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Original Research Article

Effect of Different Levels of Zinc on Yield and Quality of Groundnut (*Arachis hypogea* L.) in Inceptisol

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A B S T R A C T

A field experiment was conducted to study effect of different levels of zinc on yield and quality of groundnut (*Arachis hypogaea L.*) in Inceptisol during *kharif* season in the year 2015–2016 at departmental farm of Soil Science and Agricultural Chemistry, college of Agriculture Latur. The experiment was laid out in factorial randomized block design (FRBD) with 16 treatment combination (four levels of zinc *viz.* Zn_0, Zn_1, Zn_2 and Zn_3 and four cultivars *viz.* LGN–1, LGN– 123, JL– 24, JL–776) along with three replication. The effect of Zn on kernel and haulm yield as well as quality parameters such as oil and protein of groundnut were significantly increased with application of $ZnSO_4$ @ 30 kg ha^{-1}+ RDF, followed by $ZnSO_4$@ 15 kg ha^{-1} + RDF. However, increment of zinc (45kg ha^{-1}) did not prove superior over other treatment. The magnitude of response of groundnut cultivars to zinc levels was in the order of JL-24 > LGN-1 > JL-776 > LGN-123.In terms of yield and quality of groundnut. Thus, it can be concluded that application of zn along with recommended dose of NPK to different cultivars was found to be beneficial in increasing yield and quality of groundnut over control on low zinc containing Inceptisol soil.

Introduction

Groundnut (*Arachis shypogaea L.*) is one of the most important oilseed crops in Indian farming and ranks first in respect of area and second in respect of production after China and is grown on variety of soils. Being the best source of edible vegetable oil, groundnut also provides raw material for industrial serving as concentrated animal feed and organic manure. It contributed to sustainable agriculture being a legume and cultivated since long in both *kharif* and summer season by the agriculturist. In India, it is cultivated over an area of 8.71 million hectares comprising 45 per cent of the total oilseed production. The percentage area of groundnut in Maharashtra is 6.38 percent and the production is 5.13 per cent of the total cultivation of India. Groundnut contains on an average 12-15 percent carbohydrate, 25-30 per cent protein and 45-50 per cent oil. Groundnut oil contains unsaturated fats which is highly nutritious and contains 50-60 per cent oleic acid, 18-30 per cent linoleic acid, 8-10 per cent palmitic acid, 3-6per centstearic acid as well as 7 per cent of other fats including arachidin acid, buteric acid and lignoceric acids.

Zinc is required in various metabolic processes as catalysts. Zinc also increases the content of protein, calorific value, amino acid and fat in oilseed crop Balanced fertilization helps to improve the quality of the produce. Thus, use of fertilizer for a particular crop should be considered from quality point of view.

Zinc deficiency start yellowing of leaves from lamina to base, mid-rib and veins remain green. In Maharashtra 34 per cent soils were deficient in available zinc application of zinc in such deficient soils may improve the quality of farm produce. Hence, this study was taken on priority to see the influence effect of different levels of zinc on yield and quality of groundnut, in Inceptisol**.**

Materials and Methods

The field experiment was conducted on the farm of Department of Soil Science and Agricultural Chemistry, College of Agriculture, Latur, VNMKV Parbhani during *Kharif* 2015-2016 on groundnut crop. The experimental soil was clayey in texture, calcareous in nature and slightly alkaline in reaction; low in N, P and Zn, and high in K. The experimental soil was deep black in color with good drainage.

The experiment was laid out in factorial randomized block design (FRBD) with 16 treatment combination (four levels of zinc *viz.* Zn_0, Zn_1, Zn_2 and Zn_3 and four cultivars *viz.*LGN–1, LGN– 123, JL– 24, JL–776) along with three replication, In order to evaluate the effect of different le vels of zinc on yield and quality of groundnut in Inceptisol with recommended dose of N, P_2O_5 (25:50 kg ha^1), along with $ZnSO_4$, 0 $kgha^{-1}$15 kg ha^{-1} 30 $kgha^{-1,}$45 $kgha^{-1}$ was applied at the time of sowing. N and P were applied through urea and single superphosphate. The method for application of fertilizer adopted was band placement. With Spacing Row to Row 30 cm and Plant to Plant 15 cm.Plot size of Gross: 3.6 x 4.0 m^2 and Net: 2.7 x 3.5 $m^{2,}$and Number of treatments 16 with Number of replication is 03 and Cultivar 4 (LGN-1, LGN-123, JL-24,JL-776) and RDF(25:50:00)and Varieti V_1 = LGN-1 V_2 = LGN-123 V_3=JL-24 V_4=JL-776 with Level of Zinc Zn_0 = No Zinc Zn_1 = 15 $ZnSO_4$ kg ha^{-1} Zn_2 = 30 $ZnSO_4$ kg ha^{-1} Zn_3 = 45 $ZnSO_4$ kg ha^{-1}.

Results and Discussion

Data tabulated in Table 1 shows that the effects of different levels of zinc on kernel yield of groundnut crop. A variety shows difference in kernel yield. Cultivar JL-24 (V_3) recorded highest kernel yield 813 kg ha^{-1} over all other cultivars. V_1-779 kg ha^{-1}, V_2-597 kg ha^{-1} and V_4- 638kg ha^{-1} showed significant response over control. Zinc fertilization significantly influences the kernel yield. Highest kernel yield 776 kg ha^{-1} over control (597 kg ha^{-1}) due to the application of $ZnSO_4$@ 30 kg ha^{-1} + RDF.

Effects of different levels of zinc on kernel yield are presented and revealed that all treatments significantly increased the kernel yield over control. Among all treatment 30 kg $ha^{-1}ZnSO_4$ + RDF with JL-24recordet highest kernel yield 813 kg ha^{1}respectively.

Data indicated in Table 2 shows that the effects of different levels of zinc on haulm yield of groundnut crop. A variety shows difference in haulm yield. Cultivar JL-24 (V_3) recorded highest haulm yield 3087 kg ha^{-1} over all other cultivars. V_1–2956 kg ha^{-1}, V_2–2265kg ha^{-1} and V_4– 2421kg ha^{-1} showed significant response over control. Zinc fertilization significantly influences the haulm yield.

Table.1 Effect of zinc on kernel yield of groundnut (kg ha^{-1})

Variety	Zinc levels				Mean
	Zn_0	Zn_1	Zn_2	Zn_3	
V_1	661	785	850	820	779
V_2	515	581	651	640	597
V_3	663	829	900	861	813
V_4	549	619	702	681	638
Mean	597	703	776	750	-
	Variety		Zn		V× Zn
SE±	10.02		10.02		20.04
CD at 5%	28.94		28.94		NS

Table.2 Effect of Zinc on haulm yield of groundnut (kg ha^{-1})

Variety	Zinc levels				Mean
	Zn_0	Zn_1	Zn_2	Zn_3	
V_1	2509	2979	3225	3112	2956
V_2	1956	2207	2471	2427	2265
V_3	2518	3146	3415	3268	3087
V_4	2086	2349	2666	2583	2421
Mean	2267	2670	2944	2848	
	Variety		Zn		V× Zn
SE±	38.04		38.04		76.08
CD at 5%	109.83		109.83		NS

Table.3 Effect of zinc on oil content (%) and oil yield (kg ha^{-1}) in groundnut

Variety	Zinc levels				Mean
	Zn_0	Zn_1	Zn_2	Zn_3	
	Oil content (%)				
V_1	44.69	45.00	45.17	45.04	44.97
V_2	44.92	45.33	45.07	44.92	45.06
V_3	44.90	45.23	45.39	45.05	45.14
V_4	45.08	44.70	45.02	44.70	44.88
Mean	44.90	45.07	45.17	44.93	
	Variety		Zn		V× Zn
SE±	0.139		0.139		0.277
CD at 5%	0.400		0.400		NS
	Oil yield (kg/ha_{-1})				
V_1	295.36	353.06	383.83	369.23	350.37
V_2	231.43	263.59	293.46	287.34	268.95
V_3	297.83	374.85	408.29	387.99	367.24
V_4	247.71	277.01	316.30	304.29	286.33
Mean	268.08	317.13	350.47	337.21	
	Variety		Zn		V× Zn
SE±	4.609		4.609		9.218
CD at 5%	13.308		13.308		NS

Table.4 Effect of zinc on protein content (%) and protein yield (kgha^{-1}) of groundnut

Variety	Zinc levels				Mean
	Zn_0	Zn_1	Zn_2	Zn_3	
Protein content (%)					
V_1	20.79	22.69	23.81	23.75	22.76
V_2	20.48	22.48	23.71	22.75	22.35
V_3	20.73	22.52	24.58	23.58	22.85
V_4	20.69	22.88	22.88	23.27	22.43
Mean	20.67	22.64	23.74	23.34	
	Variety		Zn		V× Zn
SE±	0.254		0.254		0.508
CD at 5%	0.734		0.734		1.467
Protein yield (kgha^{-1})					
V_1	137.33	177.92	202.36	194.78	178.10
V_2	105.54	130.75	154.42	145.49	134.05
V_3	137.54	186.60	220.87	203.16	187.04
V_4	113.75	141.54	160.87	158.31	143.62
Mean	123.54	159.20	184.63	175.44	
	Variety		Zn		V× Zn
SE±	2.857		2.857		5.714
CD at 5%	8.249		8.249		NS

Highest kernel yield2944 kg ha^{-1} over control (2267 kg ha^{-1}) respectively due to the application of $ZnSO_4$@ 30 kg ha^{-1} + RDF. Effects of different levels of zinc on haulm yield are presented in it was revealed that all treatments significantly increased the haulm yield over control. Among all treatment$ZnSO_4$ @30 kg ha^{-1} + RDF with JL-24 recorded highest haulm yield 3087 kg ha^{-1} respectively.

Data indicated in Table 3 shows that the effects of different levels of zinc on oil content and oil yield of groundnut crop.

Variety shows difference in oil percent and oil yield. Cultivar JL-24 (V_3) recorded highest oil content 45.14 percent over all other cultivars.V_1–44.97 percent, V_2 –45.06 percent and V_4– 44.88 percent show significant response over control. Cultivar JL-24 (V_3) recorded highest oil yield (367.24 kg ha^{-1}) over all other cultivars.

Zinc fertilization significantly influences the oil contain. Highest oil contains 45.17 percent over control (44.90 percent) respectively due to the application of 30 kg $ZnSO_4$ ha^{-1} + RDF. Zinc fertilization significantly influences the oil yield. Highest oil yield was recorded in $ZnSO_4$@ 30 kg ha^{-1} + RDF, 350.47 kg ha^{-1} over control (268.08 kgha^{-1}) respectively.

Data tabulated in Table 4 shows that the effects of different levels of zinc on protein content and protein yield of groundnut crop.

Variety showed difference in protein content and protein yield. Cultivar JL-24 (V_3) recorded highest protein content 22.85 percent over all other cultivars.V_1-22.76 percent, V_2-22.35 percent and V_4- 22.43 percent showed significant response over control. Cultivar JL-24 (V_3) with $ZnSO_4$@ 30 kg ha^{-1}+ RDF recorded highest protein yield184.63 kg ha^{-1} over all other cultivars.

Zinc fertilization significantly influences the protein contain. Highest protein contains 23.74 percent over control 20.67 per cent respectively due to the application of$ZnSO_4$@ 30 $kgha^{-1}$ + RDF. Zinc fertilization significantly influences the protein yield. Highest protein yield was recorded in 30 kg $ZnSO_4$ ha^{-1} + RDF.134.04 kg ha^{-1}over control 123.54kg ha^{-1}respectively.

Effect of different levels of zinc on protein content and protein yield of groundnut. It was revealed that all treatments significantly increased protein content and protein yield over control. Among all treatment $ZnSO_4$30 kg ha^{-1} + RDF with JL-24 recorded highest protein content 45.14 per cent and protein yield 367.24kg ha^{-1} respectively. Similar findings are reported by Zinc plays important role in formulation of growth hormones, promotion of protein synthesis in kernel maturation and production. Zinc also increase the content of proteins, calorific value, and amino acid and fat in oilseed crop hence legume crop required a higher amount of zinc. Tathe *et al.,* (2008) who reported that application of 40 kg ha^{1} zinc record highest protein content of groundnut. Nadaf *et al.,* (2011) reported that crude protein content of groundnut increased significantly due to application of zinc sulphate @ 5, 10 and 20 kg ha^{-1}. And Suresh *et al.,* (2013).

Among the cultivar studied significant response was observed in JL-24 followed by LGN-1, LGN-123 AND JL-776 at 30, 60 and 90 DAS.

Kernel and haulm yield were maximum in cultivar JL-24.Increase in kernel yield of groundnut cultivar JL-24 is 36.18per cent which is higher than LGN-1 (30.48 percent) and JL-776 (6.86 percent) with $ZnSO_4$ @ 30 $kgha^{-1}$ + RDF (V_3Z_2). Kernel and haulm yield were maximum in cultivar JL-24.Increase in kernel yield of groundnut cultivar JL-24 is 36.18per cent which is higher than LGN-1 (30.48 per cent) and JL-776 (6.86 per cent) with $ZnSO_4$ @ 30 $kgha^{-1}$ +RDF (V_3Z_2). Zinc improved the quality by way of healthy and bold seeds in zinc treated plot over control.

The oil percentage and oil yield, protein percentage and protein yield were Maximum due to the application of $ZnSO_4$ @ 30 kg ha^{-1} + RDF. Highest oil percentage and oil yield, protein percentage and protein yield were recorded in cultivar JL-24 with $ZnSO_4$ @ 30 kg ha^{-1}+RDF (V_3Z_2).

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