Indian J. Hill Farmg. 14 (1) : 29 — 32 2001

RESPONSE OF GROUNDNUT TO PHOSPHORUS AND ZINC IN RELATION TO YIELD, QUALITY AND RESIDUAL AVAILABILITY OF P AND Zn IN ACID SOIL OF MEGHALAYA

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ABSTRACT

A field experiment was conducted during *kharif* (rainy seasons) of 1998 and 1999 to investigate the effect of various levels of phophorus and zinc on the kernel, protein and oil yield of groundnut and residual availability of P and Zn in an acid soil. Phosphrus and zinc application progressively and significantly enhanced the kernel, protein and oil yield of groundnut and their interaction ws also significant for these parameters. Available P and Zn contents of soil were increased significantly with their respective application. Available P and Zn contents of soil were increased significantly with their respective application. Available P content of soil was increased on Zn application and vice versa. The interaction between P and Zn was significant for available P and Zn contents in soil and their maximum values were recorded at P_{75} Zn_{20} treatment combination, which was at par with P_{50} Zn_{20} for available Zn.

INTRODUCTION

The soils of Meghalaya are low in availbale P and 60% are reported to be deficient in available Zn (Prasad *et al* 1981). Several workers (Safaya 1976, Ahmed *et al* 1986, and Yadav *et al* 1991) have reported P × Zn interactions in plants and soils. But the information regarding P × Zn interactions on groundnut in acid soil of Meghalaya is lacking. The present work was, therefore, conducted to know the effect of combined application of P and Zn on kernel, protein and oil yield of groundnut and residual availability of P and Zn in acid soil.

MATERIALS AND METHODS

A field experiment was conducted on a sandy loam soil of ICAR Complex, Umiam during *kharif* (rainy seasons) of 1998 and 1999 to study the effect of P and Zn application on yield, quality of Groundnut CV. ICGS-76 and residual availability of P and Zn in acid soil. The soil was highly acidic (pH 4.5) with 1.52% organic carbon and 1.20 meq% exchangeable Al. Available N, P, K and DTPA extractable Zn measured in the above soil were 250, 8.9, 270 kg/ha and 1.5 ppm respectively. The treatments consisted of all possible combinations of four levels of P (0,25,50 and 75 kg P_2O_5/ha) and Zn (0,10,15 and 20 kg/ha). Each treatment was replicated thrice in a factorial randomized block design (RBD). A basal application of 20 kgN/

ha through urea and 40 kg K_2O /ha through muriate of potash was provided to each plot. Total N was determined by micro-kjeldahl method and protein content was calculated by multiplying the same with conventional factor 6.25. Oil content was determined by soxhlet extraction (AOAC, 1965). Available P was determined by the method of Bray and Kurtz (1945) and DTPA extractable Zn by atomic absorption spectrophotometer.

RESULTS AND DISCUSSION

Kernel yield : Application of P and Zn significantly increased the kernel yield of groundnut (Table 1) which can be justified from the fact that the soil under study was deficient in available P and Zn. The percent increase in kernel yield was more with the application of P in comparison to Zn over control. The interaction between P and Zn was significant for kernel yield. The kernel yield increased significantly at each P level with increasing levels of Zn and vice versa. The beneficial effect of P-Zn combination on kernel yield may be because of the fact that addition of Zn with P might have maintained a favourable balance between P and Zn in the groundnut plants for optimum growth and production (Millikan, 1963; Watanabe *et al* 1965).

Protein and oil yield : The protein and oil yield of groundnut increased significantly with increasing application of P and Zn (Table 1). The protein and oil yields were enhanced by 77 and 75% over control respectively with the application of 75 kg P_2O_5/ha whereas the same were increased by 27% over control with 20 kg Zn/ha. Similar result was also reported by Pasricha *et al* (1987). The improvement in oil yield with P application may be due to the fact that P increases triglycerols and phospholipids and decreases free fatty acids and sterols in glyoxalate cycle (Pasricha *et al,* 1987 and Dwivedi and Bapat, 1998). The increase in protein yield because of Zn application is a result of the fact that Zn is involved in root nodulation, biological N fixation and protein biosynthesis (Saini *et al*, 1975; Praske and Plocke, 1975). The interaction between P and Zn was significant for protein and oil yield and the maximum protein (7.87q/ha) and oil (12.16q/ha) yield were recorded at $P_{75}Zn_{20}$ treatment combination.

Residual nutrient availability : The residual available P and Zn content increased significantly with their respective application. The findings are in agreement with the results reported by Joshi *et al.* (1973) and Chatterjee *et al.* (1983). Available P content in soil increased significantly with Zn application suggesting synergism between P and Zn in soil. Similar results were also reported by Chatterjee *et al.* (1983). Available Zn content in soil increased with increasing application of P but significant increase was found from the P_{50} dose onward. The antagonism between P and Zn did not occur in the soil as also reported by Reddy *et al.* (1973). The best suitable combinations for available P and Zn content in soil were $P_{75}Zn_{20}$ and $P_{50}Zn_{20}$ respectively.

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Table 1. Effect of Phosphorus and Zinc on Kernel, Protein and Oil yield (q/ha) of groundnut.

P levels	Zn levels (kg/ha)				
(kg/ha)	0	10	15	20	Mean
			Kernel yield		
0	10.95	14.21	15.03	15.67	13.96
25	15.93	16.69	17.45	18.69	17.19
50	19.02	19.54	20.26	20.96	19.94
75	21.32	21.97	23.04	24.32	22.66
Mean	16.80	18.10	18.94	19.91	
CD (0.05)	**P = 1.0**		**Zn = 0.8**	**PxZn = 1.0**	

P levels	Zn levels (kg/ha)				
(kg/ha)	0	10	15	20	Mean
			Protein yield		
0.	2.96	3.91	4.43	4.72	4.00
25	4.49	4.85	5.23	5.68	5.06
50	5.60	5.83	6.20	6.48	6.02
75	6.47	6.75	7.31	7.87	7.10
Mean	4.88	5.33	5.79	6.19	
CD (0.05)	**P = 0.3**		**Zn = 0.2**	**PxZn = 0.4**	
			Oil yield		
0.	4.78	6.30	6.93	7.38	6.34
25	7.03	7.54	8.39	9.17	8.03
50	8.69	9.03	9.84	10.35	9.47
75	10.33	10.68	11.37	12.16	11.13
Mean	7.70	8.38	9.13	9.76	
CD (0.05)	**P = 0.4**		**Zn = 0.3**	**P × Zn = 0.5**	

Table 2. Effect of Phosphorus and Zinc on residual available P and Zn in soil.

P levels	Zn levels (kg/ha)				
(kg/ha)	0	10	15	20	Mean
			Soil pH (1 : 2.5)		
0	4.62	4.77	4.89	5.10	4.84
25	4.64	4.82	4.90	5.16	4.88
50	4.77	5.02	5.16	5.23	5.04
75	5.00	5.10	5.20	5.26	5.14
Mean	4.75	4.92	5.02	5.18	
CD (0.05)	**P = 0.03**		**Zn = 0.03**	**P × Zn = 0.06**	
			Available P(kg/ha)		
0	2.28	2.60	2.94	3.11	2.73
25	4.75	5.50	6.19	7.00	5.86
50	6.05	8.46	10.24	11.00	8.93
75	8.22	11.13	13.25	15.14	11.93
Mean	5.32	6.92	8.15	9.06	
CD (0.05)	**P = 0.9**		**Zn = 0.7**	**P × Zn = 1.5**	
			Available Zn (ppm)		
0	1.60	2.44	2.58	2.95	2.39
25.	1.55	2.50	2.65	3.21	2.47
50	1.52	2.53	2.98	3.62	2.66
75	1.39	2.90	3.37	3.66	2.83
Mean	1.51	2.59	2.89	3.36	
CD (0.05)	**P = 0.13**		**Zn = 0.13**	**P × Zn = 0.26**	