The Pharma Innovation Journal 2022; 11(9): 2674-2676

www.ThePharmaJournal.com

The Pharma Innovation

**ISSN (E): 2277-7695**
**ISSN (P): 2349-8242**
**NAAS Rating: 5.23**
TPI 2022; 11(9): 2674-2676

www.thepharmajournal.com
Received: 06-07-2022
Accepted: 06-08-2022

**Dhyan Singh Yadav**
Department of Agronomy, National Post Graduate College, Barhalganj, Gorakhpur, Uttar Pradesh, India

**Prabhat Kumar Chaturvedi**
Department of Agronomy, National Post Graduate College, Barhalganj, Gorakhpur, Uttar Pradesh, India

**Rakesh Kumar**
Department of Agronomy, National Post Graduate College, Barhalganj, Gorakhpur, Uttar Pradesh, India

**Corresponding Author:**
**Dhyan Singh Yadav**
Department of Agronomy, National Post Graduate College, Barhalganj, Gorakhpur, Uttar Pradesh, India

# Effect of phosphorus and sulphur on growth and yield of black gram (*Vigna mungo* L.)

**Dhyan Singh Yadav, Prabhat Kumar Chaturvedi and Rakesh Kumar**

**Abstract**
A field experiment was carried out during during Zaid season 2021 showed that the basal application of 50 kg Phosphorus $ha^{-1}$ with 30 kg Sulphur $ha^{-1}$ to black gram (*Vigna mungo* L.) gave the highest plant Height, plant dry weight, Crop growth rate, test weight, seed and stover yield as well as protein content found statistically superior over rest of the treatments. Efficient use of fertilizers like Phosphors and Sulphur helps in enhancing the production, productivity and quality of the Black gram.

**Keywords:** Black gram, phosphorus, sulphur, yield attributing parameters, yield, stover yield, protein content

## Introduction
In India, crop yield is less than international scenario possibly due to many factors like poor quality seed, improper management, inefficient way of nutrient management and weed management etc. Among these factors, soil fertility is of much more importance in achieving actual yield of crops and its quality. Hence, farmers should adopt recommended dose of fertilizers and site-specific nutrient management etc. Black gram (*Vigna mungo* L.) in U.P. is much below the national average in any cropping system. Pulses are included to improve soil health and fertility status, being legume, Black gram (*Vigna mungo* L.) is a deep-rooted drought hardy crop, source of green fodder, source of green manuring, source of pulses and also source of lavish iron and zinc minerals.

India is major legume producing country in the world and Black gram (*Vigna mungo* L.) is one of the important pulse crops grown throughout India. Legume serves as economical source of complementing protein and also add variety to diet for human population. They contribute as height protein constituent in India. (Sood *et al*. 2002) [9]. Legumes are valued for their low glycemic index and high protein content. Thus, they are generally included in the diet of Indian subcontinent. (Khandelwal *et al*. 2010) [4]. Pulses contain protein 220-225 g $kg^{-1}$ in pulses whereas dry fish contain protein 335 g $kg^{-1}$ in fishes. Thus, pulses are considered as "poor man's meet" (Nunes *et al* 2006) [8]. Pulses are an excellent source of protein, amino acids and certain micronutrients such as iron and zinc also. They also have low glycemic index and no cholesterol (Food and Agriculture Organization, 2016). It has been reported that the crop produces equivalent to 22.10 kg of nitrogen $ha^{-1}$, which has been estimated to be supplement of 59 thousand tonnes of urea annually. Fertilization is essential to improve the productivity of Black gram. It can meet its nitrogen requirement by symbiotic fixation of atmospheric nitrogen. The nutrients which need attention are Phosphorus and sulphur. Both Phosphorus and sulphur can improve the quality and quantity of the crop. Efficient use of fertilizers like Phosphorus and sulphur helps in enhancing the production and productivity of the Black gram. Therefore, it was considered importance to find out judicious combination of fertilizer nutrients like Phosphorus and sulphur to boost up the production and productivity of Black gram.

## Materials and Methods
The field experiment was carried out at the Crop Research Farm, Barhalganj, Gorakhpur, U.P. The experimental site is situated in subtropical zone in Indo - gangetic plains and lies between 260471 North latitude, 820101 East longitude and 1130m above sea level. The soil of the experimental field was silty loam in texture and slightly alkaline in reaction with PH 7.6, EC 0.20 $dsm^{-1}$, organic carbon 0.40% and available Nitrogen 196 kg $ha^{-1}$, Phosphorus 18.9 kg $ha^{-1}$ and Potassium 260.50 kg $ha^{-1}$ at 0-15 Cm soil depth.

The experiment was laid out in Randomized Block Design keeping 9 treatment combinations *viz* $T_1$-P 40 kg ha$^{-1}$+S 25 kg ha$^{-1}$, $T_2$-P 40 kg ha$^{-1}$ + 30 kg ha$^{-1}$, $T_3$-P 40 kg ha$^{-1}$ + 35 kg ha$^{-1}$, $T_4$-P 50 kg ha$^{-1}$ + S 25 kg ha$^{-1}$, $T_5$-P 50 kg ha$^{-1}$ + 30 kg ha$^{-1}$, $T_6$-P 50 kg ha$^{-1}$ + 35 kg ha$^{-1}$, $T_7$-P 60 kg ha$^{-1}$ +S 25 kg ha$^{-1,}$ $T_8$-P 60 kg ha$^{-1}$ + 30 kg ha$^{-1}$, and $T_9$-P 60 kg ha$^{-1}$ + 35 kg ha$^{-1}$, respectively with 3 replications. The sowing was done in the 4th week of February. The crop was sown by using seed rate of 30 kg ha$^{-1}$ and by maintaining a spacing of 30 X 15 Cm. Phosphorus and sulphur were applied to the crops as per experimental schedule. The other agronomical cultural practices such as manuring, irrigation, weeding and plant protection measures have been performed as per requisite. The crop was harvested manually at the maturity and grain and straw were recorded.

## Result and Discussion

Different doses of Phosphorus and Sulphur had a significant effect on growth characters *viz*. plant height, dry weight, number of nodules plant$^{-1}$ and crop growth rate during the year of study given in Table 1 clearly indicates that the maximum plant hight, dry weight, number of nodules plant$^{-1}$ and crop growth rate (29.77 cm, 12.07 g, 26.84 and 0.81 gm$^{-2}$ day$^{-1}$, respectively) were recorded with the dose of Phosphorus at 50 kg ha$^{-1}$ along with Sulphur at 30 kg ha-$^{1}$, while the lowest values were observed (22.5 0 m, 3.80 g, 14.48 and 0.18 gm-$^{2}$ day$^{-1}$, respectively) with the dose of Phosphorus at 40 kg ha$^{-1}$ along with Sulphur at 25 kg ha$^{-1}$. Increased plant growth might be due to better nutritional environment in root zone. Phosphorus is vital component of ADP and ATP and it plays an important role in conservation and transfer of energy in metabolic reaction. It also stimulates cell division resulting in increased growth of plants and also improves nodulation and nitrogen fixation by roots. The fast increase in plant height in the early stage of plant growth may be attributed to the higher number of leaves producing higher food material for growth of the plant. In fact, more and large sized leaves were responsible for preparing more food photosynthates, which increased the cell division and resulted in rapid growth of the plants. (Yadav, 2011) [11]. Sulphur availability results in better formation of nodule nitrogenize enzyme, chlorophyll etc. and thereby increasing growth component of the crop. The results are similar to the findings of Yadav *et al*. (2017), Neeraj and Prakash (2015) and Mir *et al* (2017) [12, 7, 6].

**Table 1:** Growth attributes of Black gram as affected by phosphorus and Sulphur levels

| Treatment | Plant Height (cm) | Dry weight(g) | No of Nodules plant$^{-1}$ | Crop growth rate (g$^{-}$m$^{2}$day$^{-1}$) |
|---|---|---|---|---|
| $T_1$ | 22.50 | 3.80 | 14.48 | 0.18 |
| $T_2$ | 23.07 | 3.95 | 16.25 | 0.20 |
| $T_3$ | 23.73 | 5.76 | 20.44 | 0.30 |
| $T_4$ | 24.04 | 7.26 | 18.24 | 0.35 |
| $T_5$ | 29.77 | 12.07 | 26.84 | 0.81 |
| $T_6$ | 25.40 | 8.65 | 21.74 | 0.48 |
| $T_7$ | 23.50 | 6.20 | 18.15 | 0.27 |
| $T_8$ | 24.50 | 7.97 | 19.25 | 0.43 |
| $T_9$ | 25.07 | 8.45 | 20.54 | 0.47 |
| S. Em | 0.95 | 0.52 | 0.92 | 0.04 |
| CD at 5% | 2.03 | 1.13 | 1.98 | 0.10 |

## Yield Attributes, Yield and Protein Content

The data on different dose of Phosphorus and Sulphur on yield attributes, yield, stover yield and protein content of Black gram (*Vigna mungo* L.) presented in Table - 2 showed that number of pods plant$^{-1}$, number of grains pod$^{-1}$, test weight (g), grain yield (q ha$^{-1}$), straw yield (q ha$^{-1}$) and protein content (%) (26.28, 6.74, 48.62, 23.00, 62.20 and 23.51, respectively) were recorded with the dose of Phosphorus at 50 kg ha$^{-1}$ along with Sulphur at 30 kg ha$^{-1}$ while the lowest value were observed (17.32, 3.70, 30.50, 14.20, 37.10 and 17.55, respectively) with the dose of Phosphorus at 40 kg ha-1 along with Sulphur at 25 kg ha$^{-1}$. The better growth of plants in terms of growth attributes might have helped in improving yield parameters and yield of Black gram (*Vigna mungo* L.) through better translocation of food reserves to the sink.

**Table 2:** Yield attributes and yield of Black gram as affected Phosphorus and Sulphur levels

| Treatment | Number of Pod plant$^{-1}$ | Number of grain Pod$^{-1}$ | Test weight(g) | Grain yield (q ha$^{-1}$) | Stover yield (q ha$^{-1}$) | Protein content |
|---|---|---|---|---|---|---|
| $T_1$ | 17.32 | 3.70 | 30.50 | 14.20 | 37.10 | 17.55 |
| $T_2$ | 19.63 | 4.20 | 32.60 | 14.40 | 37.30 | 18.45 |
| $T_3$ | 21.03 | 4.95 | 36.14 | 15.00 | 42.80 | 19.80 |
| $T_4$ | 21.24 | 5.12 | 38.74 | 17.80 | 44.20 | 20.30 |
| $T_5$ | 26.28 | 6.74 | 48.62 | 23.00 | 62.20 | 23.51 |
| $T_6$ | 23.41 | 5.51 | 42.70 | 21.00 | 48.40 | 21.17 |
| $T_7$ | 22.45 | 5.38 | 40.60 | 19.50 | 45.20 | 21.48 |
| $T_8$ | 22.21 | 5.27 | 40.29 | 18.90 | 44.90 | 21.28 |
| $T_9$ | 21.94 | 5.21 | 39.97 | 18.40 | 44.50 | 22.38 |
| S.Em | 0.72 | 0.26 | 0.81 | 0.43 | 0.54 | - |
| CD. (at 5%) | 1.54 | 0.56 | 1.74 | 0.93 | 1.16 | - |

The levels of Phosphorus regulate the starch/sucrose ratio in the source levels of reproductive organs. Thus, the stimulatory effect of Phosphorus and Sulphur on growth and partitioning of photosynthates to sink development has contributed to increased yield attributes. This finding was similar to results obtained by Thesiya *et al*. (2013) [10]. The corresponding

lower values of these parameters at lower doses further lead support to the above statement. With increase in photosynthetic products, coupled with efficient translocation plants produced more pod plant$^{-1}$ with a greater number of seed pod$^{-1}$. Significant increase in grain and straw yields appeared to be an account of beneficial effects of Phosphorus and Sulphur on growth and yield attributes. Similar findings have been reported by Bansal (2009) and Bhat et.al. (2009) [1, 2].

## Economics

Based on input-output analysis the cost of cultivation (Rs ha$^{-1}$), gross return (Rs ha$^{-1}$), net return (Rs ha$^{-1}$) and BC ratio were work out to highlight the feasibility for adoption of recommendation by the farmers. It is obvious from the Table 3 that the treatment receiving Phosphorus at 50 kg ha$^{-1}$ along with Sulphur at 30 kg ha$^{-1}$ registered highest gross return (Rs 1,38,000), net return (Rs 98,766.44) and benefit caste ratio (2.51), this might be due to higher yield in the treatments compare to other treatment.

**Table 3:** Gross return, net return and benefit-cost ratio of Black gram as affected by Phosphorus and Sulphur levels

| Treatments | Gross return (₹ ha$^{-1}$) | Net Return (₹ ha$^{-1}$) | B:C ratio |
|---|---|---|---|
| $T_1$ | 85200 | 47175.55 | 1.24 |
| $T_2$ | 86400 | 47688.05 | 1.23 |
| $T_3$ | 90000 | 50600.55 | 1.28 |
| $T_4$ | 106800 | 68253.94 | 1.77 |
| $T_5$ | 138000 | 98766.44 | 2.51 |
| $T_6$ | 126000 | 86078.94 | 2.15 |
| $T_7$ | 117000 | 77932.07 | 1.99 |
| $T_8$ | 113400 | 73644.57 | 1.85 |
| $T_9$ | 110400 | 69957.07 | 1.72 |

The inference, from the above study has been drawn that application of Phosphorus @ 50 kg ha$^{-1}$ with Sulphur @ 30 kg ha$^{-1}$ has been found to be an ideal to exploit significantly grain production as well as quality of black gram. The maximum response was noted significant at 50 kg Phosphorus with 30 kg Sulphur ha$^{-1}$ than rest of the other treatments in respect of benefit cost ratio.

## References


1. Bansal RK. Synergistic effect of Rhizobium, PSB and PGPR on nodulation and grain yield of mung bean. Journal of Food Legumes. 2009;22(1):37-39.
2. Bhat SA, Thenua OVS, Sivakumar BG, Malik JK. Performance of summer green gram (*Vigna radiata* L.) as influenced by biofertilizers and phosphorus nutrition. Haryana Journal of Agronomy. 2009;21(2):203-205.
3. FAO. International year of pulses, also available at; c2016. http:/www.fao.
4. Khandelwal S, Udipi SA, Ghugre P. Polyphenols and tannins in Indian pulses: effect of soaking, germination and pressure cooking. Food Research International. 2010;43:526-553.
5. Kokani JM, Shah KA, Tandel BM, Nayaka P. Growth, yield Attributes and yield of summer black gram (*Vigna mungo* L.) as influenced by FYM, Phosphorus and Sulphur. An international quarterly J. of Environ. Sci. 2014, 429-433.
6. Mir AH, Lal SB, Salmani M, Abid M, Khan I. Growth, yield and nutrient content of blackgram (*Vigna mungo* L) as influenced by levels of phosphorus, sulphur and phosphorus solubilizing bacteria, SAARC Journal of Agriculture. 2017;11(1):1-6.
7. Niraj VPS, Prakash V. Influences of phosphorus and sulphur on yield and quality of blackgram (*Pysiolus mungo* L.). Journal of Agri Search. 2015;2(4):269-272.
8. Nunes MC, Raymundo A, Sousa I. Gelled vegetables desserts containing pea protein, K-carrangeenan and starch, European Food Research and Technology. 2006;222:622-628.
9. Sood M, Malhotra RS, Sood BC. Effect of processing and cooking on proximate composition of chickpea varieties. Journal of Food Science & Technology. 2002;39:69-71.
10. Thesiya NM. Chovatia PK, Kikani VL. Effect of potassium and sulphur on growth and yield of blackgram. Legume Res. 2013;63(3):255-258.
11. Yadav BK. Interaction effect of phosphorus and sulphur on yield and quality of Cluster bean in Typic Haplustept. World Journal of Agricultural Sciences. 2011;7(5):556-560.
12. Yadav M, Yadav SS, Kumar S, Yadav T, Yadav HK. Effect of phosphorus and bio-fertilizers on growth and yield of urdbean [*Vigna mungo* (L.) Hepper]. Int. J of Plant and Soil Sci. 2017;18(5):1-7.