Rai University AHMEDABAD
RISING - A Journal of Researchers
Bi-Annuals Peer Review Journal
Vol.9 Issue 1 (Jan 2025)
Impact Factor : 5.999
RISING A journal of researchers
ISSN No : 2456-7752

EFFECT OF DIFFERENT SOURCES OF NUTRIENT ON SEED AND STOVER YIELD OF CLUSTERBEAN

1 D. M. Patel, 2 J. M. Patel and 3 K. A. Kachhiyapatel

1 Assistant Professor, RSA, Rai University, Ahmedabad
2 Associate Professor, CPCA, S. D. Agricultural University, Palanpur
3 Assistant Professor, Madhav University, Rajasthan

ABSTRACT:

A field experiment was carried out at the Agronomy Instructional Farm, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during kharif 2019. The experiment consists of eight treatment combinations comprising of two nitrogen sources (urea and ammonium sulphate), two phosphorus sources (diammonium phosphate and single superphosphate) and two levels of biofertilizer (Rhizobium + PSB and no inoculation biofertilizer) were tried in randomized block design with factorial concepts with four replications. Ammonium sulphate recorded 53 and 94 kg/ha higher seed and stover yield, respectively over urea. Between two phosphorus sources, single superphosphate produced 44 and 91 kg/ha higher seed and stover yield, respectively over diammonium phosphate. Seed inoculation with biofertilizer gave 129 and 199 kg/ha higher seed and stover yield, respectively as compared to no seed inoculation.

KEYWORDS: Ammonium sulphate, urea, diammonium phosphate, single superphosphate, biofertilizer, clusterbean.

INTRODUCTION:

Clusterbean, commonly referred to as guar, is a member of the family *Leguminosae* and sub-family *Papilionaceae*. Its botanical name is *Cyamopsis tetragonoloba* (L.) Taubert. According to Gillete (1958) [5], its origin is traced to 'Tropical Africa.' This drought-resistant leguminous crop is well-suited to dry farming areas, although it is sensitive to excessive moisture and waterlogging. Clusterbean is primarily grown in arid and semi-arid regions. In India, it is cultivated on approximately 20.1 lakh hectares, yielding 13.3 lakh tonnes with an average productivity of 644 kg per hectare. The country contributes about 80% of the global guar production (Anonymous, 2017) [1]. Fertilizers play a pivotal role in enhancing agricultural productivity. Over the past few decades, their application has proven to be one of the most effective strategies for improving crop yields, particularly in conjunction with improved crop varieties and irrigation practices. Nitrogen is a key nutrient for plant growth and development, with legumes obtaining a significant portion of their nitrogen through biological fixation by *Rhizobium* bacteria. However, nitrogen availability can also be supplemented through manual inoculation or the application of commercial nitrogen fertilizers. Ammonium sulphate, which provides 24% nitrogen, is particularly beneficial as it does not easily leach into the environment. Additionally, it contains 24% sulphur, which is readily available for plant uptake. Phosphorus, the second most essential nutrient after nitrogen, is vital for energy transfer and metabolic processes in plants. It plays a critical role in root development and crop yield, especially in legumes. Single superphosphate (16% P_2O_5) enhances root growth and nutrient absorption and supports nitrogen fixation by promoting the development of root nodules. Furthermore, it supplies 11% sulphur and 21% calcium, which are beneficial for plant health. Biological inputs like *Rhizobium* bacteria, which fix atmospheric nitrogen in association with legumes, and phosphate-solubilizing bacteria (PSB), which release soil-bound phosphorus through organic acid secretion, are valuable for enhancing nutrient availability (Kalayu, 2019) [6]. Despite their importance, limited information is available on the effects of various nutrient sources on clusterbean production. Therefore, this study aims to evaluate the impact of different nutrient sources on the productivity of clusterbean.

MATERIALS AND METHODS:

A field experiment was carried out during the *kharif* season of 2019 to study the influence of different nitrogen sources, phosphorus sources, and biofertilizers on the growth, yield attributes, and productivity of clusterbean. The study was conducted at the Agronomy

Instructional Farm of Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar. The experiment included eight treatment combinations, involving two nitrogen sources (urea and ammonium sulphate), two phosphorus sources (diammonium phosphate and single superphosphate), and two biofertilizer treatments (seed treated with a combination of *Rhizobium* and phosphate-solubilizing bacteria (PSB) versus untreated seeds). The treatments were arranged in a randomized block design (RBD) with a factorial layout and replicated four times. The experimental soil was loamy sand with a slightly alkaline pH and safe levels of soluble salts. It was characterized as low in available nitrogen, medium in available phosphorus (P_2O_5), and high in potassium (K_2O). The clusterbean variety *Gujarat Clusterbean 2* was chosen for the trial. A uniform dose of nitrogen (20 kg/ha) and phosphorus (40 kg/ha) was applied using the respective treatment sources. Seeds were treated with *Rhizobium* and PSB cultures at the rate of 5 ml per kilogram of seed for the relevant treatments. Sowing was performed during the first week of July 2019, adhering to a recommended seed rate of 17.5 kg/ha, with a row spacing of 45 cm. Agronomic practices were followed according to standard recommendations for clusterbean cultivation. Observations on growth and yield attributes were recorded from five randomly selected plants per plot, excluding border rows. The seed and stover yields were measured from the net plot area. Statistical analysis of the data was performed following the methodology described by Steel and Torrie (1980) [17].

RESULTS AND DISCUSSION:

Effect of Different Nitrogen Sources

The use of different nitrogen sources showed no significant influence on plant population at 30 days after sowing (DAS) or at harvest, as well as on pod length and the number of seeds per pod (Table 1). However, applying nitrogen through ammonium sulphate resulted in significantly greater plant height (98.03 cm), a higher number of branches per plant (5.89), and an increased number of pods per plant (30.04) compared to urea. This could be attributed to higher ammonia volatilization losses associated with urea, whereas ammonium sulphate provided sulphur, which contributed to better plant growth. These findings align with those reported by Gendy et al. (2013) [4] for clusterbean and by Marwa et al. (2018) [9] and Ramdevputra et al. (2010) [12] for cowpea. Nitrogen application through ammonium sulphate also significantly enhanced the 100-seed weight (2.85 g), seed yield (873 kg/ha), and stover yield (1424 kg/ha) compared to urea. The increase in seed and stover yield with ammonium sulphate was 6.47% and 7.07%, respectively, over urea. This improvement could be due to better nitrogen availability from ammonium sulphate and the role of sulphur in energy transfer, enzyme activation, and carbohydrate metabolism. These results are consistent with the findings of Marwa et al. (2018) [9] in cowpea and Gendy et al. (2013) [4] in clusterbean.

Effect of Different phosphorus Sources

The data (Table 1) indicated that the use of different phosphorus sources did not significantly affect plant population at 30 days after sowing (DAS) or at harvest, pod length, or the number of seeds per pod. However, applying phosphorus through single superphosphate (SSP) resulted in significantly greater plant height (98.09 cm), a higher number of branches per plant (5.87), and an increased number of pods per plant (29.98) compared to diammonium phosphate (DAP). The superior performance of SSP can be attributed to its higher calcium and sulphur content and the better water solubility of its phosphorus compounds. These findings align with studies by Khaswa et al. (2014) [7] in soybean, Nadeem et al. (2017) [10] in cowpea, and Singh et al. (2015) [15] in mungbean. Furthermore, the maximum 100-seed weight (2.85 g), seed yield (868 kg/ha), and stover yield (1422 kg/ha) were observed with phosphorus application through SSP. Compared to DAP, SSP application resulted in a 5.34% increase in seed yield and a 6.84% increase in stover yield. This could be due to improved plant growth and development as a result of the enhanced phosphorus and sulphur availability, which likely facilitated greater nutrient uptake and increased the supply of assimilates to seeds, ultimately improving seed weight. These results are consistent with those reported by Devi et al. (2012) [3] in soybean and Singh et al. (2015) [15] in mungbean.

Effect of Bio-fertilizer

Seed inoculation with biofertilizers (*Rhizobium* + PSB) resulted in significantly higher values for plant population at 30 days after sowing (DAS) and at harvest, plant height (99.92 cm), number of branches per plant (6.08), number of pods per plant (30.21), pod length (5.71 cm), and the number of seeds per pod (6.29) compared to treatments without biofertilizer inoculation (Table 1). The enhanced performance can be attributed to the ability of *Rhizobium* to fix atmospheric nitrogen and the role of phosphate-solubilizing bacteria (PSB) in producing growth hormones, improving root efficiency, and increasing phosphorus availability. These findings are consistent with the studies of Rathore et al. (2007) [13], Patel et al. (2010) [11], and Kumhar et al. (2012) [8]. In addition, seed inoculation with biofertilizers significantly improved 100-seed weight (2.86 g), seed yield (911 kg/ha), and stover yield (1476 kg/ha). The treatment with biofertilizers showed a 16.5% increase in seed yield and a 15.68% increase in stover yield compared to non-inoculated seeds. This improvement can be attributed to the critical role of biofertilizers in regulating metabolic and enzymatic processes, including photosynthesis, respiration, and nitrogen fixation through the legume-*Rhizobium* symbiotic relationship, ultimately leading to better seed weight, seed yield, and stover yield. These results align with those reported by Rathore et al. (2007) [13], Kumhar et al. (2012) [8], Singh et al. (2014) [16], Brar and Singh (2016) [2], Singh et al. (2016) [14], and Sharma et al. (2018) in clusterbean studies.

CONCLUSION:

Based on the results of the present study, it can be concluded that higher yield and net realization can be secured from kharif clusterbean crop by application of recommended dose of nitrogen through ammonium sulphate; phosphorus through single superphosphate and seed inoculation with biofertilizer (Rhizobium + PSB).

REFERENCES:

1. Anonymous. Total cultivated area, production and yield data of clusterbean in India. Department of Agriculture and Co-operation, New Delhi, India, 2017.
2. Brar SK, Singh P. Response of clusterbean (Cyamopsis tetragonoloba L. Taub.) cultivars to dual inoculation with fixing and phosphorous solubilizing bacteria. Legume Research. 2016;40(1):100-104.
3. Devi KN, Khomba Singh NL, Devi TS, Devi HN, Singh TB, Singh KK, et al. Response of soybean [Glycine max (L.)Merrill] to sources and levels of phosphorus. Journal of Agricultural Science. 2012;4(6):44-53.
4. Gendy ASH, Said-Al Ahl HAH, Mahmoud AA, Mohamed HFY. Effect of nitrogen sources, bio Fertilizers and their interaction on the growth, seed yield and chemical composition of guar plants. Life Science Journal. 2013;10(3):389-402.
5. Gillete JB. Indigofera (Microcharis) in tropical Africa with the related genera Cyamopsis and Rhyncotropis. Kew Bull Add Ser. 1958;1:1-66.
6. Kalayu G. Phosphate Solubilizing Microorganisms: Promising Approach as Biofertilizers. International Journal of Agronomy. 2019;19:1-7.
7. Khaswa SL, Dubey RK, Singh S, Tiwari RC. Growth, Productivity and quality of soybean (Glycine max L. Merrill) under the different level and sources of phosphorus and plant growth regulators in sub humid Rajasthan. African Journal of Agricultural Research. 2014;9(12):1045-1051.
8. Kumhar MK, Patel IC, Ali S. Integrated nutrient management in clusterbean (Cyamopsis tetragonoloba L. Taubert). Legume Research. 2012;35(4):350-353.
9. Marwa AA, EI-Agyzy FHA, Khaled AS. Influence of nitrogen sources and biofertilizer on soil nutrients, yield and quality of cowpea under saline soil conditions. Asian Soil Research Journal. 2018;1(4):1-14.
10. Nadeem MA, Singh V, Dubey RK, Pandey AK, Singh B, Kumar N, et al. Influence of phosphorus and biofertilizers on growth and yield of cowpea genotypes [Vigna unguiculata (L.) Walp] in acidic soil of NEH region of India. Legume Research. 2017;8(41):1-4.
11. Patel CS, Patel JB, Suthar JV, Patel PM. Effect of integrated nutrient management on clusterbean [Cyamopsis tetragonoloba (L.) Taub] seed production cv. PUSA NAVBAHAR. International Journal of Agricultural Sciences. 2010;6(1):206-208.

12. Ramdevputra MV, Akbari KN, Sutaria GS, Vora VD, Padmani DR. Effect of sulphar application on yield of groundnut and soil fertility under rainfed conditions. Legume Research. 2010;33(2):143-145.
13. Rathore VS, Singh JP, Soni ML, Beniwal RK. Effect of nutrient management on growth, productivity and nutrient uptake of rainfed clusterbean (Cyamopsis tetragonoloba L.) in arid region. Indian Journal of Agriculture Sciences. 2007;77(6):349-356.
14. Singh G, Choudhary P, Meena B, Rawat R, Jat BL. Integrated nutrient management in blackgram under rainfed condition. International Journal of Recent Scientific Research. 2016;7(10):13875-13894.
15. Singh K, Manohar RS, Choudhary R, Yadav AK, Sangwan A. Response of different sources and levels of phosphorus on yield, nutrient uptake and net returns on mungbean under rainfed condition. Agricultural Science Digest. 2015;35(4):263-268.
16. Singh A, Jat NL, Singh R, Pal S, Singh AK, Gudade BA. Effect of fertility levels and bio-inoculants on growth, productivity and economics of clusterbean (Cyamopsis tetragonoloba). Indian Journal of Agricultural Sciences. 2014;84(6):784-6.
17. Steel GD, Torrie JH. Principles and procedure of statistics. Second edition McGraw Hill Book Co., New Delhi, 1980.

Rai University AHMEDABAD
RISING - A Journal of Researchers
Bi-Annuals Peer Review Journal
Vol.9 Issue 1 (Jan 2025)
Impact Factor : 5.999
RISING A journal of researchers
ISSN No : 2456-7752

Table 1: Growth, yield attributes and yield of clusterbean as influenced by nutrient sources and biofertilizer

Treatments	Plant population per meter row length		Plant height (cm)	No. of branches plant-1	Pod length (cm)	No. of pods plant-1	Number of seeds pod-1	100 seed weight (g)	Seed yield (kg/ha)	Stover yield (kg/ha)
	30 DAS	At harvest								
Nitrogen Sources										
Urea	9.97	8.54	92.92	5.54	5.84	28.14	6.08	2.80	820	1330
Ammonium sulphate	10.13	8.85	98.03	5.89	5.57	30.04	6.20	2.85	873	1424
S.Em+/-	0.17	0.15	1.65	0.10	0.1	0.54	0.10	0.01	14	31
CD (P=0.005)	NS	NS	4.85	0.31	NS	1.60	NS	0.04	40	91
Phosphorus Sources										
Urea	10.01	8.56	93.14	5.56	5.45	28.20	6.10	2.80	824	1331
Ammonium sulphate	10.10	8.82	98.09	5.87	5.60	29.98	6.17	2.85	868	1422
S.Em+/-	0.17	0.15	1.65	0.10	0.10	0.54	0.10	0.01	14	31
CD (P=0.005)	NS	NS	0.31	0.31	NS	1.60	NS	0.04	40	91
Bio-fertilizer										
Urea	10.31	8.94	99.92	6.08	5.71	30.21	6.29	2.86	911	1476
Ammonium sulphate	9.80	8.45	91.31	5.35	5.34	27.97	5.98	2.79	782	1277
S.Em+/-	0.17	0.15	1.65	0.10	0.10	0.54	0.10	0.01	14	31
CD (P=0.005)	0.51	0.45	4.85	0.31	0.29	1.60	0.29	0.04	40	91
C. V.%	6.90	7.04	6.90	7.28	7.14	7.46	6.53	2.16	6.14	8.95