

## Superabsorbent Polymers used in Agriculture

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Super Absorbent Polymers (SAPs), hydrogel, absorbent polymers, absorbent gels, super soakers, super slurpers, water gel, is a new type of macro molecular synthetic water absorbing polymer material. It has a water uptake potential as high as 100,000% of its own weight in a short period of time by osmosis and form granules in soil to enhance soil properties. SAPs are generally white sugar-like hygroscopic materials that swell in water to form a clear gel made of separate individual particles and can retain moisture even under pressure without risk of rupturing.

Super Absorbent Polymers used in agriculture are mostly prepared from acrylic acids and a cross-linking agent like potassium by suspension polymerization. The polymer so constituted is called a polyacrylate whose swelling capacity and gel modulus depends greatly on the quantity and type of cross-linker used. Polyacrylates are non-toxic, non-irritating and non-corrosive in nature and tested to be biodegradable with a degradation rate of 10%-15% per year. They demonstrate high water absorbance potential and can freely release 95% of the same under suction pressure by plant roots.

### Advantageous features for applications in agriculture

1. High absorption capacity in saline and hard water conditions
2. Optimized absorbency under load (AUL)
3. Lowest soluble content and residual monomer
4. Low price
5. High durability and stability in the swelling environment and during storage
6. Gradual biodegradability without formation of toxic species
7. pH-neutrality after swelling in water
8. Photostability
9. Re-wetting capability



Super Absorbent Polymers

## Hydrogel agriculture technology, as it is popularly called, has the following advantages

1. Improves soil quality, preserves water and resists drought stress
2. Increases seed sprouting and seedling development leading to better farm success
3. From the environmental aspects, it is non-polluting and biodegradable, helps in reducing irrigation frequency and water consumption and creates a simple cyclic process to provide water directly to roots and prevent soil compaction.
4. In agriculture and agroforestry, SAPs act as micro water reservoirs at plant roots. They absorb natural and supplied water 400-500 times their own weight and release it slowly on account of root capillary suction mechanism thus preventing water loss in soil by leaching and evaporation.
5. SAPs form a consistent cyclic process of absorption and release of water; the water so released can provide optimum moisture for quick germination and seedling maturation. Thus it reduces seedling mortality by several folds in nurseries.
6. In cold regions, death during germination and maturation is common due to moisture freezing in & around plant root tissue. Absorbed moisture in hydrogels does not freeze and makes easy accessibility to plants. It also regulates seedling growth temperature preventing death by freezing.
7. SAPs can help save water and labor by reducing irrigation frequency, help overcome drought conditions and act as soil conditioners, prevent leaching in sandy soils, runoffs in mountainous and sloping fields, improve virecence efficiency and restore soil biota.
8. SAPs can reduce overuse of fertilizers and pesticides in fields. The chemicals so absorbed with water are slowly released thus extending the operational life and uptake efficacy by root systems.
9. SAPs act as soil matter flocculants. They closely bind loose soil thus forming loams that can help better root latching. Simultaneously, the repeated absorb-release mechanism prevents over compaction of soil minerals and provides space for aeration and development of soil edaphon.
10. It has a wide area of application ranging from agriculture, forestry, industrial planting, municipal gardening, drought management, water conservation, It helps reduce soil erosion by surface run-offs, fertilizer and pesticide leaching to ground water, reducing cost of water and irrigation and success rate at growth and high yields of crops.

## Super Absorbent Polymers currently being used

**Pusa Hydrogel:** The Indian Agricultural Research Institute, New Delhi has developed an absorbent polymer called "Pusa Hydrogel" to meet the requirements of water productivity in Agriculture.

### Characteristics of Pusa Hydrogel

- ✓ Natural polymer backbone based water absorber based on cross-linked Potassium polyacrylate polymer
- ✓ Exhibits maximum absorbency at temperatures (40- 50 °C) characteristic of semi-arid and arid soils.
- ✓ Absorbs water 400 times its dry weight and gradually releases the same.
- ✓ Stable in soil for a minimum period of one year
- ✓ Less affected by salts
- ✓ Low rates of soil application – 1-2 kg / ha for nursery horticultural crops; 2.5-5 kg/ ha for field crops
- ✓ Reduces leaching of herbicides and fertilizers
- ✓ Improves physical properties of soils and the soil less media

- ✓ Improves seed germination and the rate of seedling emergence
- ✓ Improves root growth and density
- ✓ Helps plants withstand prolonged moisture stress
- ✓ Reduces nursery establishment period
- ✓ Reduces irrigation and fertilization requirements of crops with improved input use efficiency
- ✓ No undesirable effect on crops and soil as reported by experimenters and farmers.

## Method to use

### During Sowing

- **Recommended Dose:** 1 - 2 kg per Acre.
- **Method of application :**
  - Apply the Pusa Hydrogel at a depth of 6 to 8 inches of soil. For clay soil, apply at a depth of 4 inches from the soil surface, preferably at the root zone.
- **For Field Crops:**
  - Prepare the field for sowing.
  - Add 1 kg Pusa Hydrogel to 10 kg of fine dry soil and mix properly.
  - The mixture should be applied along with seeds /fertilizer or in the opened furrows before sowing.
  - For best results, the Pusa Hydrogel should be applied close to seeds.
- **In Nursery Bed for Transplants:**
  - Apply 2 g mix of Pusa Hydrogel in nursery bed uniformly for every sq. Meter. It should be placed at a depth of 2 inches of the nursery bed from the top.
  - In pot culture , mix 3 – 5 g / kg of soil before planting

### While Transplanting

- Thoroughly mix 2 g of Pusa Hydrogel in one liter of water to ensure a free flowing solution and allow it to settle for half an hour.
- Dip the roots of the transplanting plant in the solution and then transplant in the field.