

INFLUENCE OF SOURCES AND MODE OF ZINC APPLICATION ON YIELD AND UPTAKE OF ZINC BY WHEAT IN ARIDISOLS

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ABSTRACT

Field investigations were carried out to study the effect of sources and mode of Zn application on yield and uptake of Zn by wheat. Zn SO₄ produced higher grain yield than ZnO, broadcast method proved superior than placement. Seed coating with 50 g ZnO kg⁻¹ seed, produced higher yield than soil application of 5 kg Zn ha⁻¹ as ZnO applied either as broadcast or placement method. Uptake of Zn was more through ZnSO₄ at 10 kg Zn ha⁻¹ irrespective of mode of application.

INTRODUCTION

In view of the widespread deficiency of Zn in Haryana its amelioration techniques have become a serious concern in crop production. Kang and Okoro (1976) observed ZnSO₄ to be the better source and its efficiency was higher when mixed with soil in rice. Gupta and Potalia (1988) reported ZnSO₄ to be more effective than ZnO in clusterbean. The efficiency of Zn varies with sources and method of application. Therefore, the present study was conducted to investigate the efficiency and methods of Zn application on yield and Zn uptake by wheat.

MATERIAL AND METHODS

A field experiment was conducted in 1989 in a loamy sand soil (Typic Ustipsamment) of pH 8.3; Organic carbon 0.32% EC 0.12 dSm⁻¹ available P 3.2 ppm and DTPA extractable Zn 0.42 ppm. The treatment consistings of 5 and 10 kg Zn ha⁻¹ as ZnO and ZnSO₄ sources by broadcast and placement and seed coating with ZnO @ 25 and 50 g kg⁻¹ seed were replicated three times in randomised block design. A basal dose of 120, 60 and 60 kg N, P₂O₅ and K₂O ha⁻¹ was applied as urea, single superphosphate and muriate of potash respectively. Wheat (Cv WH-147) was grown, harvested to record grain yield and analysed for Zn. Physico-chemical properties were determined according to Chopra and Kanwar (1979) and Zn was estimated on atomic absorption spectrophotometer.

RESULTS AND DISCUSSION

Yield

The grain yield increased due to Zn application irrespective of Zn sources and mode of its application (Table 1). Application of 10 kg Zn ha⁻¹ resulted in higher grain yield than 5 kg Zn ha⁻¹. Broadcasting of ZnSO₄ and ZnO gave higher yield of wheat grain when compared with that of placement method. ZnSO₄ produced

Table 1. Effect of Zn sources and methods of application on yield of wheat

Zn sources	Treatments		Yield q ha ⁻¹		Per cent response
	Zn levels kg ha ⁻¹	Methods of application	Grain	Straw	Grain
Control	NPK only	—	41.7	88.7	—
ZnSO ₄	5	Placement	48.4	79.0	16.0
ZnSO ₄	10	Placement	54.7	88.4	31.1
ZnSO ₄	5	Broad cast	52.5	85.7	25.8
ZnSO ₄	10	Broad cast	58.7	88.0	40.7
ZnO	5	Placement	47.7	101.4	14.3
ZnO	10	Placement	52.1	85.0	24.9
ZnO	5	Broad cast	48.2	102.5	15.5
ZnO	10	Broad cast	55.0	85.5	31.8
ZnO	25 g kg ⁻¹ seed	Seed coating	50.9	97.9	22.0
ZnO	50 g kg ⁻¹ seed	Seed coating	52.0	85.5	24.7
CD 5%	Zn sources		1.5	5.0	
	Zn levels		2.4	2.8	
	Zn sources x Zn levels		NS	7.0	
	Control v/s other		3.6	NS	

higher than ZnO. In tomato and clusterbean crops, Gupta and Hans Raj (1980) and Gupta and Potalia (1988) recorded increase in yield due to ZnSO₄ over ZnO application. Wheat having fibrous root system explored greater volume of soil for Zn nutrition. The average per cent increase in grain yield due to broadcast of ZnSO₄ was 38 against 23 in placement method.

The increase in yield due to treatment, seed coating @ 50 g ZnO kg⁻¹ seed, 10 kg Zn ha⁻¹ as ZnSO₄ by broadcast and placement method was 25, 40 and 32 per cent respectively, when compared with that of control. The increase in yield due to seed coating is attributed to better contact of roots with the fertilizer zone. However, this method of seed coating need further investigation to prove its usefulness over other methods.

Zinc concentration and uptake

Zinc concentration increased with Zn addition irrespective of Zn sources and levels (Table 2). The highest concentration of Zn was recorded in ZnSO₄ treatment.

Table 2. Effect of sources and methods of Zn application on concentration and uptake of Zn by wheat

Zn source	Treatments		Zn concentration		Total Zn uptake g ha ⁻¹
	Zn levels kg ha ⁻¹	Mode of application	ppm.		
			Grain	Straw	
Control	(NPK)	-	20.0	6.6	141.9
ZnSO ₄	5	Placement	26.2	8.5	193.9
ZnSO ₄	10	Placement	31.7	10.2	264.4
ZnSO ₄	5	Broad cast	23.1	7.1	185.7
ZnSO ₄	10	Broad cast	32.2	9.6	273.4
ZnO	5	Placement	21.7	6.6	170.4
ZnO	10	Placement	27.6	8.5	215.9
ZnO	5	Broad cast	23.1	6.7	185.9
ZnO	10	Broad cast	26.2	8.2	214.2
ZnO	25 g kg ⁻¹ seed	Seed coating	21.9	6.2	172.1
ZnO	50 g kg ⁻¹ seed	Seed coating	22.2	7.2	176.1
C D 5%					
	Zn sources		2.3	1.2	
	Zn levels		1.3	0.7	
	Zn sources x Zn levels		3.2	NS	
	Control vs other		2.0	1.1	

Wheat straw Zn was significantly affected by Zn sources and Zn levels. The wheat grain contained higher Zn than straw. Total Zn uptake of 273.4 g ha⁻¹ was recorded with 10 kg Zn ha⁻¹ as ZnSO₄ by broadcast followed by 264.4 g ha⁻¹ through placement. Application of ZnSO₄ resulted in higher uptake of Zn over ZnO irrespective of methods of application. Similar results were also reported by Gupta and Hans Raj (1980) for tomato crops.

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