AQUASORB FLOBOND

Water Savings in Agriculture

SNF
Index

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Agriculture is the largest user of freshwater on the planet. On average, agricultural irrigation uses approximately 70% of the world’s available freshwater supply. Of the 3,600 km³ of water (~951 trillion gallons) used each year, roughly two-thirds of it is lost to evaporation, runoff, and ground percolation without providing benefit to plants.

Worldwide, steps are being taken to minimize water usage and preserve this valuable natural resource. The use of polyacrylamide-based polymers in agricultural irrigation allows for water savings of up to 30%.

SNF in Agriculture • Polyacrylamide
As a global leader in the manufacturing and processing of polyacrylamide-based, water-soluble polymers, SNF has developed a range of more than 1,000 products that help preserve our natural resources, encourage recycling, and improve efficiencies of industrial processes. Our polymers have several complementary functions, among those being, flocculation which enables solids to be separate from liquids, viscosification, and friction reduction.

Our products find use in all water-related markets such as drinking water production, wastewater treatment, sludge dewatering, oil and gas extraction, mining, agriculture, paper processing, textile manufacturing, and cosmetic preparations.

In agriculture, SNF has designed its products to preserve water, encourage recycling, and improve efficiencies. Our polymers minimize water losses due to runoff and leaching. They facilitate improvements in water management, production yields, fertilizer utilization, and preservation of the environment.
AQUASORB™ Water Retainer

AQUASORB is a water retainer (superabsorbent) that, when incorporated into the soil or a substrate, absorbs and retains large quantities of water and nutrients. Unlike most products that become hydrated, AQUASORB easily releases the absorbed water and nutrients via osmosis when the soil becomes dry. So, plants have water and nutrients readily available as a function of absorption/release cycles.

AQUASORB is an anionic, polyacrylamide-based superabsorbent. It is a crosslinked copolymer of acrylamide and potassium acrylate and is not soluble in water. AQUASORB can absorb up to four hundred times its weight in distilled water to become a hydrogel with the following properties:

- Enhances plant growth by making water and nutrients available at the root zone or optimal absorption.
- Provides a buffer against changing climatic conditions.

Large Scale Farming
The use of AQUASORB in large-scale farming at the time of planting has shown effectiveness, especially when germination and development of the root system take place. Water, from rain or irrigation, is stored and released to the seeds and young plants, thus delaying the wilting point. AQUASORB makes it possible for the plants to become well-established during irregular watering cycles. In the growing season, the absorption/release cycles are very important to the health, vitality, and survival rate of plants.

AQUASORB can be applied cost-effectively with a micro-granulator at a rate of 10 - 40 kg/hectare (9 - 36 lb./acre).

While initially developed for corn, the same application method of AQUASORB works for other annual crops like rye, soybeans, sunflowers, cotton, etc. Adjustments may be necessary to accommodate local growing conditions. SNF Agriculture has been working for several years with partners in Central Asia and Eastern Europe on large-scale field tests. These regions suffer from adverse climatic conditions, mainly long dry conditions, after planting.

AQUASORB has been proven to spare crops from weeks of drought-related stress. The results have shown yield increases of 8 - 15% for sunflowers, soybeans, corn, and cotton.
• **Sunflower in Ukraine**

AQUASORB field trials have been conducted in Ukraine with our customers by SNF Agriculture since 2014. The advantages in yield of our water retainer on sunflowers in certain pedoclimatic conditions are shown in the graph below.

Applying AQUASORB at a rate of 10 - 15 kg/hectare (9 - 13 lb./acre) strengthens sunflowers and prepares them for drought events, especially in sandy, high-porosity soils.

![Sunflower Graph](image)

• **Cotton in Uzbekistan**

In the case of cotton, the influence of AQUASORB application on yield and water consumption was studied in Uzbekistan where large-scale tests were held at research facilities and farms in 2015 and 2016. In test work conducted in 2016, a control (untreated) and a treatment of 25 kg/hectare (22 lb./acre) of AQUASORB with three cycles of irrigation were compared to similar treatment receiving only two irrigation cycles.

As a result, yield increases of 12 - 16% were realized, as well as water reductions of 98 and 94.5 m³/tonne of cotton harvested, respectively (see Graph below). The results obtained in 2016 were consistent with those from 2015.

![Cotton Graph](image)
In 2016, field trials (using Good Experimental Practices, or GEP), took place on lettuce in northern France. The results showed AQUASORB to be highly effective on this crop. As illustrated in the graphs below, AQUASORB treatments of 0.25 and 0.50 g/plant were compared to untreated (Control) lettuce plants at harvest time relative to gross weights and stem diameters. Gross weights were 13.5 and 15.5% higher, for 0.25 and 0.50 g/plant dosages, respectively, compared to the Control. Additionally, stem diameters were 10.8 and 13.5% higher than the Control at the same respective dosage rates.

AQUASORB Videos
https://vimeo.com/111625799
https://vimeo.com/200985703
• Soybean in France •

Results of AQUASORB application for soybeans using Good Experimental Practices (GEP) in France are shown below. AQUASORB was applied at a rate of 20 kg/hectare (18 lb./acre) during planting and produced a 30% yield increase at the time of harvest over the Control.

![Soybean Productivity Graph]

Forestry
The use of AQUASORB has proven its effectiveness in helping young trees survive initial planting and shock associated with transplanting by facilitating root development and growth. AQUASORB has been used successfully for years in eucalyptus and coffee tree plantations. As a result, innovative methods have been developed and utilized to blend the product into the soil, all while reducing costs and labor requirements.

![Planting of Saplings with Pre-Hydrated Gel]

Potting Mixes / Horticulture
Nurseries and potting mix suppliers incorporate AQUASORB, either in dry or pre-hydrated form, into their soils or proprietary potting mixes. This blending of AQUASORB increases the water holding capacity of soils, thus delaying the wilting point in between watering events. Watering frequencies are reduced by 30 - 50%, which lowers labor and water costs.

![Pre-hydrated AQUASORB Blended into Soil]
Hydroseeding
AQUASORB provides many proven benefits when blended into hydroseeding mixtures. When applied at a suggested rate of 28 – 34 kg/hectare (25 – 30 lb./acre), AQUASORB helps to:

- Stabilize newly-graded soils
- Keep seed and mulch hydrated for rapid germination and sprouting
- Retain fertilizer in the soil mixture, thereby reducing leaching
- Aid in uniform vegetation cover development over the entire treated surface
- Minimize drought stress.

Sod Installation
A common use of AQUASORB is in sod and turf applications. Once the soil has been properly prepared, AQUASORB is spread at a rate of 250 up to 290 kg/hectare (220 – 260 lb./acre) before new sod is laid. Application of AQUASORB in this way will improve fertilizer efficiency for newly planted sod. It encourages quicker rooting and growth, which helps protect the sod from stress, heat, and dry conditions. Also, savings on irrigation water and energy usage can be realized.
Orchards and Vineyards
SNF’s FLOQUIP Engineering Company has designed and developed the DP 110 (Photo above) in Europe for sub-surface injection of pre-hydrated AQUASORB into the soil near the roots of trees and vines. With four injection points made around each tree or vine, approximately 0.45 kg (1.0 lb.) of dry equivalent of AQUASORB is deposited as a hydrogel solution. Depending on the growth stage and the planting density, the dosage is between 40 and 100 kg/ha Re-application is only recommended every three years. This system can be easily adapted on a truck bed.

The main effects are:
- Soil de-compaction
- Increased water and air circulation
- Increased water retention next to the roots
- Improved root growth
FLOBOND • Soil Conditioner

The FLOBOND series of products are polyacrylamide-based copolymers used in a variety of agricultural applications. These products are high molecular weight, anionic, water-soluble polymers, which make them effective as soil amendments or conditioners.

**Action • Better Water Availability**

Depending on soil type and irrigation method, FLOBOND increases the amount of water available to the root zones of plants, while reducing the overall demand for irrigation water volume. Water runoff, erosion, and leaching decrease, which in turn results in savings on water, fertilizers, and other additives.

**Usage • A Little Goes a Long Way**

Simple injection in the water flow or slow dissolution of tablets allows for very small amounts of FLOBOND to viscosify the water. When this solution contacts soil, fine particles are aggregated within the upper layers where roots form. These aggregates change the porosity of the soil and allow water to penetrate into the root zones.

**Save Up to 30% of Water**

During irrigation, nearly a third of the water applied is lost due to runoff. Numerous independent studies and field trials in Australia and USA have demonstrated that by using FLOBOND, the same production can be realized while irrigating less frequently and using less water. FLOBOND also decreases losses of nutritional elements by storing them within the root zones before they are taken up by the plants.

**Implementation**

FLOBOND is offered in four different physical forms: powder, emulsion, solvent-free emulsion, and liquid. To make using these forms easy, SNF also provides the most efficient, safe, and simple application equipment.
Directly onto freshly-sown soil. This fine polymer film provides structure to the soil and prevents surface sealing. Aside from its high performance, the advantage of this technique is that it requires no equipment cleaning, no water use, and is quickly applied.

**Liquids • Drip irrigation**

This new polymer developed by SNF is easily diluted in the irrigation water, just like liquid fertilizers. It increases the efficiency of drip irrigation by favoring the capillary rising of water, thus reducing water usage.

Added to the irrigation water, this product keeps the dripping water close to the drip feed, thereby close to the root zones. There is no risk of plugging the irrigation system by the polymer.

Compared to standard drip feed, this method saves water by minimizing horizontal migration away from the roots and minimizing drainage. With a favorable capillary action, the root zones benefit more readily from all of the water applied.

**Powders • Furrow irrigation**

Flood and furrow irrigation systems, common to production agriculture, have benefitted from the use of dry polyacrylamide (PAM) for more than 25 years. Since irrigation water efficiency is a primary concern for growers around the world, PAM usage has proven to provide many valuable environmental and cost-effective advantages:

- Improved pre- and post-irrigation water quality
- Reduced soil runoff by 94% in furrow irrigation
- Increased soil stabilization of nutrients and chemicals
- Enhanced lateral movement of water in the root zones by 25%
- Improved field infiltration uniformity
- Reduced levels of contaminants in runoff
- Reduced crop stress

FLOBOND Field Flocculation Video
https://vimeo.com/226447202

FLOBOND (Powder Form) and Dry Feeder in Furrow Irrigation – 2017 Turkey
FLOBOND • Aerial Application
Aerial PAM application allows flexibility for producers to apply PAM without using irrigation water. FLOBOND needs to be applied after planting but before the first rain event or irrigation occurs. FLOBOND reduces drastically soil erosion in non-irrigated cropping systems.

RESULTS • Run-Off Data
Following the applied polymer treatments to all three treated fields, run-off water was analyzed after the first significant rain event occurred. Results showed an average 40% reduction in run-off (eroded soil) turbidity. The results shown below in Table 1 display the differences in amounts of Total Suspended Solids (TSS), Total Insoluble Phosphate (TIP), Total Nitrates (TN), and Turbidity (NTU) for each of the three test sites between the control and the treatment.

<table>
<thead>
<tr>
<th>Bolivar County</th>
<th>TSS</th>
<th>TIP</th>
<th>N</th>
<th>NTU</th>
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<tr>
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<td>2.1</td>
<td>19</td>
<td>639</td>
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<tr>
<td>Treated</td>
<td>63</td>
<td>0.6</td>
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<tr>
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<tr>
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<tr>
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<tr>
<td>% Change</td>
<td>-8%</td>
<td>-16%</td>
<td>6%</td>
<td>16%</td>
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Average Change 41% 5% 23% 40%

RESULTS: Yield Data
The Yazoo County Treated test site produced an increase in uniformity as well as an average increase of 8 bushels* of soybeans versus the Control.

In Coahoma County, another test site, the treatment provided an overall increase of 18 bushels of grain sorghum versus the Control field.

* 1 Buschel = 35.2 L of grain

CONCLUSION
By applying PAM after planting, when the soil is most susceptible to erosion, topsoil and applied products can be preserved, with anticipated yield increases seen during harvest.

In the USA, producers may also be able to take advantage of cost-sharing of the product through USDA/NRCS Practice Standard 450.
Multiple Benefits of Using FLOBOND According to Different Irrigation Methods (Filled Coins)

**Primary Benefits**
- Creates flocs
- Limits crustling
- Enhances soil porosity

**Secondary Benefits**
- Less runoff
- Improves wet bulb diameter
- Improves capillarity rise

**Tertiary Benefits**
- Reduces energy costs
- Reduces water costs

**Best FLOBOND Formulation According to Different Irrigation Methods**

- **SP** = Water soluble powder
- **EO** = Emulsion, water in oil
- **SC** = Suspension concentrate (flowable concentrate)
- **SL** = Soluble concentrate

*SP = Water soluble powder • EO = Emulsion, water in oil • SC = Suspension concentrate (flowable concentrate) • SL = Soluble concentrate*