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Research Article

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Effect of the graded levels of potassium with recommended NP on soil properties under maize cultivation in alfisols of Mandya, Karnataka

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Summary

During *Kharif* 2012, a field experiment was conducted in an alfisol of Mandya with different levels of potassium under irrigated maize to know the impact of application of potassium on various soil properties. The study involved nine treatments *viz.,* Recommended NPK as per UAS (B) package, rec. NPK 15 DAS, NP + 75, 100, 125 per cent rec. K in splits, NP only and absolute control, replicated thrice and the statistical design was RCBD. The results of the experiment indicated that, soil pH and EC not varied much due to application of graded levels of potassium in maize. Highest organic carbon content was recorded in the treatment of recommended dose of NP + recommended dose of K in two splits (basal and at the time of topdressing). The soil available NPK content after the harvest of maize crop differed due to application of graded levels of potassium and the highest NPK content was recoded with the application of recommended NPK as per UAS (B) package and lowest available nitrogen was registered in the control. Similar trend was also observed with respect to exchangeable Ca, Mg and available sulphur. Application of recommended NP + 125 per cent of recommended K in two splits recorded the higher values for the various soil properties studied.

Key words : Maize, Graded levels of potassium, Soil properties

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Introduction

Potassium is the major nutrient required for variety of crops along with nitrogen and phosphorus for their normal growth and development. However, imbalanced use of these nutrients without considering soil test value may often result in poor economic yield. Numerous studies on soil potassium have been carried out in the past. But, there is enough scope to study the availability of soil potassium for plant growth. The integrated approach in linking soil properties with plant response would be necessary for deriving maximum benefit from added fertilizers. Response of added potassium would enhance the yield of agricultural crops.

Maize crop bears high yield potential and responds to various agro management practices. Low yield of maize is due to many constraints. Among them, imbalanced use of fertilizers, traditional sowing methods and lack of optimal crop stand are the prime factors.

Response of maize hybrids to various agro-management practices especially, fertilizers, sowing methods and plant population are different. This variable response of maize is mainly due to differences in plant morphology, intraspecific competition among plants and difference in growth rate. Soils of India are generally deficient in nitrogen and phosphorus. Now-a-days, deficiency of potassium is also being reported from some parts of the country. Therefore, application of adequate amount of nitrogen, phosphorus and potassium fertilizers in a balanced proportion is considered imperative under irrigated conditions.

Based on the individual crop response to added fertilizes, the fertilizer recommendations are made. The fertilizer use efficiency of maize crop with respect to individual elements is affected by its proportion in soil. With this view, the research work was carried out on "studies on the effect of graded levels of potassium on soil properties under maize cultivation in alfisols of mandya"

Resource and Research Methods

The study was conducted at Zonal Agricultural Research Station, Vishweshwaraiah Canal Farm, Mandya (University of Agricultural Sciences, Bengaluru) during *Kharif* 2012. Topography of the land was fairly uniform with a gentle gradient towards northern side. It is located in the southern dry zone of Karnataka.

The experiment consisted of nine treatments with varying K doses and were tested in RCBD with 3 replications. The fertilizer dosage was 100-75- 40 kg ha^{-1} of N, P_2O_5 and K_2O, respectively. The three nutrients *i.e.* nitrogen, phosphorus and potassium were applied through urea, single super phosphate and muriate of potash, respectively. The present investigation was carried under the following treatments, *i.e.* recommended NPK as per UAS (B) package (T_1), recommended NPK as per UAS (B) package after 15 days of sowing (T_2), recommended NP + recommended K in two splits (basal and at the time of topdressing) (T_3), recommended NP + 75 % of recommended K as basal (T_4), recommended NP + 75 % of recommended K in two splits (basal and at the time of topdressing) (T_5), recommended NP + 125 % of recommended K as basal (T_6), recommended NP + 125 % of recommended K in two splits (basal and at the time of topdressing) (T_7), recommended NP only (T_8) and absolute control (T_9).

A field experiment was conducted during *Kharif* 2011-2012 at V.C. farm Mandya to study the response of maize to added potassic fertilizers. Maize (var. Hema: NAH 1137) was the test crop. Soil was sandy loam in texture with neutral pH (7.21), available nitrogen (266.42 kg ha^{-1}), medium phosphorus (56.17 kg ha^{-1}) and potassium (211.56 kg ha^{-1}), available sulphur (12.71 mg kg^{-1}) and DTPA extractable zinc (1.65 mg kg^{-1}). The initial soil properties of the experimental site are presented in the Table A, after the harvest of the crop soil samples were drawn from 0-15 cm depth, dried in shade, powdered and passed through 2 mm sieve, the samples were used for determination of pH, EC, OC, N, P, K, Ca, Mg, S and Zn.

Table A : Physical and chemical properties of soil in the experimental site

Sr. No	Properties/ parameter	Value
1.	Mechanical composition	
	Sand (%)	65.12
	Silt (%)	19.57
	Clay (%)	15.31
2.	Textural class	Sandy loam
3.	BD (g/cm^3)	1.39
4.	MWHC (%)	21.54
5.	pH	7.21
6.	EC (dSm^{-1})	0.42
7.	OC (%)	0.83
8.	CEC [c mol (p^+) kg^{-1}]	11.9
9.	Available N (kg ha^{-1})	266.42
10.	Available P_2O_5 (kg ha^{-1})	56.17
11.	Available K_2O (kg ha^{-1})	221.56
12.	Exch. Ca (meq $100g^{-1}$)	5.43
13.	Exch. Mg (meq $100g^{-1}$)	1.94
14.	Available S (mg kg^{-1})	12.71
15.	DTPA extractable Zn (mg kg^{-1})	1.65

Research Findings and Discussion

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

Effect of graded levels of potassium on soil physico-chemical properties of soil :

The data pertaining to the effect of graded levels of potassium on soil pH, EC and organic carbon after harvest of maize are presented on the Table 1.

Soil pH :

Soil pH did not differ significantly due to application of graded levels of potassium to maize. Highest soil pH (7.89) was recorded in the T_2 treatment which received recommended NPK as per UAS (B) package after 15 days of sowing and the lowest soil pH (6.66) was noticed with the application of (T_4) recommended dose of NP + 75 % of recommended dose of K as basal. The decrease in soil pH may be due to increase in partial pressure of CO_2 and production of organic acids, during organic matter decomposition. These results are in conformity with those reported by Babu and Reddy (2000), they stated that addition of FYM increases soil pH initially and decreases in the later stage due to releasing of organic acids during decomposition.

Electrical conductivity (dSm^{-1}) :

Lower EC was recorded in T_1 treatment receiving recommended NPK as per UAS (B) package (0.43dS m^{-1}) and higher EC (0.54dSm^{-1}) was recorded with application of recommended NP +125 per cent of recommended K as basal (T_6). However, the EC of the soil did not vary much due to incorporation of FYM and fertilizers and the results are in conformity with the findings of Shujrah *et al*. (2011), who reported the salt content increased slightly due to application of 100 per cent NPK in combination with farm yard manure.

Organic carbon (%) :

Higher organic carbon content (0.92%) was recorded in the treatment T_7 which had recommended dose of NP + recommended dose of K in two splits (basal and at the time of topdressing). However, least organic carbon was recorded in the (T_9) absolute control (0.51%) than other treatments. Increase in organic carbon content may be due to application of farm yard manure along

Table 1 : Soil pH, EC and organic carbon content in soil after harvest of maize as influenced by application of graded levels of potassium

Treatments	pH	EC (dS m^{-1})	OC (%)
T_1: Recommended NPK as per UAS (B) package	7.38	0.43	0.91
T_2: Recommended NPK as per UAS (B) package after 15days of sowing	7.89	0.50	0.88
T_3: Recommended NP + recommended K in two splits (basal and at the time of topdressing)	7.40	0.53	0.92
T_4: Recommended NP + 75% of recommended K as basal	6.66	0.48	0.76
T_5: Recommended NP + 75% of recommended K in two splits (basal and at the time of topdressing)	6.91	0.46	0.78
T_6: Recommended NP + 125% of recommended K as basal	7.59	0.54	0.83
T_7: Recommended NP + 125% of recommended K in two splits (basal and at the time of topdressing)	7.73	0.53	0.86
T_8: Recommended NP only	6.93	0.49	0.67
T_9: Absolute control	6.97	0.52	0.51
S.E.±	0.33	0.03	0.01
C.D. (P=0.05)	NS	NS	0.04

NS= Non-significant

Table 2: Available nitrogen, phosphorus and potassium content of soil (kg ha^{-1}) after harvest of maize as influenced by application of graded levels of potassium

Treatments	N	P_2O_5	K_2O
		(kg ha^{-1})	
T_1: Recommended NPK as per UAS (B) package	300.86	84.18	228.70
T_2: Recommended NPK as per UAS (B) package after 15days of sowing	292.49	81.21	225.65
T_3: Recommended NP + recommended K in two splits (basal and at the time of topdressing)	300.28	76.20	229.32
T_4: Recommended NP + 75% of recommended K as basal	288.04	68.17	218.93
T_5: Recommended NP + 75% of recommended K in two splits (basal and at the time of topdressing)	299.84	67.94	218.16
T_6: Recommended NP + 125% of recommended K as basal	282.54	59.59	208.47
T_7: Recommended NP + 125% of recommended K in two splits (basal and at the time of topdressing)	276.86	58.02	207.26
T_8: Recommended NP only	271.30	55.54	194.92
T_9: Absolute control	256.53	47.60	186.01
S.E.±	5.77	5.46	4.91
C.D. (P=0.05)	17.30	16.36	14.72

with chemical fertilizers; similar results were obtained by Shujrah *et al*. (2011) and Imanparast *et al*. (2012).

The data pertaining to the effect of graded levels of potassium on available NP and K in soil after harvest of maize are presented on the Table 2.

Available nitrogen (kg ha^{-1}) :

Higher available nitrogen content was recorded with the application of (T_1) recommended dose of NPK as per UAS (B) package (300.86 kg ha^{-1}). However, lower available nitrogen (256.53 kg ha^{-1}) was registered in the (T_9) control, increase in available nitrogen content may be due to combined application of FYM along with recommended dose of NP and 125 per cent K, Wakeel *et al*. (2002) reported that higher available nitrogen content in soil under FYM addition could be due to favorable microbial activity and improved physical condition of soil (as it is evident by the present study), higher soil nitrogen was noticed may be due to the fact that uptake of nitrogen by the treatment combination. In control recorded less available nitrogen, may be due to higher uptake of nitrogen by the plant from the soil. The results are in conformity with the findings of Kumar and Mishra (1991) and Govindan and Thirumurugan (2005).

Available phosphorus (kg ha^{-1}) :

The higher available phosphorus content was recorded in T_1 receiving recommended NPK as per UAS (B) package (84.18kg ha^{-1}) and least available phosphorus (47.64 kg ha^{-1}) was recorded in the (T_9) control compared to other treatments, increase in available phosphorus may be due to the increase in organic carbon content, Prasad *et al.* (1996) and Yurtseven *et al*. (2002) also reported the influence of FYM in increasing the phosphorus availability in soil. Organic manure application along with 100 per cent NPK increased phosphorus availability from native and applied sources, more than 100 per cent K cause antagonism to available P.

Available potassium (kg ha^{-1}) :

Higher available potassium (228.70 kg ha^{-1}) was noticed in the (T_1) recommended NPK as per UAS (B) package and lower available potassium was recorded in the control (186.01 kg ha^{-1}), Organic manure FYM 10 t ha^{-1} and 125 per cent K increased markedly the available potassium status in soil. The results are in accordance with the findings of Khatic and Dikshit (2001) and Wortmann *et al*. (2009).

The data pertaining to the effect of graded levels of potassium on exchangeable Ca, Mg, available S and Zn in soil after harvest of maize are presented on the Table 3.

Exchangeable calcium and magnesium [c mol. (p+) kg^{-1}] :

Higher calcium and magnesium content of 6.84 c mol. (p+) kg^{-1} and 2.04 coml.(p+) kg^{-1}, respectively in the T_1 treatment receiving recommended NPK as per UAS (B) package and lowest exchangeable calcium and magnesium content of 4.45 c mol. (p+) kg^{-1} and 0.94 c mol. (p+) kg^{-1} was recorded in the control (T_9).

Application of graded levels of potassium recorded higher exchangeable calcium and magnesium upto 100 per cent NPK. At 125 per cent potassium levels, Ca and Mg content decreases, it may be due to higher potassium levels in soil was antagonistic to Ca and Mg. Similar

Table 3: Exchangeable calcium, magnesium [c mol. (p+) kg^{-1}], available sulphur (mg ka^{-1}) and DTPA extractable zinc (ppm) content of soil after harvest of maize as influenced by application of graded levels of potassium

Treatments	Ca	Mg	Avail. S	Zn
	C mol (p$^+$) kg^{-1}		ppm	
T_1: Recommended NPK as per UAS (B) package	6.84	2.04	15.22	1.70
T_2: Recommended NPK as per UAS (B) package after 15days of sowing	6.78	1.95	14.24	1.65
T_3: Recommended NP + recommended K in two splits (basal and at the time of topdressing)	6.41	1.85	14.65	1.70
T_4: Recommended NP + 75% of recommended K as basal	5.83	1.49	12.84	1.49
T_5: Recommended NP + 75% of recommended K in two splits (basal and at the time of topdressing)	6.17	1.59	11.99	1.51
T_6: Recommended NP + 125% of recommended K as basal	4.89	1.07	12.28	1.72
T_7: Recommended NP + 125% of recommended K in two splits (basal and at the time of topdressing)	4.95	1.11	13.24	1.74
T_8: Recommended NP only	5.53	1.12	12.04	1.52
T_9: Absolute control	4.45	0.94	10.20	1.47
S.E.±	0.19	0.04	0.28	0.01
C.D. (P=0.05)	0.58	0.13	0.85	0.03

results are obtained by the findings of Singh and Singh (2002) and Singh and Tomar (1994).

Available sulphur (mg ka^{-1}) :

Application of recommended NPK as per UAS (B) package: T_1) has recorded higher available sulphur (15.22 mg kg^{-1}) and lowest available sulphur was recorded (10.20 mg kg^{-1}) in the control. This may be due to mineralization of sulphur from organic matter and the release of sulphur from sulphur containing amino acids during the process of decomposition of FYM and synergistic effect of higher potassium levels on sulphur availability. These results are in agreement with the findings of Bansal (1991) and Venkatesh *et al.* (2004).

Available zinc (mg ka^{-1}) :

Application of recommended NP + 125 per cent of recommended K in two splits (basal and at the time of topdressing) has recorded higher available zinc (1.74 mg kg^{-1}) and lowest available zinc was recorded (1.47 mg kg^{-1}) in the control than other treatments, it may be due to the application higher potassium and FYM to the soil which increased the availability of zinc. Increase in the availability of zinc, may be due to the chelating action of organic compounds released during decomposition of FYM by preventing their fixation, oxidation, precipitation and leaching (Kumar *et al*., 1994), the results of the present study are in conformity with the findings of Venkatesh *et al*. (2004).

Conclusion :

Soil physico-chemical properties like pH and EC did not differ significantly among the treatments, other properties like OC, N, P, K, Ca, Mg, S and Zn differed significantly among the treatments due to application of graded levels of potassium.

Literature Cited

Babu, R. and Reddy, V.C. (2000). Effect of nutrient sources on growth and yield of direct seeded rice. *Crop Res*., **19**: 189-193.

Bansal, K.N. (1991). Effect of ammonium nitrate and urea on the release of non-exchangeable potassium by eight eastern prairie soils during continuous cropping in green house. *Canadian. J. Soil Sci.,* **54**: 255-263.

Govindan, K. and Thirumurugan, V. (2005). Synergistic association of *Rhizobium* with phosphate-solubilizing bacteria under different sources of nutrient supply on productivity and soil fertility in soybean. *Indian J. Agron*., **50**(3): 214-217.

Imanparast, Leila, Reza, Mohammad, Neyshabouri, Mohammad Reza and Hassanpanah, Davoud (2012). The evaluation of potassium humate and keratin effects on the saline sodic soil structure stability under sterile and non-sterile conditions. *Inter J. Agric. Res. Rev.*, **2**(4) : 328-335.

Khatic, S.K. and Dikshit, P. R. (2001). Integrated use of organic manure and inorganic fertilizer on yield, quality, economics and nutrition of sunflower grown in *Haplustert* clay soil. *Indian J. Agric. Sci*., **21**: 87-90.

Kumar, A., Ranbir Singh and Chhilar, R.K. (1994). Influence of nitrogen and potassium application on growth, yield and nutrient uptake by onion. *Indian J. Agron*., **46**(4): 742-746.

Kumar, Virendra and Mishra, B. (1991). Effect of two types of press mud cakes on growth of rice-maize and soil properties. *J. Indian Soc. Soil. Sci*., **39**: 109-113.

Prasad, J., Srivatava, N.C. and Mathur, B.S. (1996). Available nutrient status of continuously fertilized and cropped acid soil. *J. Indian Soc. Soil Sci*., **44** : 171-173.

Shujrah, Amjad Ali, Mohd. Khanif Yusop, Hussin, Aminuddin, Othman, Radziah and Ahmed, Osumanu Haruna (2011). Impact of potassium humate on selected chemical properties of an acidic soil. 19th World Congress of Soil Science, Soil Solutions for a Changing World. 119-122 pp.

Singh, Vinay and Tomar, J.S. (1994). Effect of potassium application on the yield and content of Ca and Mg in wheat, barley, oats and linseed. *J. Potash Res*., **10**: 78-82.

Singh, Vinay and Singh Ravendra (2002). Effect of potassium and magnesium application on yield, quality and uptake of nutrients in wheat. *J. Potash Res*., **18**: 109-111.

Venkatesh, Kailash Kumar, M.S., Majumdar, B. and Patiram (2004). Effect of P levels, FYM and lime on uptake of micronutrients by maize and their availability in an acidic *Alfisol* of Meghalaya. *Indian J. Hill Farm.*, **17**: 29-35.

Wakeel, A., Hassan, A., Aziz, T. and Iqbal, M. (2002). Effect of different potassium levels and soil texture on growth and nutrient uptake of maize. *Pak. J. Agric. Sci*., **39**(2): 98-102.

Wortmann, C.S., Dobermann, A.R., Fergouson, R.B., Hergert, G.W., Shapiro, C.A., Tarkalson, D.D. and Walters, D.T. (2009). High-yielding corn response to applied phosphorus, potassium, and sulfur in Nebraska. *Agron. J*., **101**(3): 546- 555.

Yurtseven, E., Kesmez, G.D. and Unlukara, A. (2002). The effects of water salinity and potassium levels on yield, fruit quality and water consumption of a native central Anatolian tomato species. *Agric. Water Mgmt*., **78** : 128-135.