AGRIBLOSSOM
ISSN-2582-8258
A monthly peer reviewed e-magazine for Agriculture & allied Sciences

Hydrogels Application:An Alternate Source For Irrigation

D.K.D. Deekshitha[1], V.S.L. Raj Rushi.K[2], Ch. Vidhyashree[3]
[1,2,3]Ph.D Scholars, Department of Soil Science and Agricultural Chemistry, Agricultural College, Bapatla

Introduction

Irrigation water is becoming scarce and the world is looking for water-efficient agriculture. In India, most of the area is located in arid and semi-arid regions. Increasing food demand and declining water resources are challenges for food security. So under such areas, proper management practices should be done inorder to conserve moisture and to increase water holding capacity of the soil. The best possible solution to the above said problem is 'hydrogel'.

What is Hydrogel?

Hydrophilic gels called hydrogels are cross-linked materials absorbing large quantities of water without dissolving that absorb substantial amounts of aqueous solutions. The gel is a state that is neither completely liquid nor completely solid. This half liquid-like and half solid-like properties cause many interesting relaxation behaviors that are not found in either a pure solid or a pure liquid state. The terms gels and hydrogels are used interchangeably. They absorb many times their weight in water, and can be distributed into dry regions in order to improve the soil ability to absorb water. Hence, it is known as Super Absorbent Polymer (SAP). Due to their excellent properties, these SAPs were already well established in various applications such as disposable diapers, hygienic napkins, cement, drug delivery systems, sensors, and agriculture. Agricultural hydrogels are synthetic polymers generally made from petroleum products. In presence of water, it expands to around 200-800 times the original volume. There is ample possibility to trap irrigation and rainwater that can then be collected, stored and gradually released for crop requirements over prolonged durations. The SAP particles acts as "miniature water reservoirs" in soil and water will be removed from these reservoirs upon the root demand through osmotic pressure difference. Application of hydrogel decreases the irrigation requirements of several crops by improving water holding capacity resulting in delay and onset of permanent wilting percentages under intense evaporation. An increase in water

holding capacity due to hydrogel amendment significantly reduced the irrigation requirement of many plants.

The salient features of hydrogel:

- Low price
- Less affected by salts
- The pH-neutrality after swelling in water
- Photo stability
- Re-wetting capability
- Exhibits maximum absorbency @ temperatures (40- 500C) characteristic of semi-arid and arid soils
- Absorbs water 400 times its dry weight and gradually releases the same
- Low rates of soil application – 1-2 kg / ha for nursery horticultural crops; 2.5-5 kg/ ha for field crops
- High absorption capacity in saline and hard water conditions
- High durability and stability in the swelling environment and during storage
- Stable in soil for a minimum period of one year
- Gradual biodegradability without formation of toxic species

Soil properties as influenced by hydrogels:

- Reduces irrigation and fertigation requirements of crops
- Reduces leaching of herbicides and fertilizers
- Improves physical properties of soils and soil less media
- Delays onset of permanent wilting point
- Stop soil erosion, farm run-off & surface leaching

Plant properties as influenced by hydrogels:

- Improves seed germination and seedling emergence rate
- Improves root growth and density
- Helps plants withstand prolonged moisture stress

- Reduces nursery establishment period
- Promotes early and dense flowering and fruiting/ tillering
- Extensive root growth resulting in increased water and nutrient use efficiency

Application of Hydrogel granules:

Depending on the salt content of the water, one kilogram of hydrogel can absorb water up to 500-600 times of their weight. Hydrogel can be applied wet (Liquid) or dry (granule) formulation.

- **Wet Application:** Mix the granules in water and allow them to stand for 60-90 minutes (Hot water works faster). Once the polymer is all soaked up, the application rate is roughly one part hydrated polymer to four parts of soil. Best for small applications such as repotting house plants, planting shrubs, small trees and bedding plants. Some commonlysuper absorbent hydrophilic polymer (Hydrogel) used in agriculture are; Pusa Hydrogel; Luquasorb; Agrosoak; Soil moist;Jalshakthi.
- **Dry Application:** For proper functioning, hydrogel should e kept in a dry place. Mix the desired amount of hydrogel (5 kg/ ha) with dry, fine sand of less than 0.25mm size in a 1:10 ratio. For vegetable crops, mix the mixture of hydrogel and sand with upper 5cm of soil. For economical use, hydrogel should be applied in line where seed is to be sown.

Application rate of hydrogel in soil

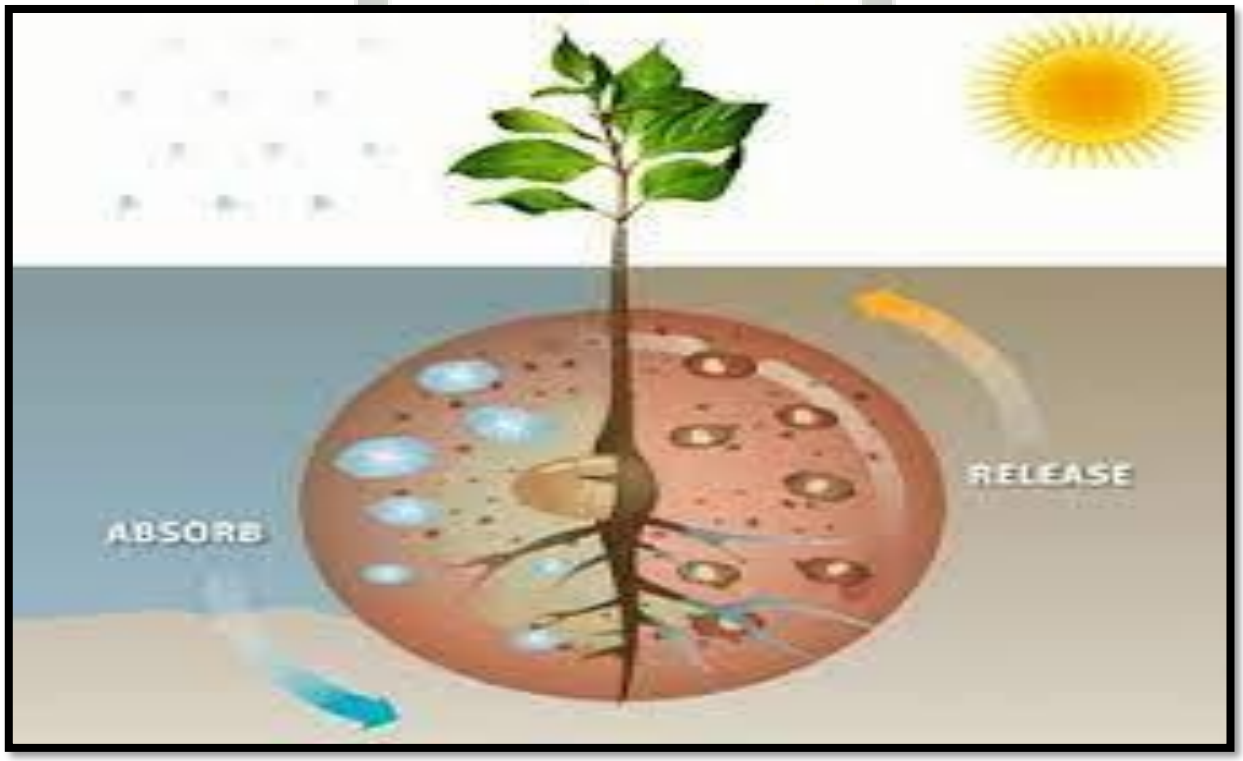
Type of Soil	Suggested dosage of Hydrogel
Arid & Semi-arid Regions	4-6 g/kg soil
For all level of water stress treatment and improved irrigation period	2.25-3 g/kg soil
To delay permanent wilting point in sandy soils	0.2-0.4 g/kg OR 0.8% of soil whichever is more
To reduce irrigation water by 50% in loamy soil	2-4 g/ plant pit
To improve relative water content and leaf water use efficiency	0.5-2.0 g/pot
To reduce drought stress	0.2-0.4 % of soil

To prohibit drought stress totally	225-300 kg/ha of cultivated area
To decrease water stress	3% by weight

Disadvantages of Hydrogel in Agriculture:

- These water absorbent polymers or Hydrogels have been around for a couple decades and are not as useful in plant agriculture as they might appear to be.
- The amount of water absorbed by hydrogels decreases greatly if there are any ions in the water. The data for Hydrogel water absorption are usually in distilled water. In the real world, soils contain ions from fertilizers and irrigation water, that substantially reduce the water absorption by the Hydrogels.
- Most soils can hold reasonable amounts of water for plant growth. If there is insufficient rainfall, the soil water is depleted. Hydrogels will not solve that problem.
- Hydrogels are very costly, which limits their use to high value crops such as potted ornamental plants, landscape trees and for home garden uses. One study found that adding peat moss costing the same as the recommended rate of Hydrogel increased the water-holding capacity of a potting soil by the same amount as the Hydrogel.
- Possibly the most common commercial use of Hydrogel in plant agriculture is as a slurry to coat bare-rooted transplants. This supposedly prevents the roots from drying out.

AGRIBLOSSOM
ISSN-2582-8258
A monthly peer reviewed e-magazine for Agriculture & allied Sciences



Hydrogel:Absorb large quantities of water and release them slowly for longer period