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APPLICATION OF NANOTECHNOLOGY IN WEED MANAGEMENT

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INTRODUCTION

Nanoparticles have abundant utility in various fields and also unleashed huge scope for scientific experimentation in agriculture (Kanjana, 2015). Because of very small size (100 nm or less), they exhibit large surface area volume ratio which ensures effective applications of chemical inputs that were almost impossible in the past. Nanoactive herbicides control weeds even without use of synthetic chemicals resulting in reduced requirement of the latter. The application of nanoherbicides can be observed in varying entities.

HERBICIDE FORMULATIONS

The use of nanomaterials in herbicide formulations increase its efficacy not only by improved absorption and translocation in the plant but also increased adsorption of herbicide onto clay. It helps in reducing runoff, potential contamination of ground water and protects the herbicide from microbial or UV degradation causing increased residual activity. Micro emulsions (ME) of 10 - 50 nm in size are commercially available (Gogos *et al.*, 2012) as premix of fluroxypyr + clopyralid + MCPA and S-metolachlor + metribuzin. Specifically one adjuvant marketed as Nano Excel for glyphosate and 2, 4-D can be used in turfgrass.

NANOPARTICLES AS CARRIERS

Nanocarriers are effective for many soil-applied herbicides viz. flumioxazin, imazethapyr, S-metolachlor, and thiobencarb which have short half-lives in soil under aerobic conditions (Shaner, 2014). They allow gradual release of herbicide in soil which is beneficial for its prolonged effective activity and reduced losses via leaching, runoff, volatilization, or UV degradation. Also, compared to conventional formulation higher activity of atrazine nanocapsules was observed in the 0 to 4 cm soil depth as it controlled the sensitive weed species more effectively without causing any injury to corm. (Pereira *et al*., 2014).

HERBICIDE SENSORS

Modified a glassy carbon electrode comprising a novel polyaniline-carbon nanotube cyclodextrin matrix is used to analyze MCPA which is an easy and cost effective way compared to High Performance Liquid Chromatography. The nanocrystals have the ability to penetrate cell walls and

cell membranes and can be effective tracers of chemicals or biomolecules in plants. This will be helpful for studying entry, movement, and metabolism of herbicides in plants as nanocrystals locate the organelle and molecular target of an herbicide or the destination metabolites. Recently, for the first time that gold nanorods (39.4 nm x 11.3 nm) were used as fluorescent tracer for 2,4-D herbicide using tobacco (*Nicotiana tabacum* L.) as test plant (Jia *et al*. 2016).

CONCLUSION

The innovation and application of nanoparticles in toward of agrochemicals are in progress. The development of nanotechnology in agribusiness will bring clear economic, social, and ecological benefits. Though the applications of nanotechnology in creating novel tools for weed management are quite promising, there are also equal chances of high uncertainties. Still we do not know much about the fate of nanomaterials in the ecosystem and its impact on plants, animals and human beings. Thus, it is an imperative assignment for researchers to investigate more in field and explore the advantages of nanotechnology by minimizing the risks involved if any.

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