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Effect of nitrogen and phosphorus levels on growth, yield and quality of summer mungbean [*Vigna radiata* (L.) Wilczek]

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Abstract
A field experiment was conducted at Research Farm of Mewar University, Chittorgarh (Rajasthan) during *Summer,* 2025 on loamy sand soil, which consisted sixteen treatments *viz*., two factors with where four levels of nitrogen are (Control, 20, 30 and 40 kgha^{-1}) and four source of phosphorus are (Control, 40, 60 and 80 kg ha^{-1}) in factorial randomized block design (FRBD). The mungbean variety "RMG-492" was used for experiment.
Results clearly showed that application of application of nitrogen @ 40 kg ha^{-1} significantly increased growth attributes *viz*. plant height, plant dry matter, number of branches plant^{-1}, number of nodules plant^{-1} and yield parameters *viz.* number of pods plant^{-1}, number of seeds pod^{-1}, seed, straw and biological yield as compare to rest of the treatments whereas lowest value recorded under control. Further, application of phosphorus @ 80 kgha^{-1} recorded maximum growth, yield over control. However; there were no interaction was found between nitrogen and phosphorus.

Keywords: Mungbean, phosphorus, nitrogen, stages

Introduction
Pulses stand a strategic position in the agriculture economy of our country. They contain high percentage of quality protein three times more than cereals. Pulses contain vitamin B, minerals and also contain a certain quality fiber, which is desirable in human diet because of medical consideration. Pulse crops enrich the soil through symbiotic nitrogen fixation from atmosphere. Besides being a rich source of protein, they maintain soil fertility through biological nitrogen fixation in soil and thus, play a vital role in sustainable agriculture. Mungbean is one of the most important pulse crops and an excellent source of high-quality protein. India alone accounts for 65% of its world acreage and 54% of the total production. Due to short duration nature, it is an excellent crop to fit in intercropping system with different major crops. It is an important conventional pulse crop of India. The calorific value of green gram is 334 calories per 100 g. it is known for high nutritional content crude protein 24.0%, fat 1.3%, carbohydrate 56.6%, minerals 3.5%, lysine 0.43%, methionine 0.10% and tryptophan 0.04%.
The World Health Organization recommends a per capita consumption of pulses at 80 g/day and the Indian Council of Medical Research (ICMR) has recommended a minimum consumption of 40 g/day. It has a wide range of adaptability due to short growth period, high tonnage capacity and outstanding nutritional values of food, feed and forage. Among the various constraints to low productivity of mungbean, inadequate use of fertilizers and lack of improved package of practices are important.
Nitrogen plays an important role in various metabolic process of plant. Nitrogen is an essential constituent of protein and chlorophyll and is present in many other compounds of great physiological importance in plant metabolism, such as nucleotides, phosphatides, alkaloids, enzymes, hormones, vitamins, etc.
Phosphorus is second most critical plant nutrient. But for pulses, it assumes primary importance, owing to its important role in root proliferation, which are the seat of biological N fixation and helps plants to draw nutrients from lower layers and consequently thrive

under moisture stress conditions. Application of phosphorus also plays an important role in growth, development and maturity of crop. Hence, phosphorous has referred to as the "master key element" in crop production (Taliman *et al*., 2019 [9]; Plants effect of phosphorus fertilization on the growth, photosynthesis, nitrogen fixation, mineral accumulation, seed yield, and seed quality of a soybean low-phytate line).

Materials and methods

The field experiments were carried out during *summer* season (2025) to study the "Effect of Nitrogen and Phosphorus Levels on Growth, Yield and Quality of Summer Mungbean [*Vigna radiata* (L.) Wilczek]" in factorial randomized block design (FRBD) with consisted sixteen treatments *viz*., two factors with where four levels of nitrogen are (Control, 20, 30 and 40 kg/ha) and four source of phosphorus are (Control, 40, 60 and 80 kg/ha) at Research Farm, Mewar University, Chittorgarh (Rajasthan). The experimental farm is geographically located at 075º88'99" E longitude and 26º81'17" N latitude and this region falls under agro-climatic zone IV A of Rajasthan. The experimental fields were clay loam and the soil fertility status contained available nitrogen (137.8 kg ha^{-1}) by Subia and Asija 1996 [8], available phosphorus (16.3 kg ha^{-1}) by Olsen *et al*. 1954 [4] and available potassium (250.12 kg ha^{-1}). The organic carbon content was from 0.34-0.38 percent. The weekly mean maximum and minimum temperatures were of temperature during both summers (40.6° C) and winters (2.7° C). The mean relative humidity fluctuated from 63.50 to 91 percent during the crop season. The average rainfall is 557 mm per annum, which is mostly received during july to september. The sporadic showers during winters are also common, which are probably observed during this period. The observation were recorded at harvest was analysed by statistical methods (Fisher, R.A. 1950) [3].

Results and Discussion

It is clear from the result of present study that, nitrogen and phosphorus levels had significantly affected the growth and yield parameters of mungbean at harvest. Application of nitrogen @ 40 kg ha^{-1} recorded the highest growth attributes *viz*. plant height (67.09 cm), dry matter accumulation (9.17 g $plant^{-1}$), number of branches $plant^{-1}$ (6.69) and number of nodules $plant^{-1}$ (35.17) at harvest which was remained statistically at par with 20 and 30 kg nitrogen ha^{-1}(Table-1). Further results revealed that the application of phosphorus @ 80 kg ha^{-1} recorded maximum growth parameters *viz*., plant height (9.25 cm), dry matter accumulation (6.73 g $plant^{-1}$) number of branches $plant^{-1}$ (6.73) and number of nodules $plant^{-1}$ (35.27) at harvest over controlbut it was remained statistically at par with application of phosphorus @ 40 and 60 kg ha^{-1} (Table-1). Plant height and dry matter accumulation increased with the application of nitrogen and phosphorus due to increased cell division and cell elongation at higher level of nutrients. Probably the increase in auxin supply with higher levels of nitrogen brought about increase in the dry matter and branches per plant.

The observed improvement might be due to an early and plentiful availability of nitrogen leading to better nutritional environment in the root zone for growth and development. As nitrogen is one of the major essential plant nutrients required for growth (Budige *et al*., 2021 and Somvanshi *et al.,* 2024) [1, 7]. It is obvious that phosphorus has long been considered as an essential constituent of all living organism, which plays an important role in conservation and transfer of energy in metabolic reactions of living cells including biological energy transformations. Phosphorus not only plays an important role in root development and proliferation but also improves nodulation and N fixation by supplying assimilates to the roots. It is the main constituent of co-enzymes, ATP and ADP which act as "energy currency" within plants. Almost every metabolic reaction of any significance proceeds *viz*., phosphate derivatives. Thus, phosphorus influenced photosynthesis, biosynthesis of protein and phospholipids, nucleic acid synthesis, membrane transport and cytoplasmic streaming (Taliman *et al*., 2019 and Shafiqullah *et al*., 2020) [9].

Further yield attributes and yields like number of pods $plant^{-1}$ (25.45), number of seeds pod^{-1} (8.79), seed yield (811 kg ha^{-1}), stover yield (1639 kg ha^{-1}) and biological yield (2450kg ha^{-1}) presented in table 2, recorded with the application of nitrogen@ 40 kg ha^{-1} over control but it was remained statistically at par with 20 and 30 kg nitrogen ha^{-1}. Morever; application of phosphorus @ 80 kg ha^{-1}gave maximum yield attributes and yields like number of pods $plant^{-1}$ (25.48), number of seeds pod^{-1} (8.82), seed yield (817 kg ha^{-1}), stover yield (1642 kg ha^{-1}) and biological yield (2457 kg ha^{-1}) (Table 2). However, test weight and harvest index was found non significant by nitrogen andphosphoruslevels in cowpea. Yield components by enhancing cell division, cell elongation process and photosynthetic activity leading to production and accumulation of more carbohydrates and auxins which favours retention of more flowers ultimately leading to more number of reproductive parts $plant^{-1}$ (Dharwe *et al*., 2019) [2].

Table 1: Effect of nitrogen and phosphorus levels on growth attributes of mungbean

Treatments	Growth attributes			
	Plant height (cm)	Dry matter accumulation (g $plant^{-1}$)	Number of branches $plant^{-1}$	Number of nodules $plant^{-1}$
Nitrogen (kg/ha)				
Control	61.21	7.60	4.85	30.51
20	65.12	8.63	6.38	33.09
30	66.23	8.93	6.47	33.78
40	67.09	9.17	6.69	35.17
SEm±	1.25	0.36	0.19	0.84
CD (P=0.05)	3.75	1.09	0.57	2.52
Phosphorus (kg/ha)				
Control	61.29	7.65	4.92	30.52
40	65.96	8.68	6.39	33.28
60	66.76	8.99	6.50	33.91
80	67.87	9.25	6.73	35.27
SEm±	1.25	0.36	0.19	0.84
CD (P=0.05)	3.75	1.09	0.57	2.52
C.V. (%)	9.24	7.92	10.27	10.89

Table 2: Effect of nitrogen and phosphorus levels on yield attributes, yields and harvest index of mungbean

Treatments	Yield attributes				
	Number of pods/plants	**Number of seeds/pods**	**Seed yield (kg/ha)**	**Straw yield(kg/ha)**	**Biological yield (kg/ha)**
Nitrogen (kg/ha)					
Control	19.10	5.31	506	1171	1787
20	23.57	7.57	689	1515	2204
30	24.94	8.19	717	1531	2248
40	25.45	8.79	811	1639	2450
SEm±	0.80	0.49	20	56	64
CD (P=0.05)	2.42	1.48	59	168	193
Phosphorus (kg/ha)					
Control	19.13	5.65	508	1174	1682
40	23.59	7.83	693	1517	2210
60	24.99	8.34	721	1534	2255
80	25.48	8.82	817	1642	2457
SEm±	0.80	0.49	20	56	64
CD (P=0.05)	2.42	1.48	59	168	193
C.V. (%)	9.29	8.32	8.87	8.34	9.34

Conclusion

Based on the results of one year experimentation, it may be concluded that the Application of 40 kg nitrogen and 80 kg phosphorus ha^{-1} found suitable to produce good yield of mungbean.

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