

EFFECT OF NANOMATERIALS ON GROWTH AND DEVELOPMENT OF BARLEY



Since-1981

By:

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INTRODUCTION

1. Barley (*Hordeum vulgare* L.) a member of the **grass family**, is a cereal grown in **temperate climates** globally. it ranks **4th** in the world among the cereals in total grain production. In India, total production **1.6 million tonnes**.
2. Barley is an excellent source of **β -glucan, B-complex, vitamins, tocotrienols, and tocopherols**. Among cereals, barley contains highest level (**up to 6%**) of β -glucan, a water soluble polysaccharide nutritionally classified as soluble dietary fiber.
3. Nanoparticles(**1-100nm**) exhibit completely new properties based on specific characteristics such as size, distribution and morphology.
4. The interaction of nanoparticles with plants results in several physiological, morphological, and genotoxic changes, and their understanding is important for the effective use of nanotechnology in agriculture.

OBJECTIVES

1. Evaluation of nanomaterials on Barley seed germination and seedlings growth.
2. To evaluate potential effect of nanoparticles on *in vitro* morphogenesis in Barley.
3. To study effect of nanoparticles on various biochemical parameters in Barley.
4. To study the effect of nanomaterials on agronomic traits of plants grown by seed priming.

Work Done:

- Collection of Plant Material: Certified seeds were procured from Rajasthan Agriculture Research institute, Durgapura, Jaipur
- Effect of Multi-Walled Carbon Nanotubes (MWCNTs) ranging in size from 1 to 100 nm on seed germination and seedling growth in natural environmental conditions was studied by giving seeds a pre-treatment with different concentrations of MWCNTs for 24hrs.

Seeds of Barley Sterilized with 20% Extran and 0.1% HgCl₂ for 3 minutes.



Rinsed with distilled water for 1 minute for 3 times to remove excess detergent



Different concentrations of MWCNT solution prepared by using sonicator



Seeds were soaked in MWCNT solution on shaker for 24 hrs



Soaked Seeds transferred on petriplates

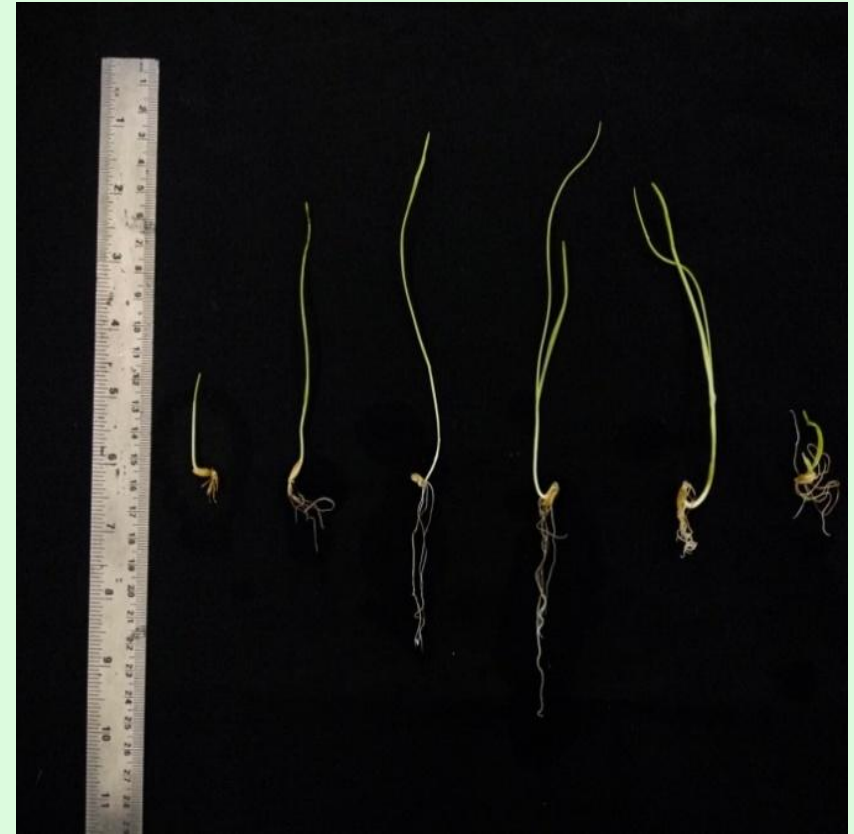


After 14 days reading were noted (fresh weight, dry weight, root and shoot length, fresh and vegetative to flowering state)

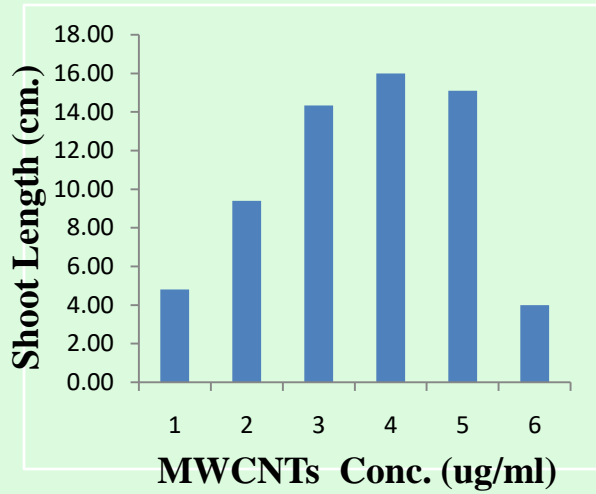
Effect of MWCNTs on seedling stage in Barley



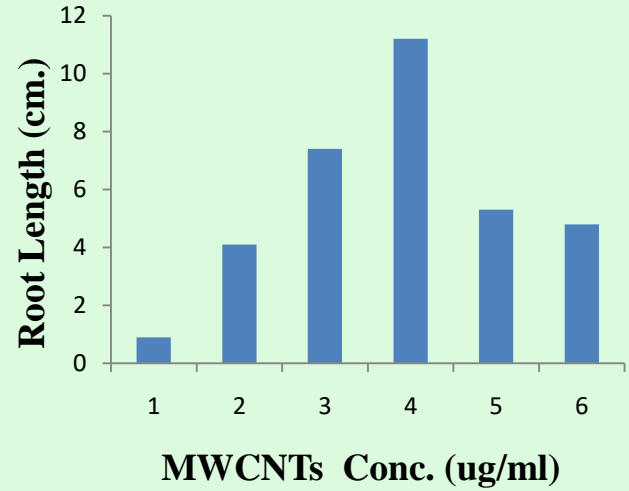
Pot Experiment



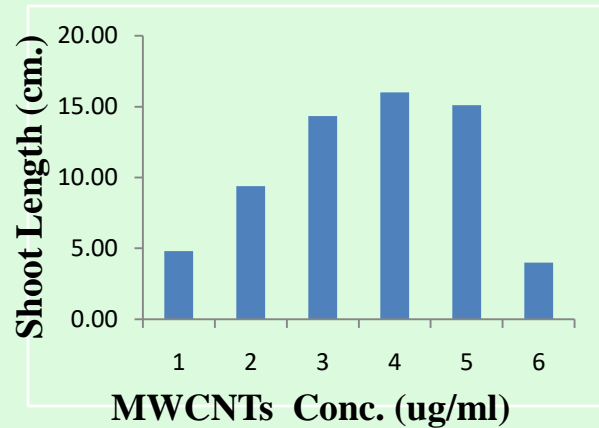
Petri dish experiment



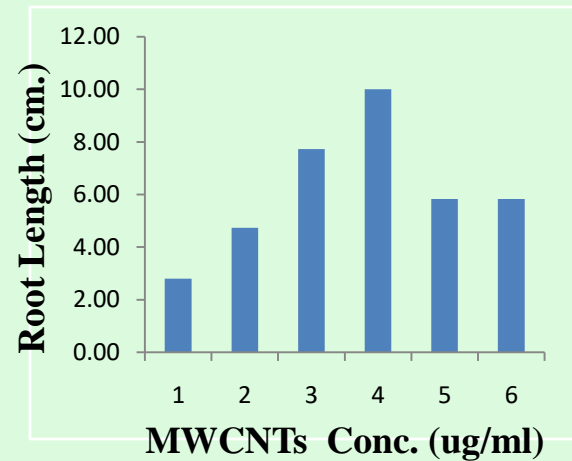
Shoot Length(Petri dish exp.)



Root Length(Petri dish exp.)



Shoot Length(Pot exp.)



Root Length(Pot exp.)

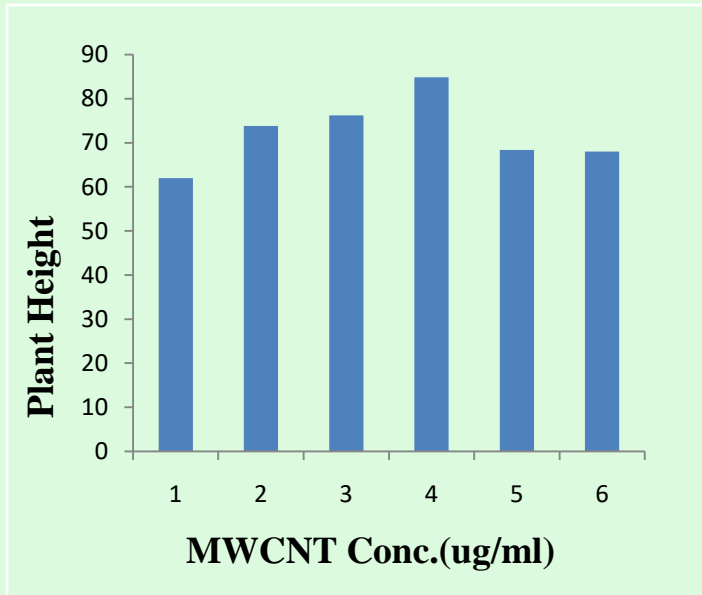
- Different morphological and biochemical parameters were studied.

Morphological parameter

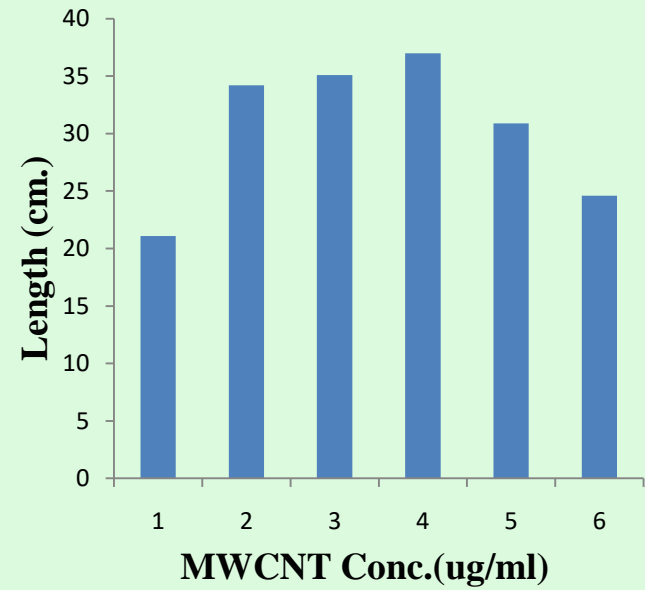
- a) Germination percentage
- b) Plant height
- c) Days to sowing
- d) Days to flowering
- e) No.of tillers per plant
- f) Spike length
- g) flag leaf
- h) No. of spikelet per spike
- i) No. of grains per spikelet
- g) Grain weight
- h) Harvest index



Effect of MWCNT at inflorescence stage in Barley



Plant Height



Flag Leaf Length

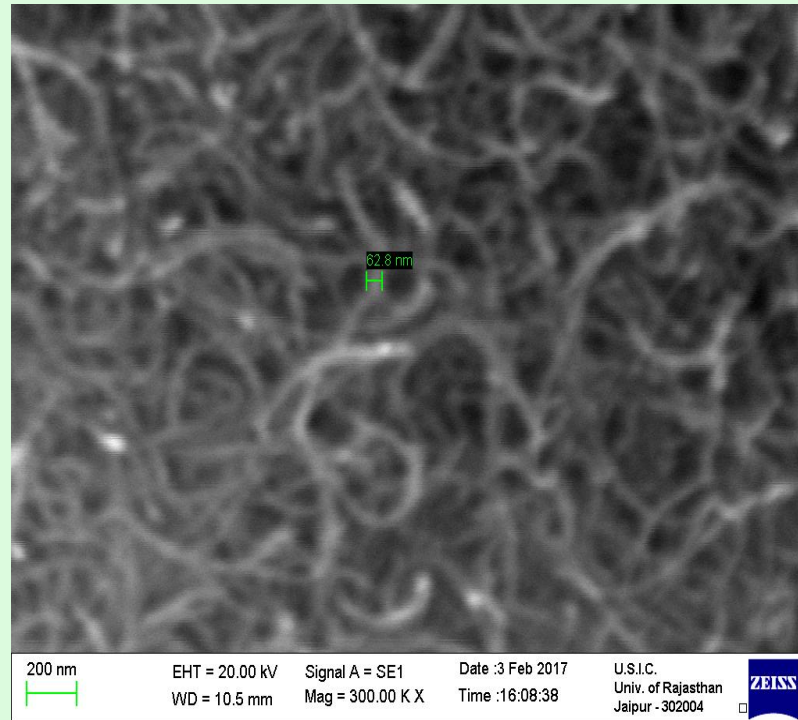
Biochemical parameter

- 1.Total chlorophyll content
- 2.Phenols
- 3.Peroxidase enzymes
- 4.Proline
- 5.Catalase
- 6.IAA estimation
- 7.MDA analysis
- 8.SOD activity

- Data was collected during experiment plant season.

Characterization of nanomaterial

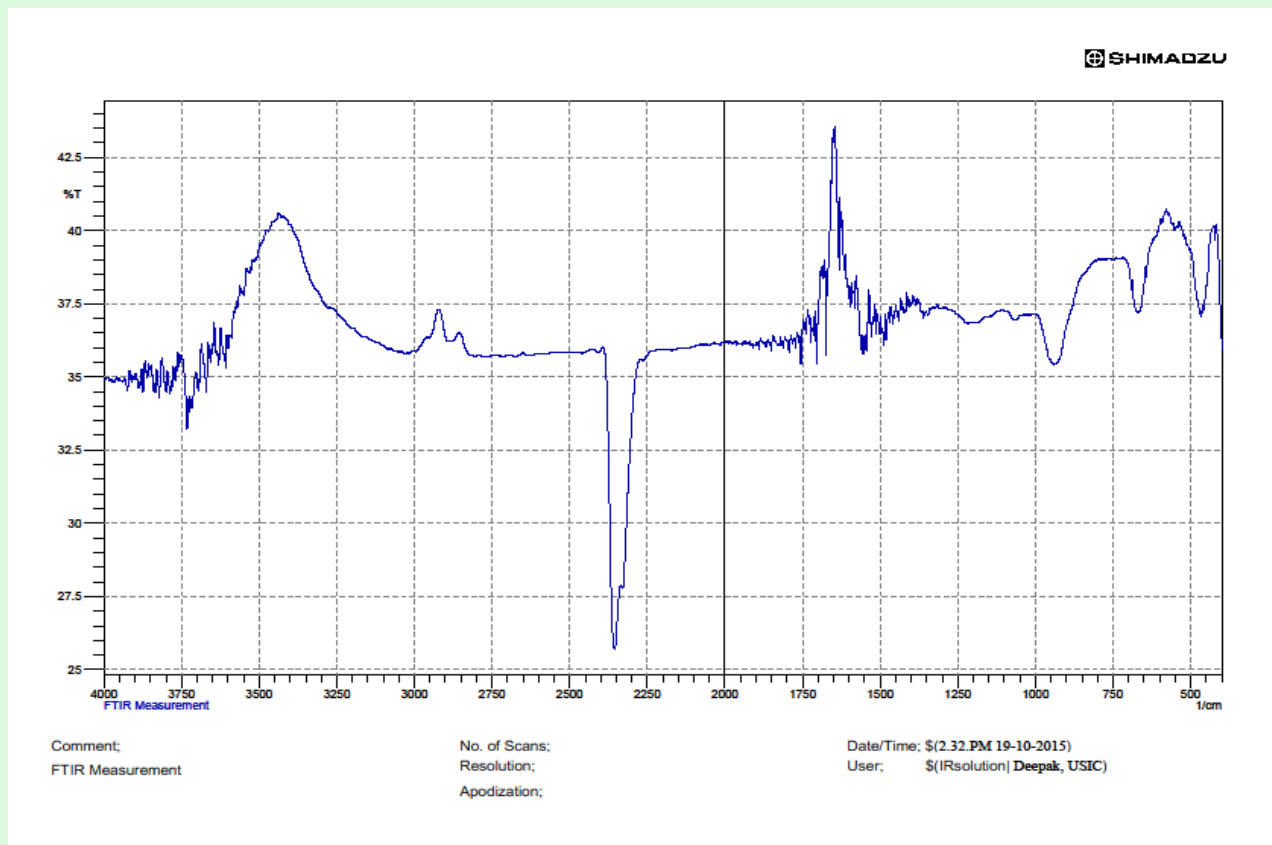
▪ Scanning Electron Microscopy (SEM)



The actual sizes and agglomeration state of the materials were studied using Scanning electron microscope. The size (diameter) of the Carbon Nanotubes was found to be 62.8 nm at its widest point for a MWCNTs using Scanning Electron Microscope (SEM) imagery.

Fourier Transform Infrared (FTIR) Spectroscopy

This exercise was done to know the functional groups present over the surfaces of the materials.



SUMMARY OF THE WORK DONE

The effect of MWCNTs on Barley depends on the concentration of the nanoparticles exposure media and plant species. In general at particular concentration of MWCNTs improved seed germination, shoot length, root length response in comparison to control was observed. MWCNTs enhanced germination, root shoot length at particular concentration range but reduction was noticed at higher doses. In the current study in Barley, we have observed-

- Improvement in the growth
- Early maturation
- Yield improvement

MWCNTs produced maximum seed yield at particular dose. The work confirmed the dose specific effect of MWCNTs on seed germination, crop growth and seed yield in Barley plant.

THANK YOU