

## EFFECT OF FOLIAR SPRAYS OF ZINC SULPHATE AND SODIUM MOLYBDATE ON NODULE NUMBER, SHOOT AND ROOT LENGTH

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Foliar spray of zinc sulphate and sodium molybdate in higher concentrations has significant adverse effect on nodule number while 50 ppm concentrations promoted the number of nodules, shoot and root length, the promotion was insignificant in case of zinc sulphate but significant effect was found in shoot and root length in sodium molybdate. Zinc sulphate is more toxic than sodium molybdate.

**Keywords :** Foliar application; Nodulation; Sodium molybdate; Zinc sulphate.

The effect of foliar application of trace elements on nodulation of leguminous plants have so far been studied by few workers<sup>1-5</sup>. Babu and Gupta<sup>6</sup> studied the effect of zinc sulphate on *Trifolium alexandrinum* and reported that nodule number decreased at higher concentrations. Kumar and Gupta<sup>7</sup> reported that foliar application of lower concentration of zinc sulphate promoted the nodule number, shoot and root length while higher concentration reduced the nodule number and plant growth. Babu and Gupta<sup>6</sup> reported that higher concentration of zinc sulphate has adverse effect on nodulation in *Vicia faba* Linn. Vieira *et al.*<sup>8</sup> reported that the foliar application of sodium molybdate at 25 days after plant emergence decreased nodule number per plant, while weight was not effected. Tripathy *et al.*<sup>9</sup> reported that soil application of Zn, B and Mo singly or in combination improved nodulation and nitrogenase activity in groundnut (*Arachis hypogea*).

Seeds were surface sterilized with 0.1 percent aqueous HgCl<sub>2</sub> solution and sown in small earthen ware pots containing equal amounts of double sterilized soil and precaution was taken to prevent contamination of soil with *Rhizobium* until inoculation. Six days after the sowing 10 seedlings of equal size were selected and retained in each pot and the rest were removed.

Before spraying the pots were inoculated with equal amounts of a homogenous suspension of an appropriate strain of *Rhizobium*. Latter was isolated from the effective (Pink) nodules and was grown on the yeast extract mannitol agar medium. Three concentration of zinc sulphate and sodium molybdate (25, 50 and 100 ppm) were prepared in sterilized distilled water. Two consecutive spraying were made, first when plants become 15 days old and second six days after the first spraying. Control plants were sprayed with sterilized distilled water. Home spray atomizer was used as sprayer. Soil contamination of solutions was prevented by covering the soil surface with sterilized cotton. Solutions were sprayed at the rate of 10

ml per plant. Sixteen days after the second spraying, nodule number, shoot and root length were recorded. Data were subjected to 't' test.

In the case of zinc sulphate treated plants, it was found that the concentration of 50 ppm insignificantly increased the number of nodules while 100 and 200 ppm significantly inhibited the number of nodules. 50 ppm and 100 ppm concentrations of spraying did not show significant decrease in shoot and root length. Maximum inhibition in the number of nodules, shoot and root length was noted at 200 ppm concentration (Table 1).

In the case of sodium molybdate sprayed plants it was found the 50 ppm concentration insignificantly promoted the number of nodules. While the same concentrations significantly increased shoot and root length. 100 and 200 ppm concentrations spraying significantly inhibited the number of nodules. Maximum inhibition in the number of nodules, shoot and root length was observed in 200 ppm sprayed plant (Table 2).

Zinc sulphate is more toxic than sodium molybdate. The present findings of concentrations are in accordance with the observations of Prasad and Ram<sup>4</sup>, Tripathy *et al.*<sup>9</sup> and Kumar and Gupta<sup>7</sup> who reported that the increasing concentrations of zinc caused a decrease in nodule number and size. Albino and Campo<sup>5</sup> reported that the application of molybdenum reduced nodulation in *Glycine max*. Vieira *et al.*<sup>8</sup> reported that molybdenum application at 25 days after plant emergence decreased nodule number per plant, while nodule weight was not affected. Balachandra *et al.*<sup>10</sup> reported that soil application of the nutrients molybdenum as sodium molybdate at 1 kg/ha at sowing time significantly increased the number and weight of nodules, plant height and grain yield.

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**Table 1.** Effect of foliar spray of zinc sulphate on nodule number, shoot and root length.

Treatment	Concentrations (ppm)	Mean number of nodules	Value of 't'	Mean shoot length (cm)	Value of 't'	Mean root length (cm)	Value of 't'
Zinc sulphate	Control	24.9	-	30.70	-	33.26	-
	50	25.6	1.32	32.33	1.84	34.37	1.48
	100	23.0	2.43*	30.44	0.31	33.89	0.90
	200	17.7	8.23**	26.86	4.77**	29.94	4.88**

\* Significant at 5% level = 2.101

\*\* Significant at 1% level = 2.878

**Table 2.** Effect of foliar spray of sodium molybdate on nodule number, shoot and root length.

Treatment	Concentrations (ppm)	Mean number of nodules	Value of 't'	Mean shoot length (cm)	Value of 't'	Mean root length (cm)	Value of 't'
Sodium molybdate	Control	24.90	-	31.15	-	33.81	-
	50	25.40	0.75	34.08	3.63**	36.26	2.82
	100	23.0	2.35*	31.57	0.46	33.27	0.63
	200	19.7	6.92**	27.12	5.30**	29.07	6.10**

\* Significant at 5% level = 2.101

\*\* Significant at 1% level = 2.878

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#### References

- Shukla UC and Yadav OP 1982, Effect of Phosphorus and zinc on nodulation and nitrogen fixation in chickpea. *Plant and Soil*. **65**(2) 239-248.
- Malewar GU, Jadhav NS and Budhewar LM 1983, Possible role of zinc in nodulation and other growth attributes of ground nut. *J. Maharashtra Agric. University*. **7** 241-242.
- Marsh DB and Luther W 1985, Effect of zinc on nodulation and nitrogen fixation in Cowpea (*Vigna unguiculata*). *J. Am. Soc. Hort. Sci.* **119** 9-11.
- Prasad I and Ram H 1992, Effect of zinc, copper and *Rhizobium* inoculation on microbial population in soil and yield of green gram (*Phaseolus radiatus*). *Int. J. Tropical Agriculture* **10**(2) 157-160.
- Albino UB and Campo RJ 2001, Effect of sources and levels of Molybdenum on *Bradyrhizobium* survival and on biological nitrogen fixation in Soyabean. *Pesquisa-Agropecuaria Brasileira*. **36**(3) 527-534.
- Babu Mahesh and Gupta VK 2001, Effect of foliar sprays of copper sulphate and zinc sulphate on nodule development, shoot and root length. *Int. J. Mendal* **18** 127-128.
- Kumar Sushil and Gupta VK 2003, Effect of foliar sprays of zinc and ferrous sulphates on nodule number, shoot and root length of *Phaseolus aconitifolius* Jaco. *Geobios* **30** 151-152.
- Vieira RF, Cardoso E J B N, Vieira C and Casini STA 1998, Foliar application of molybdenum in common bean III Effect on nodulation. *J. Plant Nutrition (USA)*. **21** (10) 2153-2163.
- Tripathy SK, Patra AK and Samui SC 1999, Effect of micronutrients on nodulation, growth, yield and nutrient uptake by groundnut (*Arachis hypogaea* L.). *Indian J. Plant Physiol.* **4** (3) 207-209
- Balachandra D, Nagarajan P, Gunasekaran S 2003, Effect of organic amendments and micronutrients on nodulation and yield of black gram in acid soil. *Legume-Research* **26**(3) 192-195