Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 04, Issue: 06 (NOV-DEC, 2024)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

# Climate Smart Agriculture with Nano Technology

(*Mr. M. Jitendra and Dr. I. Jagga Rao)
Kadiri Babu Rao College of Agriculture, C.S Puram-523112,
Affiliated to ANGRAU, Lam, Guntur-522 034, A.P, India
*Corresponding Author's email: jitendramajji@gmail.com

Farmers are highly dependent on synthetic chemicals to meet the requirement of crops. Indiscriminate use of inorganic chemicals causing soil pollution, degradation of soil and leading to high cost of cultivation and low production and productivity. Sustainable strategies are critical to meeting agriculture's potential to feed the world's population while conserving the ecosystems and biodiversity on which we depend.

**Keywords:** Climate smart Agriculture, Nano Fertilizers, Nano Technology ..etc.,

## Introduction

Nanotechnology possesses the potential to augment agricultural productivity through genetic improvement of plants and animals along with cellular level delivery of genes and drug molecules to specific sites in plants and animals. The potential is increasing with suitable techniques and sensors being identified for precision agriculture, natural resource management, efficient delivery systems for agrochemicals such as herbicides, fertilizers and pesticides, food processing, packaging and other areas like monitoring agricultural and food system security. Nanoherbicides and fertilizers are non-toxic and are less harmful to humans and the environment. Nano urea, Nano DAP developed by Indian Farmers' Fertilizer Cooperative Limited (IFFCO) as a substitute to urea and DAP to meet the nutrient requirement of crops especially during critical growth stages. In reacent days It is applied as a foliar spray, helps in efficient absorption and penetration into the leaves and reaches plant parts and release nutrients in a controlled manner, thereby reducing wastage into the environment. Further, it improves physiological traits of crops especially under drought stress conditions.

## Nano Fertilizers

Nanofertilizers, which can supply one or more nutrients to the plants when are fortified with nutrients. The synthesis of nanofertilizers is done by fortification of nutrients with nano-dimension singly or in combination on to various adsorbent materials (Liu and Lal, 2015). Nanofertilizer technology is very innovative and somany literatures are available in reseatrch journals. Nutrient use efficiencies of conventional fertilizers approximately35%, 20% and 40% for N, P and K respectively. Liquid nano fertilizers are readily soluble in water leading to leaching, denitrification and volatilization losses resulting in low nitrogen use efficiency and environmental pollution. Nano-fertilizers are nutrient carriers that are being developed using substrates with nano dimensions of 1 – 100 nm. Nano particles have more surface area

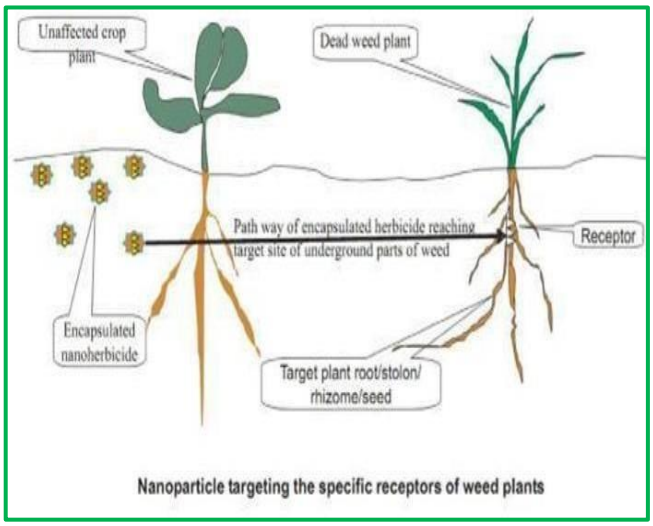
and capable of holding nutrients and release slowly and steadily such that it facilitates uptake of nutrients matching the crop requirement without any associated ill effects of customized fertilizer inputs. The current growing awareness of the phenomenon and availability of inexpensive natural zeolites in the world has aroused considerable commercial interest on developing zeolite based nano fertilizer. Examples for the nano fertilizer are Nano urea, Nano DAP, Potasium Nano fertilizers, Secondary nutrient Nano fertilizers..etc.,

## Nano herbicides For Effective Weed Control

Weeds are big hazard in agriculture; they reduce the yield up to a great extent. So there is no other option except eradicating them. Nanotechnology has potential to get rid of weeds by using Nano-herbicides in an ecofriendly way, without leaving any toxic residues in soil and environment. Less amount of herbicide will be used if active ingredient is combined with a "smart" delivery system. Having size in nano dimensions, these will blend with soil particles and prevent the growth of weed species that have become resistant to conventional herbicides. Herbicides available in the market are designed to control or kill the above ground part of the weed plants. None of the herbicides inhibit activity of viable underground ground plant parts like rhizomes or tubers, which act as a source for new weeds in the ensuing season. Developing a target specific herbicide molecule encapsulated with nanoparticle is aimed for specific receptor in the roots of target weeds, which enters into roots system of the weeds and translocated to parts that inhibit glycolysis of food reserves in the root system ultimately making the specific weed plant to starve for food and gets killed. Detoxification of weed residues is necessary as excessive use of herbicides for longer period of times leaves residues in soil and causes damage to succeeding crops. As well as continuous use of same herbicide for persistent period of time leads to evolution of weed resistance against that particular herbicide. Up to 88% detoxification of a herbicide atrazine by Carboxy Methyl Cellulose (CMC) nanoparticles has been reported.

## Smart delivery mechanism

Developing a target specific herbicide molecule encapsulated with nanoparticle are aimed for specific receptor **(Fig.1)** in the roots of target weeds, which enter into system and translocated to parts that inhibit glycolysis of food reserve in the root system. This will make the specific weed plant to starve for food and gets killed. In rainfed areas, application of herbicides with insufficient soil moisture may lead to loss as vapour. Still, we are unable to predict the rainfall very preciously; herbicides cannot be applied in advance anticipating rainfall. The controlled release of encapsulated herbicides is expected to take care of the competing weeds with crops.



Nanoparticle targeting the specific receptors of weed plants

**1. Slow release:** The capsule releases its payload slowly over a longer period of time (e.g., for slow delivery of a substance in the body) (Garrard, 2004).

**2. Quick release:** The capsule shell breaks upon contact with a surface (e.g., when pesticide hits a leaf).

**3. Specific release:** The shell is designed to break open when a molecular receptor binds to a specific chemical (e.g., upon encountering protein in the body).

## Conclusion

Nano technology is a sustainable option for farmers towards smart agriculture and combat climate change. Its application increases resourses availability to crop. In addition to this, nano fertilizers and herbicides helps in minimizing the environmental footprint by reducing the loss from agriculture fields which used to cause environmental pollution and climate change. The new form of nano particles would prove to be a boon for the sector as farmers would get high yield at a reduced cost.

## References

1. Garrard. “Brainy Food: Academe, Industry Sink Their Teeth into Edible Nano.” Small Times, 2004; 21:2-20.
2. Kaila Tara Meghana., *et al.* “Nanofertilizers in Agriculture". *Acta Scientific Agriculture* 5.3 (2021): 35-46.
3. Selva Preetha, P. and Balakrishnan, N. 2017. A Review of Nano Fertilizers and Their Use and Functions in Soil. *Int.J.Curr.Microbiol.App.Sci.* 6(12): 3117-3133.