

# Sustainable Agriculture

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Nanotechnology, Biotechnology, Management  
and Food Security

Edited by

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Smriti P. Rao, Faria Fatima\*

## Chapter 2

# Greening the future: sustainable agriculture through nanobiotechnology management

**Abstract:** The current situation is crucial for meeting the world's population's fast increasing nutritional needs. Due to infestations of insects, microbial attacks, catastrophic events, inadequate soil quality, and a lack of nutrients, about one-third of crops grown conventionally suffer harm. By contaminating the soil, ongoing fertilizer and pesticide use makes the situation worse. Due to its increased efficacy, reduced input requirements, and lesser environmental toxicity, nanotechnology has recently grown in popularity. Nanotechnology has had a significant impact in the fields of health and pharmacology, while agricultural applications have received far less attention. Sustainable agriculture may benefit from the use of nanotechnology to manage abiotic stress in plants. By imitating the effects of antioxidative enzymes, nanomaterials (NMs) shield plants from oxidative harm in harsh environmental conditions. In agricultural studies, NMs can act as growth regulators, nanopesticides, nanofertilizers, nano-antimicrobial agents, targeted transporters in plants, as well as their effectiveness in lowering the risk of abiotic stress in crops. This chapter intends to provide a clear assessment of current knowledge of the different roles of NMs in agricultural studies. Addressing the interactions between plants and NMs provides new options for optimizing agricultural methods by boosting traits like disease resistance, crop output, and effective fertilizer use.

**Keywords:** Agriculture, nanotechnology, nanopesticides, nanofertilizers, nanoantimicrobial agents

## 2.1 Introduction

Agriculture is an essential component of developing economy since it supplies food for a better standard of living. Some of the issues that the agricultural sector is currently facing include unexpected climate change, soil pollution by pollutants like pesticides

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