



## Effect of integrated nutrient management practices on productivity of blackgram (*Vigna mungo*)

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Blackgram (*Vigna mungo* L.) is an important summer (*kharif*) season pulse crop belongs to legumenaceae family. It is very nutritious and contains high quality protein (24%), carbohydrates (60%), fat (1–5%), amino acids, vitamins and minerals like potassium, calcium, iron (Brink 2006). The productivity of blackgram is low in India as compared to world productivity. There are numerous reasons for low productivity like non-availability of quality seed of improved and short-duration varieties, growing under marginal and less fertile soil with low inputs and without pest and disease management; growing under moisture stress conditions; unscientific post-harvest practices and storage under unfavourable condition. There is immense scope to increase blackgram productivity with adoption of high yielding varieties and better nutrient management practices. The production potential of this crop can be enhanced by use of organic manures, inorganic manures and biofertilizers. Although, chemical fertilizers are playing a crucial role to meet the nutrient requirement of the crop, persistent nutrient depletion is posing a greater threat to the sustainable agriculture. Therefore, there is an urgent need to reduce the usage of chemical fertilizer and in turn, increase in the usage of organics which is needed to enhance the yield and quality levels. Keeping the above facts in view, the study was carried out with the objectives: to study the effect of different INM practices on productivity, profitability and nutrient acquisition by blackgram.

A field experiment was conducted at Chatabara village, Institute of Agricultural Sciences (IAS), Siksha “O” Anusandhan Deemed to be University, Bhubaneswar, Odisha (28.4' N and 27.12' E and at an altitude of 45.0 m amsl) during winter (*rabi*) season of 2019–20. The experimental area was characterized by hot dry summer and mild cold

winter. The sowing of the experimental crop was done on 5 November, 2019 and the crop growth period extended up to 3<sup>rd</sup> week of January. The weekly minimum and maximum temperature during that crop growth period ranged between 13.2°C and 31.8°C, respectively. The mean weekly relative humidity ranged between 87–97%. The soil of the experimental field was sandy loam in texture having 1.58 g/cm<sup>3</sup> bulk density, 0.22 dS/m EC, 0.45% organic carbon, 180 kg/ha available N, 12 kg/ha available P and 181 kg/ha available K. The experiment was laid out in randomized block design (RBD) with three replications. Eight INM treatments, viz. T<sub>1</sub>, 100% RDF (20:40:20 and 20:: N: P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O and S kg/ha); T<sub>2</sub>, T<sub>1</sub>+FYM; T<sub>3</sub>, T<sub>1</sub>+Nutri priming with Mo and P (Ammonium molybdate 0.1% and 1% P solution of SSP); T<sub>4</sub>, T<sub>1</sub>+FYM + Nutripriming with Mo and P; T<sub>5</sub>, 75% RDF; T<sub>6</sub>, T<sub>5</sub>+FYM; T<sub>7</sub>, T<sub>5</sub>+Nutri priming with Mo and P; T<sub>8</sub>, T<sub>5</sub>+FYM+Nutri priming with Mo and P. The fertilizer nutrient were supplied through urea, DAP and MOP. Full starter dose of nitrogen, phosphorus and potassium as per treatment were applied at the time of sowing. Seeds were treated with rhizobium @25 g/kg of seed and were sown after drying for 6 h under shade. Blackgram variety (PU 30) was sown in 30 cm × 10 cm crop geometry apart during first week of November with the seed rate of 25 kg/ha. Normal crop husbandry practices were followed for successful rising of the crop. The observations of growth parameters and yield attributes were recorded. The data were analyzed statistically by following the standard ANOVA techniques and the difference between the treatment means was tested as for their statistical significance with appropriate critical difference (CD) value at 5% level of significance (Gomez and Gomez 1984).

**Growth parameters:** The growth parameters of blackgram at 60 DAS were influenced significantly by different INM practices (Table 1). The maximum plant height (22.87 cm) was recorded in treatment T<sub>4</sub> followed by T<sub>8</sub>. The application of FYM or nutripriming alone or their combination with RDF did not significantly influence the plant height in blackgram. The maximum leaf area index

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Table 1 Effect of different nutrient management practices on growth parameters, yield and yield attributes during 2019–20

Treatment	Plant height at 60 DAS (cm)	Dry matter accumulation at 60 DAS (g/plant)	No. of leaves/plant at 60 DAS	LAI at 60 DAS	No. of branches/plant	No. of pods/plant	No. of seeds/pod	Seed yield (g/plant)	1000 seed weight (g)	Seed yield (kg/ha)	Stover yield (kg/ha)	Harvest index (%)
T <sub>1</sub>	20.9	11.6	16.9	2.64	9.29	14.4	9.34	4.10	38.2	526	1360	29.0
T <sub>2</sub>	21.3	12.2	18.6	2.84	10.1	17.6	10.1	4.48	42.2	687	1720	28.5
T <sub>3</sub>	21.5	12.2	17.8	2.24	9.26	15.0	10.2	4.20	40.4	673	1660	28.9
T <sub>4</sub>	22.8	13.3	19.9	3.06	11.5	20.2	10.6	5.10	43.6	741	1800	29.1
T <sub>5</sub>	19.7	11.2	13.8	2.24	7.41	14.0	9.27	3.57	37.7	470	1050	28.4
T <sub>6</sub>	20.9	12.2	16.6	2.60	9.33	16.2	10.1	4.00	41.2	565	1310	28.5
T <sub>7</sub>	21.5	12.1	14.4	2.32	7.89	14.6	10.1	3.80	40.3	568	1350	28.9
T <sub>8</sub>	22.4	13.1	16.8	2.79	11.3	18.8	10.4	4.60	43.2	620	1360	29.2
SEm (±)	0.51	0.67	0.69	0.15	0.50	0.58	0.36	0.15	0.51	035	0.70	1.70
CD (P=0.05)	1.67	2.03	2.11	0.45	1.52	1.78	1.11	0.45	1.55	108	210	NS

Refer to methodology for treatment details.

(LAI) (3.06) was noticed in T<sub>4</sub> which was significantly higher compared to T<sub>5</sub> and T<sub>3</sub>. Application of 100% RDF either with FYM or nutripriming with Mo and P was found not to differ significantly compared to 75% RDF + FYM or 75% RDF + Nutripriming with Mo and P. The highest dry matter (13.38 g/plant) was recorded in treatment T<sub>4</sub> followed by T<sub>8</sub>. It might be due to increased growth parameters of blackgram because more activity of meristematic tissues of plants under integrated nutrient management that resulted adequate nutrients availability for longer time that results in more cell differentiation, more meristematic division and translocation of food materials in plants, thereby resulting in higher production of branches at different growth stages (Javed and Panwar 2013).

**Yield attributes and yield:** The seed yield and different yield attributing parameters of blackgram were influenced significantly by different nutrient management practices (Table 1). The highest number of pods per plant (20.2) was recorded in treatment T<sub>4</sub> followed by T<sub>8</sub> and T<sub>2</sub>. The maximum number of seeds per pod (10.6) was noticed in T<sub>4</sub>, while the minimum (9.27) was recorded in T<sub>5</sub>. With the addition of FYM @5.0 t/ha over the 100% or 75% RDF, there was marginal increase in number of seeds per pod. The maximum seed yield per plant (5.10 g/plant) was recorded in treatment T<sub>4</sub> which was significantly higher compared to all the other nutrient management practices. The lowest seed yield (3.57 g/plant) was obtained in treatment T<sub>5</sub> (75% RDF) and it was significantly lower than treatment T<sub>1</sub> (100% RDF). The maximum and minimum test weight was recorded in treatment T<sub>4</sub> and T<sub>8</sub>. The stover yield was influenced significantly by different nutrient management practices. With 100% RDF the maximum stover yield (1800 kg/ha) was recorded in T<sub>4</sub>, whereas the minimum was recorded in T<sub>5</sub>. However, when 100% RDF was supplemented with FYM @5.0 t/ha, it resulted in significantly higher stover yield (1720 kg/ha) in treatment T<sub>2</sub>. Among the treatment

receiving 75% RDF, the treatment T<sub>5</sub> resulted the lowest stover yield (1310 kg/ha).

Likewise, the maximum and the minimum harvest index were obtained in treatment T<sub>4</sub> and T<sub>1</sub>. The application of different organic sources of nutrients might have resulted in better growth that helped in optimum fertilization of flowers and increased pollen grain viability and thereby increased number of pods/plant (Chaudhary *et al.* 2016). The increase in seed and stover yield under adequate nutrients supply might be ascribed mainly due to the combined effect of higher plant height, more dry matter accumulation at different stages, more number of branches/plant, number of pods/plant and higher pod weight, which was the result of better translocation of photosynthates from source to sink and ultimately pod and stover yield was increased (Singh *et al.* 2002).

**Nutrient acquisition by crop:** The nutrient uptake in seed and stover was influenced significantly due to different INM practices but nutrient content did not influence significantly (Fig 1). The maximum N uptake in seed (28.1 kg/ha) and stover (26.3 kg/ha), respectively was recorded in treatment T<sub>4</sub>, whereas T<sub>5</sub> recorded the minimum uptake of N in seed (13.0 kg/ha) and stover (12.1 kg/ha). The highest total uptake of N (54.5 kg/ha) was recorded in T<sub>4</sub> and the minimum of 25.2 kg/ha was recorded in T<sub>5</sub>. The total uptake of N was significantly higher in combined application of RDF and FYM compared to RDF alone. The maximum P uptake in seed (2.80 kg/ha) and stover (4.34 kg/ha) was recorded in treatment T<sub>4</sub>, whereas T<sub>5</sub> recorded the minimum uptake of P in seed (1.3 kg/ha) and stover (2.18 kg/ha). The total P uptake was influenced significantly due to different nutrient management practices. The maximum total P uptake (7.14 kg/ha) was obtained in treatment T<sub>4</sub>, whereas the minimum P uptake (3.47 kg/ha) was recorded in T<sub>5</sub>. The maximum K uptake in seed (5.89 kg/ha) and stover (17.49 kg/ha) was recorded in T<sub>4</sub>, whereas the T<sub>5</sub> recorded the minimum uptake

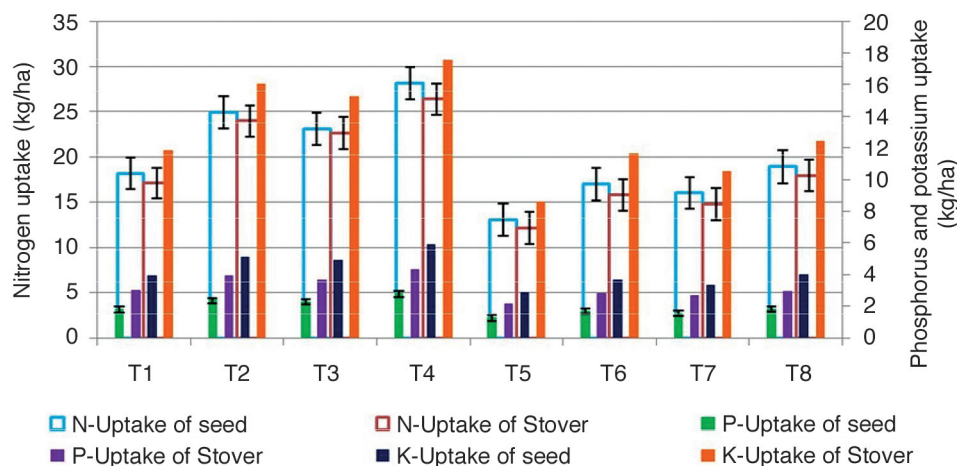


Fig 1 Nutrient uptake in seed and stover of blackgram as influenced by INM practices during winter (*rabi*) season of 2019–20.

of K in seed (2.86 kg/ha) and stover (8.53 kg/ha). With the incremental increase in fertilizer level from 75% to 100% RDF, there was a significant increase in K uptake in both seed and stover. The maximum total K uptake (23.37 kg/ha) was recorded in treatment  $T_4$ , while the minimum K uptake (11.38 kg/ha) was recorded in  $T_5$ . The treatment with organic sources of nutrition gave the better nutrient content and uptake by the crop because organic sources of nutrients help in improve the nutrients availability in soil. Application of organic sources of nutrients improved the physical properties (water and nutrient holding capacity) of soil thus making more availability of nutrients to the plants and would have also provided both macro and micro nutrients in soil.

**Economics:** The cost of production varied from  $22.8 \times 10^3$  ₹/ha in  $T_5$  to  $29.3 \times 10^3$  ₹/ha in  $T_4$ . The production cost varied based on the treatment composition. At the recommended level of fertilizer application ( $T_1$ ) the cost of cultivation was  $23.3 \times 10^3$  ₹/ha, application of FYM @5.0 t/ha increased the production cost to  $28.3 \times 10^3$  ₹/ha. The gross returns for blackgram due to different integrated nutrient management treatments influenced significantly. The highest gross returns of  $68.5 \times 10^3$  ₹/ha was obtained in  $T_4$ , while the lowest gross returns of  $38.8 \times 10^3$  ₹/ha was obtained in  $T_5$ . Between 100% RDF and 75% RDF, the former treatment resulted in significantly higher gross returns than the later. FYM application over RDF ( $T_2$ ) resulted in higher gross returns than only RDF. Similarly, the FYM application resulted significantly higher gross returns either at 75% RDF or 100% RDF. The net returns influenced significantly due to different INM treatments. The maximum

net returns of  $39.25 \times 10^3$  ₹/ha was obtained in  $T_4$  which was significantly higher than  $T_1$  (100% RDF). For net returns,  $T_2$ ,  $T_3$ , and  $T_4$  remained on par. The B:C ratio varied between 1.70–2.34 and was the maximum in  $T_4$  treatment. With the application of FYM, there was increase in B:C ratio, both at 100% and 75% RDF.

## SUMMARY

A field study was carried out at Chatabara village, Institute of Agricultural Sciences (IAS), Siksha “O”

Anusandhan Deemed to be University, Bhubaneswar, Odisha during winter (*rabi*) season of 2019–20 to evaluate the effect of different INM practices on productivity, profitability and nutrient acquisition by blackgram. Results showed that INM with 100% RDF+ FYM (5 t/ha) + Nutri-priming with Mo and P (Ammonium molybdate 0.1% and 1% P solution of SSP) can be the best practice for the cultivation of blackgram under winter (*rabi*) season with a yield level of 741 kg/ha and net returns of  $39.2 \times 10^3$  ₹/ha. However, for farmers convenience point of view, INM with RDF+5.0 t/ha of FYM can be the 2<sup>nd</sup> best practice for the cultivation of blackgram with a yield level of 687 kg/ha and net returns of  $35.2 \times 10^3$  ₹/ha.

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