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MOISTURE CONSERVATION PRACTICE BY USING HYDROGEL IN AGRICULTURE: A REVIEW

V. Prakash[1], J. R. Kavitha[2] and P. Maheshwari[3]
[1]Department of Agronomy, SRSIAT, Vedeasandur.Tamilnadu-624710, India
[2]Department of Plant Biotechnology, SRSIAT, Vedsandur, Tamil Nadu-624710, India
[3]Department of Agricultural Microbiology, SRSIAT, Vedeasandur, Tamil Nadu-624710, India
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ABSTRACT

Agriculture is the backbone of Indian economy. In the agriculture, water is the major resources for crop cultivation in the field, in case of agricultural sector water is the major problem because of onset monsoon. So that less rainfall is occur in the cropped area. Natural rainfall is the source of elixir for crops on the major chunk of arable land. Of the 1.5 billion ha (11% of the world's land surface of 13.4 billion ha) of cropland worldwide, 1.2 billion ha (82%) is rain fed (FAO, 2005). To minimize the water scarcity problem in the cropped field due to various methods, like moisture conservation practices such as composted coir pith, straw mulch, antitranspirant, hydrogel etc. Hydrogel is the one of the method to maintain the moisture in the cropped field and supply the adequate water for crop growth. The hydrogel maintain the moisture in the field from sowing to harvest of the crops.

Keywords: Hydrogel, Water scarcity, Water holding capacity (WHC).

INTRODUCTION

Water scarcity is one of major environmental constraint to the plant. Due climate change and lack of rainfall, the drought occurs in tropical and sub tropical region. The impact of drought stress on the respiration, penology, crop growth, water and application of nutrients relations in plants. The cultivation of crops is can be reduced because of scarcity of water in the cropped field. To solve the scarcity of water problem in the field by application of hydrogel. The hydrogel is used to increase the water content in the soil and increase the water retention in root zones region of the soil. These hydrogels are polymer that retain water and swell into ordinary of their unique size and weight and are utilized in soil to make a water reserve near the rhizosphere region (Han *et al.*, 2010). During high temperature, the effective root system of the plants pulls out and depletes the amount of water from the root system of the plants. While using the hydrogel to increase the amount of moisture in the soil and also reduce the water stress of plants, resulting in increased the growth and development of the plant. Sivapalan (2006) reported that polymer addition to sandy soil increased water use efficiency for plants. Moreover, the germination process, the crop growth uptake of nutrients, the yield and both the water and fertilizer use efficiency were increased by mixing the hydrogel with plant pits in sandy soil, (El-Hady *et al.*, 2002). The replenishment for the heavy water scarcity in the cropped field by using the hydrogel application.

Change the physical properties of soils by hydrogels

- Increasing their WHC
- Reducing erosion and runoff
- Reducing frequency of irrigation
- Increasing the water use efficiency
- Increasing the soil permeability and infiltration
- Reducing the tendency of the soil to get compacted
- Help plant performance

Types of hydrogel

It is the water soluble and insoluble polymers used in the agriculture. The hydrogel is used as soil conditioners and do not form a gels. Water soluble hydrogels are polyacrylamides and polyacrylates. Its reduce the erosion, improve percolation, improve the crop yield at very droughty and structure less soils. In 1970, the applications of hydrogel polymers were first introduced in agricultural sector. It's having the capacity to the capacity of hydrogel to retain the water up to 1,000 times of their weight in water and form gels.

Salient features

- It helps the plants withstand in moisture stress conditions.
- It increasing the agriculture productivity, through the improvement of water use efficiency.
- Reduces irrigation and fertigation requirements of crops.
- Suitable for semi-arid and arid regions. Absorbs the water at minimum of 350 times of its dry weight and gradually releases it.
- It exhibits the maximum absorbency at high temperatures (40-50^{o}c)
- And hence it improves the physical properties of soils and the soil less media.

Hydrogel Products Available In India

Trade name	Manufacturing company
Pusa Hydrogel	IARI, New Delhi
Waterlock 93N	Acuro Organics Ltd, New Delhi
Agro-forestry water absorbent polymer	Technocare Products, Ahmedabad
Super absorbent polymer	Gel Frost Packs Kalyani Enterprises, Chennai
Hydrogel	Chemtex Speciality Ltd, Mumbai
Rain drops	M5 Exotic Lifestyle Concepts, Chennai

Source: - Aniket *et al.,* 2016

Characteristics and Potential Applications of Hydrogel

S.No	Parameter	Characteristic and potential applications
1.	Chemical constitution	Cross linked anionic polyacrylate
2.	Appearance	Amorphous granules
3.	Particle size	20-100 mesh (micro granules)
4.	pH	7.0-7.5
5.	Stability at 50°C	Stable
6.	Sensitivity of UV light	Not sensitive
7.	Temperature	40-50 °C
8.	Stability	~ 2 Years
9.	Other properties	• Absorbs the water 400 times of it's dry weight and slowly releases the same. • Exhibits high absorbency temperature ranged from 40-50 0C in semi-arid and arid soils • Improves % seed germination and seedling emergence rate • Reduces the irrigation and fertigation requirements and dose of urea to be applied

Source: - Aniket *et al.,* 2016

Hydrogel in the soil

Hydrogel in soil application

Swallon hydrogel (water absorb) and dried hydrogel (plant absorb)

The Uses of Hydrogel in Agricultural

It reduces the excess uses of water in crop field through the way of hydrogel application. The hydrogel is used to reclaim the barren land. In top layer of soil the hydrogel is added is increased the water retention capacity and percolates the rainfall in to the soil. It's prevented the runoff and reduces the nutrient losses from the soil. The application of hydrogel to the field either mixed with soil or by spraying. The hydrogel is the gel-forming polymers, its improve the WHC in different soils, such as clays and

sandy loams. It helps to reduce the soil erosion, leaching, reduce the need for irrigation, reduce compaction and improve the plant growth.

Effect of hydrogel

Hydrogels is the hygroscopic polymers. They are categorizing as water soluble and insoluble polymers, but the water insoluble hydrogel is an important because it provides the water for plants during the water stressful condition. The capacity of cellulosic hydrogel (PUSA HYDROGEL) has a to swell 350-500 times its weight in pure water and hence it releases the similar quantity of water at slowly them to crops as per its requirements. The cross-linked polyacrylamides hold water up to 400 times their weight and release 95% of the retained water to growing plants (Bowman and Evans, 1991).

Effect of hydrogel on soil water availability

Increasing the availability of moisture in the root zone was due to the use of hydrogel as a result, the interval of irrigation had increased (Allahdadi *et al.,* 2005; El-Hady *et al.,* 2009). Another study reported that application of hydrogel in sandy soils significantly increased the water retention capacity (Abedi-Koupai and Sohrab, 2004). El-Hady and Abo-Sedera (2006) reported that the application of hydrogel in sandy soils results in improving the water availability to the plant by increasing the retention pores and reduced saturated hydraulic conductivity by decreasing the drainage pores. Leciejewski (2009) observed that the soil-water storage increased mainly in the range of pF < 2 by the application of hydrogel to sandy soils.

CONCLUSIONS

Hydrogel application is helps to increase the productivity of all crops (cereals, vegetables, oilseeds, flowers, spices, etc) in terms of crop yield. The ensuring the quality and quantity of agricultural produces such as fruits, flower size, plant biomass and biological environment of the soil. And hence the hydrogel practices in the water stressed areas for improve the agricultural productivity with ecological sustainability. The hydrogel used in the scanty of rainfall and irrigation in an area.

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