The Pharma Innovation Journal 2023; 12(9): 1476-1478

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(9): 1476-1478

www.thepharmajournal.com
Received: 09-06-2023
Accepted: 13-07-2023

Saleemali Kannihalli
Ph.D Scholar, Department of Entomology, College of Agriculture, University of Agricultural Sciences, Dharwad, Karnataka, India

SG Rayar
Professor and Head, Department of Entomology, College of Agriculture, University of Agricultural Sciences, Dharwad, Karnataka, India

CP Mallapur
Professor, Department of Entomology, College of Agriculture, University of Agricultural Sciences, Dharwad, Karnataka, India

PV Patil
Professor, Department of Plant Pathology, College of Agriculture, University of Agricultural Sciences, Dharwad, Karnataka, India

Ravikumar Hosamani
Assistant Professor (Entomology), Department of Biotechnology, College of Agriculture, University of Agricultural Sciences, Dharwad, Karnataka, India

Corresponding Author:
Saleemali Kannihalli
Ph.D Scholar, Department of Entomology, College of Agriculture, University of Agricultural Sciences, Dharwad, Karnataka, India

Foliar application of nanofertilizers to enhance growth and yield of mulberry

Saleemali Kannihalli, SG Rayar, CP Mallapur, PV Patil and Ravikumar Hosamani

Abstract
A field experiment was conducted in a well established mulberry garden with V-1 variety during 2021-22 and 2022-23 to study the impact of nanofertilizers sprayed at 35 and 45 days after pruning on mulberry. The analysis of pooled data revealed that, the application of nanofertilizers through foliar spray had a significant impact on the growth and yield of mulberry. Among the nanofertilizers sprayed, nano 19 all at 6 g/L emerged as the best treatment by recording longer shoot length of (126.60 cm), higher number of leaves per shoot (26.83), maximum leaf area (144.78 cm^2), increased hundred leaf weight (245.59 g) and leaf yield (747.94 g/plant).

Keywords: Mulberry, nanofertilizers, pruning, growth and yield

Introduction
Mulberry, scientifically known as *Morus alba* L., is a perennial species characterized by its deep rooted nature, rapid growth rate and abundant biomass production. Notably, its leaves serve as the exclusive nourishment for the silkworm, *Bombyx mori*, making it a vital component in sericulture. The productivity of mulberry leaves per unit area significantly influences cocoon harvests, establishing their economic significance in this field. To increase the yield of mulberry, application of manures and fertilizers is considered crucial. However, a substantial portion of added fertilizers, particularly those containing nitrogen and phosphorus, often becomes inaccessible to plants shortly after soil application due to diverse factors like leaching, volatilization, and fixation (Qaiyyum and Bari, 1991) [5]. In response to such scenarios, an alternative approach involves directly supplying soluble nutrients to mulberry leaves via foliar application. This immediate nutrient supply can be subsequently consumed by the silkworms, thereby benefiting their growth and silk production. Contemporary interest has surged towards incorporating nanomaterials for nutrient elements in the field of fertilizers, leading to the term "nanofertilizers". Conventional fertilizers encounter limitations in terms of nutrient absorption efficiency, leading to substantial losses and adverse environmental consequences. Therefore, the adoption of nanofertilizers holds the potential to mitigate nutrient losses and potentially reduce the required fertilizer quantities. However, existing research pertaining to nanomaterial based fertilization for mulberry primarily revolves around micronutrients such as zinc, copper, manganese and iron. Considering these factors, the present study aims to investigate the impact of nanofertilizers applied to mulberry through foliar spray on the growth and yield.

Material and Methods
An experiment was conducted in a well established mulberry garden with V-1 mulberry variety grown as per package of practices to know the effect of nanofertilizers on mulberry growth and yield at Sericulture Section, Department of Entomology, University of Agricultural Sciences, Dharwad during 2021-22 and 2022-23. The experiment was laid out in Randomized block design with 10 treatments replicated thrice. Mulberry plants were raised by using recommended fertilizers and other management practices. Recommended package of practice (FYM- 20 tons/ha/year, N: P: K: - 350: 140: 140 kg/ha/year) was uniformly applied to all the treatement plots. Nanofertilizers were sprayed to mulberry as per the treatment details at 35 and 45 days after pruning. At 50 days after pruning, three plants were selected randomly for recording observations on growth and yield parameters *viz*., shoot length, number of leaves per shoot, leaf area, hundred leaf weight and leaf yield.

Results and Discussion

Considering the pooled data of both the seasons, foliar application nanofertilizers *viz*., nano 19 all at 6 g/L, nano 19 all at 4 g/L and nano urea at 6 mL/L had a significant impact on plant growth and yield as compared to seriboost at 2.5 mL/L and untreated mulberry at 50 days after pruning (Table 1). Significantly longer shoot length of 126.60 cm was recorded in the mulberry sprayed with nano 19 all at 6 g/L against shoot length of 106.19 cm in seriboost at 2.5 mL/L. It was followed by nano 19 all at 4 g/L (119.97 cm) which was on par with nano 19 all at 6 g/L. Whereas, water sprayed mulberry recorded shoot length of 90.16 cm which was significantly shorter. Nano 19 all at 6 g/L produced significantly more number of leaves per shoot (26.83) over seriboost at 2.5 mL/L (20.48). The next best treatments were nano 19 all at 4 g/L (25.31), nano urea at 6 mL/L (24.17) and nano 19 all at 2 g/L (22.06) which were statistically on par with nano 19 all at 6 g/L. While, minimum leaves per shoot was observed in untreated (15.13) and water sprayed (14.69) mulberry shoots. Maximum leaf area was recorded in nano 19 all at 6 g/L (144.78 cm^2). While, nano 19 all at 4 g/L (134.43 cm^2) did not differed with nano 19 all at 6 g/L. Whereas, leaf area of 120.61 cm^2 was noticed in seriboost at 2.5 mL/L. The minimum leaf area of 100.59 cm^2 and 98.96 cm^2 was recorded in untreated and water sprayed mulberry (Table 1).

Table 1: Effect of nanofertilizers on growth and yield of mulberry (pooled data of 2021-22 and 2022-23)

Treatments	Shoot length (cm)	Number of leaves/shoot	Leaf area (cm^2)	Hundred leaf weight (g)	Leaf yield (g/plant)
T_1 : Nano urea @ 2 mL/L	104.76^{de}	19.59^{d}	117.59^{cd}	197.46^{cde}	621.53^{ef}
T_2 : Nano urea @ 4 mL/L	110.35^{bcd}	21.89^{bcd}	125.17^{bcd}	208.05^{bcde}	665.23^{cde}
T_3 : Nano urea @ 6 mL/L	115.63^{bc}	24.17^{abc}	129.59^{bc}	227.18^{abc}	710.46^{abc}
T_4 : Nano 19 all @ 2 g/L	111.83^{bcd}	22.06^{bcd}	125.23^{bcd}	216.56^{abcd}	688.57^{bcd}
T_5 : Nano 19 all @ 4 g/L	119.97^{ab}	25.31^{ab}	134.43^{ab}	236.07^{ab}	719.43^{ab}
T_6 : Nano 19 all @ 6 g/L	126.60^{a}	26.83^{a}	144.78^{a}	245.59^{a}	747.94^{a}
T_7 : Urea @ 2.5%	99.96^{ef}	18.72^{de}	111.02^{de}	188.56^{de}	596.90^{fg}
T_8 : Seriboost @ 2.5 mL/L	106.19^{cde}	20.48^{cd}	120.61^{bcd}	200.28^{cde}	642.04^{def}
T_9 : Absolute control	90.16^{f}	14.69^{e}	98.96^{e}	181.90^{e}	565.65^{g}
T_{10} : Untreated control	90.35^{f}	15.13^{e}	100.59^{e}	182.67^{e}	568.85^{g}
S.Em (±)	3.38	1.43	4.79	10.97	16.58
C.D @ 5%	10.05	4.25	14.25	32.98	49.33
C.V (%)	8.72	11.88	8.23	9.22	10.64

Nano 19 all at 6 g/L recorded higher hundred leaf weight of 245.59 g over seriboost at 2.5 mL/L (200.28 g) followed by nano 19 all at 4 g/L (236.07 g), nano urea at 6 mL/L (227.18 g) and nano 19 all at 2 g/L (216.56 g) which were on par with nano 19 all at 6 g/L. Significantly lower hundred leaf weight was recorded in water sprayed mulberry (181.90 g). Leaf yield was significantly higher in nano 19 all at 6 g/L (747.94 g/plant) as compared to 565.65 g/plant in water sprayed mulberry. However, nano 19 all at 4 g/L (719.43 g/plant) and nano urea at 6 mL/L (710.46 g/plant) did not vary significantly with nano 19 all at 6 g/L. While, leaf yield of 642.04 g/plant was noticed upon spraying seriboost at 2.5 mL/L.

The results clearly indicate a significant increase in growth and yield of mulberry upon foliar application of nanofertilizers *viz*., nano 19 all at 6 g/L, nano 19 all at 4 g/L and nano urea at 6 mL/L over spraying of seriboost at 2.5 mL/L. Although, seriboost at 2.5 mL/L was superior when compared to untreated and water sprayed mulberry in increasing the growth and yield attributes, it was found inferior to all nanofertilizers used in the study except for nano urea at 2 mL/L. The superiority of nanofertilizers could be attributed to the fact that foliar spraying bypasses the root uptake process, allowing plants to rapidly absorb nutrients through their leaves. Smaller particle size and larger surface area of nanofertilizers allows them to penetrate deeper into the leaf tissues facilitating swift uptake of nutrients. Sharma *et al*. (2022) [7] opined nanofertilizers play a vital role in crop physiological and biochemical processes by boosting nutrient availability, which aids in increasing metabolic processes and stimulating meristematic activities, resulting in increased apical growth and photosynthetic area. Improved solubility of 19 all nanofertilizer can enhance nutrient efficiency and can quickly address nutrient deficiencies, as plants can rapidly absorb the required nutrients. This can lead to faster recovery and improved overall plant health. Physiological activities of plants *viz*., cell division and differentiation, expansion of cell, formation of cell wall enhanced by nanofertilizers might have led to longer shoot length, higher number of leaves per shoot and maximum leaf area over seriboost at 2.5 mL/L and untreated mulberry. Higher hundred leaf weight and leaf yield was recorded in nano 19 all at 6 g/L, followed by nano 19 all at 4 g/L and nano urea at 6 mL/L as compared to unsprayed mulberry. Improvements in hundred leaf weight and leaf yield as a result of nanofertilizer application might be attributed to improved photosynthetic and other metabolic activities, which result in enhanced levels of plant metabolites responsible for cell division and elongation. Large leaf area increased the plants ability to intercept enough sunlight, which may have resulted in the synthesis of more assimilates improving crop growth and development. There are insufficient studies on application of nanofertilizers in mulberry. Hence, comparison of results was made with the available literature on other crops and foliar application of nano micronutrients in mulberry.

The present findings are in agreement with Merghany *et al*. (2019) [3] who recorded highest plant height (101.4 and 87.11 cm), number of leaves (22.67 and 15) and leaf area (188.2 and 251.7 cm^2) in cucumber sprayed with 6 ml nano NPK during first and second season, respectively. Significantly higher shoot height (96.63 cm), number of leaves per shoot (18.60), leaf area (96.90 cm^2) and leaf yield (0.46 kg/plant) of mulberry was observed upon foliar application of nano zinc

oxide at 50 ppm (Nithya *et al*., 2018) [4]. Combined application of nano Zn + Cu at 500 ppm each to mulberry resulted in highest shoot length (202.33 cm), leaf area (266.77 cm^2), hundred leaf weight (338.35) and leaf yield (1000.47 g/plant) (Choudhury *et al*., 2019) [2]. Increase in yield contributing parameters such as shoot length, number of leaves per shoot and leaf area might also have increased leaf yield. These findings are in close conformity with those of Bose *et al*. (1995) [1], Sundareswaran *et al*. (1997) [8] and Rashmi *et al*. (2006) [6].

Conclusion

Application of nanofertilizers such as nano 19 all and nano urea have a great role in enhancing the yield and improving the leaf quality of mulberry. In the present study, nano 19 all at 6 g/L, nano 19 all at 4 g/L and nano urea at 6 mL/L significantly improved the growth and yield of mulberry and hence these nanofertilizers hold promise as valuable recommendations for farmers.

References

1. Bose PC, Singhvi NR, Dutta RK. Effect of micronutrients on the biochemical parameters of mulberry (*Morus alba* L.) leaf. Sericologia. 1995;35(1):65-69.
2. Choudhury P, Ashoka J, Hadimani DK, Sreenivas AG, Sharanagouda H. Effect of nano micronutrients supplementation to mulberry for growth, yield and quality parameters. International Journal of Chemical Studies. 2019;7(6):1187-1192.
3. Merghany M, Shahein MM, Sliem MA, Abdelgawad KF, Radwan AF. Effect of nano-fertilizers on cucumber plant growth, fruit yield and its quality. Plant Archives. 2019;19(2):165-172.
4. Nithya BN, Naika R, Naveen DV, Kumar ST. Influence of nano zinc application on growth and yield parameters of mulberry. International Journal of Pure and Applied Bioscience. 2018;6(2):317-319.
5. Qaiyyum MA, Quader MA, Bari MA. Effect of foliar spray of urea on the mulberry leaf yield and its nutritive quality. Pakistan Journal of Agricultural Research. 1991;12(3):188-192.
6. Rashmi K, Shankar MA, Narayanaswamy TK, Sreeramulu KR, Rajegowda. Effect of application of organic manures and inorganic fertilizers on growth, yield and quality of S36 mulberry. Paper presented In: National conference on new strategies in research and development of sericulture - Indian Perspective, March 9-10, 2006, Bangalore University, Bangalore, Karnataka, India, p. 36-37.
7. Sharma SK, Sharma PK, Mandeewal RL, Sharma V, Chaudhary R, Pandey R, *et al*. Effect of foliar application of nano-urea under different nitrogen levels on growth and nutrient content of pearl millet (*Pennisetum glaucum* L.). International Journal of Plant & Soil Science. 2022;34(20):149-155.
8. Sundareswaran P, Subbarayappa CT, Munirathanam Reddy TM, Srinivasan EB, Himantharaj MT. Nutritional studies on mulberry in relation to cocoon production. Indian Journal of Sericulture. 1997;36:147-149.