Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 7 [11] October 2018 : 127-129

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD
Global Impact Factor 0.876
Universal Impact Factor 0.9804
NAAS Rating 4.95

ORIGINAL ARTICLE **OPEN ACCESS**

Effect of different levels of Potassium on Yield and Nutrient uptake by soybean in vertisols

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ABSTRACT
The field experiment was conducted to assess theeffect of various levels of potassium on yield of soybean and soil nutrient status on farmer's field in vertisols at Kanehri, Tq. Barshitakli, Dist. Akoladuring Kharif 2015-16.The experiment comprised four treatments and six replications as six farmer's laid out in Randomized Block Design. The treatments comprised of 30:75:00 kg NPK ha^{-1} (T_1), 30:75:30 kg NPK ha^{-1} (T_2), 30:75:60 kg NPK ha^{-1}(T_3) and 30:75:90 kg NPK ha^{-1} (T_4). The results of the present experiment indicated that application of 30:75:90 kg NPK ha^{-1} resulted significant improvement in grain (17.21 q ha^{-1}) and straw (27.04 q ha^{-1}) yield of soybean.The uptake of N, P and K were increased with the increase in the levels of K. The higher uptake of N (134.12 kg ha^{-1}), P (16.37 kg ha^{-1}) and K (44.67 kg ha^{-1}) was recorded with the application of 30:75:90 kg NPK ha $^{-1}$.
***Key words**: Potassium, Farmer's field, soybean, nutrient uptake.*

Received 12.07.2018 Revised 20.08.2018 Accepted 11.09.2018

INTRODUCTION

Soybean (*Glycine max*. L.) is one of the important oil seed as well as leguminous crop. It is originated in Eastern Asia/China. It is second largest oilseed crop in India after groundnut. Soybean is a miracle "Golden bean" of the 21st century mainly due to its high protein (40%) and oil (20%). In India, it is mainly grown as oil seed as well as pulse crop. It is the cheapest and richest source of high quality protein. It supplies most of the nutritional constituents essential for human health. Soybean occupies an intermediate position between legumes and oilseeds [1-4].

Soybean is also called as `Gold of soil' due to its various qualities such as ease in cultivation, less requirement of fertilizer and labour. It builds up the soil fertility by fixing atmospheric nitrogen through nodules. Soybean fixes nitrogen symbiotically and leaves about 25% for succeeding crop. All these qualities have made it an ideal for crop rotation [8-15].

Potassium is well known equality nutrient essential for improving quality of produce particularly oilseed crops [17-19]. The requirement of K to for different crops is varied. In view of the varying response among crops, the present experiment was under taken to study the effect of various levels of potassium on yield of soybean and soil nutrient status on farmer's field in vertisols.

MATERIAL AND METHODS

Field experiment on soybean was conducted on farmer's field at Kanehri, Tq. Barshitakli, Dist. Akola during Kharif 2015-16 on effect of various levels of potassium on yield of soybean and soil nutrient status on farmer's field in vertisols.The experiment comprised four treatments and six replications laid out in Randomized Block Design. The treatments comprised of30:75:00 kg NPK ha^{-1} (T_1), 30:75:30 kg NPK ha^{-1} (T_2), 30:75:60 kg NPK ha^{-1} (T_3) and 30:75:90 kg NPK ha^{-1} (T_4).

The representative soil samples from the farmer`s field were collected by using soil auger. The soil samples were air dried in shade and ground to passed through 2 mm sieve. The processed samples were well mixed and stored in clean cloth bags with proper labels for subsequent analysis.

The treatment wise plant samples were selected randomly from each net plot at harvesting stage. The plant samples were dried in shade and then placed in oven at 65 ^{0}C till the constant weight obtained. The

oven dried weights were recorded. These plant samples were ground in electrically operated stainless steel blade grinder (Willey mill) up to maximum fineness.

Finely ground and well mixed plant samples were weighted accurately (0.2 g) and transferred into micro digestion tube and 5 ml di-acid mixture was added and digested on microprocessor based (KES-12L) digester. After completion of digestion (clear white) the extract was diluted and filtered through Whatman filter paper No. 42. These extracts were used for determination of phosphorus and potassium [11].

Total nitrogen was determined by digesting the plant sample in microprocessor based digestion system (KES-12L) using conc. H_2SO_4 and salt mixture (Micro - Kjeldahl's method) [5] followed by distillation with automatic distillation system.

RESULTS AND DISSCUSSION

Effect of different levels of potassium on soybean yield

The results revealed that increasing levels of potassium significantly increased the grain and straw yield of soybean.Among the various treatments, significantly higher grain yield (17.21 q ha^{-1}) and straw yield (27.04 q ha^{-1}) was recorded with the higher levels of potassium *viz.,*30:75:90 kg NPK ha^{-1} followed by application of 60 kg K_2O ha^{-1} along with recommended dose of N and P which was found to be on par with each other indicating response to 60 kg applied K. In view of the initial very high K status and low requirement of K particularly by soybean as per general recommended dose, it is essential to re-examine the response of applied potassium to soybean in swell-shrink soil of vidarbha region. The lower grain yield (14.19 qha^{-1}) and straw yield (21.02qha^{-1}) was recorded with absolutely no application of K along with recommended dose of N and P.

The results are in consonance with Deshmukh *et al.* [6], Mandal and Pramanik [10] and Farhad *et al.* [7] they reported that increasing levels of potassium significantly increased the grain and straw yield of soybean.

Effect of different levels of potassium on nutrient uptake by soybean Nitrogen uptake

The N uptake ranged between 101.76 to 134.12 kg ha^{-1}.Result indicates that the N uptake by soybean increased significantly with the application of different levels of potassium along with recommended dose of N and P. The application of 30:75:90 kg NPK ha^{-1} recorded the maximum nitrogen uptake (134.12 kg ha^{-1}) followed by application of 30:75:60 kg NPK ha^{-1}which was 127.43 kg ha^{-1} and found to be on par with each other. The lowest N uptake i.e. 101.76 kg ha^{-1} was recorded with the application of 30:75:00 kg NPK ha^{-1}.

The application of 30:75:90 kg NPK ha^{-1} resulted 31.8% increase in total N over 30:75:00 kg NPK ha^{-1}followed by the application of 30:75:60 kg NPK ha^{-1} which was increasedto 25.2% as compared to the 30:75:00 kg NPK ha^{-1}.

Similar results were reported by Krishnan and Alourduraj [9], Singh *et al.* [16] and Raskar [13] they reported that uptake of nitrogen increased significantly with the application of various levels of potassium.

Phosphorus uptake

The P uptake ranged between 12.14 to 16.37 kg ha^{-1}.Result indicates that the P uptake by soybean increased significantly with the application of different levels of potassium. The application of 30:75:90 kg NPK ha^{-1} recorded maximum phosphorus uptake (16.37 kg ha^{-1}) followed by application of 30:75:60 kg NPK ha^{-1}i.e. 15.28 kg ha^{-1} and found to be on par with each other. Minimum P uptake (12.14 kg ha^{-1}) was registered with the application of 30:75:00 kg NPK ha^{-1}.

The application of 30:75:90 kg NPK ha^{-1} resulted in increase 34.8% increase in total phosporus over 30:75:00 kg NPK ha^{-1}followed by the application of 30:75:60 kg NPK ha^{-1} which was increased to 25.8% as compared to the 30:75:00 kg NPK ha^{-1}.

Similar results were reported by Basith *et al.* [4], Krishnan and Alourduraj [9], Singh *et al.* [16] and Raskar [13] they reported that uptake of phosphorus increased significantly with the application of various levels of potassium.

Potassium uptake

The potassium uptake ranged between 26.32 to 44.67 kg ha^{-1}.Result indicates that the potassium uptake by soybean increased significantly with the application of different levels of potassium. The application of 30:75:90 kg NPK ha^{-1} recorded maximum potassium uptake which was 44.67 kg ha^{-1}followed by application of 30:75:60 kg NPK ha^{-1}(39.14 kg ha^{-1}). Least uptake (26.32 kg ha^{-1}) was registered with the application of 30:75:00 kg NPK ha^{-1}.

The application of 30:75:90 kg NPK ha^{-1} resulted 69.7% higher over 30:75:00 kg NPK ha^{-1} whereas, the application of 30:75:60 resulted 48.7% higher uptake as compared to the application of 30:75:00 kg NPK ha^{-1}.

Similar results were reported by Basith *et al.* [4], Krishnan and Alourduraj [9], Singh *et al.* [16] and Raskar [13] they reported that uptake of potassium increased significantly with the application of various levels of potassium.

Table 1. Effect of different levels of potassium on yield and nutrient uptake by soybean

Treatments	Yield (q ha^{-1})		Nutrient uptake (kg ha^{-1})		
	Grain	Straw	N	P	K
30:75:00 kg NPK ha^{-1}	14.19	21.02	101.76	12.14	26.32
30:75:30 kg NPK ha^{-1}	15.76	25.06	117.81	14.16	33.44
30:75:60 kg NPK ha^{-1}	16.56	26.37	127.43	15.28	39.14
30:75:90 kg NPK ha^{-1}	17.21	27.04	134.12	16.37	44.67
SE(m) ±	0.27	0.64	1.975	0.313	0.933
CD at 5 %	0.82	1.93	9.192	1.458	4.34

CONCLUSION

It can be concluded that, application of 90 kg K_2O ha^{-1} along with recommended dose of N and P_2O_5 resulted increase nutrient uptake as well as grain and straw yield of soybean.

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CITATION OF THIS ARTICLE

Tupaki Lokya, D.V. Mali, V. V. Gabhane, P. R. Kadu and A. N. Paslawer. Effect of different levels of Potassium on Yield and Nutrient uptake by soybean in vertisols. Bull. Env. Pharmacol. Life Sci., Vol 7 [11] October 2018: 127-129