

Effect of soil and foliar application of zinc on seed yield of mustard, *Brassica juncea* (L) Czernj and Cosson in Typic Ustochrept soil of Hisar, Haryana

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ABSTRACT

In a field experiment on Typic Ustochrept the individual effect of zinc sulphate (0, 12.5, 25.0 and 37.5 kg/ha) as soil application and 0.5 per cent zinc sulphate solution sprayed at 45 and 55 days after sowing (DAS) was studied under dryland farm conditions on mustard at a fixed site at the farm of AICRP for Dryland Agriculture, CCS Haryana Agricultural University, Hisar, Haryana during five consecutive Rabi seasons. It was found that application of varying doses of zinc sulphate as soil application had significant effect on seed yield of mustard over control in all the five years. It increased the average seed yield from 13.3 to 17.5 q/ha which accounted for 32 per cent increase over control. The seed yield of mustard was also influenced significantly by foliar application (0.5% ZnSO_4 solution) with corresponding average yield response of 4.7 q/ha which accounted for 35 per cent. Results revealed the superiority of foliar application of zinc over soil application under dryland farm conditions.

Keywords: Dryland; Ustochrept soil; zinc sulphate; mustard; yield

INTRODUCTION

Indian mustard, *Brassica juncea* (L) Czernj and Cosson is one of the most important edible oil seed crops of the Indo-Gangetic plains. Intensive cropping coupled with cultivation of high yielding varieties has extensively exhausted soil fertility not only in respect of macronutrients but also micronutrients. Zinc is very essential micronutrient which has attracted the scientists to focus their research on this nutrient due to its wide spread deficiency noted in almost all soils of India. This problem can be mitigated through the application of zinc sulphate. Soil application and foliar sprays are the most commonly used methods of Zn application. In the present study attempts have been made to evaluate the effect of graded doses as well as foliar spray of Zn on seed yield of mustard.

MATERIAL and METHODS

The experiment was conducted on sandy loam Typic Ustochrept at a fixed site at the farm of AICRP for Dryland Agriculture, CCS Haryana Agricultural University, Hisar, Haryana during five consecutive Rabi seasons with mustard. The treatments consisted of four

levels of ZnSO_4 (0, 12.5, 25.0 and 37.5 kg/ha as soil application) and one level of foliar spray (45 and 55 DAS) of 0.5 per cent ZnSO_4 ; while spraying the acidity of ZnSO_4 was neutralized. These treatments were triplicated in RBD. Each plot measured 6.0 x 4.5 m net. The soil of the experimental site was slightly alkaline in reaction (pH 7.80) with EC 0.60 dS/m and organic carbon 0.15 per cent. The soil was medium in available N (215 kg/ha), low in P_2O_5 (15 kg/ha), high in K_2O (300 kg/ha) and deficient in available Zn (0.5 mg/kg soil).

Mustard (cv RH 30) crop was sown 45 cm apart on conserved moisture in the fields kept fallow during Kharif season and fertilized with 40 kg N + 20 kg P_2O_5 /ha as basal. Full dose of nitrogen and phosphorus were applied at the time of sowing. Observations on seed yield were recorded at harvest. The details on date of sowing, harvesting and rainfall received during crop growth period in various seasons under study are presented in Table 1. Normal and sub-normal years were classified depending upon the total rainfall, rainfall received during the months of crop season and by the crop yields.

Table 1. Season-wise total rainfall and its distribution during cropping periods

Season	Total rainfall (mm)	Crop season rainfall (mm)	Antecedent + crop season rainfall (mm/M)	Date of sowing	Date of harvest	Classification based on rainfall
First	224	31 (4)	204	3 rd week of Oct	Last week of March	Below normal
Second	292	25 (4)	195	3 rd week of Oct	Last week of March	Below normal
Third	445	30 (4)	151	3 rd week of Oct	First week of April	Above normal
Fourth	601	40 (4)	182	Last week of Oct	First week of April	Above normal
Fifth	629	62 (8)	187	Last week of Oct	Last week of March	Above normal

Figures in parentheses indicate number of rainy days; Total annual rainfall 380 mm spread over 32 rainy days

The weather data (except rainfall) during Rabi seasons for the crop growth period were recorded at the meteorological station situated one kilometer away from the experimental site and are presented in Table 2. The rainfall was recorded by the rain gauge located at the experimental site.

RESULTS and DISCUSSION

The trend of rainfall during different Rabi seasons was more or less at par except in the fifth season although total winter rain was 62 mm but it was received very late i.e. in mid of February. The seed yield of mustard as influenced by various levels of zinc sulphate during the five Rabi seasons is presented in Table 3. The low yield level of mustard during first and second seasons could be due to low moisture in the seeding zone due to early withdrawal of monsoon and low total rainfall (193 mm and 267 mm respectively) received during Kharif seasons. Normal annual rainfall of this station was 380 mm spread over in 32 rainy days.

The perusal of the data (Table 3) reveals that soil application of ZnSO_4 increased the seed yield of mustard at all the levels as compared to control during all the five seasons. The increase in seed yield was significant at all levels of soil application of ZnSO_4 as well as in comparison to the control except in the second and third season of experimentation. During these seasons the increase in yield did not differ significantly between control and application of 12.5 kg ZnSO_4/ha although higher levels of application of ZnSO_4 resulted in significant increase in yield. It was further observed

that the seed yield of mustard did not show any significant increase between any two consecutive levels of ZnSO_4 during all the five seasons. The mean seed yield of five seasons indicated 15, 20 and 31 per cent increase in yield over control with 12.5, 25.0 and 37.5 kg ZnSO_4/ha respectively. Foliar spray of 0.5 per cent ZnSO_4 solution (45 and 55 DAS) also resulted in significant increase in seed yield of mustard over control and up to soil application of 25 kg ZnSO_4/ha during all the seasons. The increase in yield was not found to be significantly different between highest level of ZnSO_4 (37.5 kg/ha) and foliar application (0.5% ZnSO_4 solution). The results further revealed that foliar spray of 0.5 per cent ZnSO_4 solution gave comparable yield to that of highest level of ZnSO_4 (37.5 kg/ha) in both during normal and sub-normal seasons of rainfall.

The mean data of five seasons (Table 3) revealed a 35, 18, 13 and 4 per cent increase in yield over control due to 12.5, 25.0 and 37.5 kg ZnSO_4/ha respectively of foliar application. Though the yield response was maximum at the highest level of ZnSO_4 as compared to control but the seed yield was not influenced significantly at any two consecutive levels of ZnSO_4 . Thus a dose of 12.5 kg ZnSO_4/ha is suggested to meet the Zn requirement of mustard grown on Zn deficient dryland soils. These results corroborate the findings of Takkar and Nayyar (1986), Takkar et al (1989), Nayyar et al (1990) and Sangwan and Raj (2004).

The superiority of foliar application over soil application of Zn might be due to readily and timely availability of Zn under dryland conditions.

Table 2. Climatic data pertaining to Rabi season (Oct to April) of the region

Parameter	Season					LTA
	1 st	2 nd	3 rd	4 th	5 th	
Cropping season rainfall (mm)	31	25	30	40	62	60
Maximum temperature (°C)	35.2	34.4	36.5	35.5	36.7	34.7
Minimum temperature (°C)	3.8	1.9	2.8	2.6	1.4	4.2
Evaporation (mm/day)	1.2-5.6	1.2-8.9	1.0-5.9	1.0-5.6	1.2-5.0	1.9-10.4
Relative humidity (%)						
Morning	77-95	56-95	71-91	78-92	79-95	53-87
Evening	19-70	18-58	16-61	19-75	24-57	23-46

LTA= Long-term average (1971-1996)

Table 3. Seed yield of mustard (q/ha) as influenced by various Zn levels

Treatment	Seed yield in season					Mean response over control (q/ha)	Average yield
	1 st	2 nd	3 rd	4 th	5 th		
Soil application (kg ZnSO ₄ /ha)							
0	9.9	12.7	14.1	15.5	14.3	13.3	-
12.5	10.9	14.4	16.5	18.6	16.1	15.3	2.0
25.0	11.4	15.3	17.0	19.7	16.6	16.0	2.7
37.5	12.6	17.0	18.6	21.2	17.9	17.5	4.2
Foliar application (% ZnSO ₄ solution)							
0.5	12.9	17.7	19.1	21.4	18.9	18.0	4.7
SEm±	0.24	0.66	0.79	0.47	0.47	-	-
CD _{0.05}	0.77	2.15	2.59	1.53	1.53	-	-

CONCLUSION

It may be concluded that soil application of Zn @ 12.5 kg ZnSO₄/ha in the light-textured soil as basal dose or two sprays (45 and 55 DAS) of 0.5 per cent ZnSO₄ solution proved most effective in increasing the yield of mustard grown on Zn deficient soils under dryland conditions.

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REFERENCES

- Nayyar VK, Takkar PN, Bansal RL, Singh SP, Kaur NP and Sadana US 1990. Micronutrients in soils and crops of Punjab. Research Bulletin, Department of Soils, Punjab Agricultural University, Ludhiana, Punjab, India.
- Sangwan PS and Raj M 2004. Effect of zinc nutrition on yield of chickpea (*Cicer arietinum* L) under dryland conditions. Indian Journal of Dryland Agriculture Research and Development **19(1)**: 1-3.
- Takkar PN and Nayyar VK 1986. Integrated approach to combat micronutrient deficiency. Proceedings, FAI Seminar on Growth and Modernization of Fertilizer Industry PS III/2.1-2.16.
- Takkar PN, Chhibba IM and Mehta SK 1989. Twenty years of coordinated research on micronutrients in soil and plants. Bulletin I, Indian Institute of Soil Science, Bhopal, Madhya Pradesh, India.