International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(6): 2318-2321

Received: 28-09-2019
Accepted: 30-10-2019

Palsande VN
Assistant Professor, Department of Soil Science and Agricultural. Chemistry Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli. Ratnagiri, Maharashtra, India

Bankar RT
Ph.D., Scholar, Department of Soil Science and Agricultural. Chemistry Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli. Ratnagiri, Maharashtra, India

Kapse VD
Ph.D., Scholar, Department of Soil Science and Agricultural. Chemistry Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli. Ratnagiri, Maharashtra, India

Kasture MC
Associate Professor, College of Agriculture, Dapoli, Maharashtra, India

More SS
Assistant Professor, College of Agriculture, Dapoli, Maharashtra, India

Corresponding Author:
Palsande VN
Assistant Professor, Department of Soil Science and Agricultural. Chemistry Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli. Ratnagiri, Maharashtra, India

Effect of application of different levels of N, K and Zn on yield and economics of groundnut in lateritic soil of Konkan

Palsande VN, Bankar RT, Kapse VD, Kasture MC and More SS

Abstract
A field experiment was conducted to study the "Effect of application of different levels of N, K and Zn yield and economics of groundnut crop in lateritic soils of Konkan" was conducted at Irrigation Scheme, Pangari Block of C.E.S., Wakawali during *Kharif* season of 2012 and 2013. The field experiment was laid out in split-split plot design comprising of 27 treatment combinations replicated in thrice. Main plots consisting of three levels of nitrogen application (12.5, 25 and 50 kg N ha^{-1}). In sub plot, treatment comprised of three levels of potassium (15, 30 and 45 kg K_2O ha^{-1}) and sub-sub plot treatment comprised of three levels of zinc application (2.5, 5.0 and 7.5 kg Zn ha^{-1}). The application of nitrogen at (50 kg ha^{-1}) recorded the maximum net return and benefit cost ratio in both the years. In the year 2012, the maximum net returns and B:C ratio were recorded in the treatment K_2 (30 kg K_2O ha^{-1}). On other hand the treatment K_3 (45 kg K_2O ha^{-1}) recorded the highest net returns and B:C ratio in the year 2013. In respect to zinc levels the treatment Zn_2 (5 kg ha^{-1}) and Zn_1 (2.5 kg ha^{-1}) recorded the maximum net returns and B:C ratio in the year 2012. However, the highest net returns and B:C ratio were recorded with application of zinc at 7.5 kg ha^{-1} (Zn_3).

Keywords: Nitrogen, potassium, zinc, groundnut, B:C ratio, net return

Introduction
Groundnut (*Arachis hypogaea* L.) is an important oil seed crop and food grain legume, Groundnut cultivation occurs in 108 countries around the world, which is grown in all tropical and subtropical countries, up to 40° N and S. of the equator. It is a valuable cash crop planted by millions of small farmers because of its economic and nutritional value. About two thirds of world production is crushed for oil and remaining one third is consumed as food. The shelled nuts are consumed after roasting, frying, salting or boiling and in many culinary preparations and confectionery products. The high-energy value, protein content, and minerals make groundnut a rich source of nutrition at a comparatively low price. Groundnut cakes obtained after oil extraction is a high protein animal feed. It contains about 50% oil, 25-30% protein, 20% carbohydrate and 5% fiber and ash which make a substantial contribution to human nutrition (El Habbasha *et al.*, 2013) [13]. Besides, it's a valuable source of vitamins E, K and B. It is the richest plant source of thiamine and is also rich in niacin, which is low in cereals. In India, groundnut is known as poor man's almond. In India, groundnut is grown on 4.56 million hectare and production of 6.77 million tonnes with an average productivity of 1486 kg ha^{-1} (DAC and FW, 2016) [6]. Soil analysis of Indian soils has indicated that the soils are medium to low in the potassium and zinc. So effect of nitrogen, potassium and zinc levels are plays an important role in nutrition of plants. Individual and combined effect of these nutrients on yield and yield attributes is not well documented, though these factors play an important role in groundnut production. So far there is no practically systematic research has been done to evaluate the effect of different levels of nitrogen, potassium and zinc through soil application on groundnut crop in this region.

Materials and Methods
The field experiment was conducted during kharif seasons of 2012-13 to 2013-14 at Pangari Block, C.E.S., Wakawali, of Dr. B.S.K.K.V., Dapoli, District Ratnagiri, Maharashtra to study the effect of application of different levels of N, K and Zn on yield and economics of groundnut crop on lateritic soil belonging to Pangari series, isohyperthermic family of Typic Haplustepts (Challa *et al.*, 2008) [4].

The experiment was laid out in a split-split plot design comprising of twenty seven treatments combination with three replications. The treatments comprises three levels of nitrogen, potassium and zinc. The plots of 3.9 x 2.4 m were prepared and demarked manually. In all the treatments, groundnut seeds were inoculated with *Rhizobium* (5.2×107 CFU g-1 of powder) + phosphate solubilizing bacteria (PSB) (5.15 × 107 CFU g-1 of powder). After the preparation of plots, FYM was added @ 5 t ha^{-1} as common to all treatments. Nitrogen was applied in two splits *viz.,* first dose of 50 per cent N at the time of sowing and second dose of 50 per cent at flowering stage in the pertinent treatments. Phosphorus @ 50 kg ha^{-1}, potassium and zinc were applied in a single dose at the time of sowing in the pertinent treatments. The groundnut variety 'Konkan Gaurav' was sown manually in rows at 4-5 cm depth using 150 kg seed rate with 30 x 15 cm spacing. Other management practices were followed as recommended. The data recorded on each character were analyzed by the ANOVA technique as described by Panse and Sukhatme (1967) [12].

Results and Discussion

The results obtained from the present investigation are summarized below:

Effect different levels of N, K and Zn on yield of crop

The perusal of results (Table 1) showed that the significantly highest haulm (44.54 and 39.63 q ha^{-1}) and pod yield (23.76 and 28.18 q ha^{-1}) of groundnut were recorded during the year 2012 and 2013, respectively with the treatment N_3 receiving 50 kg N ha^{-1} and which were found significantly superior over rest of all the treatments. The application of potassium @ 45 kg K_2O ha^{-1} (K_3) was recorded significant higher haulm yield (43.88 q ha^{-1}) and (38.65 q ha^{-1}) as compare to other treatments during the year 2012 and 2013, respectively. The highest pod yield (22.49 q ha^{-1}) was recorded in treatment K_2 (30 kg K_2O ha^{-1}) in year 2012. Whereas, in the year of 2013 application of 45 kg K_2O ha^{-1} (K_3) recorded higher pod yield (25.32 q ha^{-1}). This increase in yield is in accordance with essential requirement for K in plant biochemistry and physiology, in processes including photosynthesis, water relationships, protein synthesis and the requirement for K in at least 60 different enzyme systems within the plant. Similar results showing the benefit of K on crop yield have also been reported by Trivedi *et al.* (2013) [16]. The significantly highest haulm yield (43.62 and 37.64 q ha^{-1}) and pod yield (21.69 and 24.98 q ha^{-1}) were recorded in treatment Zn_3 (7.5 kg Zn ha^{-1}). The increase in yield might be due to role of zinc in biosynthesis of indole acetic acid (IAA) and especially due to its role in initiation of primordial for reproductive parts and partitioning of photosynthates towards them, which resulted in better flowering and fruiting. The findings of present investigation are supported by (Jat and Mehra, 2007) [9].

Effect different levels of N, K and Zn on economics of crop

Data furnished in Table 1 revealed that the cost of cultivation, gross monitory returns, net monitory returns and benefit to cost ratio of groundnut was statistically analyzed and hence inferences in respect of those were drawn on the basis of numerical values.

Effect of nitrogen levels

Scrutiny of the Table 1 implies that, treatment N_3 (50 kg N ha^{-1}) were recorded significantly the highest cost of cultivation (Rs. 64188 and 67687 ha^{-1}), gross return (Rs.111017 ha^{-1} and Rs.132010 ha^{-1}), net returns (Rs.46828 ha^{-1} and Rs.64323 ha^{-1}) and B:C ratio (1.73 and 1.95) during the year 2012 and 2013, respectively. While the lowest cost of cultivation (Rs. 59853 and 60569 ha^{-1}), gross return (Rs.88028 ha^{-1} and Rs.92323 ha^{-1}), net returns (Rs.28175 ha^{-1} and Rs. 31754 ha^{-1}) and B:C ratio (1.47 and 1.52) were noted during the year 2012 and 2013, respectively within the treatment N_1 (12.5 kg N ha^{-1}). This could be ascribed to higher grain yield obtained owing of higher levels of N. The increase in net returns by the application of N fertilizer might be due to positive effect of these nutrients on grain yield. The results of present investigation were in close agreement with the results obtained by Agasimani (1996) [1], Bhagat (2001) [3] and Chavan *et al*. (2012) [5].

Effect of potassium levels

The data showed that, the application of various levels of potassium significantly influenced gross return in groundnut crop. From the data it was showed that, the application of 30 kg K_2O ha^{-1} (K_2) were recorded maximum gross return (Rs. 105177 ha^{-1}), net returns (Rs. 42242 ha^{-1}) and B;C ratio (1.67) during the year 2012 over the treatment (K_3) and treatment (K_1). While in year 2013, the higher gross return (Rs.119124 ha^{-1}) net returns (Rs. 53478 ha^{-1}) and B;C ratio (1.81) were recorded with the treatment K_3 (45 kg K_2O ha^{-1}) followed by treatment K_2 (30 kg K_2O ha^{-1}) and K_1 (15 kg K_2O ha^{-1}) in the descending order of significance. The findings were in accordance with those of Jat *et al*. (2013) [8], Banerjee *et al.* (2014) [2] and Goud *et al.* (2014) [7]. The impact of potassium levels with other nutrients was improvement in pod yield might have helped in accruing higher net profit (Chavan *et al*., 2012) [5]. The results are in accordance with the findings of Kavimani *et al*. (2002) [11] and Venkataramana and Kiraman (2002) [17].

Effect of zinc levels

Glimpses of data presented in Table 1 denoted that cost of cultivation of groundnut increased gradually as increases the levels of zinc application. In year 2012 and 2013, the significantly maximum value of cost of cultivation (Rs. 63099 and 65692 ha^{-1}) were recorded with application of zinc @ 7.5 kg ha^{-1} (Zn_3) followed by treatment Zn_2 (5 kg Zn ha^{-1}) and Zn_1 (2.5 kg Zn ha^{-1}). The findings were in accordance with those Jat *et al*. (2013) [8]. While in year 2012 the treatment Zn_2 (5 kg Zn ha^{-1}) was recorded the highest gross return (Rs. 102276 ha^{-1}) and net returns (Rs. 39825 ha^{-1}). On other hand in the year 2013 the maximum value of gross return (Rs. 117451 ha^{-1}) and net returns (Rs. 51759 ha^{-1}) were recorded with application of zinc @ 7.5 kg ha^{-1} (Zn_3). Whereas the treatment Zn_1 (2.5 kg Zn ha^{-1}) and Zn_3 (7.5 kg Zn ha^{-1}) were recorded significantly the highest B:C ratio (1.64 and 1.78) in year 2012 and 2013 respectively. The experimentation results indicated that maximum benefit cost ratios was with higher dose of Zn. This could be ascribed to higher grain yield obtained owing of higher levels of Zn (Jeetarwal *et al.*, 2015) [10]. These results are akin to those reported by Singh and Singh (2012) [14] and Singhal *et al*. (2014) [15].

Economics of the different N, K and Zn treatment combinations

The data pertaining to the cost of cultivation, gross monitory returns, net monitory returns and B:C ratio as influenced by different treatments combinations are presented in Table 2. Glimpses of the data illustrated that, the higher cost of cultivation recorded under the treatment combinations of

$N_3K_2Zn_3$ i.e. (50: 30: 7.5 kg N: K_2O: Zn ha^{-1}) and which was Rs. 65,365/- ha^{-1} during the year 2012. While, in year 2013 the treatment combinations $N_3K_3Zn_3$ i.e. (50: 45: 7.5 kg N: K_2O: Zn ha^{-1}) recorded the highest cost of cultivation (Rs. 69,287/- ha^{-1}). The higher gross return recorded under the treatment combinations of $N_3K_2Zn_2$ i.e. (50: 30: 5 kg N: K_2O: Zn ha^{-1}) and which was Rs. 1,16,838/- ha^{-1} during the year 2012. While, in year 2013 the treatment combinations $N_3K_3Zn_3$ i.e. (50: 45: 7.5 kg N: K_2O: Zn ha^{-1}) recorded the highest gross return (Rs. 1,35,025/- ha^{-1}).

The data showed that, the highest net return of groundnut crop (Rs. 51,883/- and 65,974/- ha^{-1}) were recorded by the treatment combinations $N_3K_2Zn_1$ i.e. (50: 30: 2.5 kg N: K_2O: Zn ha^{-1}) over the rest of all treatment during the years 2012 and 2013, respectively. This means that the higher quantity of inorganic fertilizers required for obtaining higher yield resulted in higher investment but ultimately gave the higher returns. While the highest B:C ratio (1.80 and 1.98) of groundnut crop were recorded by the treatment combinations $N_3K_2Zn_1$ i.e. (50: 30: 2.5 kg N: K_2O: Zn ha^{-1}) over the rest of all treatment during the years 2012 and 2013, respectively.

Table 1: Effect of different levels of N, K and Zn on yield and yield attributes of groundnut

Parameters	Yield (q ha^{-1})				Cost of Cultivation (₹ ha^{-1})		Gross Returns (₹ ha^{-1})		Net Returns (₹ ha^{-1})		B:C ratio	
	Haulm (q ha^{-1})		Pod (q ha^{-1})									
	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013
Nitrogen Levels												
N_1:12.5 kg ha^{-1}	41.04	32.87	18.42	19.67	59853	60569	88028	92323	28175	31754	1.47	1.52
N_2:25.0 kg ha^{-1}	42.52	38.20	22.77	25.11	63056	65030	106236	118085	43180	53055	1.68	1.81
N_3:50.0 kg ha^{-1}	44.54	39.63	23.76	28.18	64188	67687	111017	132010	46828	64323	1.73	1.95
S.E±	0.62	0.26	0.17	0.39	--	--	--	--	--	--	--	--
C.D. at 5%	2.45	1.03	0.68	1.54	--	--	--	--	--	--	--	--
Potassium Levels												
K_1:15 kg ha^{-1}	40.68	35.90	21.08	22.77	61565	62938	99272	107512	37707	44574	1.61	1.70
K_2:30 kg ha^{-1}	43.54	36.16	22.49	24.88	62935	64703	105177	115783	42242	51080	1.67	1.78
K_3:45 kg ha^{-1}	43.88	38.65	21.38	25.32	62597	65646	100831	119124	38234	53478	1.61	1.81
S.E±	0.58	0.40	0.19	0.27	--	--	--	--	--	--	--	--
C.D. at 5%	1.79	1.24	0.58	0.82	--	--	--	--	--	--	--	--
Zinc Levels												
Zn_1:2.5 kg ha^{-1}	41.92	35.80	21.60	24.05	61546	63373	101109	112070	39563	48697	1.64	1.76
Zn_2:5.0 kg ha^{-1}	42.56	37.27	21.65	23.93	62452	64222	102276	112897	39825	48676	1.63	1.75
Zn_3:7.5 kg ha^{-1}	43.62	37.64	21.69	24.98	63099	65692	101895	117451	38795	51759	1.61	1.78
S.E±	0.38	0.21	0.25	0.20	--	--	--	--	--	--	--	--
C.D. at 5%	1.08	0.62	0.72	0.59	--	--	--	--	--	--	--	--

Table 2: Economics of the different N, K and Zn treatment combinations

Sr. No.	Treatment combination	Cost of Cultivation (₹ ha^{-1})		Gross Returns (₹ ha^{-1})		Net Returns (₹ ha^{-1})		B:C ratio	
		2012	2013	2012	2013	2012	2013	2012	2013
1	$N_1K_1Zn_1$	57868	58556	82704	86828	24836	28272	1.43	1.48
2	$N_1K_1Zn_2$	59715	59488	89517	88156	29802	28668	1.50	1.48
3	$N_1K_1Zn_3$	59983	60948	86856	92647	26873	31699	1.45	1.52
4	$N_1K_2Zn_1$	58742	58619	85631	84891	26889	26272	1.46	1.44
5	$N_1K_2Zn_2$	59748	60224	87397	90257	27649	30032	1.46	1.50
6	$N_1K_2Zn_3$	60429	61858	87215	95790	26786	33932	1.44	1.55
7	$N_1K_3Zn_1$	59484	61045	87762	97131	28278	36085	1.48	1.59
8	$N_1K_3Zn_2$	60895	61789	91964	97329	31069	35539	1.51	1.57
9	$N_1K_3Zn_3$	61813	62593	93202	97882	31389	35289	1.51	1.56
10	$N_2K_1Zn_1$	60120	60710	95207	98748	35087	38038	1.58	1.63
11	$N_2K_1Zn_2$	61426	62095	98775	102794	37350	40699	1.61	1.66
12	$N_2K_1Zn_3$	62480	64101	100834	110557	38353	46456	1.61	1.72
13	$N_2K_2Zn_1$	63474	64867	113015	121371	49541	56504	1.78	1.87
14	$N_2K_2Zn_2$	64234	65791	113307	122650	49073	56859	1.76	1.86
15	$N_2K_2Zn_3$	64919	67199	113151	126831	48231	59632	1.74	1.89
16	$N_2K_3Zn_1$	63902	66211	113265	127117	49363	60906	1.77	1.92
17	$N_2K_3Zn_2$	63347	65716	105670	119882	42323	54166	1.67	1.82
18	$N_2K_3Zn_3$	63597	68583	102897	132817	39300	64234	1.62	1.94
19	$N_3K_1Zn_1$	63123	65569	111207	125882	48084	60313	1.76	1.92
20	$N_3K_1Zn_2$	64412	67031	114680	130389	50267	63358	1.78	1.94
21	$N_3K_1Zn_3$	64956	67945	113670	131605	48715	63661	1.75	1.94
22	$N_3K_2Zn_1$	64346	67164	116229	133138	51883	65974	1.80	1.98
23	$N_3K_2Zn_2$	65158	67888	116838	133216	51680	65328	1.79	1.96
24	$N_3K_2Zn_3$	65365	68714	113809	133904	48444	65190	1.74	1.95
25	$N_3K_3Zn_1$	62854	67615	104959	133526	42105	65911	1.67	1.97
26	$N_3K_3Zn_2$	63128	67972	102340	131403	39211	63431	1.62	1.93
27	$N_3K_3Zn_3$	64353	69287	105418	135025	41065	65738	1.64	1.95

Conclusion
In general, it is concluded that the application of 50 kg N, 45 kg K_2O and 7.5 kg Zn ha^{-1} ($N_3K_3Zn_3$) was found that increasing the haulm and pod yield. In the year 2012 and 2013 the maximum B:C ratio was recorded in $N_3K_2Zn_1$ treatment combination. The treatment combinations $N_3K_2Zn_2$ (50: 30: 5 kg N: K_2O: Zn ha^{-1}) was registered the maximum net return in both the years.

Reference

1. Agasimani CA. Effect of organic and inorganic fertilizers on growth and yield of groundnut. Journal of Maharashtra Agricultural University. 1996; 21(3):470.
2. Banerjee H, Dutta SK, Pramanik SJ, Ray K, Phonglosa A, Bhattacharyya K. Productivity and profitability of spring planted sunflower hybrid with nitrogen, phosphorus and potassium fertilizer. Annals of Plant and Soil Research. 2014; 16(3):250-256.
3. Bhagat RK. Integrated nutrient management in groundnut-wheat cropping system. Journal of. Research Birsa Agricultural University. 2001; 13(2):137-139.
4. Challa O, Gajbhiye KS, Velayutham, MV. Soil Series of Mahartashtra, NBSS Publ. No. 79, NBSS&LUP, Nagpur, 2008, 428.
5. Chavan AP, Jain NK, Sagvekar VV, Taresh Kumar. Integrated nutrient management in groundnut (*Arachis hypogaea* L.). Research on Crops. 2012; 15(2): 454-460.
6. DAC and FW All India Area, Production and Yield in groundnut. Directorate of Economics and Statistics, Agricultural Statistics at a Glance, 2016.
7. Goud VV, Konde NM, Mohod PV, Kharche VK. Response of chickpea to potassium fertilization on yield, quality, soil fertility and economic in vertisols. Legume Research. 2014; 37(3):311-315.
8. Jat G, Majumdar SP, Jat NK, Mazumdar Sonali. Potassium and zinc fertilization of wheat (*Triticum aestivum*) in western arid zone of India. Indian Journal of Agronomy. 2013; 58(1):67-71.
9. Jat JR, Mehra RK. Effect of sulphur and zinc on yield, macronutrient content in and uptake by mustard on haplustepts. Journal of the Indian Society of Soil Science. 2007; 55(2):190-195.
10. Jeetarwal RL, Shivran AC, Dhaka MS, Jat ML, Choudhari GL. Influence of phosphorous and zinc fertilization on economics, quality and nutrient uptake of groundnut (*Arachis hypogaea* L.). Environment and Ecology. 2015; 33(1):19-22
11. Kavimani R, Annadurai K, Rangaraju G. Spacing and nutrients management on yield maximization of irrigated groundnut. Crop Research. 2002; 23(1):58-60.
12. Panse VG, Sukhatme PV. Statistical methods for Agricultural workers, I.C.A.R., New Delhi, 1967.
13. El-Habbasha SF, Taha MH, Jafar NA. Effect of Nitrogen Fertilizer Levels and Zinc Foliar Application on Yield, Yield Attributes and Some Chemical Traits of Groundnut. Research Journal of Agriculture and Biological Sciences. 2013, 9(1):1-7.
14. Singh D, Singh H. Effect of phosphorus and zinc nutrition on yield, nutrient uptake and quality of chickpea. Annals of Plant and Soil Research. 2012; 14(1):71-74.
15. Singhal S, Jain KK, Kumawat A. Response of cluster bean (*Cyamopsis tetragonoloba*) cultivars to different levels of zinc in north western Rajasthan. Annals of Agricultural Bio Research. 2014; 19(3):437-440.
16. Trivedi SK, Pachauri RK, Sharma Geeta, Joshi BS, Rajput B. Effect of moisture regimes, NPK and zinc levels on growth, yield, quality, nutrient uptake and economics of mustard (*Brassica juncea*). Journal of Soils and Crops. 2013; 23(1):78-85.
17. Venkataramana P, Kiraman NJ. Influence of different levels of organic and inorganic fertilizers on groundnut cultivars. Environment and Ecology. 2002; 20:89-91.