

Nano Herbicides – An Innovative Approach In Weed Management

Palaparthy Nileesha and Y.S.Parameswari

Professor Jayashankar Telangana State Agricultural University

College of Agriculture, Rajendranagar, Hyderabad-30.

Email ID: nileeshapalaparthy2929@gmail.com

Manuscript No: KN-V2-07/0010

Weeds are the major biotic constraint in Agriculture. The economic loss due to weeds about USD 11 Billion was estimated in 10 major crops in India (Ghardeetal., 2018). Weeds impair product quality and also effect environment. Herbicides are one of the most effective tools to control weeds. Herbicides account for 47.5% of overall yearly pesticide use of 2 million tonnes. Herbicides shown a negative impact on the environment i.e. soil, water pollution which target the other organisms. Because of continuous use of same herbicides or same family herbicides or same mode of action made the weeds resistant to herbicide. Weeds acquired resistance to 164 different herbicides. Hence to turnout the present situation we need to depend on the new tool i.e. nanotechnology.

Nanotechnology is the science and technology of tiny things. The materials that are less than 100nm in size. It is a new scientific approach that includes the use of materials and equipment capable of using physical and chemical proportion of a substance at molecular levels to explore the biological and material worlds in nano meter scale and use it in various carriers from medical to agriculture.

Different Nano Formulations In Weed Management.

Nano encapsulation: It is a membrane controlled method in which herbicides are coated with any semi permeable membrane, which could be organic or inorganic Eg: Chitosan, Poly ethylene, Poly propylene. Herbicides can be encapsulated with nano particles to increase their efficacy by focusing at the unique receptor of specific weed after entering into the root system and inhibiting glycolysis, starving them death.

Nano carrier: It is used to decrease the environmental impact of herbicides, specially reducing herbicide non target toxicity Eg: Alginate and starch. Chitosan / Tripoly phosphate nano particles (NP's) with paraquat herbicide were less hazardous to crops and safe to use in weed management (Grillo et al. 2014).

Nano emulsion: Nano emulsion are used to improve the delivery of active herbicidal substances. Nano emulsion droplets are typically 20-200 nm in size. The nano emulsion of pretilchlor micro emulsion and monolithic dispersion was found to be much superior in managing *Echinochloa crusgalli* compared to the commercially available formulation (Kumar et al., 2016).

Nano biosensors: Nano Biosensors can be used as a tool for detection of enzyme inhibiting herbicide. The herbicide metsulfuron methyl (an acetoacetate synthase inhibitors) was detected in the solid using a novel nano-bio sensor based on atomic force microscopy (Da silva et al., 2013).

Advantages:

- Minimize environmental pollution
- Enhanced soil herbicide residues mitigation.
- Safety to the microbiota in the soil.
- Enhanced efficacy of herbicides.

Disadvantages:

- Inhibition of seed germination
- Nano particles can easily enter the human body through skin.
- High production cost of nano particles.

Brindha and Chinnamuthu,(2017) reported that the presence of higher amount of starch (142 mg g⁻¹) phenol in the control treatment inhibited germination of tubers and no germination (0) was recorded. Whereas, the ZnO treated tubers at the rate of 1500mg kg⁻¹ registered lower content of starch (102 mg g⁻¹) phenol (60 mg g⁻¹) and higher percent of germination (80 Percent), ZnO nanoparticles acts as a powerhouse of electron donor possessing ability to degrade organic and inorganic compounds present in the tubers and thus starving the tubers which results in the germination of the tubers.

Kumar and Chinnamuthu, (2017) proved that nano encapsulated pendimethalin using solvent evaporation method released the herbicide over a period of 40 days under controlled conditions. Through outer covering and porous nature of polymer determine the release pattern of encapsulated herbicide. When irrigation is applied to the field the entrapped herbicide inside the carrier is slowly released and the left over herbicide inside the carrier will be released during the subsequent irrigations. Which helps in controlling the germination of weeds over the entire crop growing period and also the biosafety the germination of weeds for longer period and also the biosafety studies proved that nano encapsulated pendimethalin by solvent evaporation was non toxic to earth worms.

Weed control efficiency with pretilachlor emulsion 450g ha⁻¹ was higher when compared to pretilachlor 600 g ha⁻¹ which proves that pretilachlor micro emulsion is superior to pretilachlor (Kumar et al., 2016). Vimalrajiv et al. (2018) reported that application of nano particle herbicide combination significantly influenced the plant height of black gram.

Conclusion: Nano herbicide shown the effective weed control as well as it reduced the herbicide residue in the soil. However, Need to study the nano herbicides on long term basis in different situations.

References

- Brindha, K and Chinnamuthu, R. 2017. Zinc oxide nanorods to degrade phenolics and stored starch of *Cyperus rotundus* tubers management. *Journal of crop and weed*. 13(3): 184-188.
- Dasilva, A.C., Deda, D.K., Da Roz, A.L., Prado, R.A., Carvalho, C.C., Viviani, V and Leite, F.L. 2013. Nano biosensors based on Chemically modified AFM Probes : a useful tool for metsulfuron methyl detection. *Sensors*. 13(2): 1477-1489.
- Gharde, Y., Singh, P.K., Dubey, R.P and Gupta, P. 2018. Assessment of yield and economic losses in agriculture due to weeds in India. *Crop Protection* 107.10.1016/J. Cropro. 2018.01.007.
- Kumar, N., Kumar, R., Shakil, N.A. and Das, T.K. 2016. Nano formulations of pretilachlor herbicide preparation, characterization, and activity. *Journal of Scientific and Industrial Research*. 75:616-680.
- Vimalrajiv, B., Chinnamuthu, C. P., Subramanian, E and Senthil, K. 2018. Effect of nano particles in combination with pendimethalin and hydrogen peroxide on growth parameters and nodulation of black gram (*Vigna Mungo* L). *International Journal of communication and society*. (3) :2816-2819.

Grillo, R., Rosa, A.H., Fraceto, L.F. 2014. Poly (E-caprolactone) nano capsules carrying the herbicide atrazine effect of chitosan coating agent on physico-chemical stability and herbicide release profile. International Journal environmental Science Technology.11: 1691-1700.

Kumar and Chinnamuthu. 2017. Assembly of nano encapsulated pendimethalin herbicide using solvent evaporation method for season long weed control under irrigated ecosystem. International Journal of Pure and applied Bio science. 5(1): 349-357.