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Original Research Article

Effect of Potassium on Urdbean in Relation to Growth, Productivity and Nutrient Efficiency

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Potassium, Urdbean, Foliar spray

A B S T R A C T

An experiment was conducted during the *kharif* season of the year 2013, 2014 and 2016 to study the effect of potassium on growth and yield of urdbean under rainfed condition. There was a significant effect of potash levels on plant height, number of branches per plant, number of pods per plant, length of pod, 100-grain weight and grain yield. Significantly the highest grain yield (1291 kg ha^{-1}) was recorded with 20 kg K_2O ha^{-1}, which was at par with 30 kg K_2O ha^{-1} in case of grain yield. However, the grain yield with 20 kg K_2O ha^{-1} was reported statistically equivalent yield with two foliar spray of KCL at flowering and pod filling stage. The K use efficiency parameters of AE, AR, ENUE and VCR were relatively high with potash application @ 20 kg ha^{-1} thereafter it declines.

Introduction

Urdbean is the major pulse crop grown in Maharashtra and dominantly on medium deep swell shrink soils in Vidarbha region of Maharashtra in *kharif* season. Potassium is rarely applied to pulse crops because of high content of K in the soils particularly in soils which have high K-bearing clay minerals like illite. Potassium fertilizer use is limited in pulse crops only 41 per cent of the cropped area under pulses receives about 6.3 kg K_2O/ha, indicating that lack of adequate K use in pulses is one of the major reasons for their low yields and poor crop quality in India (Singh *et al.*, 2016). Potassium is equally important for all aspects of growth and has a large influence on the nutritional balance of the plant, potassium reaching the roots by the process of diffusion is replaced by movements of exchangeable K from the soil particle into the soil solution. Plants normally require this element to produce energy in form of ATP that contributes in photosynthesis by transferring carbohydrates from source to sink. K plays an essential role in enzyme activation, protein synthesis, photosynthesis, osmoregulation, stomatal movement, energy transfer, phloem transport, cation-anion balance and stress resistance (Marschner, 2012). Dobermann and Cassman (2002) have reported that K plays an important role in the direct and indirect activation of more than 120 enzymes responsible for energy usage, nitrogen assimilation and respiration. But increased intensity of cropping and introduction of high yielding varieties resulted in considerable use of potassium reserved and the crops are becoming responsive to potassium fertilizer. However, in view of above field experiment was conducted to study the response of urdbean to application of potassium in Inceptisol.

Materials and Methods

The investigations were carried out 2013, 2014 and 2016 at Pulses Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during 2013 and Agriculture Research Station, Buldhana in 2014 and at Washim in 2016, respectively, on Inceptisols having Available N, 210 to216 kg ha^{-1}, available P_2O_5, 15.60 to 17.10 and K_20, 322 to 351 kg ha^{-1}, respectively. The quadruplicated experiment was laid out using randomized complete block design. The net plot size was 4.5 x 4.0 m^2. The experiment comprised Absolute control, RDF alone, RDF + 20 kg K_2O ha^{-1}, RDF+30 kg K_2O ha^{-1}, RDF+40 kg K_2O ha^{-1}, and RDF + 2% Foliar spray of KCL at flowering stage and RDF + 2% Foliar spray of KCL at flowering and pod filling stage. A uniform dose of 20 and 40 kg ha^{-1} of N and P_20_5, respectively was used in all the treatments excluding absolute control. A promising variety of urdbean PKV Udid15 was sown during the last week of June in 45 cm apart rows using 15 kg seed ha^{-1}. Whole quantity of N, P and K in the form of urea, di-ammonium phosphate and potassium chloride, respectively was side drilled just after sowing. All other cultural practices were kept normal and uniform for all the treatments. Observations were recorded on some important plant parameters like plant height, number of branches $plant^{-1}$, number of pods $plant^{-1}$, seed weight $plant^{-1}$, seed yield and seed protein contents. The seed protein estimation was made from N content of the seeds. The data collected were statistically analysed using analysis of variance technique and Least Significant Difference (LSD) test at 5% probability to compare the difference among the treatments means.

Results and Discussion

Yield

The results revealed that application of 30 and 40 kg K_2O ha^{-1} along with recommended dose of N and P_2O_5 recorded significant increase in grain yield of urdbean over lower levels of potassium and RDF alone (Table 1). However, yield at 30 kg K_2O ha^{-1} was found at par with lower (20 kg K_2O ha^{-1}) and higher (40 kg K_2O ha^{-1}) levels of potassium indicating response of urdbean to potassium up to 20 kg ha^{-1}. The yield obtained at application of 20 kg K_2O ha^{-1} and foliar sprays of 2% KCL at flowering and 15 days after first spray (pod filling stage) was found at par. The minimum grain yield was observed where no potash fertilizer was applied. Thesiya *et al.*, (2013) reported that the application of potassium at the rate of 20 kg K_2O /ha to blackgram significantly affected seed yield.

Growth and quality parameters

It was observed that the highest plant height, number of branches, number of pods $plant^{-1}$, grain weight $plant^{-1}$except test weight were significantly affected by application of potassium at 40 kg K_2O ha^{-1} and it was found at par with 30 kg K_2O ha^{-1} (Table 2). The test weight was higher with RDF + potash application over RDF alone. K application not only enhanced the availability of other nutrient but also increased the transportation of photosynthates; protein synthesis from source to sink might be the main reason for increase growth and quality parameters. The lowest growth and yield contributing parameters were recorded in no potassium might be due to the reason that high root shoot ratio is associated with potassium uptake (Yang *et al.,* 2004).

Nutrient management efficiency

Nutrient use efficiency (Table 3) can be expressed by crop Agronomic Efficiency (AE), Apparent Recovery (AR), Economic Nutrient Use Efficiency (ENUE) and Value Cost ratio (VCR). The different values for K nutrient use efficiency were related to how much fertilizer was used and how much grain yield or yield increase was obtained by K application. Crop response in terms of per kg of K_2O applied ranged from 9.63 to 7.03 kg grain, however, lower level of potassium recorded highest agronomic efficiency over higher level of potash. The greater AE, AR, ENUE and VCR was observed with potash application @ 20 kg/ha thereafter it declines. Regarding VCR application of potash @ 20 kg ha gave the highest VCR of 24.85 suggesting that potash @ 20 kg/ha in the form of muriate of potash was found to be optimum dose for recommendation to get increased yield of urdbean.

Economics

It is evident from the data that maximum and minimum gross return recorded Rs.62069 and Rs.39361 ha^{-1} from potassium level of 40 kg and 0 kg K_2O per hectare respectively (Table 1). The highest net return (Rs.41888) was recorded from the potassium dose of 40 kg/ha which was at par with lower level of 30 kg K_2O ha^{-1} (Rs.40607) and 30 kg K_2O ha^{-1} was at par with 20 kg K_2O ha^{-1} (Rs.38562), while minimum net return obtained with 0 kg/ha (Rs.23213).

Similar results obtained by Asgar *et al.*, (2007) in chickpea. The benefit: cost ratio recorded with different level of potassium (20, 30 and 40 kg K_2O ha^{-1}) was not much changed.

Understanding the yield responses, profitability and K use efficiency parameters with 20 kg ha^{-1}K application is essential for further improvement of K use efficiency for high yielding urdbean production.

Table.1 Grain yield of urdbean as influenced by different treatment

Treatment	Grain yield (kg ha^{-1})				COC (Rs/ha)	GMR (Rs/ha)	NMR (Rs/ha)	B:C ratio
	Akola	Buldhana	Washim					
T_1 - Absolute control	821	804	999	875	16148	43735	27587	2.71
T_2- 100 % RDF	966	1218	1110	1098	18638	54897	36258	2.94
T_3- RDF+20 Kg K_2Oha^{-1}	1111	1352	1408	1291	19512	64526	45014	3.30
T_4- RDF+30 Kg K_2Oha^{-1}	1170	1383	1479	1344	19867	67194	47327	3.38
T_5- RDF+40 Kg K_2Oha^{-1}	1202	1398	1538	1379	20181	68965	48784	3.41
T_6- RDF+2% KCL (Once)	1004	1256	1251	1170	19344	58517	39174	3.02
T_7- RDF+2% KCL (Twice)	1100	1332	1326	1253	20081	62626	42545	3.12
S Em$\pm$	29.66	42	40	18.7	--	829	829	--
CD at 5 %	89	126	120	57	--	2486	2486	--

Table.2 Ancillary parameters of urdbean as influenced by different treatment (Mean of 3 years)

Treatment	Plant height (cm)	Branches /plant	Pods/ plant	Grain weight/ Plant (g)	100-seed weight(g)
T_1 - Absolute control	39.9	4.2	17.5	4.3	4.842
T_2- 100 % RDF	50.4	5.1	26.7	5.0	4.995
T_3- RDF+ 20 Kg K_2Oha^{-1}	49.8	5.5	33.4	6.0	5.053
T_4- RDF+ 30 Kg K_2O ha^{-1}	51.6	6.2	37.0	6.4	5.165
T_5- RDF+ 40 Kg K_2O ha^{-1}	53.9	6.7	39.6	6.7	5.268
T_6- RDF+ 2% KCL (Once)	46.9	4.1	29.2	5.4	5.028
T_7- RDF+ 2% KCL (Twice)	47.1	4.9	33.9	5.8	5.183
S Em$\pm$	0.88	0.19	0.92	0.19	0.05
CD at 5 %	2.65	0.58	2.75	0.58	0.15

Table.3 Effect of potassium on nutrient management efficiency of urdbean (Mean of 3 years)

Treatment	Relative Yield (%)	Agronomic Efficiency (kg grain /kg K applied)	Apparent Recovery (kg of K uptake/kg of K added)	Economic Nutrient Use Efficiency (kg of grain/Rs invested)	Value Cost Ratio of potassium
T_1 -Absolute control	--	--	--	--	--
T_2- 100% RDF	--	--	--	--	--
T_3- RDF+ 20 Kg K_2O ha^{-1}	117.53	9.63	0.347	3.33	24.85
T_4- RDF+ 30 Kg K_2O ha^{-1}	122.39	8.20	0.282	2.31	21.15
T_5- RDF+ 40 Kg K_2O ha^{-1}	125.62	7.03	0.245	1.78	18.15
T_6- RDF+ 2% KCL (Once)	106.59	12.10	0.253	20.18	62.37
T_7- RDF+ 2% KCL (Twice)	114.07	12.92	0.372	10.80	66.61

References

Asgar Ali, Nadeem MA, Muddassar Maqbool and Ejaz M. 2007. Effect of different levels of potash on growth, yield and protein contents of mungbean varieties. Journal of Agriculture Research, 44(2):121-126.

Dobermann, A., and K.G. Cassman. 2002. Plant nutrient management for enhanced productivity in intensive grain production systems of the United States and Asia. Plant Soil, 247:153-175.

Marschner P. 2012. *Mineral Nutrition of Higher Plants*, 3rd edn.; Academic Press: London, UK, pp. 178–189.

Singh U, Dutta, SK and Stayanarayana T. 2016. 4R Nutrient stewardship for sustainable pulse production in India. Better Crops International 10 (1): 27-29.

Thesiya NM, Chovatia, PK and Kikani VL. 2013. Effect of potassium and sulphur on growth and yield of blackgram (*Vigna mungo* (L.) Hepper) under rainfed condition. Legume Research 36 (3): 255-258.

Yang XE, Wang WM and He ZL. 2004. Physiological and genetic characteristics of nutrient efficiency of plants in acid soils. Pp. 78-83.