza *et al.*, 2014) ^[9]. Consequently, biofertilizers have become an important component of modern nutrient management practices (Palaniraja, 2018) ^[11].

Rhizobium is a beneficial soil bacterium that plays an important role in biological nitrogen fixation through its symbiotic association with legume crops. Commonly present in tropical soils, it converts atmospheric nitrogen into forms usable by plants. Inoculating legumes with *Rhizobium* is a widely adopted and economical practice to enhance pulse yields, offering an efficient alternative to synthetic nitrogen fertilizers (Allito *et al.*, 2015) ^[1]. Adequate phosphorus improves seedling establishment, accelerates maturity, and enhances yield and grain quality (Sharma and Pathania, 2019) ^[12]. Phosphate-solubilizing microorganisms convert unavailable forms of phosphorus into plant-accessible forms, and seed inoculation with *Rhizobium* and PSB can increase pulse yields by 10–12% (Keifer and Effenberger, 2018) ^[6]. For blackgram, optimum phosphorus application combined with effective biofertilizer strains is essential for maximum productivity and profitability. Potassium, known as the “quality nutrient,” is crucial for crop growth, yield improvement, and protein synthesis in pulses (Srinivasa Rao *et al.*, 2003). Although soils contain large potassium reserves, much of it remains fixed in mineral forms and is released slowly, limiting plant availability (Oborn *et al.*, 2005) ^[10]. Potassium-releasing bacteria (KRB) help solubilize bound potassium, enhancing its availability and supporting sustainable crop production. However, blackgram varieties differ in their response to fertilizers and biofertilizers due to variations in root architecture, nodulation efficiency, nutrient use efficiency, crop duration, and source sink relationships (Venkatesh and Basu, 2014) ^[14].

Hence, research efforts are required to find out the ideal combination of liquid biofertilizers at graded nutrient levels to satisfy the overall nutrient requirement of newly released blackgram varieties.

Materials and Methods

A field experiment was conducted at Regional Agricultural Research Station, Lam, Guntur during *rabi*, 2024-25. The soil of the experimental field was clay in texture, slightly alkaline in reaction with pH 7.7, electrical conductivity 0.43 dS m⁻¹, non-saline, low in organic carbon (0.45), low in available nitrogen (258.0 kg ha⁻¹), medium in available phosphorus (49.0 kg ha⁻¹) and high in available potassium (695 kg ha⁻¹). Average mean maximum temperature was 33.1^o C and minimum temperature was 20.9^o C during the crop growth period. A total amount of rainfall received was 24 mm in three rainy days. The experiment was laid out in a Factorial Randomized Block Design (FRBD) with 3 varieties *i.e.*, M₁: LBG-884, M₂: LBG904, M₃: LBG-752(check variety) as factor - I and nutrient levels (5) *i.e.*, S₁: Absolute control, S₂: Rhizobium seed treatment + soil application of PSB and KRB alone, S₃: 100% RDF (20500 kg NPK ha⁻¹) S₄: 75% RDF + Rhizobium seed treatment + PSB+ KRB and S₅: 50% RDF + Rhizobium seed treatment + PSB+ KRB as factor - II and replicated thrice. Nitrogen and phosphorus was applied in the form of urea and single super phosphate (SSP) respectively. Sowing was done with a spacing of 30 cm x 10 cm on 3rd December, 2024. Need based irrigation was applied at weekly intervals to the entire plots. The recommended plant protection measures were followed whenever necessary. The data was analyzed statistically following the standard procedures as described by Gomez and Gomez (1984) ^[3].

Results and Discussion

Nutrient Content

Nutrient content of different varieties were significantly affected

by different nutrient levels (Table. 1). Among the varieties tested, M₂ (LBG 904) recorded the highest nitrogen content in both seed (3.20%) and haulm (1.42%), followed by M₁ (LBG 884) (2.97 and 1.27%, respectively) in both seed and haulm. The least was noted by M₃ (LBG 752) in both seed and haulm (2.89 and 1.23%, respectively). Nitrogen content in both seed and haulm increased significantly with higher fertilizer doses. Application of S₃-100% RDF recorded the highest nitrogen content (3.57 in seed and 1.43% in haulm), and the least was observed under S₁ - Control (2.70 and 1.20%) in seed and haulm, respectively. Among the varieties tested, M₂ (LBG 904) recorded the highest phosphorus content in both seed (0.50%) and haulm (0.40%), which was on par with M₁ (LBG 884) (0.48 and 0.38%, respectively) in both seed and haulm followed by M₃ (LBG 752) in both seed and haulm (0.47 and 0.37%, respectively). Among the nutrient levels tested phosphorus content in both seed and haulm increased significantly with application of S₃ - 100% RDF recorded the highest phosphorus content (0.54 in seed and 0.44% in haulm) and the least was observed under control S₁ (0.45 and 0.35%) in seed and haulm. Among the varieties tested, M₂ (LBG 904) recorded the highest potassium content in both seed (1.61%) and haulm (1.64%), followed by M₁ (LBG 884) (1.42 and 1.52% respectively) in both seed and haulm least was recorded by M₃ - (LBG 752) in both seed and haulm (1.36 and 1.47%, respectively).

Among the nutrient levels tested potassium content in both seed and haulm increased significantly with application of S₃ 100% RDF recorded the highest potassium content (1.67 in seed and 1.76% in haulm) and the least was observed under control S₁ (1.27 and 1.40%) in seed and haulm. The application of 100% RDF markedly enhanced the nutrient content in both seeds and haulms. This improvement can be attributed to the greater nutrient availability in the soil resulting from fertilizer use. Since nutrient absorption depends on both nutrient concentration and biomass, the enhancement may be due to improved rhizosphere conditions and plant nutrition, facilitating efficient nutrient translocation within the plant (Goyal *et al.* 2017) ^[4] observed that the recommended fertilizer dose maintained a synergistic effect by enhancing nutrient efficiency. As the supply of NPK to the crop increased, nutrient uptake also rose due to better nutrient accessibility, leading to higher biomass production (Almaz *et al.* 2017) ^[2].

Nutrient Uptake

Nutrient uptake of different varieties were significantly affected by different nutrient levels (Table. 2). Among the varieties M₂ (LBG 904) recorded the highest nitrogen uptake in both seed (68.4 kg ha⁻¹) and haulm (43.1 kg ha⁻¹), followed by M₁ (LBG 884) (51.2 kg ha⁻¹ and 34.4kg ha⁻¹), respectively in both seed and haulm. Lowest nitrogen uptake was recorded with the variety M₃ (LBG 752) (43.0 kg ha⁻¹, 32.4 kg ha⁻¹) in both seed and haulm. Highest nitrogen uptake of both seed and haulm in nutrient levels is recorded with the application of S₃ - 100% RDF (78.1 and 44.0 kg ha⁻¹), while the lowest uptake was observed with S₁ - Control (31.3 and 29.7 kg ha⁻¹). Among the varieties M₂ - LBG 904 recorded the highest phosphorus uptake in both seed (10.6 kg ha⁻¹) and haulm (12.3 kg ha⁻¹), followed by M₁ - LBG 884 (8.12 and 10.2 kg ha⁻¹), respectively in both seed and haulm. Lowest phosphorus uptake was recorded with the variety M₃ LBG 752 (7.0 and 9.7 kg ha⁻¹) in both seed and haulm. Highest phosphorus uptake of both seed and haulm in nutrient levels is recorded with the application of S₃ - 100% RDF (11.8 and 13.5kg ha⁻¹), while the lowest uptake was observed with control S₁ (5.25 and 8.73 kg ha⁻¹). Among the varieties M₂ LBG 904

recorded the highest potassium uptake in both seed (33.3 kg ha⁻¹) and haulm (49.9 kg ha⁻¹), followed by M₁ LBG 884 (24.3 and 41.4 kg ha⁻¹), respectively in both seed and haulm. Lowest potassium uptake was recorded with the variety LBG 752 (20.6 and 40.5 kg ha⁻¹) in both seed and haulm. Highest potassium uptake of both seed and haulm in nutrient levels is recorded with the application of S₃ - 100% RDF (36.3 and 53.7 kg ha⁻¹), while

the lowest uptake was observed with control S₁ (14.9 and 34.8 kg ha⁻¹). The increased NPK uptake likely promoted the diversion of more photosynthates toward protein synthesis, thereby improving nutrient absorption and utilization efficiency in the plants (Meena *et al.* 2014) [8]. Higher NPK uptake with application of 100% RDF (S₃) was due to higher NPK contents and enhanced biomass production.

Table 1: Nutrient content (%) of blackgram as influenced by liquid biofertilizers and graded nutrient levels

Treatments	Nutrient content (%)					
	Nitrogen		Phosphorous		Potassium	
	Seed	Haulm	Seed	Haulm	Seed	Haulm
Varieties						
M ₁ : LBG - 884	2.97	1.27	0.48	0.38	1.42	1.52
M ₂ : LBG - 904	3.20	1.42	0.50	0.40	1.61	1.64
M ₃ : LBG - 752(check variety)	2.89	1.23	0.47	0.37	1.36	1.47
S.E.m (±)	0.05	0.02	0.01	0.01	0.05	0.03
CD (P=0.05)	0.15	0.06	0.03	0.03	0.14	0.07
Nutrient levels						
S ₁ - Absolute control (No fertilizer/ biofertilizer)	2.70	1.20	0.45	0.35	1.27	1.40
S ₂ - <i>Rhizobium</i> seed treatment + soil application of PSB & KRB alone	2.82	1.25	0.46	0.36	1.42	1.41
S ₃ - 100% RDF (20-50-0 kg NPK ha ⁻¹)	3.57	1.43	0.54	0.44	1.67	1.76
S ₄ - 75% RDF+ <i>Rhizobium</i> seed treatment + PSB +KRB	3.09	1.34	0.50	0.40	1.51	1.61
S ₅ - 50% RDF+ <i>Rhizobium</i> seed treatment + PSB+ KRB	2.92	1.30	0.47	0.37	1.44	1.53
S.E.m (±)	0.07	0.03	0.01	0.01	0.06	0.03
CD (P=0.05)	0.20	0.08	0.04	0.04	0.18	0.10
Interaction (MxS)						
S.E.m (±)	0.12	0.05	0.02	0.02	0.11	0.06
CD (P=0.05)	S	NS	NS	NS	NS	NS
CV (%)	6.8	6.1	7.9	10.0	12.4	6.4

Table 2: Nutrient uptake (kg ha⁻¹) of blackgram as influenced by liquid biofertilizers and graded nutrient levels

Treatments	Nutrient uptake (kg ha ⁻¹)					
	Nitrogen		Phosphorous		Potassium	
	Seed	Haulm	Seed	Haulm	Seed	Haulm
Varieties						
M ₁ : LBG - 884	51.2	34.4	8.12	10.2	24.3	41.4
M ₂ : LBG - 904	68.4	43.1	10.6	12.3	33.3	49.9
M ₃ : LBG - 752(check variety)	43.0	32.4	7.03	9.75	20.6	39.1
S.E.m (±)	1.22	1.28	0.31	0.52	0.88	1.32
CD (P=0.05)	3.54	3.71	0.89	1.49	2.55	3.83
Nutrient levels						
S ₁ - Absolute control (No fertilizer/ biofertilizer)	31.3	29.7	5.25	8.73	14.9	34.8
S ₂ - <i>Rhizobium</i> seed treatment + soil application of PSB & KRB alone	42.7	33.6	6.97	9.72	21.2	38.0
S ₃ - 100% RDF (20-50-0 kg NPK ha ⁻¹)	78.1	44.0	11.8	13.5	36.3	53.7
S ₄ - 75% RDF+ <i>Rhizobium</i> seed treatment + PSB +KRB	66.0	39.1	10.5	11.5	32.0	46.8
S ₅ - 50% RDF+ <i>Rhizobium</i> seed treatment + PSB+ KRB	52.8	36.9	8.39	10.4	25.9	43.9
S.E.m (±)	1.58	1.65	0.40	0.67	1.14	1.71
CD (P=0.05)	4.56	4.79	1.15	1.93	3.29	4.94
Interaction (MxS)						
S.E.m (±)	2.73	2.87	0.69	1.15	1.97	2.95
CD (P=0.05)	S	S	S	S	S	S
CV (%)	8.7	13.5	13.8	18.4	13.0	11.7

Conclusion

Based on the above results, it can be concluded that newly released varieties of blackgram *ie*, LBG-904 and LBG-884 responded to liquid biofertilizers and recorded higher nutrient content and uptake and comparable with 75% RDF + *Rhizobium* seed treatment + PSB+ KRB compare to 100% RDF.

References

- Allito BB, Nana EM, Alemneh AA. *Rhizobia* strain and legume genome interaction effects on nitrogen fixation and yield of grain legume: a review. An International Journal for
- Almaz MG, Halim RA, Martini MY, Samsuri AW. Integrated application of poultry manure and chemical fertiliser on soil chemical properties and nutrient uptake of maize and soybean. *Malaysian Journal of Soil Science*. 2017;21:13-28.
- Gomez KA, Gomez A. *Statistical procedures for agricultural research*. 1st ed. New York: John Wiley & Sons; 1984.
- Goyal P, Swaroop N, Thomas T. Effect of organic,

Micropedology and Molecular Biology of Soil Organisms. 2015;6(2):1-6.

- inorganic, biofertilizer and seed inoculation on soil properties, growth and yield of maize (*Zea mays* L.) var. hybrid MM-2255. International Journal of Current Microbiology and Applied Sciences. 2017;6(6):95-100.
5. Gupta K, Dubey NK, Singh SP, Kheni JK, Gupta S, Varshney A. Plant growth-promoting rhizobacteria (PGPR): current and future prospects for crop improvement. In: Current trends in microbial biotechnology for sustainable agriculture. 2021:203-226.
 6. Keifer G, Effenberger F. Pulses revolution: from food to nutritional security. Ministry of Agriculture and Farmers Welfare. Angewandte Chemie International Edition. 2018;6(11):951-952.
 7. Khan F, Nayab M, Ansari AN, Zubair M. Medicinal properties of mash (*Vigna mungo* (L.) Hepper): a comprehensive review. Journal of Drug Delivery and Therapeutics. 2021;11:121-124.
 8. Meena JS, Verma HP, Pancholi P. Effect of fertility levels and biofertilizers on yield, quality and economics of cowpea. Agriculture for Sustainable Development. 2014;2(2):162-164.
 9. Murtaza G, Ehsanullah, Zohaib A, Hussain S, Rasool T, Shehzad H. The influence of Rhizobium seed inoculation and different levels of phosphorus application on growth, yield and quality of mash bean (*Vigna mungo* L.). International Journal of Modern Agriculture. 2014;3(3):92-96.
 10. Oborn I, Andrist-Rangel Y, Askegaard M, Grant CA, Watson CA, Edwards AC. Critical aspects of potassium management in agricultural systems. Soil Use and Management. 2005;21:102-112.
 11. Palaniraja K. Response of biofertilizers on growth attributes of black gram *Vigna mungo* (L.) Hepper. International Journal of Current Research in Life Sciences. 2018;7(4):1495-1496.
 12. Sharma A, Pathania P. Effect of FYM, PSB inoculation and phosphorus levels on growth and developmental stages of blackgram. International Journal of Current Microbiology and Applied Sciences. 2019;8:2450-2457.
 13. Srinivasarao C, Masood A, Ganeshamurthy AN, Singh KK. Potassium requirements of pulse crops. Better Crops International. 2003;17(1):8-11.
 14. Venkatesh MS, Basu PS. Genotypic variation in phosphorus use efficiency in grain legumes. Journal of Plant Nutrition. 2014;37:1519-1534.