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Research Article

EFFECT OF DIFFERENT LEVELS OF FYM, PHOSPHORUS AND NITROGEN ON YIELD AND ECONOMICS OF MOTHBEAN [*Vigna aconitifolia* L.]

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Abstract: The field experiment was conducted at Regional Research Station, S.D. Agricultural University, Bhachau, Kachchh to evaluate the effect of different levels of FYM, phosphorus and nitrogen on yield and economics of mothbean [*Vigna aconitifolia* L.] during *Kharif* season of 2017-18, 2019-20 and 2020-21. The experiment consists of eighteen treatment combinations comprised 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. The results revealed that 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 per cent. The treatment P_2 and P_1 over P_0 (776 kg/ha) was 21.92 and 13.51 per cent, 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 and stover yields 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. The application of FYM @ 2.5 t/ha with phosphorus @ 40 kg P_2O_5/ha and nitrogen @ 20 kg N/ha secured the higher net realization of 23853, 26076 and 23626 /ha, respectively.

Keywords: *Mothbean, Yields, Economics*

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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 fibres. 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. Compaired to other parts of Gujarat, Kachchh contains highest number of degraded lands. Main cause for the degradation of land is 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.

Yields of mothbean are much less as compaired 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 [1].

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 [2].

The nitrogen fixing ability of common bean in association with rhizobia is often characterized as poor compaired to other legumes and nitrogen fertilizers are commonly used in bean production to achieve high yields [3].

Hence the present study on effect of different levels of FYM, phosphorus and nitrogen on yield and economics of mothbean was under taken.

Material and Methods

The experiment was conducted at Regional Research Station, SDAU, Bhachau to study the effect of different levels of FYM, phosphorus and nitrogen on yield and economics of mothbean [*Vigna aconitifolia* L.] during the *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. Mothbean 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 given in the 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

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-1]. This increment attributed to amplified growth probably because of effective use of nutrients absorbed through ramified root system

Table-1 Seed yield and stover yield of mothbean 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 Effects of different treatments on economics of Mothbean

Treatments	Seed yield (kg/ha)	Stover yield (kg/ha)	Gross realization (₹/ha)	Cost of cultivation (₹/ha)	Net Realization (₹/ha)	BCR (%)
FYM						
F_0	698	1251	37379	15060	23721	2.73
F_1	792	1467	42511	20060	23853	2.28
Phosphorus						
P_0	666	1179	35656	14760	20898	2.46
P_1	756	1384	40544	17560	24386	2.53
P_2	812	1514	43634	20360	26076	2.52
Nitrogen						
N_0	668	1197	35797	17300	19897	2.29
N_1	741	1365	39784	17560	23626	2.49
N_2	824	1515	44254	17820	27838	2.73

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 Krishna Jagadish (2002) [4] in blackgram, Arunakumar and Uppar (2007) [5], Patel *et al.* (2019), Ruheentaj *et al.* (2020) [6] and Patel *et al.* (2020) [7].

The highest net returns of 23853 /ha were obtained with application of FYM @ 2.5 t/ha (F_1). While lowest value 23721 /ha was recorded with FYM @ 0 t/ha (F_0). In case of BCR, the highest value of 2.73 was recorded under FYM @ 0 t/ha (F_0) and it was followed by FYM @ 2.5 t/ha (F_1). It might be due to less cost of cultivation incurred and more net returns obtained under FYM @ 0 t/ha (F_0) as compaired to other treatment [Table-4]. This result was agreement with research results of Raj Singh (2008) [8], Sadashivanagowda *et al.* (2017) [9], Patel *et al.* (2020) and Ruheentaj *et al.* (2020).

Effect of phosphorus

Among different phosphorus levels, significantly 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-1]. 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 constituent 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), Meena *et al.* (2010) [10], Singh *et al.* (2017) [11], Patel *et al.* (2019) and Patel *et al.* (2020).

The highest net returns of 26076 /ha were obtained with application of phosphorus @ 40 kg P_2O_5/ha (P_2). While lowest value 20898 /ha was recorded with 0 kg P_2O_5/ha (P0). In case of BCR, the highest value of 2.53 was recorded under 20 kg P_2O_5/ha (P_1). and it was followed by 40 kg P_2O_5/ha (P_2). It might be due to less cost of cultivation incurred and more net returns obtained under 20 kg P_2O_5/ha (P_1) as compared to other treatment [Table-4]. This result was agreement with research results of Kokani *et al.* (2014) [12], Himani *et al.* (2017) [13], Patel *et al.* (2020) and Ruheentaj *et al.* (2020)

Effect of nitrogen

It is evident from the data presented in [Table-1] 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 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) [14] in black gram, Saraswathy *et al.* (2004) [15] in green gram and Indoria and Majumdar (2007) [15] in cowpea.

The data given in [Table-4] indicated that the highest net realization of 27838 /ha and BCR the value of 2.73 was secured with application of 40 kg N/ha (N_2) from urea in mothbean it was followed by application of 20 kg N/ha (N1). It is mainly due to the increased yield with comparatively less additional cost of nitrogen under these treatments. This result was agreement with research results of Kokani *et al*. (2014), Himani *et al*. (2017) and Patel *et al*. (2020).

Table-2 Combined effect of phosphorus and nitrogen on seed yield (kg/ha) of mothbean (Pooled)

	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-3 Combined effect of phosphorus and nitrogen on stover yield (kg/ha) of mothbean (Pooled)

	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		

Interaction effect

Data presented in [Table-2] and [Table-3] 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 (905kg/ha) and stover yield (1699 kg/ha) as compared to rest of the treatment combinations but it was at par with P_1N_2 (851 and 1577 kg/ha) and P_2N_1 (844 and 1600 kg/ha) seed and straw 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) and Ruheentaj *et al.* (2020)

Conclusion

From the results of experimentation, it can be concluded that mothbean (GMO-2) should be fertilized with application of FYM @ 2.5 t/ha along with 40 kg P_2O_5/ha through PROM and 20 kg N/ha from urea under light textured soil of Kachchh region for getting higher yield profit (net realization) and BCR.

Application of research: Study of Yields and economics of mothbean

Research Category: Agriculture economics

Abbreviations: RBD-Randomized Block Design, CD-Critical difference
GMO-2-Genetically Modified Organism-2, FYM-Farm Yard Manure
PROM-Phosphorus Rich Organic Manure, BCR-Benefit Cost Ratio

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Study area / Sample Collection: Regional Research Station, Bhachau-Kachchh, 370140

Cultivar / Variety / Breed name: *Vigna aconitifolia* L. GMO-2

Conflict of Interest: None declared

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References

[1] Kumar A.B.M., Gowda N.C.N., Shetty G.R. and Karthik M.N. (2011) *Research j. Agricultural science*, 2(2), 304-307.
[2] Patel B.N., Patel K.H., Singh N., Shrivastava A. (2019) *Journal of Pharmacognosy and Phytochemistry*, 8(5), 1108-1112.
[3] Reinprecht Y., Schram L., Marsolais F., Smith T.H., Hill B. and Pauls K.P. (2020) *Plant Science*, 11(1), 1172
[4] Krishna Jagadish S.V. (2002) *M.Sc. (Agri.) Thesis, University of Agricultural Sciences, Dharwad, India.*
[5] Arunakumar S.H. and Uppar D.S. (2007) *Karnataka J. Agric. Sci*., 20(2), 394-396.
[6] Ruheentaj, Vidhyarthi G.Y., Sarawad I.M. and Surakod V.S. (2020) *International Journal of Current Microbiology and applied Sciences*, 10, 660-667.
[7] Patel B.K., Patel H.K., Makawana S.N., Shiyal V.N. and Chotaliya R.L. (2020) *International Journal of Current Microbiology and applied Sciences*, 11, 745-752.
[8] Raj Singh (2008) *J. Arid Legumes*, 5(2), 101-104.
[9] Sadashivangowda S.N.O., Alagundagi S.C., Nadagouda B.T., Bagali A.N. and Nadagouda B.T. (2017) *Res. Environ. Life Sci*., 10(6), 546-549.
[10] Meena B.L., Pareek B.L., Kumar R. and Singh A.K. (2010) *Environment and Ecology*, 28(4A), 2614-2617.
[11] Singh S., Gupta V., Singh S.P. and Yadava N.S. (2017) *Journal of Pharmacognosy and Phytochemistry*, 6(3), 811-814.
[12] Kokani J.M., Shah K.A., Tandel B.M. and Nayaka P. (2014) *Int. J. Env. Sci*., 6, 429-433.
[13] Himani B.P., Shah K.A., Barvaliya M.M. and Patel S.A. (2017) *Int. J. Curr. Microbiol. App. Sci.,* 6 (10), 3443-3451.
[14] Trivedi S.K. (1996) *Legume Research*, 19, 7-9.
[15] Saraswathy R., Krishnasamy R. and Singhara P. (2004) *Madras Agric. Journal*, 91(4-6), 230-233.
[16] Indoria A.K. and Majumdar S.P. (2007) *Forage Research*, 33(2), 122-124.