

Foliar Application Of Nanoparticles: An Innovative Technique To Boost Income Of Strawberry Growers Under Protected Conditions

Anjali Thakur¹ and Amit Saurabh²

¹M.Sc.Student, Department of Horticulture, Dr. Khem Singh Gill Akal College of Agriculture, Eternal University, Baru Sahib, Sirmour (H.P.)

²Assistant Professor, Department of Horticulture, Dr. Khem Singh Gill Akal College of Agriculture, Eternal University, Baru Sahib, Sirmour (H.P.)

Corresponding Author: dramitsaurabh@gmail.com

AUTHOR ID: 023

INTRODUCTION

Nanotechnology is an emerging area of research with its application in the field of science and technology for manufacturing new materials at nanoscale level. The recent practice involves use of nanoparticles on growth as well as control of diseases in plants. The term nanotechnology was coined by Professor Norio Taniguchi of Tokyo Science University in 1974. Nanoparticles are naturally occurring or engineered material with at least one dimension and less than 100 nm size. Nanoparticles have properties of effectively release of nutrients and chemical fertilizers on demand that enhance the target activity as well as plant growth. Efficacy of nanoparticles depends upon their chemical composition, surface covering, size, reactivity and concentration.

Various researches have been done involving the biological effect of nanoparticles on higher plants. In many studies, increasing evidence suggests that Zinc oxide (ZnO) nanoparticles play a very important role in growth and development of plant as Zinc acts as catalyst and promoting various organic reactions taking place within the plant and is important for cultivation of horticultural crops as it plays structural and functional role in plants and hormone production in buds. A study was conducted at Research farm of Eternal University in order to know the effect of foliar application of nanoparticles on strawberry crop and compared with the traditional method of using water soluble inorganic fertilizers on

the yield and quality attributes. Application of micronutrient fertilizers in the form of nanoparticles is proved to be an important source as it provide nutrients to plants in a controlled way which is essential to mitigate the pollution problems related to fertilizer application.

KEY BENEFITS OF USING NANOPARTICLES IN HORTICULTURAL CROPS

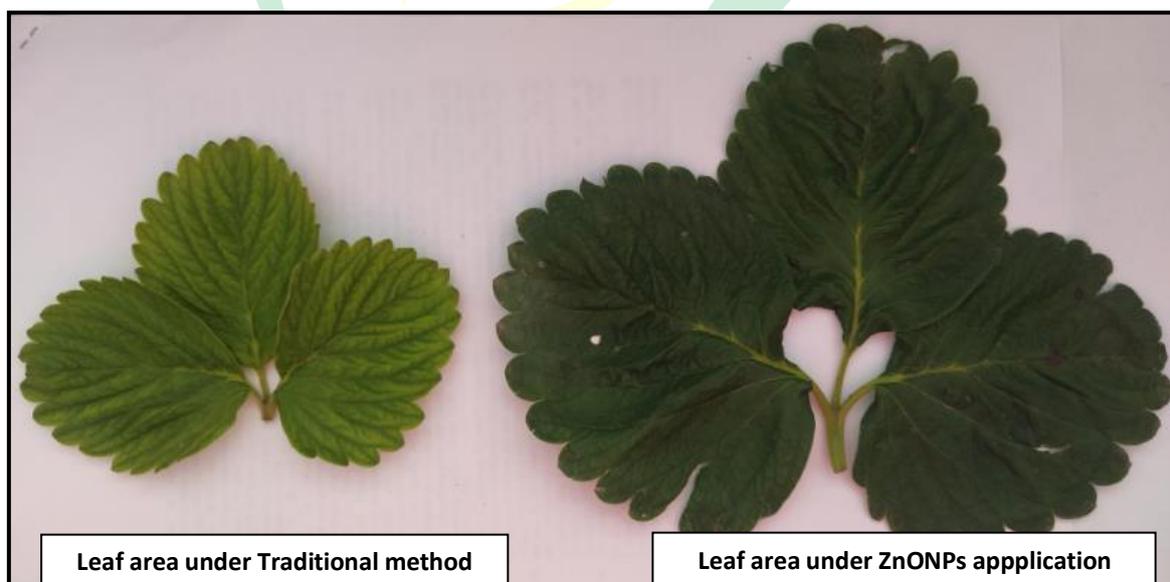
- The use of nanotechnology in horticultural crops is used for the extension of shelf life of fruits and increasing strength and quality of produce.
- Application of nanoparticles helps to control growth and development of quality deteriorating micro-organisms as well as disease, pest and weed control.
- Nanoparticles are used in agriculture to enhance seed germination and various other properties.
- Among different nanoparticles Zinc oxide (ZnO) nanoparticles are most commonly used for effective growth in various plants as its application leads to many morphological and physiological changes in plants.
- Use of nanoparticles over any other source of nutrient application lowers the use of chemical fertilizers because of more absorption due to lesser particle size ultimately decreasing quantity of fertilizes as well environmental pollution generated by use of chemical fertilizer.

OBSERVED RESULTS OF ZNO NANOPARTICLES APPLICATION IN STRAWBERRY CROP

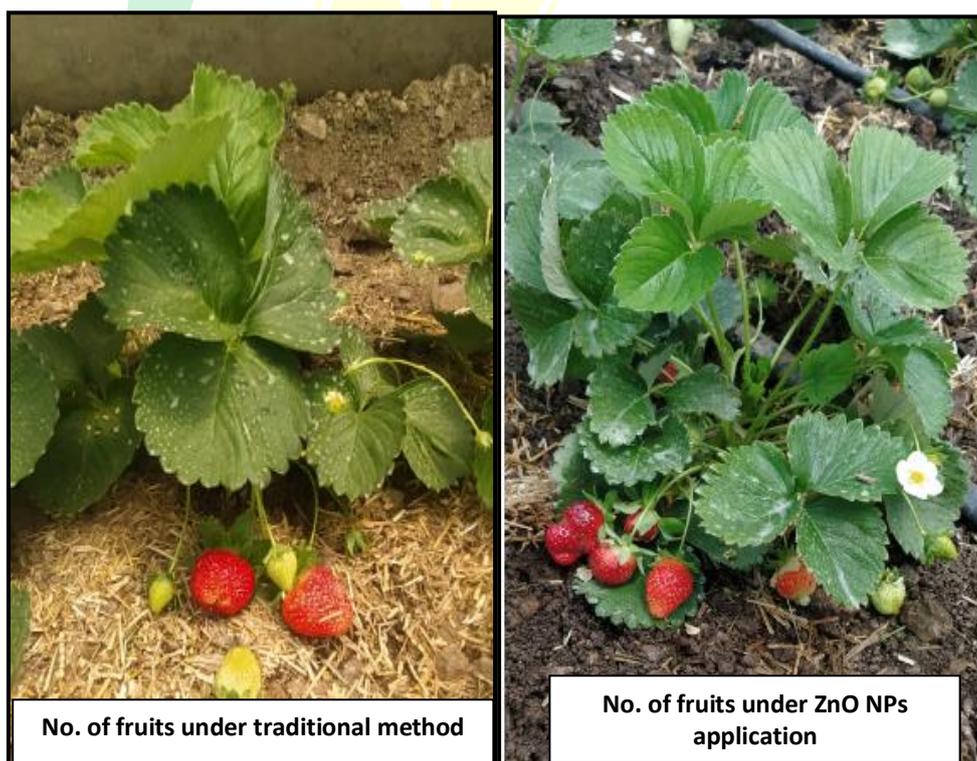
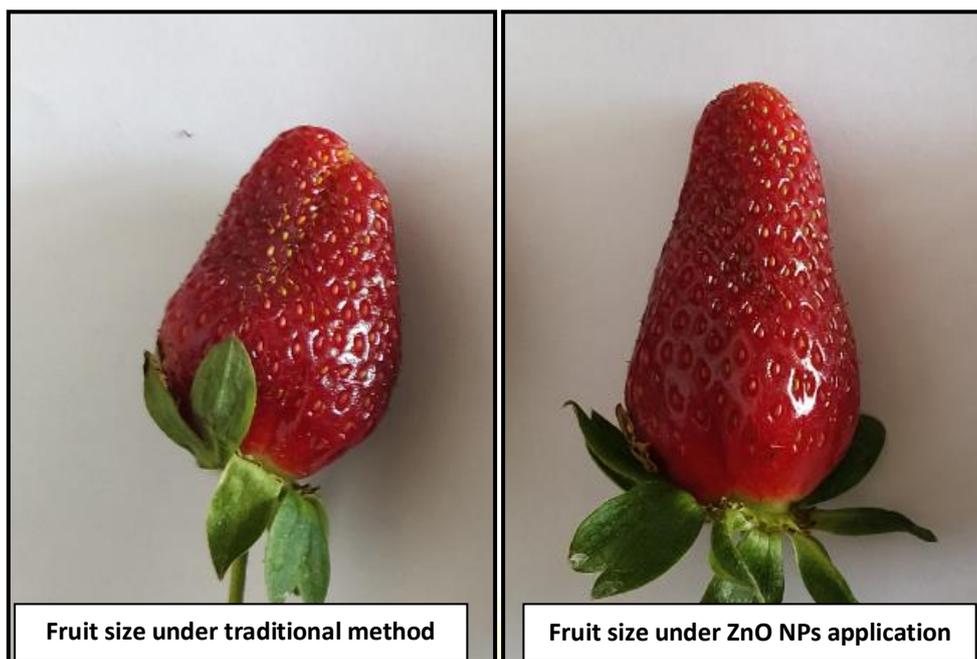
In strawberry, application of ZnO nanoparticles at different concentrations through foliar application resulted into better plant growth, fruit quality and yield as well as net returns to the grower. These results were obtained from an experiment conducted at Experimental Farm Chhapang, Eternal University, Baru Sahib, Sirmour (H.P.).

- In terms of growth parameters, the foliar application of ZnO nanoparticles leads to increase in plant height, more plant spread with highest leaf area ultimately resulting into more number of flowers and finally more number of runners in the end of growing season. The possible reason for this could be that Zn helps in production of Tryptophan which is the precursor of Auxin (Indole-3-Acetic Acid) leading to better

vegetative growth of plant and applying Zn as nanoparticles despite of other sources makes its availability easier because of more absorption due to lesser particle size.



- The most important quality attribute in strawberry is the shelf life of fruits and most strawberry growers face losses because of its poor shelf life. When strawberry plants are treated with ZnO nanoparticles through foliar application in the growing season, it is proved that shelf life increased upto some extent than normal schedule of fertilizer application. The possible reason could be the role of Zn in various enzymatic activities in plant responsible to increase shelf life of fruits. Besides shelf life, ZnO nanoparticles also positively affect many other quality attributes in strawberry like TSS, Total sugars (along with reducing and non-reducing sugars), Anthocyanin content and Ascorbic acid content. The positive increase in these attributes is directly concerned with the better quality produce that fetch more income to producer in the market.
- Yield of strawberry also get affected when the ZnO nanoparticles were applied as foliar spray as fruit size got bigger (both length and breadth) with more fruit weight. Number of fruits also increases than normal conditions because of increased number of flowers during vegetative growth period. Due to increase in all these attributes whole plant yield also increases directly benefiting the growers. ZnO nanoparticles application increases fruit yield because of role of Zn in photosynthesis, certain membrane functions and tolerance to environmental stresses.



LIMITATIONS IN ADOPTING USE OF NANOPARTICLES

- Lack of awareness among farmers because of more popularity of traditional methods as nanotechnology is a much new concept.

- Use of nanoparticles may lead to phytotoxicity if used beyond the recommended concentration because the particle size is less but the absorption rate is higher than other source of nutrients. So, it should be used in much lesser concentration than the other sources to avoid damage.
- Nanoparticles may have negative effects on environment due to toxicity generated by free radicles leading to DNA damage.
- Nanoparticles application sometimes lead to various processes like dissolution and redox reactions and these may cause toxicological effects that would not be produced by bulk particles of same chemical composition.

CONCLUSION

The use of ZnO nanoparticles in fruit crops particularly in strawberry gave better growth, quality and yield that ultimately lead to more profits to the growers. But, the efficacy of these nanoparticles depends upon the concentration in which they are being used because at much higher concentration (>200 ppm) these may cause phytotoxicity resulting into poor growth and yield as well as deteriorated quality. Nanoparticles if applied in controlled concentration, it will result into better quality produce that fetch more profits in the market ultimately benefiting the strawberry growers. The quality of strawberry grown under protected condition is much better than open conditions due to more controlled environment, better absorption of nanoparticles applied, low pest and disease incidence and better utilization of resources. Hence, the application of nanoparticles under protected conditions benefit the farmer in all aspects so as to generate more income and profit to the grower.