Optimizing Rates and Method of Zinc Application for Ashwagandha

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INTRODUCTION

The Indian system of medicine has identified 1500 medicinal plants, including 500 species that are mostly used to prepare drugs. At the national level, 32 medicinal plants have been prioritized for development. Ashwagandha (*Withania somnifera* L.) is one of the several important herb plants widely used for medicinal purposes. Ashwagandha roots and seeds contain different alkaloids which are used widely in Ayurveda and Unani medicines to cure a number of diseases. It is grown on marginally fertile lands, which results in poor yields that are Zn deficient (Singh 2006). Information about the effects of Zn on yield and nutrition quality of the Aswagandha crop is lacking. Therefore, a field study was planned to evaluate the response of Aswagandha to Zn levels in an Alfisol of central India.

METHODS

To optimize the rate and method of Zn application to medicinal plant, a field experiment was conducted on a sandy loam soil (Alfisol) at the herbal garden of Acharya N.G. Ranga Agricultural University, Rajendranagar, Hyderabad, India. The soil had initially an available-Zn status of 0.59 mg kg^{-1}. The experiment was laid out in a randomized block design with eight treatments and three replications in 2003 to 2004 (Table 1). The treatments consisted of five levels of $ZnSO_4$ as soil application (5, 10, 15, 20 and 25 kg ha^{-1}), two levels of $ZnSO_4$ foliar sprays (0.1 and 0.2 % at the flowering stage) and one control (NPK without Zn). All recommended agronomic practices were followed to grow the crop. Plant parts were collected for chemical analysis and at maturity for recording yield of root, shoot and leaves.

RE SULTS AND DISCUSSION

Different levels of Zn application to the soil (5, 10, 15, 20 and 25 kg $ZnSO_4$ ha^{-1}) and foliar Zn-sprays (0.1 and 0.2 % $ZnSO_4$) increased root girth, root length, root and seed yield significantly when compared to the Zn-control. Increasing Zn levels improved plant growth and yields (Table 1). Application of 25 kg $ZnSO_4$ ha^{-1} resulted in maximum root girth (5.06 cm), root yield (557 kg ha^{-1}) and seed yield (647 kg ha $^{-1}$) when compared to the other Zn treatments. Kattimani et al. (2000) also reported that soaking seeds with Zn increased the dry root yield of Ashwagandha. Among the foliar sprays, 0.2% $ZnSO_4$ at the flowering stage resulted in significantly more root girth, root length and root yield when compared to the 0.1 % spray-treatment. Zinc concentrations in plant parts increased from 10.70 to 58.72 mg Zn kg^{-1} in roots and from 26.45 to 47.60 mg Zn kg^{-1} in seeds with increasing levels of $ZnSO_4$ applications from 5 to 25 kg ha^{-1}, but the Zn content of roots and seeds did not vary significantly as a result of the foliar Zn-spray treatments. The increase of available soil-Zn after the harvest of crops was only significant for the soil application of 20 and 25 kg $ZnSO_4$ ha^{-1}.

Table 1. Effect of Zn levels on the root and seed yield, root girth and Zn content in Ashwagandha plants.

Treatment $ZnSO_4$ Levels kg ha^{-1}	Root yield	Seed yield	Root girth	Zinc content (mg kg^{-1})		
	kg ha^{-1}		cm	Root	Seed	Soil DTPA-Zn
5 Soil application	412	325	3.20	10.70	26.45	1.38
10 Soil application	455	349	4.00	14.22	32.70	1.39
15 Soil application	494	448	4.02	22.07	37.92	1.40
20 Soil application	529	556	4.36	44.92	41.45	1.41
25 Soil application	557	647	5.06	58.72	47.60	1.46
0.1% foliar spray	442	368	3.28	9.37	21.45	1.38
0.2% foliar spray	446	405	4.06	9.82	22.92	1.54
0 Zn (NPK)	268	300	2.48	7.25	20.07	1.34
CD at 5%	**17**	**30**	**0.32**	**1.78**	**2.19**	**0.11**

CONCLUSIONS

Results suggest that a soil application of 20-25 kg $ZnSO_4$ ha^{-1} to Aswagandha increased crop productivity and quality significantly. Foliar sprays were not beneficial when compared to soil applications.

REFERENCES

Kattimani, K.N., Reddy, Y.N. and Rao, B.R.R. (2000) National Seminar on the Frontiers of Research and development in medicinal plant, Lucknow.

Singh,M.V. (2006) Zinc deficiency in Indian soils. In Micro and Secondary Nutrient and Pollutant Elements Research in soils and Plants. IISS, Bhopal. Pp 3-20.