The Pharma Innovation Journal 2022; 11(9): 2495-2499

www.ThePharmaJournal.com

The Pharma Innovation

**ISSN (E): 2277-7695**
**ISSN (P): 2349-8242**
**NAAS Rating: 5.23**
TPI 2022; 11(9): 2495-2499

www.thepharmajournal.com
Received: 01-06-2022
Accepted: 07-07-2022

**AH Sipai**
Associate Research Scientist
Regional Research Station,
S.D. Agricultural University,
Bhachau, Kachchh, Gujarat,
India

**NN Damor**
Associate Research Scientist
Regional Research Station,
S.D. Agricultural University,
Bhachau, Kachchh, Gujarat,
India

**Ashok Chuadhary**
Associate Research Scientist
Regional Research Station,
S.D. Agricultural University,
Bhachau, Kachchh, Gujarat,
India

**KC Addangadi**
Associate Research Scientist
Regional Research Station,
S.D. Agricultural University,
Bhachau, Kachchh, Gujarat,
India

**Corresponding Author:**
**AH Sipai**
Associate Research Scientist
Regional Research Station,
S.D. Agricultural University,
Bhachau, Kachchh, Gujarat,
India

# Effect of different treatments on growth, yield attributes and yields of Mothbean (*Vigna aconitifolia* L.) under light textured soil of Kachchh region

## AH Sipai, NN Damor, Ashok Chuadhary and KC Addangadi

**Abstract**
A field experiment was conducted at Regional Research Station, S. D. Agricultural University, Bhachau, Kachchh to study the effect of different treatments on growth, yield attributes and yields of Mothbean during Kharif season of 2017-18, 2019-20 and 2020-21. These were eighteen treatments comprising of two FYM levels [0 t/ha ($F_0$) and 2.5 t/ha ($F_1$) combined with three phosphorus levels [0 kg $P_2O_5$/ha ($P_0$), 20 kg $P_2O_5$/ha ($P_1$) and 40 kg $P_2O_5$/ha ($P_2$)] along with three levels of nitrogen [0 kg N/ha ($N_0$), 20 kg N/ha ($N_1$) and 40 kg N/ha ($N_2$)]. Phosphorus applied in the form of PROM and nitrogen in form of urea. The experiment was laid out in factorial RBD with three replications. Growth parameters, yield attributes, seed and stover yields of moth bean were significantly increased by the FYM, phosphorus and nitrogen treatments. The increased in seed yield due to $F_1$ over $F_0$ (698 kg/ha) increased in seed yield by 13.46%. The treatment $P_2$ and $P_1$ over $P_0$ (776 kg/ha) was 21.92 and 13.51%, respectively and treatment $N_2$ and $N_1$ over $N_0$ (783 kg/ha) was increased 23.35 and 10.93, respectively. Similar trend in stover yield was noted by FYM, phosphorus and nitrogen treatments. The interaction of P X N effect was significant on seed yield and stover yield indicate that nutrient use efficiency of P was higher when phosphorus was applied along with organic FYM @ 2.5 t/ha and nitrogen @ 20 kg N/ha.

**Keywords:** Yields, yield attributes, FYM, phosphorus and nitrogen etc.

## Introduction
Mothbean is one of the important legumes widely grown in arid and semiarid parts of the country. Mothbean are a good source of protein (24%) and are high in dietary fibers. In India it is mostly confined to Gujarat, Karnataka, Rajasthan, Maharashtra and Haryana. In Gujarat Kachchh is the largest district and covers one third part of the Gujarat. Pulses are becoming major crops growing under Kachchh region. Compared to other parts of Gujarat, Kachchh contains highest amount of degraded lands. Main cause for the degradation of land are the arid and semi-arid climatic condition, salinization, alkalinization, light texture soil with low organic carbon content and poor water holding capacity. The soils of arid and semi-arid regions have very low inherent productivity potential due to physical and nutritional constraints and are highly vulnerable to various degradation processes. Mothbean is minor *Kharif* pulse crop and considered as one of the most drought tolerant among the grain legumes (Arunakumar and Uppar, 2007) [1].
Yields of Mothbean are much less as compared to other pulse crops. Hence, FYM is known to play an important role in improving the fertility and productivity of soils through its positive effects on soil physical, chemical and biological properties and balanced plant nutrition. It improves the structure and water holding capacity of soil (Kumar *et al.* 2011) [2].
Phosphorus is one of the most needed elements for pulses production. Phosphorus, although not required in large quantities, is critical to Mothbean yield because of its multiple effects on nutrition. Phosphorus plays a key role in various physiological processes like root growth and dry matter production, nodulation and nitrogen fixation and also in metabolic activates especially in protein synthesis (Patel *et al.* 2019) [8].
The nitrogen fixing ability of common bean in association with rhizobia is often characterized as poor compared to other legumes and nitrogen fertilizers are commonly used in bean production to achieve high yields (Reinprecht *et al.* 2020) [10].
Hence the present study on effect of different modules on yield and yield attributes of Mothbean grown on light textured soil of Kachchh region was under taken.

**Material and Methods**

The experiment was conducted at Regional Research Station, S. D. Agricultural University, Bhachau, Kachchh to study the effect of different treatments on growth, yield attributes and yields of Mothbean during *Kharif* season of 2017-18, 2019-20 and 2020-21. The soil was sandy loam and low in organic matter. The soil pH was 8.03 and having organic carbon (0.27%), available nitrogen (172.48 kg $ha^{-1}$) and available phosphorus (36.60 kg $ha^{-1}$) and medium in potassium (308.40 kg $ha^{-1}$). Total eighteen treatment combinations comprising of all possible treatments of two levels of FYM *viz.,* $F_0$ (0 t/ha) and $F_1$ (2.5 t/ha), three levels of phosphorus *viz.,* $P_0$ (0 kg $P_2O_5$/ha), $P_1$ (20 kg $P_2O_5$/ha) and $P_2$ (40 kg $P_2O_5$/ha) and three levels of nitrogen *viz.*, $N_0$ (0 kg N/ha), $N_1$ (20 kg N/ha) and $N_2$ (40 kg N/ha) were tested in factorial RBD with three replications. Moth bean variety $GMO^{-2}$ was sown by opening furrow at distance of 45 cm. the full dose of fertilizers was applied according to the treatments manually before sowing the seeds. Phosphorus and nitrogen were applied in form of PROM and urea, respectively. All the recommended cultural practices and plant protection measures were followed throughout the experimental periods.

**Results and Discussion**

The results obtained from the present investigation as well as relevant discussion have been summarized under following headings.

**Effect of FYM**

The growth parameters *viz.,* plant height (32.11 cm) and number of branches per plant (3.84) showed significant improvement with application of FYM @ 2.5 t/ha ($F_1$) in pooled results (Table 1). It might be due to application of FYM supplied all essential nutrients, growth hormones and enzymes to plant, which favours rapid cell division and ultimately results into better growth plant. These results are in collaborated with research findings reported by Arunakumar and Uppar (2007) [1], Patel *et al.* (2019) [8], Patel *et al.* (2020) [7] and Ruheentaj *et al.* (2020) [12].

It is evident from the data presented in Table 1 that significantly higher number of pods per plant (17.26), number of seeds per pod (8.07) were obtained with application of FYM @ 2.5 t/ha ($F_1$) on pooled data basis. FYM application might have increased the efficiency of added chemical fertilizer in soil, activity of N fixing bacteria and increased rate of humification. Humic acid in FYM might have enhanced the availability of both native and added nutrients in soil and as a result improved growth and yield of crop significantly. FYM also supply phosphorus which increased availability of phosphorus in soil, being a major structural element of cell and helped in cell elongation greater availability of photosynthates, metabolites and nutrients to develop reproductive structures which ascribed to increased growth parameters and lead to higher yield attributes and yields of mothbean crop. These results are conformity with those reported by Arunakumar and Uppar (2007) [1], Patel *et al.* (2019) [8], Patel *et al.* (2020) [7] and Ruheentaj *et al.* (2020) [12].

Significantly higher grain yield (918, 761, 695 and 792 kg/ha) and stover yield (1536, 1461, 1404 and 1467 kg/ha) were reported with incorporation of FYM @ 2.5 t/ha ($F_1$) during 2017-18, 2019-20, 2020-21 and in pooled results, respectively (Table 3). This increment attributed to amplified growth probably as a consequence of effective use of nutrients absorbed through ramified root system and productive shoot growth due to amended nourishment through organics fertilization and it also might be due to application of organics which improves the physicochemical and biotic properties of soil which in turn benefited plants by providing balanced nutrition to crop as and when needed which helped in production of a greater number of yield parameters and ultimately increased the Mothbean yield. These results are conformity with those reported by Arunakumar and Uppar (2007) [1], Chaudhari *et al.* (2016) [2], Patel *et al.* (2019) [8], Patel *et al.* (2020) [7], Rekha *et al.* (2018) [11] and Ruheentaj *et al.* (2020) [12].

**Effect of phosphorus**

Close examined of data (Table 1) indicated that application of 40 kg $P_2O_5$/ha ($P_2$) produced significantly higher growth parameter *viz.,* plant height (32.78 cm) and number of branches per plant (3.82) in moth bean on the basis of pooled results. The increase in plant growth could be attributed to better proliferation of roots and increased nodulation due to higher phosphorus availability. Phosphorus also promotes formation of new cells, cell elongation, plant vigor and hasten the leaf development, which helps in harvesting more solar energy, better utilization of nitrogen which in turn leads to higher plant growth in moth bean. These results are in close agreement with those of Meena *et al.* (2010) [6], Singh *et al.* (2017) [14], Patel *et al.* (2019) [8], Patel *et al.* (2020) [7] and Ruheentaj *et al.* (2020) [12].

The data tabulated in Table 1 revealed that significantly higher number of pods per plant (17.38) and number of seeds per pod (8.13) were obtained with application of 40 kg $P_2O_5$/ha ($P_2$) on the basis of pooled data. Increase in yield attributes might be due to excess assimilates stored in the leaves and later it translocated into seeds at the time of senescence. Phosphorus application not only plays a vital role in root development and proliferation, but also improves nodulation and nitrogen fixation by supplying assimilates to roots. These results are conformity with those reported by Arunakumar and Uppar (2007) [1], Patel *et al.* (2019) [8], Patel *et al.* (2020) [7] and Ruheentaj *et al.* (2020) [12].

Among different phosphorus levels, the higher seed yield (942, 781, 714 and 812 kg/ha) and stover yield (1585, 1507, 1451 and 1514 kg/ha) were noticed with the supply of phosphorus @ 40 $P_2O_5$ kg/ha ($P_2$) during 2017-18, 2019-20, 2020-21 and in pooled results, respectively (Table 3). The reason to such stimulating effect of phosphorus may be assigned to the fact that phosphate is a constitutes of many intermediates products of legumes crop and considered as an essential constituents of all living organisms and plays an important role in conservation and transfer of energy in metabolic reactions of living cells including biological energy transformations. Thus, application of increasing levels of phosphorus may have enhanced cell division, root elongation and proliferation of roots. Thereby more absorption of nutrients and moisture from deeper layer of soil could have taken place. Several reports indicated that cell division is increased with application of phosphorus, as a result of which growth is enhanced in legumes. These findings are in concordant with Arunakumar and Uppar (2007) [1], Meena *et al.* (2010) [6], Kumar *et al.* (2012) [5], Patel *et al.* (2013) [9], Singh *et al.* (2017) [14], Patel *et al.* (2019) [8] and Patel *et al.* (2020) [7].

**Effect of sources of nitrogen**

The results (Table 1) revealed plant height (32.78 cm) and number of branches per plant (3.99) showed significant improvement with application of nitrogen @ 40 kg N/ha ($N_2$) on the pooled data basis. It might be due to basal application of urea supplies nitrogen, growth hormones and enzymes to plant, which favours rapid cell division and ultimately results into better growth of plant. These results are in close agreement with those of Patel *et al.* (2020) [7].

Significantly higher number of pods per plant (17.45) and number of seeds per pod (8.16) were reported with application of nitrogen @ 40 kg N/ha ($N_2$) from urea in pooled results (Table 1). This increment was attributed to increased photosynthetic rate and increased translocation of photosynthate to sink. These findings are in concordant with Trivedi (1996) [15] in black gram Saraswathy *et al.* (2004) [13] in green gram and Indoria and Majumdar (2007) [3] in cowpea.

It is evident from the data presented in Table 3 that significantly higher seed yield (955, 794, 725 and 824 kg/ha) and stover yield (1586, 1510, 1448 and 1515 kg/ha) were obtained with application of nitrogen @ 40 kg N/ha ($N_2$) from urea during 2017-18, 2019-20, 2020-21 and in pooled results, respectively. This increment was attributed due to supply of nitrogen and phosphorus, resulted in amplified photosynthetic activity and helps to develop a ramified root system and thus empowers the plant to withdraw extra water and nutrient from deeper layers, resulted in better growth and yield attributes. Present results are in concordant with the finding of Trivedi (1996) [15] in black gram Saraswathy *et al.* (2004) [13] in green gram and Indoria and Majumdar (2007) [3] in cowpea.

**Interaction effect**

Data presented in Table 2 revealed that treatment combination of $P_2N_2$ (40 kg $P_2O_5$/ha with 40 kg N/ha) recorded significantly the higher plant height (35.40 cm) as compaired to rest of the treatment combinations but it was at par with $P_1N_2$ (33.66 cm) and $P_2N_1$ (34.00 cm) during in pooled results. Also data presented in Table 4 and 5 revealed that treatment combination of $P_2N_2$ (40 kg $P_2O_5$/ha with 40 kg N/ha) recorded significantly the higher seed yield (905 kg/ha) and stover yield (1699 kg/ha) as compaired to rest of the treatment combinations but it were at par with $P_1N_2$ (851 and 1577 kg/ha) and $P_2N_1$ (844 and 1600 kg/ha) seed and stover yields, respectively during in pooled results. This increment was attributed due to favourable influence of combined application of mannures and fertilizers in sink component resulted to improve development of the plants in relations of growth parameters (plant height), seed yield and stover yield on account of balanced nutrition and synergistic influence of combined incorporation as contract to control. Present findings were in accordance with the study conducted by Patel *et al.* (2019) [8] and Ruheentaj *et al.* (2020) [12]

**Table 1:** Growth parameters and yield attributes of moth bean as influenced by different treatments (Pooled results)

| Treatment | Plant height (cm) | Number of branches per plant | Number of pods per plant | Number of seeds per pod |
|---|---|---|---|---|
| **FYM** | | | | |
| $F_0$ | 29.04 | 3.67 | 15.85 | 7.42 |
| $F_1$ | 32.11 | 3.84 | 17.26 | 8.07 |
| S.Em.± | 0.40 | 0.03 | 0.22 | 0.09 |
| C.D. at 5% | 1.12 | 0.09 | 0.61 | 0.26 |
| **Phosphorus** | | | | |
| $P_0$ | 28.01 | 3.69 | 15.44 | 7.22 |
| $P_1$ | 30.93 | 3.75 | 16.84 | 7.88 |
| $P_2$ | 32.78 | 3.82 | 17.38 | 8.13 |
| S.Em.± | 0.49 | 0.04 | 0.27 | 0.11 |
| C.D. at 5% | 1.37 | NS | 0.74 | 0.31 |
| **Nitrogen** | | | | |
| $N_0$ | 28.28 | 3.43 | 15.58 | 7.29 |
| $N_1$ | 30.66 | 3.84 | 16.63 | 7.78 |
| $N_2$ | 32.78 | 3.99 | 17.45 | 8.16 |
| S.Em.± | 0.49 | 0.04 | 0.27 | 0.11 |
| C.D. at 5% | 1.37 | 0.11 | 0.74 | 0.31 |
| **FxP** | | | | |
| S.Em.± | 0.69 | 0.06 | 0.38 | 0.16 |
| C.D. at 5% | NS | NS | NS | NS |
| **FxN** | | | | |
| S.Em.± | 0.69 | 0.06 | 0.38 | 0.16 |
| C.D. at 5% | NS | NS | NS | NS |
| **PxN** | | | | |
| S.Em.± | 0.844 | 0.07 | 0.459 | 0.193 |
| C.D. at 5% | 2.369 | NS | NS | NS |
| **FxPxN** | | | | |
| S.Em.± | 1.19 | 0.10 | 0.65 | 0.27 |
| C.D. at 5% | NS | NS | NS | NS |
| YxT | NS | | | |
| C.V. % | 11.72 | 7.65 | 11.77 | 10.56 |

**Table 2:** Combined effect of phosphorus and nitrogen on plant height (cm) of moth bean (Pooled results)

| Plant height (cm) Pooled | | | | |
|---|---|---|---|---|
| | **$P_0$** | **$P_1$** | **$P_2$** | **Mean** |
| $N_0$ | 27.02 | 28.87 | 28.94 | 28.28 |
| $N_1$ | 27.74 | 30.25 | 34.00 | 30.66 |
| $N_2$ | 29.28 | 33.66 | 35.40 | 32.78 |
| Mean | 28.01 | 30.93 | 32.78 | |
| S.Em.± 0.84 | | C.D. at 5% 2.369 | | |

**Table 3:** Seed yield and stover yield of moth bean as influenced by different treatments

| **Treatment** | **Seed yield (kg/ha)** | | | | **Stover yield (kg/ha)** | | | |
|---|---|---|---|---|---|---|---|---|
| | **2017-18** | **2019-20** | **2020-21** | **Pooled** | **2017-18** | **2019-20** | **2020-21** | **Pooled** |
| **FYM** | | | | | | | | |
| $F_0$ | 815 | 670 | 608 | 698 | 1317 | 1245 | 1190 | 1251 |
| $F_1$ | 918 | 761 | 695 | 792 | 1536 | 1461 | 1404 | 1467 |
| S.Em.± | 17 | 20 | 20 | 11 | 53 | 46 | 40 | 27 |
| C.D. at 5% | 49 | 57 | 59 | 31 | 153 | 133 | 116 | 76 |
| **Phosphorus** | | | | | | | | |
| $P_0$ | 776 | 640 | 582 | 666 | 1236 | 1176 | 1124 | 1179 |
| $P_1$ | 881 | 726 | 660 | 756 | 1458 | 1376 | 1317 | 1384 |
| $P_2$ | 942 | 781 | 714 | 812 | 1585 | 1507 | 1451 | 1514 |
| S.Em.± | 21 | 24 | 25 | 14 | 65 | 57 | 49 | 33 |
| C.D. at 5% | 61 | 69 | 72 | 38 | 187 | 163 | 142 | 93 |
| **Nitrogen** | | | | | | | | |
| $N_0$ | 783 | 640 | 581 | 668 | 1265 | 1189 | 1137 | 1197 |
| $N_1$ | 861 | 713 | 649 | 741 | 1428 | 1360 | 1306 | 1365 |
| $N_2$ | 955 | 794 | 725 | 824 | 1586 | 1510 | 1448 | 1515 |
| S.Em.± | 21 | 24 | 25 | 14 | 65 | 57 | 49 | 33 |
| C.D. at 5% | 61 | 69 | 72 | 38 | 187 | 163 | 142 | 93 |
| **FxP** | | | | | | | | |
| S.Em.± | 30 | 34 | 35 | 19 | 92 | 80 | 70 | 47 |
| C.D. at 5% | NS | NS | NS | NS | NS | NS | NS | NS |
| **FxN** | | | | | | | | |
| S.Em.± | 30 | 34 | 35 | 19 | 92 | 80 | 70 | 47 |
| C.D. at 5% | NS | NS | NS | NS | NS | NS | NS | NS |
| **PxN** | | | | | | | | |
| S.Em.± | 36 | 42 | 43 | 24 | 113 | 98 | 85 | 57 |
| C.D. at 5% | NS | NS | NS | 66 | NS | NS | NS | 161 |
| **FxPxN** | | | | | | | | |
| S.Em.± | 52 | 59 | 61 | 33 | 159 | 139 | 121 | 81 |
| C.D. at 5% | NS | NS | NS | NS | NS | NS | NS | NS |
| YxT | NS | | | | NS | | | |
| C.V. % | 10.31 | 14.34 | 16.33 | 13.39 | 19.36 | 17.78 | 16.11 | 17.92 |

**Table 4:** Combined effect of phosphorus and nitrogen on seed yield (kg/ha) of Mothbean (Pooled results)

| | **$P_0$** | **$P_1$** | **$P_2$** | **Mean** |
|---|---|---|---|---|
| $N_0$ | 629 | 687 | 688 | 668 |
| $N_1$ | 651 | 728 | 844 | 741 |
| $N_2$ | 717 | 851 | 905 | 824 |
| Mean | 666 | 756 | 812 | |
| S.Em.± 23.51 | | C.D. at 5% 65.93 | | |

**Table 5:** Combined effect of phosphorus and nitrogen on stover yield (kg/ha) of moth bean (Pooled results)

| | **$P_0$** | **$P_1$** | **$P_2$** | **Mean** |
|---|---|---|---|---|
| $N_0$ | 1108 | 1238 | 1244 | 1197 |
| $N_1$ | 1159 | 1335 | 1600 | 1365 |
| $N_2$ | 1269 | 1577 | 1699 | 1515 |
| Mean | 1179 | 1384 | 1514 | |
| S.Em.± 57.38 | | C.D. at 5% 160.95 | | |

## Conclusion

On the basis of present results, it could be concluded that for securing the higher growth parameters, yield attributes, seed yield and straw yield from *Kharif* Mothbean cultivation (cv. GMO[2]), the crop should be fertilized with FYM @ 2.5 t/ha with 40 kg $P_2O_5$/ha through PROM and 20 kg N/ha from urea under light textured soil of Kachchh region.

## References


1. Arunakumar SH, Uppar DS. Influence of integrated nutrient management on seed yield and quality of mothbean. Karnataka J Agric. Sci. 2007;20(2):394-396.
2. Chaudhari S, Thanki JD, Chaudhari V, Verma C Yield attributes, yield and quality of black greengram (*Vigna radiata* L.) as influenced by organic manures, biofertilizer and phosphorus fertilization. The Bio Scan. 2016;11(1):431-433.
3. Indoria AK, Majumdar SP. Effect of combined application of nitrogen and phosphorus on the performance of cowpea [*Vigna unguiculata* (L.) Walp.] crop on the Typic ustipsamments. Forage Research. 2007;33(2):122-124.
4. Kumar ABM, Gowda NCN, Shetty GR, Karthik MN. Effect of organic manures and inorganic fertilizers on available NPK, microbial density of the soil and nutrient uptake of brinjal. Research J Agricultural science. 2011;2(2):304-307.
5. Kumar R, Singh YV, Singh S, Latare AM, Mishra PK, Supriya. Effect of phosphorus and sulphur nutrition on yield attributes, yield of mungbean (*Vigna radiata* L. Wilczek). Journal of Chemical and Pharmaceutical Research. 2012;4(5):2571-2573.
6. Meena BL, Pareek BL, Kumar, R. Singh AK. Response of Mothbean (*Vigna aconitifolia*) cultivars on different levels of phosphorus. Environment and Ecology. 2010;28(4A):2614-2617.
7. Patel B K, Patel HK, Makawana SN, Shiyal VN Chotaliya RL. Effect of various sources of nitrogen and phosphorus on growth, yield and economics of summer green gram (*Vigna radiate* L. Wilczek). International Journal of Current Microbiology and applied Sciences. 2020;11:745-752.
8. Patel BN, Patel KH, Singh N, Shrivastava A. Effect of phosphorus, FYM and Bio-fertilizer on growth, yield attribute, yield and quality of summer green gram (*Vigna radiate* L.). Journal of Pharmacognosy and Phytochemistry. 2019;8(5):1108-1112.
9. Patel HR, Patel HF, Maheriya VD, Dodia IN. Response of kharif greengram (*Vigna radiata* L. Wilczek) to sulphur and phosphorus fertilization with and without bio fertilizer application. The Bio scan. 2013;8(1):149-152.
10. Reinprecht Y, Schram L, Marsolais F, Smith TH, Hill B Pauls KP. Effect of nitrogen application on nitrogen fixation in common bean production. Plant Science. 2020;11(1):1172
11. Rekha K, Pavaya RP, Malav JK, Chaudhary N, Patel IM, Patel JK. Effect of FYM, phosphorus and PSB on yield, nutrient content and uptake by greengram (*Vigna radiata* (L.) Wilckzek) on loamy sand. Indian Journal of Chemical Studies. 2018;(2):1026-1029.
12. Ruheentaj, Vidhyarthi GY, Sarawad IM, Surakod VS. Response of Mothbean (*Vigna acontifolia*) to different levels of fertilizers and organic manures in shallow black soils of northern dry zone, Karnataka. International Journal of Current Microbiology and applied Sciences. 2020;10:660-667.
13. Saraswathy R, Krishnasamy R, Singhara P. Nutrient management for rainfed green gram (*Vigna radiata*). Madras Agric. Journal. 2004;91(4-6):230-233.
14. Singh S, Gupta V, Singh SP, Yadava NS. Growth and productivity of Mothbean [*Vigna aconitifolia* (Jacq.) Marechal] in response to different varieties and phosphorus levels. Journal of Pharmacognosy and Phytochemistry. 2017;6(3):811-814.
15. Trivedi SKs. Response of blackgram (*Phaseolus munga*) to nitrogen, phosphorus and sulphur. Legume Research. 1996;19:7-9.