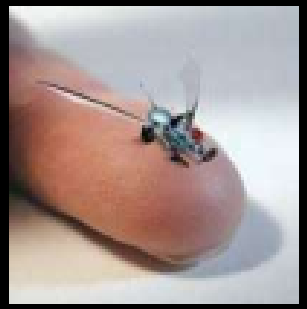
Application of Nanotechnology in Agriculture

1. Students will understand the basic concepts of Nanotechnology.
2. The role of Nanotechnology in agriculture sciences.

- Introduction
- Background of Nanotechnology
- Nanoparticles
- Applications of nanotechnology
- Nanotechnology in Agriculture and allied sciences
- Nanotechnology in pest management
- Nanopesticides
- Conclusion



3

‘Nano’- Greek word means ‘Dwarf’

A. 1 nm = one billionth (10^{-9}) of metre B. Size range between 0.1 and 100 nm

Father of nano technology Nobel Laureate -1965, Richard Feynman, Physicist

Norio Taniguchi, Professor - coined the term “Nanotechnology” (1974)

“Nano-technology” - Processing, separation, consolidation and deformation of materials by one atom or by one molecule.

~ 2000 Years Ago	Sulfide nanocrystals used by Greeks and Romans to dye hairs
~ 1000 Years Ago	Gold nanoparticles of different sizes used to produce different colors in stained glass windows
1959	"There is plenty of room at the bottom" by R. Feynman
1974	Taniguchi uses the term nanotechnology for the first time
1981	IBM develops Scanning Tunneling Microscope
1985	"Buckyball" - Scientists at Rice University and University of Sussex discover C_{60}
1986	• "Engines of Creation" - First book on nanotechnology by K. Eric Drexler. • Atomic Force Microscope invented by Binnig, Quate and Gerbe
1989	IBM logo made with individual atoms
1991	Carbon nanotube discovered by S. Iijima
1999	"Nanomedicine" – 1st nanomedicine book by R. Freitas
2000	"National Nanotechnology Initiative" launched

(British Standards Institution, 2005)

School of Agriculture

Course Code :AGRI3007 Course Name: Geoinformatics and Nano Technology for Precision Farming

Name of the Faculty: Dr. Ganesh D. Bhatt Program Name: B.Sc. (Hons.) Agriculture

Semester: 5th

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Nanomaterials and Agriculture

- There has been significant interest in using nanotechnology in agriculture

The goals fall into several categories

- Increase production rates and yield
- Increase efficiency of resource utilization
- Minimize waste production
- Nano-based treatment of agricultural waste
- Nanosensors
- Specific applications include:

Nano-fertilizers, Nano-pesticides

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Application of Nanotechnology in Agriculture and Allied Sciences

- Food technology
- Crop improvement
- Seed technology
- Precision farming
- Nano-fertilizer for balance crop nutrition
- Plant disease diaganose
- Weed management
- Water management
- Biosensors (Electronic nose)
- Agricultural engineering issue
- Animal science
- Fishery and aquaculture
- Pest management

- **Gene therapy for plants** : use of 3-nm mesoporous silica nanoparticle (MSN) for smuggling foreign DNA into cells.

  Peterson *et al.,2014*

- Shown the feasibility of **DNA sequencing** using a fluidic nanochannel functionalized with a graphene nanoribbon

  kyu min *et al., 2013*

Seed technology

- Use of carbon Nanotubes increases the germination through better penetration of the moisture

  Khodokovskaya *et al.,2010*

Precision farming

Smart Field System

- Bio-Nanotechnology has designed sensors which give increased sensitivity and earlier response to environmental changes and linked into GPS
- These monitor **soil conditions** and **crop growth** over vast areas
- Such sensors have already been employed in US and Australia

UASD

Plant pathology

- 100% growth inhibition was seen in the *Pythium ultimum*, *Magnaporthe grisea*, *Colletotrichum gloeosporioides*, *Botrytis cinere* and, *Rhyzoctonia solani*, showed at 10 ppm of the nanosized silica-silver

  Park *et al.*, 2006

- QDs have emerged as pivotal tool for detection of a particular biological marker with extreme accuracy

  Madhuri *et al.*, 2010