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Effect of Cultivars and Phosphorus Levels on Nutrient Uptake and Quality of Moth Bean [*Vigna aconitifolia* (Jacq.) Marechal]

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Authors' contributions

This work was carried out in collaboration between all authors. Author SS designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors VG and AC managed the analyses of the study. Author SPS managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

A field experiment was conducted on moth bean during *kharif*, 2016 at Agronomy Farm, College of Agriculture, Bikaner. The experiment was laid out in randomized block design with three replications. The treatments consisted of four varieties namely, RMO 40, RMO 225, RMO 435 and RMO 257 and four levels of phosphorus viz., 20, 40, 60 and 80 kg P_2O_5 ha^{-1}. Variety RMO 257 found superior to RMO 225 and RMO 435 in terms of nitrogen uptake in grain, straw, total nitrogen uptake and phosphorus uptake in grain however, it was at par with RMO 40 in all these characters. Different varieties of moth bean did not show significant variations in nitrogen and phosphorus content of grain and straw, protein content of grain, phosphorus uptake in straw and total phosphorus uptake. Nitrogen content in seed and straw, protein content in seed, nitrogen uptake in straw, total nitrogen uptake, phosphorus uptake by seed and straw and total phosphorus uptake

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were significantly higher with 80 kg P_20_5 ha^{-1} compared with preceding levels but found at par with 60 kg P_20_5 ha^{-1} while nitrogen uptake by seed was significantly higher with 40 kg P_20_5 ha^{-1} compared to preceding level.

Keywords: Nitrogen; phosphorus; protein; moth bean.

1. INTRODUCTION

Among the leguminous *kharif* crops of arid western Rajasthan, moth bean [*Vigna aconitifolia* (Jacq.) Marechal] is of utmost significance due to its drought and heat tolerance characteristics. Above and beyond assured production under harsh and hostile arid environment, the crop conventionally supports dietary requirement of local people to a great extent by offering a range of edible products such as dried seeds, mature and immature green pods vegetable. Traditional preparations of moth bean like dal, kheech, papad, bhujia, mangori, etc. as a part of their food habits also fulfill the nutritional need of local people well, as it contains 22–24 per cent high quality protein along with high amount of essential amino acids particularly lysine and leucine and also certain vitamins [1]. Bikaneri bhujia, given identity to Bikaner in world trade, also carries the distinction of having a geographical indication tag from 2010 onwards. The credit of such recognition goes to one and only moth bean crop of this region, flour of which is used for the preparation of such a savory. The arid districts of Rajasthan are privileged to have moth bean as a traditional crop. It would not be out of place to mention that out of 85 per cent of moth bean area in Rajasthan, 93 per cent is confined to just 12 arid districts of the state. In Rajasthan, with an area of 9.27 lakh hectares and production of 2.67 lakh tones, the crop exhibits the productivity of 288 kg ha^{-1} [2], which is still low in arid districts (about 200 kg/ha). During recent past, however, need based and deliberate attempts yielded success of desired level in developing the varieties of this hardy crop more productive and adaptive to harsher and more hostile environment. Quite a large variation in yielding performance of moth bean genotypes has been reported across the region and within the region among different years [3,4,5,6]. Such variations convincingly demonstrate presence of genotype-environment interactions in moth bean and reasonably demand to evaluate the relative performance of different varieties particularly under changing climate scenario. The role and importance of phosphorus applications to pulse crops have long been recognized and is regarded as an essential prerequisite in the production of these leguminous crops. Phosphorus is not only essential for the development of root system but also plays a vital role in the formation of energy rich bond phosphates like Adenosine di phosphate (ADP), Adenosine tri phosphate (ATP), nucleoproteins, phospholipids, etc. It is also essential for the growth of bacteria responsible for nitrogen fixation. However, supply of phosphorus is more important than that of nitrogen because of nitrogen is fixed by the bacteria lodged in the root nodules of plant. Phosphorus application to moth bean has also been justified even in low-rainfall years because of its ability to improve yield under water-limited conditions [7].

2. MATERIALS AND METHODS

The field experiment was conducted at Agronomy Farm, Collage of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner during *Kharif* session of 2016. The soil of the experimental field was loamy sand in texture, alkaline in reaction, poor in organic carbon, low in available nitrogen and low in phosphorus but medium in available potassium. The experiment was laid out in randomized block design (R.B.D.) with three replications. Treatments are consisted of four varieties of moth bean viz. RMO 40, RMO 225, RMO 257 and RMO 435 and four levels of P_2O_5 viz. 20 kg ha^{-1}, 40 kg ha^{-1}, 60 kg ha^{-1} and 80 kg ha^{-1} thus making 16 factorial combinations in all. As per treatment seed of different varieties duly treated with Rhizobium culture was sown @ 20 kg ha^{-1} in lines spaced at 30 cm at a depth of 5 cm by “Kera” method in open furrows. For evaluating growth and yield attributes, five plants were randomly selected in each plot from the sampling rows and tagged permanently. At maturity, experimental crop was harvested from the net plot. The boarder rows were harvested separately. Threshing was done manually by beating and trampling the pods of each plot separately and grains were collected in numbered bags. After winnowing, cleaned seeds were weighted to record grain yield and expressed as kg ha^{-1}. Nutrient content and protein content in

grain was determined by using standard methods.

3. RESULTS AND DISCUSSION

3.1 Effect of Varieties

Data reveal that no significant variations occurred among different varieties in respect of nitrogen and phosphorus contents of their grain and straw (Table 1). Similarly, protein content of grain was also not affected significantly due to different varieties. Nevertheless, different varieties expressed remarkable variations in terms of nitrogen and phosphorus uptake by grain and straw and their total uptake as well. It is clear from the data that variety RMO 257 recorded significantly higher uptake of both the nutrients in grain as compared to RMO 225 and RMO 435 but did not differ significantly from RMO 40 in these respects. Resultantly, total uptake of these nutrients also showed similar trend in respect of individual performance of different varieties namely RMO 40, RMO 225, RMO 257 and RMO 435. Since varying uptake of both the nutrients among different varieties is a function of their seed and straw yield, it convincingly explains the reason of those significant variations noted among different varieties. These results are in close conformity of the findings of [7,8,9], who also reported significant variations in nutrient uptake of different genotypes mainly due to their genetic makeup and its expression under different growing environments.

3.2 Effect of Phosphorus Levels

A glance over data reveals that significant increase in nitrogen and protein content of grain was noticed with the application of 60 kg P_2O_5 ha^{-1}, whereas, such increase in terms of nitrogen content of straw, nitrogen uptake by grain and straw and also total nitrogen uptake, was recorded with application 40 kg P_2O_5 ha^{-1}. Phosphorus content of grain and straw, though remained unaffected due to varying doses of phosphorus yet, significant increase in its uptake in grain and straw and consequently in the total uptake, was noticed due to application of 40 kg P_2O_5 ha^{-1}. Phosphorus application at higher doses to moth bean produced plants having more nitrogen content than lowest dose i.e. 20 kg P_2O_5 ha^{-1}. This must have been probably due to efficient and effective working of nitrogen fixing bacteria and better root development due to phosphorus application. Since protein content of grain was computed by multiplying nitrogen content with a factor 6.25, the trend similar to nitrogen content of grain is convincingly clear. Since uptake of nitrogen and phosphorus is the function of seed and straw yield and their respective contents, the reason of significant variations in uptake pattern so observed may be assigned to such variations in seed and straw yield and also to variations in respective contents (nitrogen and phosphorus) so recorded due to varying levels of phosphorus. Beneficial effects of phosphorus on growth and yields have already been discussed in preceding paragraphs. Similar results have also been reported by [9,10] etc.

Table 1. Effect of cultivars and levels of phosphorus on protein content, nitrogen content and uptake of moth bean

Treatment	Nitrogen content (%)		Nitrogen uptake (kg ha^{-1})		Total nitrogen uptake (kg ha^{-1})	Protein content in grain (%)
	Grain	Straw	Grain	Straw		
Varieties						
RMO 40	3.70	1.08	29.74	21.00	50.73	23.11
RMO 225	3.60	1.02	24.67	19.35	44.02	22.51
RMO 257	3.77	1.12	31.36	22.16	53.51	23.54
RMO 435	3.58	1.02	22.82	18.00	40.81	22.37
S.Em.±	0.07	0.04	1.30	0.98	1.93	0.42
CD(*p*=0.05)	NS	NS	3.74	2.82	5.56	NS
Phosphorus level (kg P_2O_5 ha^{-1})						
20	3.41	0.91	18.87	12.33	31.20	21.30
40	3.59	1.02	27.71	18.91	46.62	22.43
60	3.75	1.12	30.29	23.64	53.93	23.46
80	3.89	1.19	31.71	25.62	57.33	24.32
S.Em.±	0.07	0.04	1.30	0.98	1.93	0.42
CD(*p*=0.05)	0.20	0.10	3.74	2.82	5.56	1.22

Table 2. Effect of cultivars and levels of phosphorus on phosphorus content and uptake of moth bean

Treatment	Phosphorus content (%)		Phosphorus uptake (kg ha^{-1})		Total phosphorus uptake (kg ha^{-1})
	Grain	Straw	Grain	Straw	
Varieties					
RMO 40	0.325	0.23	2.60	4.48	7.08
RMO 225	0.334	0.24	2.28	4.43	6.71
RMO 257	0.348	0.23	2.89	4.56	7.45
RMO 435	0.330	0.23	2.13	4.04	6.18
S.Em.±	0.012	0.00	0.15	0.19	0.30
CD(*p*=0.05)	NS	NS	0.45	NS	0.87
Phosphorus levels (kg P_2O_5 ha^{-1})					
20	0.319	0.23	1.76	3.08	4.84
40	0.331	0.23	2.59	4.29	6.88
60	0.338	0.24	2.71	5.01	7.72
80	0.349	0.24	2.84	5.13	7.97
S.Em.±	0.012	0.00	0.15	0.19	0.30
CD(*p*=0.05)	NS	NS	0.45	0.53	0.87

4. CONCLUSION

It was concluded that variety RMO 257 is superior to RMO 225 and RMO 435, closely followed by RMO 40, which can also be an alternative choice for the cultivation of moth bean in the region. As well as application of phosphorus @ 80 kg ha^{-1} found better as compared to other levels in terms of nutrient uptake.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Kumar D, Singh NB. Moth bean Agronomy in Moth bean in India. Scientific Publishers, Jodhpur. 2001;73.
2. Govt. of Rajasthan. Commissionerate of agriculture, Jaipur, Rajasthan; 2015. Available: www.krishi.rajasthan.in
3. Anonymous. Annual Progress Report. National Network Research Project on Arid Legumes. 2013;113-121.
4. Anonymous. Annual Progress Report, Network Research Project on Arid Legumes. 2014;119-124.
5. Anonymous. Annual Progress Report, Network Research Project on Arid Legumes. 2015;52-54.
6. Anonymous. Annual Progress Report of Network Research Project on Arid Legumes. 2016;52-56 .
7. Garg KB, Burman Uday, Kathju Shyam. The influence of phosphorus nutrition on the physiological response of moth bean genotypes to drought. Journal of Plant Nutrition and Soil Science. 2004;167(4): 503–508.
8. Nagar KC, Meena NL. Effect of phosphorus, sulphur and phosphate solubilizing bacteria on yield components, yield and quality of cluster bean [*Cyamopsis tetragonoloba* (L.) Taub] Legume Research. 2004;*27(*1):27-31.
9. Sepat S. Response of moth bean [*Vigna aconitifolia* (Jacq.) Marechal] to phosphorus and sulphur fertilization under rainfed conditions. M.Sc. (Ag.) Thesis, Rajasthan Agricultural University, Bikaner; 2005.
10. Yadav SS. Growth and yield of green gram (*Vigna radiata* L.) as influenced by phosphorus and sulphur fertilization. Haryana Journal of Agronomy. 2004;20(1): 10-12.

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