Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.6204

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **6 (2):** 317-319 (2018)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Influence of Nano Zinc Application on Growth and Yield Parameters of Mulberry

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Received: 28.01.2018 | Revised: 25.02.2018 | Accepted: 2.03.2018

ABSTRACT

A field experiment was conducted during 2016 to study the influence of nano zinc application on mulberry and cocoon productivity at College of Sericulture, Chintamani. The experiment consisted of seven treatment combinations with three replications (RCBD). Field experiment recorded significantly higher shoot height (96.63cm), number of branches/plant (8.47), number of leaves/ shoot (18.60), number of leaves/ plant (157.15), leaf area (96.90 cm^2) and leaf yield (0.46 kg/plant) were recorded in nano zinc oxide of 50 ppm as foliar spray. The net returns per hectare of mulberry was more (Rs.1, 53,083.492) in treatment nano zinc oxide 20 ppm foliar spray. The nano zinc fertilizer was found to be cost effective with higher B: C ratio (2.93) as compared to $ZnSO_4$ fertilizer used in experiment which recorded B: C ratio of 2.43.

Key words: *Growth, Yield, Mulberry and Nano zinc.*

INTRODUCTION

Sericulture is a farm-based, labour intensive and commercially attractive economic activity falling under the cottage and small scale sector. The soil fertility and its management affect the quality and quantity of mulberry foliage production. To get quality leaves balanced application of major and minor nutrients need to be followed properly. Micronutrients are essential for crop production, among the micronutrients, Zn deficiency in plants and soils has been reported across the world[1]. Mulberry plants that are deficient in zinc become stunted because zinc is not mobile element in the plant system and hence, the zinc deficiency mainly occurs in the younger parts of the plants. Most of the mulberry growing farmers are using only the zinc sulphate for soil and foliar application as a source of zinc. However, the retention time of zinc in the plant system is low and hence, the bioavailability of zinc for longer period is not sure with the use of zinc sulphate fertilizers[3].

Many studies suggested that ZnO nanoparticles increases plant growth and development in peanut[3], in wheat Ramesh *et al.*[4] and in onion[5] and lower concentration of ZnO nano particles exhibit beneficial effect plant growth.

Cite this article: Nithya, B.N., Naika, R., Naveen, D. V. and Kumar, S.T., Influence of Nano Zinc Application on Growth and Yield Parameters of Mulberry, *Int. J. Pure App. Biosci.* **6(2):** 317-319 (2018). doi: http://dx.doi.org/10.18782/2320-7051.6204

In Kolar and Chikkaballapur soils were deficient with zinc (less than 0.6) to address the farmers problem in producing quality leaves the present experiment was planned.

MATERIAL AND METHODS

The experiment was conducted at College of Sericulture, Chintamani in V-1 mulberry garden geographically located in Eastern dry zone (Zone-5) of Karnataka state during *kharif* season of 2016. The experiment was laid in a completely randomized block design with seven treatments and three replications each *viz.*, **T_1** – Control, **T_2**- Soil application of recommended $ZnSO_4$, **T_3**- Foliar application of $ZnSO_4$ (2 %), **T_4**- Nano zinc oxide (ZnO) at 5 ppm as foliar spray, **T_5**- Nano zinc oxide (ZnO) at 10 ppm as foliar spray, **T_6**- Nano zinc oxide (ZnO) at 20 ppm as foliar spray and **T_7** - Nano zinc oxide (ZnO) at 50 ppm as foliar spray. Package of practice was followed as per the recommended standards.

The growth and yield parameters of mulberry *viz.*, shoot height (cm), number of branches per plant, number of leaves per shoot, number of leaves per plant, single leaf area (cm^2) and leaf yield (g/plant) were recorded at 45 day after pruning as per the standards suggested and analyzed statistically.

RESULTS AND DISCUSSION

Effect of nano zinc oxide on growth and yield attributes of Mulberry

Among the different treatments, nano zinc oxide at 50 ppm as foliar spray recorded significantly higher values for the growth and yield parameters *viz.*, shoot height (96.63cm), number of branches/plant (8.47), number of leaves/ shoot (18.60), number of leaves/ plant (157.15), leaf area (96.90 cm^2) and leaf yield (0.46 kg/plant and 5.71 t/ha/crop) at 45^{th} days after pruning (Table 1 and 2).

However, nano zinc oxide at 50 ppm recorded maximum growth and yield parameters followed by 20 ppm nano zinc oxide. The parameters recorded were lowest in the control treatment *viz.*, shoot height (81.53 cm), number of branches/plant (6.00), number of leaves/ shoot (16.80), number of leaves/ plant (112.49), leaf area (78.34 cm^2) and leaf yield (0.30 kg/plant and 3.67 t/ha/crop). The present research findings clearly indicated that significantly higher growth and leaf yield parameters were recorded in 50 ppm nano zinc oxide applied treatment compared to rest of the treatments which could be mainly due to significant increase in shoot height, number of branches/plant, number of leaves/ shoot, number of leaves/ plant, leaf area and leaf yield. This could be attributed to adequate supply of zinc which accelerates the activity of enzyme and auxin metabolism in plants. Among various sources of zinc, it is imperative to note that nano carriers of the treatment receiving nano zinc application have resulted in significant increase in plant height/ shoot height, number of branches and yield as compared to that of $ZnSO_4$ application. Further it was observed that the treatment received nano zinc oxide as foliar spray resulted in production of taller plants. The nano zinc treatment combination was able to supply zinc at the time of its requirement. These results were in agreement with the findings of Khan *et al.*[2], Prasad *et al.*[3], Suriyaprabha *et al.*[6] and Van *et al*[7].

Table 1: Effect of nano zinc oxide on growth parameters of mulberry leaves in field experiment

Treatments	Shoot height (cm)	Number of branches/plant	Number of leaves/ shoot	Number of leaves/ plant	Leaf area ($cm^{2)}$
T_1: Control	81.53	6.00	16.80	112.49	78.34
T_2: Soil application of recommended $ZnSO_4$	88.60	7.40	17.07	128.29	79.19
T_3: Foliar application of $ZnSO_4$ (2 %)	92.40	7.43	17.27	130.69	86.89
T_4 :Nano zinc oxide (ZnO) at 5 ppm as foliar spray	85.67	7.37	17.17	126.50	80.78
T_5: Nano zinc oxide (ZnO) at 10 ppm as foliar spray	96.27	7.57	17.32	127.58	85.52
T_6: Nano zinc oxide (ZnO) at 20 ppm as foliar spray	96.40	8.00	17.73	139.75	96.42
T_7: Nano zinc oxide (ZnO) at 50 ppm as foliar spray	96.63	8.47	18.60	157.15	96.90
Mean	**91.55**	**7.44**	**17.42**	**131.78**	**86.50**
F- Test	**NS**	*****	**NS**	*****	**NS**
S. Em ±	**3.93**	**0.25**	**0.71**	**7.57**	**6.74**
CD at 5 %	-	**0.76**	-	**23.33**	-

*** : Significant at 5 %**

NS: Non-significant

Table 2: Effect of nano zinc oxide on leaf yield of mulberry

Treatments	Leaf yield/plant(kg)	Leaf yield /ha/crop (tons)
T_1: Control	0.30	3.67
T_2: Soil application of recommended $ZnSO_4$	0.40	4.90
T_3: Foliar application of $ZnSO_4$ (2 %)	0.41	5.02
T_4:Nano zinc oxide (ZnO) at 5 ppm as foliar spray	0.38	4.63
T_5: Nano zinc oxide (ZnO) at 10 ppm as foliar spray	0.39	4.80
T_6: Nano zinc oxide (ZnO) at 20 ppm as foliar spray	0.42	5.20
T_7: Nano zinc oxide (ZnO) at 50 ppm as foliar spray	0.46	5.71
Mean	**0.39**	**4.85**
F- Test	*****	*
S. Em ±	**0.02**	**0.29**
CD at 5 %	**0.07**	**0.89**

: Significant at 5 %

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