The nano-priming of *Eleusine coracana seeds* and an evaluation of salinity stress tolerance

IECPS 2024 Conference

Vikash Kumar[#1], Pooja Yadav[#1], Mohini Yadav[1], Saurabh C. Saxena[1]*

[1]Department of Biochemistry, Central University of Haryana, Mahendergarh, Haryana-123031, India

*Corresponding Author Email id: saurabhcs@cuh.ac.in, vikash211119@cuh.ac.in

Abstract

One of the biggest threats to agriculture worldwide is salinity, which inhibits crop growth and yield. Soil salinization directly impact the physiological and molecular processes of plants. The plants use a variety of tolerance mechanisms, including complicated physiological features, metabolic pathways, and molecular or gene networks, to battle salt stress. Genetic engineering, plant breeding, and other methods have been used to increase plant growth and productivity. Priming techniques, on the other hand, have a lot of potential as a "stress reliever" in agricultural crop production due to their economic viability and simplicity of use. Seed priming improves seed germination and seedling growth by activating several physiological and metabolic processes. Through enhanced expressions of numerous stress-related genes and proteins, priming controls molecular pathways which accelerate the stress responses and maintain cross-tolerance. Seed nano-priming has shown enhanced antioxidant activity in Eleusine coracana seedlings after challenging them with salinity stress. Nano-primed seedlings showed better salinity stress tolerance, as revealed by many stress markers like proline content, H2O2 content, chlorophyll content, etc. The use of copper oxide nanoparticles (CuONPs) via seed priming is a novel and cost-effective approach that improves seed germination and subsequent plant growth in Eleusine coracana by strengthening the antioxidant system and providing resistance against salinity stress.

Objectives

Following objectives are performed in study:

1. Green synthesis and characterization of CuONPs using leaf extract obtained from the *Agave americana* plant
2. Priming of *Eleusine coracana* seeds with CuONPs and assessment of following from salinity stressed seedlings:

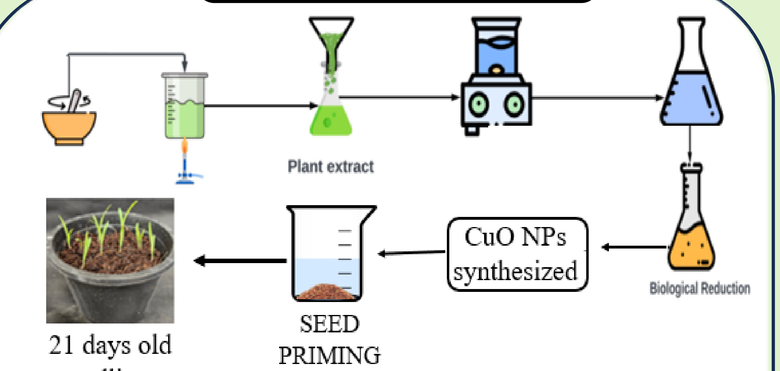
- Total phenolics
- Proline content
- H_2O_2 content
- MDA content
- Carotenoid content
- Chlorophyll content

Eleusine coracana

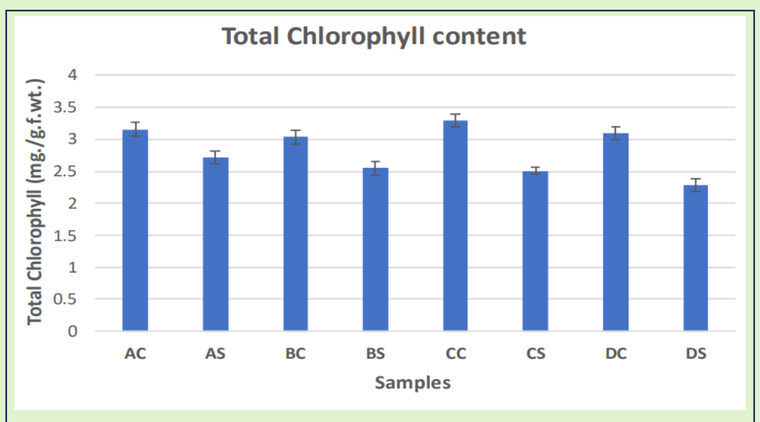
Kingdom – Plantae
Order – Poales
Family – Poaceae
Genus – Eleusine
Species – coracana

- Also known as Finger millet and Ragi.
- Successfully grown in plains as well as in hilly regions of India.
- Superior nutritional qualities.
- High medicinal values.

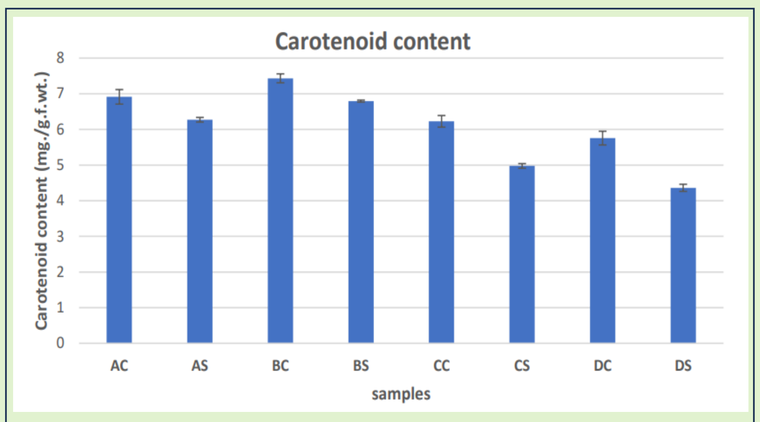
Methodology



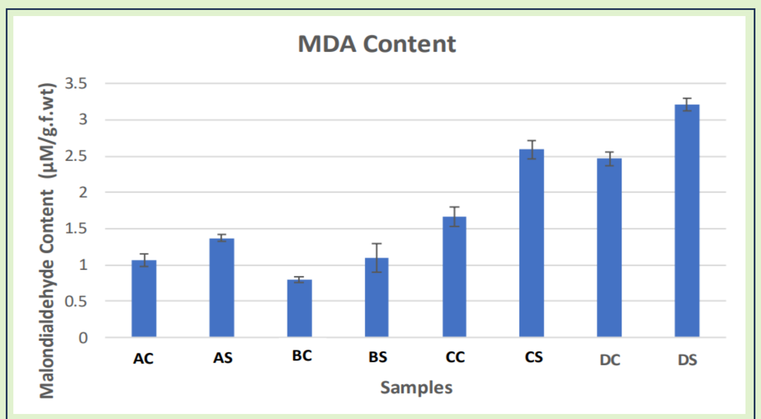
Results



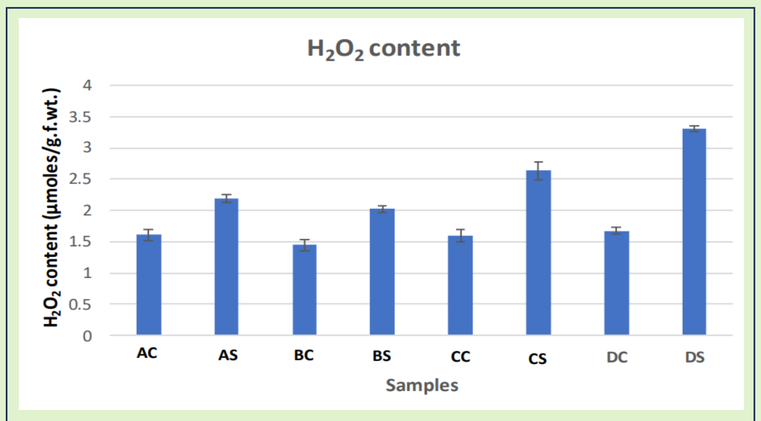
AC= 0.12% CuONP & No stress, AS = 0.12% CuONP &NaCl stress (150 mM), BC= 0.16% CuONP & No stress, BS = 0.16% CuONP & NaCl stress (150 mM), CC = Distilled water & No stress, CS = Distilled water & No stress, DC = No priming & No stress, DS = No priming & NaCl stress (150 mM)



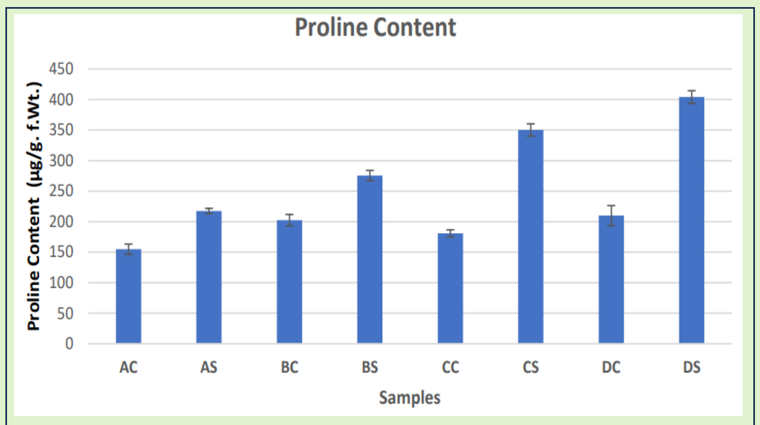
AC= 0.12% CuONP & No stress, AS = 0.12% CuONP &NaCl stress (150 mM), BC= 0.16% CuONP & No stress, BS = 0.16% CuONP & NaCl stress (150 mM), CC = Distilled water & No stress, CS = Distilled water & No stress, DC = No priming & No stress, DS = No priming & NaCl stress (150 mM)



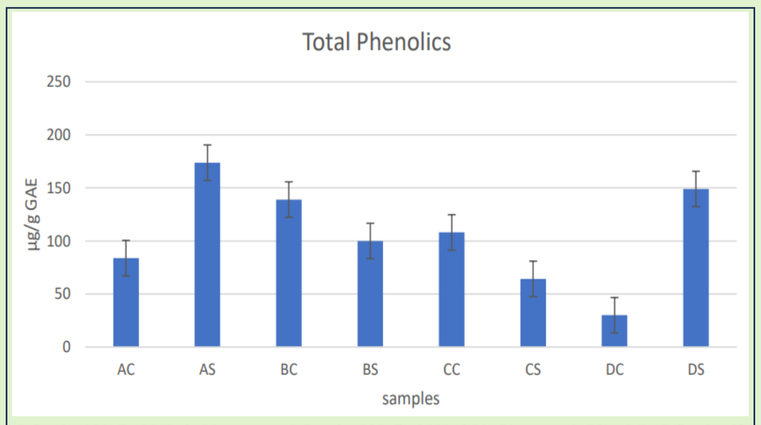
AC= 0.12% CuONP & No stress, AS = 0.12% CuONP &NaCl stress (150 mM), BC= 0.16% CuONP & No stress, BS = 0.16% CuONP & NaCl stress (150 mM), CC = Distilled water & No stress, CS = Distilled water & No stress, DC = No priming & No stress, DS = No priming & NaCl stress (150 mM)



AC= 0.12% CuONP & No stress, AS = 0.12% CuONP &NaCl stress (150 mM), BC= 0.16% CuONP & No stress, BS = 0.16% CuONP & NaCl stress (150 mM), CC = Distilled water & No stress, CS = Distilled water & No stress, DC = No priming & No stress, DS = No priming & NaCl stress (150 mM)

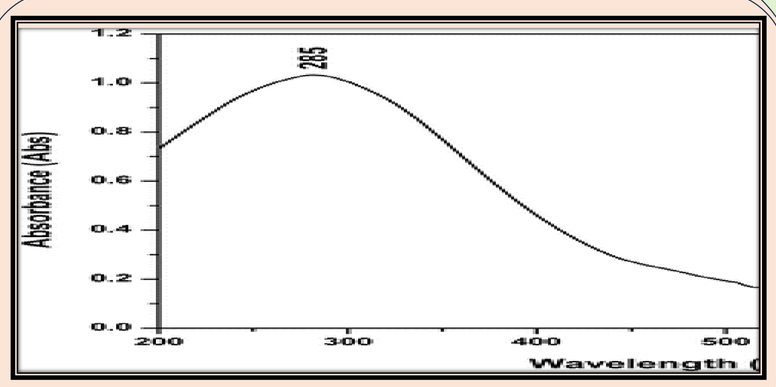


AC= 0.12% CuONP & No stress, AS = 0.12% CuONP &NaCl stress (150 mM), BC= 0.16% CuONP & No stress, BS = 0.16% CuONP & NaCl stress (150 mM), CC = Distilled water & No stress, CS = Distilled water & No stress, DC = No priming & No stress, DS = No priming & NaCl stress (150 mM)

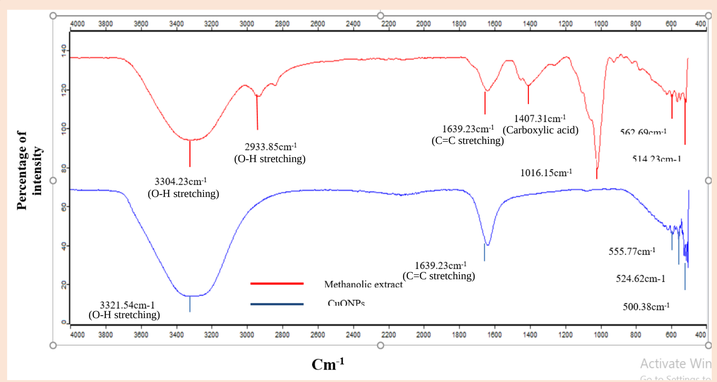


AC= 0.12% CuONP & No stress, AS = 0.12% CuONP &NaCl stress (150 mM), BC= 0.16% CuONP & No stress, BS = 0.16% CuONP & NaCl stress (150 mM), CC = Distilled water & No stress, CS = Distilled water & No stress, DC = No priming & No stress, DS = No priming & NaCl stress (150 mM)

Characterization



UV-Visible Spectrophotometric Analysis



FTIR ANALYSIS

Conclusion

- ✓ Nanoparticles have shown potential in improving abiotic stress tolerance in *Eleusine coracana*.
- ✓ Nanoparticles possess antioxidant properties and can scavenge ROS which are produced during abiotic stress.
- ✓ Nanoparticles can utilise in seed priming to improve different aspects of seed germination, seedling growth and overall plant performance.
- ✓ Seed priming has been shown to enhance carotenoid synthesis which results in higher carotenoid content in compared to non-primed seeds.
- ✓ Nanoparticles hold promise as a strategy for enhancing plant stress tolerance by improving nutrient uptake, water use efficiency, ROS regulation.

Acknowledgement – Authors are grateful to have support from Department of Biochemistry ,Central University of Haryana, Mahendergarh , Haryana 123031, INDIA and DBT.

Conference: "The 3rd International Electronic Conference on Plant Sciences (IECPS 2024)", Date: 15 – 17 January 2023