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GC Kakde
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

VD Patil
Ex. Dean and DI (F/A), Vasantrao Naik Marathwada Krishi Vidyapeeth,college of Agriculture, VNMKV, Parbhani, Maharashtra, India

Corresponding Author:
GC Kakde
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Impact of potash and zinc application on better crop production of chickpea grown in Vertisol

GC Kakde and VD Patil

Abstract
A field experiment was planned and conducted during *Rabi* 2012-13 to evaluate the "Response of chickpea to graded levels of potassium and zinc in Vertisol". The field experiment was conducted at the Departmental Research Farm of Vasantrao Naik Marathwada Agricultural University, Parbhani. The experiment was laid out in Randomized Block Design with three replications. There were eight treatments comprising of K levels and zinc viz ; T_1- Absolute control, T_2- Only RDF through soil (25:50:0 NPK kg ha^{-1}) T_3 –RDF + 15 kg K_2O ha^{-1},T_4- RDF + 30 kg K_2O ha^{-1}, T_5- RDF+45 kg K_2O ha^{-1}, T_6- RDF+15 kg K_2O ha^{-1}+25 kg $ZnSO_4$ ha^{-1}, T_7- RDF + 30 kg K_2O ha^{-1} + 25 kg $ZnSO_4$ ha^{-1}, T_8- RDF + 45 kg K_2O ha^{-1} + 25 kg $ZnSO_4$ ha^{-1}.The results indicated that application of RDF+15 or 30 kg K_2O ha^{-1}+25 kg $ZnSO_4$ ha^{-1} improved growth i.e. plant height (64.94cm) and number of pods per plant (64.94) and pod yield (15.40q/ha) and biomass yield (33.14q/ha) and quality parameters i.e. test weight (25.30gms) and protein content (23.53%).

Keywords: chickpea, potash, zinc, Vertisol, yield

Introduction
Chickpea (*Cicer arientinum* L.) is an important pulse crop of the semi arid tropics, particularly in rainfed ecology of Indian Subcontinent. It is the main source of dietary protein for majority of Indian population and its average production is much below the potential. Average productivity of chickpea in India (823 kg ha^{-1}) and Maharashtra (614 kg ha^{-1}) is very low. Low productivity of Chickpea in India is mainly attributed to improper and inadequate nutritional supply to plant. In the region of Marathwada, it is observed that in the recommended fertilizer schedule of pulses particularly green gram, black gram, chickpea and red gram do not have potassium and zinc is important limiting nutrient elements in pulse production. Under this situation, it is necessary to test effect of potash and zinc in these crops. Hence, the present study was planned to study the effect of application of graded levels of potassium and zinc on growth, yield and quality of chickpea to achieve balance in the use of N, P, and K nutrients.

Materials and Methods
A field experiment was carried out during *Rabi* 2012-13 using chickpea (var. *Akash*) at the Departmental Research Farm of Vasantrao Naik Marathwada Agricultural University, Parbhani. The experiment was laid out in Randomized Block Design with three replications. There were eight treatments comprising of K levels and zinc viz ; T_1- Absolute control, T_2- Only RDF through soil (25:50:0 NPK kg ha^{-1}) T_3 –RDF + 15 kg K_2O ha^{-1},T_4- RDF + 30 kg K_2O ha^{-1}, T_5- RDF+45 kg K_2O ha^{-1}, T_6- RDF+15 kg K_2O ha^{-1}+25 kg $ZnSO_4$ ha^{-1}, T_7- RDF + 30 kg K_2O ha^{-1} + 25 kg $ZnSO_4$ ha^{-1}, T_8- RDF + 45 kg K_2O ha^{-1} + 25 kg $ZnSO_4$ ha^{-1}.(All fertilizers were applied at the time of sowing below the seed.) The experimental soil was fine, smectitic calcareous, Iso-hyperthermic Typic Haplusterts. It was alkaline in reaction (pH 7.84), safe in soluble salt concentration (EC 0.61 dSm^{-1}) and low in organic carbon content (0.43%). The free calcium carbonate was 4.69%. Potassium permanganate oxidisable available N (197.76 kg/ha), Olsen`s available P (12.57 kg/ha), 1M ammonium acetate exchangeable available K (701.76 kg/ha) and DTPA extractable Zn (0.8860 mg/kg) at the commencement of the experiment. Growth and yield contributions characters were recorded at different growth stages. In each plot, 5 random plants were selected to be record biometric observations on growth and yield attributes. Five plants uprooted from the observation unit for recording the dry matter studies and after removing the roots, plant samples were kept in well labelled brown paper bag.

First the samples are dried in shade and after that kept in oven at 65 ^{0}C ± 2 ^{0}C, and then weight of dry matter was taken and expressed on per plant basis. All the data were subjected to analysis of variance.

Result and Discussion

The data (Table 1) revealed that plant height, number of pods per plant, test weight, protein content, pod yield and biomass yield of chickpea at harvest stage of chickpea significantly increased with application of potash and zinc application over absolute control. The improvement in these parameters could have resulted from supply of levels of potash and zinc to soil at the time of sowing.

Plant height and Number of pods

The presented data revealed that the plant height and number of pods at harvesting stage was varied from 53.21 to 64.94 cm and 53.21 to 64.94 with an average of 58.78 cm and 58.77 respectively. The maximum plant height and number of pods was observed in the treatment T_7 (RDF+ 30 kg K_2O ha^{-1}+ 25 kg $ZnSO_4$ ha^{-1}) which was followed by T_6 (RDF+15 kg K_2O ha^{-1} + 25 kg $ZnSO_4$ ha^{-1}) and T_8 (RDF + 45 kg K_2O ha^{-1} + 25 kg $ZnSO_4$ ha^{-1}) and minimum was in the treatment T_1 absolute Control. However, treatment T_7, T_6 and T_8 were at par with each other and they were significantly superior over rest of the treatments. This might be due to the favorable influence of optimum potash and zinc on metabolism and biological activity and its stimulatory effects on growth of plant. Similar findings were observed by Talooth *et al*. (2006) [9]

Pod yield and Biomass yield

Treatment T_4 comprises recommended dose of N and P with 30 kg K_20 ha^{-1} produced 14.08 q ha^{-1} pod yield and showed significant increase over absolute control and application of 15 and 45 kg K_2O ha^{-1}. Further addition of zinc to growing media enhanced the chickpea yield. The chickpea crop receiving RDF + 15 or 30 kg K_2O with 25 kg $ZnSO_4$ ha^{-1} recorded the highest yield (14.56 and 15.40 q ha^{-1}) and found at par with RDF + 45 kg K_2O ha^{-1}+25 kg $ZnSO_4$ ha^{-1}. The biomass yield was in the range of 18.33 to 33.14 q ha^{-1}. Maximum biomass yield was observed in treatment T_7 (RDF+30 kg K_2O ha^{-1} +25 kg $ZnSO_4$ ha^{-1}). It is significantly superior over absolute control but at par with rest of the treatments excluding T_2 and T_3 respectively (i.e. RDF and RDF + 15 kg K_2O ha^{-1}) (Fig.1).This may be due fact that potassium and zinc are reported to enhance the absorption of native as well as added major nutrient such as N and P which might have been attributed to improvement of yield. Increase rate of photosynthetic and symbiotic activity following balanced application of NPK stimulated better vegetative and reproductive growth of the crop resulting in higher green pod yield due to the effect of both potassium and micronutrients. Similar findings were reported by Jat *et al*. (2013) [2], Patil and Dhonde (2009) [4, 5], Khrogamy and Farnia (2009) [3] in case of chickpea.

Quality parameters

The data presented in Table 1 revealed that test weight (100 seed weight) was in the range of 21.77 to 25.30 and maximum test weight was observed in treatment T_6 (RDF+ 15 kg K_2O ha^{-1} +25 kg $ZnSO_4$ ha^{-1}) and it is at par with T_7 (RDF+ 30 kg K_2O ha^{-1} +25 kg $ZnSO_4$ ha^{-1}). However, said treatment showed significantly over rest of the treatments. The protein content was in the range of 19.39 to 23.53% and maximum protein content was observed in treatment T_8 (RDF +45 kg K_2O ha^{-1} + 25 kg $ZnSO_4$ ha^{-1}). Treatment T_4 (RDF + 30 kg K_2O ha^{-1}), T_7 (RDF+ 15 kg K_2O ha^{-1} +25 kg $ZnSO_4$ ha^{-1}) was at par with T_8. As potash has synergistic effect on N and K uptake, facilitates protein synthesis and activates different enzymes. Therefore, protein content increased significantly with increase in K levels. Results are in confirmation with earlier results reported by Selvaraj *et.al* (2014) [7].

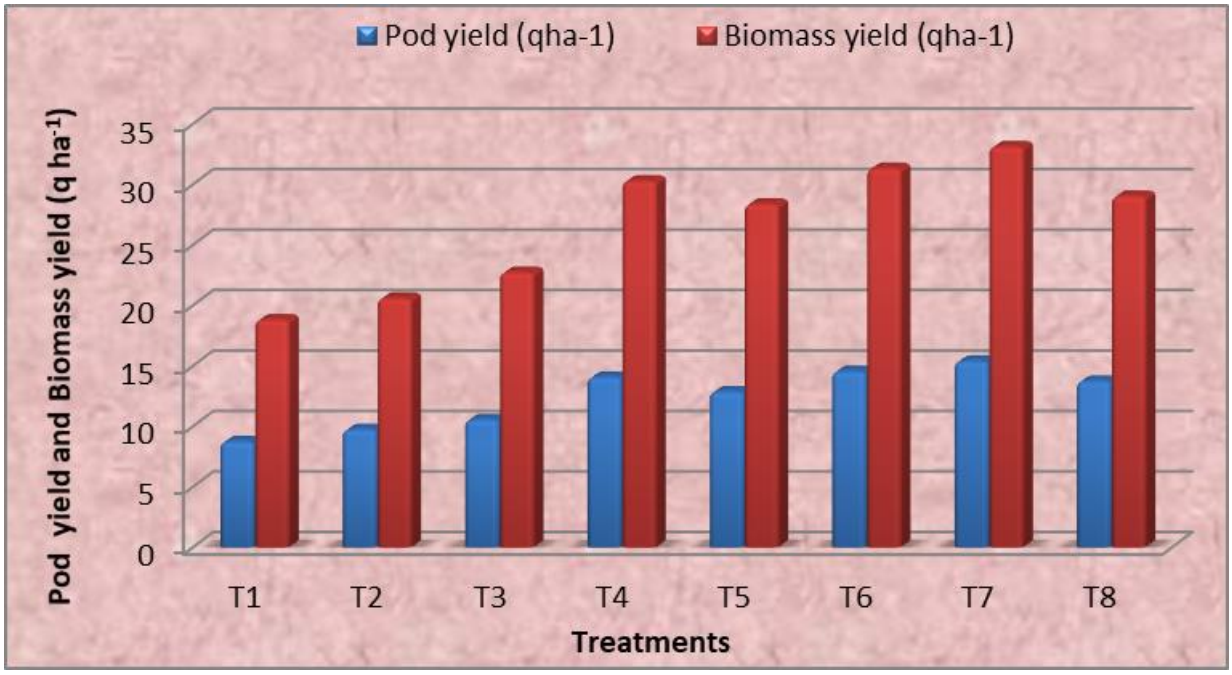

Fig 1: Effect of graded levels of potassium and zinc on pod yield (q ha^{-1}) and biomass yield (q ha^{-1}) of chickpea.

Table 1: Effects of graded levels of potassium and zinc on plant height, number of pods, pod yield, biomass yield, test weight and protein content at harvest stage.

Tr. No.	Treatment details	Plant Height (cm)	No. of pods	Pod yield (qha^{-1})	Biomass yield (qha^{-1})	Test Weight (gm)	Protein Content (%)
T_1	Absolute Control	53.21	53.21	8.75	18.83	21.77	19.39
T_2	Only RDF (25:50 NP kg ha^{-1})	54.17	54.17	9.75	20.61	22.20	20.10
T_3	RDF+ 15 kg K_2O ha^{-1}	56.40	56.40	10.57	22.75	23.10	20.50
T_4	RDF+ 30 kg K_2O ha^{-1}	59.48	59.48	14.08	30.30	23.47	21.33
T_5	RDF +45 kg K_2O ha^{-1}	58.95	58.95	12.87	28.39	22.10	21.39
T_6	RDF+ 15 kg K_2O ha^{-1} +25 kg $ZnSO_4$ ha^{-1}	62.43	62.43	14.56	31.34	25.30	21.60
T_7	RDF+ 30 kg K_2O ha^{-1} +25 kg $ZnSO_4$ ha^{-1}	64.94	64.94	15.40	33.14	24.33	23.14
T_8	RDF +45 kg K_2O ha^{-1} +25 kg $ZnSO_4$ ha^{-1}	60.63	60.63	13.75	29.04	23.07	23.53
SEm (±)		2.39	2.38	0.75	2.9	0.81	0.61
CD at 5%		7.26	7.26	2.3	8.85	2.48	1.83
CV %		7.06	6.99	11.07	9.05	5.82	6.22
Grand mean		58.78	58.77	11.88	26.80	22.79	17.17

Conclusions

It can be concluded the application of graded levels of potassium and zinc with recommended dose of N and P (25: 50 kg ha^{-1}) recorded increase in yield. Addition of potassium 30 kg ha^{-1} with 25 kg $ZnSO_4$ ha^{-1} recorded significant improvement in yield and all parameters contributing grain yield, biomass yield and quality. While, the application of higher dose of 45 kg K_2O ha^{-1} reduced the chickpea yields. "Even under high potassium content of soil for pulses in general and chickpea in particular it is essential to include potassium in fertilizer application schedule in the Vertisol of Marathwada region.

References

1. AOAC. Associated of official analytical chemist, Washington, D.C. U.S.A, 1975.
2. Jat Gajanand, Jat NK. Potassium and zinc fertilization of wheat (*Triticum aestivum*) in western arid zone of India. Indian Journal of Agronomy. 2013;58(1):67-71. Journal of food legumes. 21(2):112-114.
3. Khorgamy A, Farnia. Effect of phosphorus and zinc fertilisation on yield and yield components of chick pea cultivars. African Crop Science Conference Proceedings. 2009;9:205-208.
4. Patil SM, Dhonde MB. Effect of potash levels and foliar spray of cowurine on growth and yield of summer green gram. J. Maharashtra agric. Univ. 2009;34(1):106-107
5. Patil SM, Dhonde MB. Effect of potash levels and foliar spray of cowurine on growth and yield of summer green gram. J. Maharashtra agric. Univ. 2009;34(1):106-107.
6. Patil VD, Pholane LP, Adsul PB. plant nutrient mining in different agroclimatic zones of Maharashtra. Fertilizer News. July 2001;46(7)/43-48 and 51-54
7. Selvaraj S, Lakshmi Prasanna K. Dry matter production, yield attributes, yield and quality of clusterbean [(*cyamopsis tetragonoloba* (L.) taub.] as influenced by nitrogen and zinc application Indian Journal of Plant Sciences.1 (2-3Jul.-Sept.&Oct.-Dec.) 2012, 167-176 http://www.cibtech.org/jps
8. Subbiah BV, Asija GL. A rapid procedure for the estimation of available nitrogen in soils. Curr. Sci. 1956;25:259-260.
9. Talooth AT, Tawfik MM, Mohamed HM. A Comparative Study on the Effect of Application of Zinc, Potassium and Magnesium on Growth, Yield and Some Chemical Constituents of Mungbean Plants Grown under Water Stress Conditions World Journal of Agricultural Sciences. 2006;2(1):37-46.
10. Tandon HLS. Methods of Soil, Plants, Water and Fertilizer Analysis, FDCO, New Delhi, 1993, 190-205.