



HYDROGEL AND ITS ROLE IN AGRICULTURE

Sachin Sharma, Ayush Bahuguna and Basant Kumar Dadrwal

Institute of Agricultural Sciences, Banaras Hindu University, Varanasi (U.P), India 221005

Coresponding author: sssachin726@gmail.com

Abstract

Nowadays water management is considered one of the major challenges for all countries in arid and semi-arid regions, in fact, by 2030, global water demand is probable to be 50% higher than today, resulting in water scarcity, in the same time agricultural sector used over 70 percent of freshwater in most regions of the world. Research evidence suggests that when the soil is treated with water hydrogel composite the water volumetric content of the soil increases significantly and when the surrounding soil dries, the stored water is released back slowly into the soil. The hydrogel increases efficient water consumption, decreasing irrigation costs and increasing irrigation intervals, also, implement soil's water holding capacity and soil porosity, providing plants with eventual moisture and nutrients as well as enhancing plant viability and ventilation and root development which provides a conducive atmosphere for better growth of plants and finally increases crop yield

Keywords: Hydrogel , soil porosity , arid , root development

Hydrogel

Arid regions countries are intense a lot of and a lot of water from virtual water to supply daily needs, the usage of latest technologies for enhancing water and nutrient use potency can become a lot of necessary over time, particularly in arid regions with limiting water availability. Polymers play important role in agricultural sector and use as structural materials for creating a climate beneficial to plant growth and increasing irrigation water efficiency (Dehkordi KD 2017). Polymer hydrogels is classified as a Super absorbent polymer, it's measure visco-elastic, loosely crosslink, and hydrophilic three-dimensional networks of versatile polymer chains with unconnected ionic purposeful group that may absorb an oversized quantity of water or alternative biological fluids in an exceedingly short time and retain them beneath sure conditions and considered as a soil conditioner which hold up to housand times of their existing weight of water and increase crop yield (James 1986, Li *et al.* 2009).

There are three groups of a polymer as follow:

- Starch-polyacrylonitrile graft polymers (starch co-polymers),
- Vinyl alcohol-acrylic acid co-polymers (polyvinyl alcohols)
- Acrylamide sodium acrylate co-polymers – cross-linked polyacrylamides

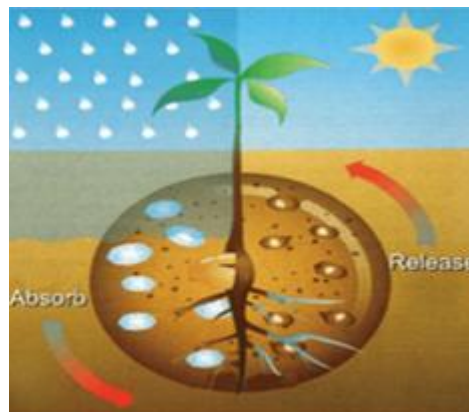
Mode of action for polymer hydrogel

When the hydrogel is mixed with the soil, it forms an associate amorphous gelatin-like mass on hydration and is adept of absorption and desorption for an extended time, thus acts as a slow unharness supply of water within the soil. Due to the respectable volume

reduction of the hydrogel as water is released to the plant, hydrogel creates at intervals the soil, free pore volume providing further space for air and water infiltration, storage and root growth (Milani 2017). Hence hydrogel polymer deed as a slow–release basis of water and dissolved fertilizers in the soil.

Application of Hydrogel in Agriculture

- 1) Seed additives to support seed germination or seed coatings
- 2) Dipping of seedling roots before establishment
- 3) Immobilizing plant growth substances
- 4) Coating protecting agents (herbicides and pesticides) for slow release
- d) Increase the water use efficiency
- e) Increase irrigation intervals due to increasing the time to reach a permanent wilting point
- f) Minimizing soil erosion and water run–off
- g) Implement soil penetration and infiltration



Mode of Action of Hydrogel

Effect of hydrogel on nutrients

Hydrogel application minimizes micronutrients from washing out to water tables and increase water consumption efficiency; also, they reduce the quantity of fertilization, since the nutrient leaching is prohibited by decreasing runoff.

Future areas for Hydrogels

Use of hydrogel polymer has shown a great potential and growth in the agricultural sector, also, in arid and semiarid regions there is attracting considerable interest for usage of hydrogel polymer to increase soil water retention and improve crop productivity. From other side most of these materials for multi–functional applications especially in the field of slow release nutrients are now being acquired using natural materials.



Hydrogel



Hydrogel application in soil

References

- Dehkordi KD. 2017.** Effect of superabsorbent polymer on salt and drought resistance of eucalyptus globulus. *Applied Ecology and Environmental Research*, 15(4):1791–1802.
- James EA, Richards D. 1986.** The influence of iron source on the water-holding properties of potting media amended with water absorbing polymers. *Scientia Hort*, 28(3):201–208.
- Li YK, Xu TW, Ouyang ZY, 2009.** Micromorphology of macromolecular superabsorbent polymer and its fractal characteristics. *J Appl Polym Sci.*;113(6):3510–3519
- Milani P, França D, Balieiro AG, 2017.** Polymers and its applications in agriculture. *Polímeros*.27(3):256–266.