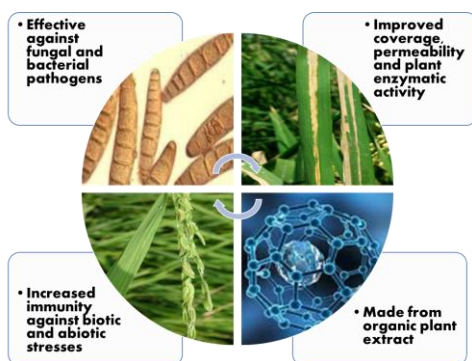




## Plant based nano-formulations for use in crop protection

*Achieving sustainable plant disease management via ecofriendly nano formulations*



**PAKISTAN ATOMIC ENERGY  
COMMISSION (PAEC), ISLAMABAD**



Dr. Sumaira Yousaf, Principal Scientist  
Dr. H. M. Imran Arshad,  
Principal Scientist  
Dr. Kamran Saleem, Principal Scientist

### **For Further information, please contact**

Dr. Sajid Nadeem, DCS/Head  
Plant Protection Division  
Nuclear Institute for Agriculture and Biology  
(NIAB)  
Jhang Road, P.O. Box 128, Faisalabad, Pakistan  
Telephones: 041-9201751-60  
Fax: 041-9201776  
Email: niabmail@niab.org.pk  
Website: [http:// www.niab.org.pk](http://www.niab.org.pk)

**PREFACE:** Ecofriendly plant protection strategies are required to achieve sustainable agriculture in the current scenario of climate change. Plant diseases are one of the major challenges to food security causing significant (20-40%) loss to agricultural production. Existing plant disease management relies predominantly on toxic pesticides that are potentially harmful to humans and the environment. Furthermore, millions of dollars are being spent on import of fungicides/pesticides to cope these issues worldwide. It is a dire need of the era to minimize these threats and combat the pathogens/pests involved in crops yield losses using ecofriendly approaches like applications of nanotechnology in agriculture.

**Prof. Dr. Muhammad Yussouf Saleem, CS  
Director, NIAB**

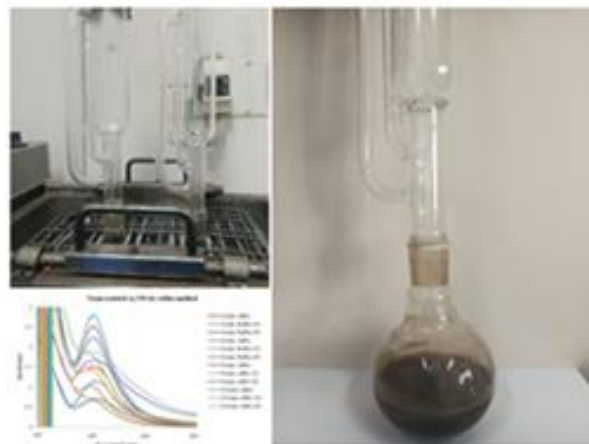
Sustainable and broad-spectrum plant protection measures using safe chemicals are equally effective in plant disease management against all pathogens and insects. Nanotechnology has great contribution in agricultural practices. Plant based green synthesized nanomaterials (NMs) are proven effective against different phyto pathogens such as fungi/bacteria causing various plant diseases as well as insect pests attacking crop plants. Silver (Ag) in ionic/NM form and Zinc (Zn; an important obligatory micronutrient for plants) as ZnO NM have antimicrobial properties for controlling plant pathogens/pests. Green

synthesized Ag and ZnO nanomaterials are safe potential alternative of toxic chemicals, ecofriendly and cost effective formulations. These can be applied through seed treatment, seedling root immersion and foliar spray under natural field conditions for the management of seed, soil and air borne field crop diseases.

**NIAB NanoSilver** is an ecofriendly formulation containing nano-sized Ag ( $23 \pm 7$  nm), coated and stabilized with neem (*Azadiracta indica*) extract. It stops the growth of plant pathogens by interfering with cellular mechanism of pathogen development and results in its growth inhibition. It helps to increase plant's defense response and prevents spread of disease.

**NIAB NanoZn** is an organic formulation consisting of nano sized zinc oxide ( $29 \pm 6$  nm), stabilized with neem (*Azadiracta indica*) plant extract and acetic acid. It acts by restricting the development of plant pathogens through absorption of nano ZnO into the cell membrane and control its spread. Absorption of Nano ZnO in the plant results in improving plant growth. It promotes tolerance to biotic and abiotic stresses and resistance against plant diseases.

Plant based Ag and ZnO nano formulations are green candidates for the control of diverse plant diseases and insect pests as possible alternative of synthetic pesticides/fungicides.



**Green Synthesis of Nanoformulations**



**NIAB NanoSilver & NIAB NanoZn**

## Benefits

- Made from organic extract of plant
- Less hazardous to environment than chemical pesticides
- Inhibition of pathogen growth
- Improved plant enzymatic activity
- Higher absorption rate
- Improved coverage on plant
- Effective against wide range of fungal, bacterial and viral diseases
- Increased plant immunity against abiotic stress
- Preventive and curative effects simultaneously



## Method of Application

- Seed and seedlings treatment
- Foliar spray

## Instructions for use

1 L for 20 Liter water; (100 Liter/ acre)