

Hydrogel:

An efficient tool
to achieve high
productivity



GREEN SOLUTIONS AG LTD
AGRICULTURE & HORTICULTURE SOIL SOLUTIONS



Hydrogel:

An efficient tool to achieve
high productivity

What are Superabsorbent Polymers?

Definition

Polymers

- Polymers are macromolecules formed from smaller structural units (monomers).
- Monomers are molecules of low molecular mass which, from the polymerization reactions, come to generate the polymeric macromolecule.

Superabsorbent Polymers

- The superabsorbent polymer can absorb and retain extremely high quantities of a liquid in relation to its own mass.
- Polymers that absorb water, which are classified as hydrogels. They absorb aqueous solutions by bonding hydrogen with water molecules.

Source: Ma, X., Wen, G. 2020. Journal of Polymer Research 27:136. doi: 10.1007/s10965-020-02097-2 | Vandenberg, E. J. 2012. Contemporary Topics in Polymer Science. Vol. 5. New York: Springer Science



GREEN SOLUTIONS AG LTD
AGRICULTURE & HORTICULTURE SOIL SOLUTIONS





Hydrogel:

An efficient tool to achieve high productivity

What are Superabsorbent Polymers?

Absorbent vs. Superabsorbent



Absorbent Fiber

- The liquid is often kept mainly on the surface or in cavities/empty spaces
- The liquid is released when pressure or high temperatures are applied
- Poor stability



Superabsorbent

STOCKOSORB® 660

Absorbs and releases water to plants

- The liquid is mainly kept within its molecular structure
- Does not release the liquid under pressure
- It is designed to release water to plants
- Stability (absorption and desorption cycles)



GREEN SOLUTIONS AG LTD
AGRICULTURE & HORTICULTURE SOIL SOLUTIONS



Hydrogel:

An efficient tool to achieve
high productivity

What are Superabsorbent Polymers?

Applications (examples)



Absorbent

- Sponge
- Paper
- Plantation fiber
- Cellulose fiber
- Cotton
- Towel



Superabsorbent

- Water retention for plant supply
- Controlled release of insecticides and herbicides
- Fire retardant
- Dust control on dirt roads
- Artificial Snow
- Diapers



GREEN SOLUTIONS AG LTD
AGRICULTURE & HORTICULTURE SOIL SOLUTIONS



Hydrogel:

An efficient tool to achieve high productivity

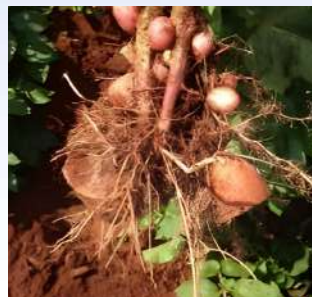
Why use Superabsorbent Polymers in the planting of different crops?



Decrease in plant mortality rate



Plants hydrated for a longer period



Greater root development

Plants with a better development, consequently higher productive potential

With **STOCKOSORB®**



Without **STOCKOSORB®**



GREEN SOLUTIONS AG LTD
AGRICULTURE & HORTICULTURE SOIL SOLUTIONS



Hydrogel:

An efficient tool to achieve
high productivity

Why use **Superabsorbent Polymers** in the planting of different crops?

Possibilities of applications

Pre-Hydrated



Via Irrigation



3rd Planter Box



Mix with Fertilizer



GREEN SOLUTIONS AG LTD
AGRICULTURE & HORTICULTURE SOIL SOLUTIONS

Hydrogel:

An efficient tool to achieve high productivity

Why use Superabsorbent Polymers?

Water Stress

- Less resistance to drought
 - Difficulty of development
- Plant more susceptible to attacks of pests and diseases
- Lower production potential
 - Shallow roots
- Lower formation and development of secondary roots



High Productivity

- Drought resistant plant
- Sturdy plant
- Higher resistance to pest and disease attack
- Greater production potential
- Greater development of roots and deeper roots
- Greater formation and development of secondary roots



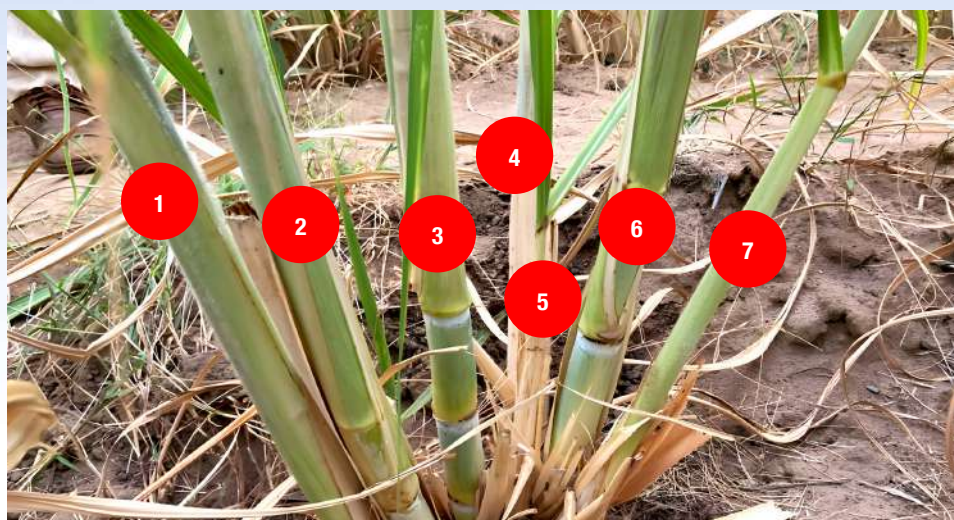
GREEN SOLUTIONS AG LTD
AGRICULTURE & HORTICULTURE SOIL SOLUTIONS

Hydrogel:

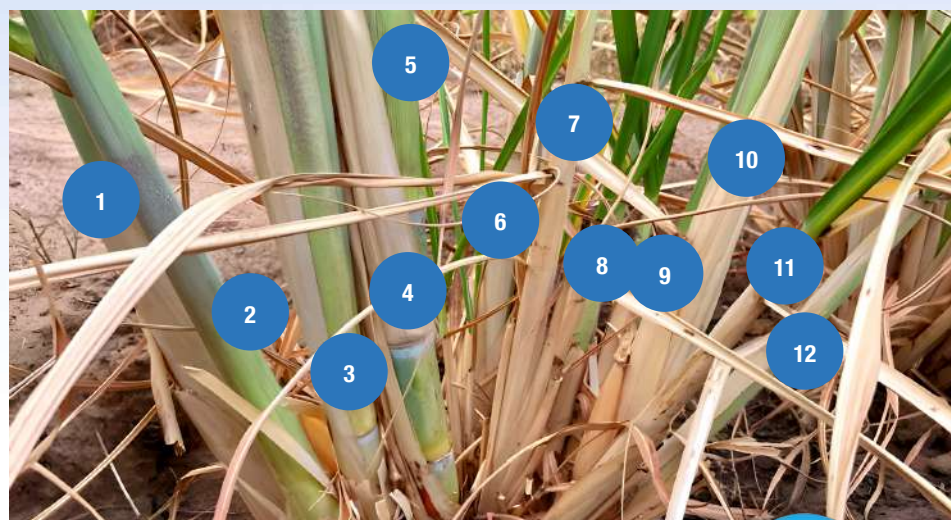
An efficient tool to achieve
high productivity

Evaluation **186 Days** After Planting

Without **STOCKOSORB®** Medium



With **STOCKOSORB®** 660 Medium



Increase of 71% in the number of tillers!



GREEN SOLUTIONS AG LTD
AGRICULTURE & HORTICULTURE SOIL SOLUTIONS

Hydrogel:

An efficient tool to achieve
high productivity

Evaluation **186 Days** After Planting



With
STOCKOSORB® 660



With
STOCKOSORB® 660



GREEN SOLUTIONS AG LTD
AGRICULTURE & HORTICULTURE SOIL SOLUTIONS

Hydrogel:

An efficient tool to achieve
high productivity

STOCKOSORB® 660

Description

STOCKOSORB® 660 - Is a homopolymer based on acrylic acid and potassium (does not contain acrylamide). It is a water-insoluble superabsorbent, cross-linked and partially neutralized with potassium. This product has been specially designed for use in agriculture

STOCKOSORB® 660 - Is a soil conditioner specifically designed and developed for water and nutrient retention in soil

The water absorption capacity of **STOCKOSORB® 660** is determined by the quality of the water and the type of soil. Therefore, the water holding capacity in the soil varies between **150 to 300 times its weight**.

Dry SAP
Particle



Water



Hydrated
“Swollen” SAP

SAP = Super Absorber Polymer
with microscopic ducts
in the whole particle



GREEN SOLUTIONS AG LTD
AGRICULTURE & HORTICULTURE SOIL SOLUTIONS

Hydrogel:

An efficient tool to achieve
high productivity

STOCKOSORB® 660

Applications

Agriculture



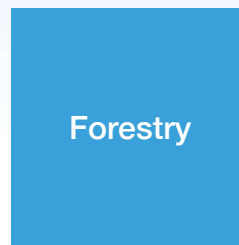
Horticulture
Fruits, Veggies



Landscaping
and
Gardening



Forestry



GREEN SOLUTIONS AG LTD
AGRICULTURE & HORTICULTURE SOIL SOLUTIONS

Hydrogel:

An efficient tool to achieve high productivity

STOCKOSORB® 660

Top 10 Benefits



1. Improves water and nutrient storage capacity in the soil
2. Increases the availability of water and nutrients for plants
3. Enables reducing the frequency of irrigation
4. Improves water infiltration and decreases runoff
5. Reduces soil erosion and fertilizer leaching
6. Improves the survival rate of plants
7. Promotes uniform plant growth and development
8. Promotes greater root growth
9. Greater stability in production
10. Higher productivity



GREEN SOLUTIONS AG LTD
AGRICULTURE & HORTICULTURE SOIL SOLUTIONS



Hydrogel:

An efficient tool to achieve
high productivity

STOCKOSORB® 660

Particle Sizes

STOCKOSORB® 660 is available in different particle sizes
for recommended applications and available equipment:

Product	Particle Size (mm)	Recommended for
STOCKOSORB® 660 XL	2.0 - 4.0	E.g. in combination with granular fertilizer
STOCKOSORB® 660 (Medium)	1.0 - 2.5	E.g. landscaping (grass), direct application on soil, soil amendment
STOCKOSORB® 660 (Micro)	0.1 - 1.0	E.g. forestry
STOCKOSORB® 660 (Powder)	< 0.2	E.g. bare root plants



GREEN SOLUTIONS AG LTD
AGRICULTURE & HORTICULTURE SOIL SOLUTIONS



Hydrogel:

An efficient tool to achieve
high productivity

STOCKOSORB® 660

Ecotoxicology



STOCKOSORB® 660 is environmentally safe

Ecotoxicological tests were performed in laboratories certified according to the rules of “Good Laboratory Practices (GLP)”.

There is no evidence of adverse effects of **STOCKOSORB® 660** on animals, plants, soil or groundwater.

Thus, **STOCKOSORB® 660** is *non-toxic* and environmentally safe, as it will not contaminate plants, soil or groundwater.



GREEN SOLUTIONS AG LTD
AGRICULTURE & HORTICULTURE SOIL SOLUTIONS



Hydrogel:

An efficient tool to achieve
high productivity

STOCKOSORB® 660

Ecotoxicology



STOCKOSORB® 660 is susceptible to mechanical, physical, chemical and biological degradation

Will be degraded to safe products such as: potassium oxide, carbon dioxide and water

The degradation occurs without any negative or toxic effect to the soil and/or microorganisms.



GREEN SOLUTIONS AG LTD
AGRICULTURE & HORTICULTURE SOIL SOLUTIONS



Hydrogel:

An efficient tool to achieve
high productivity

STOCKOSORB® 660

Positive Effects

Increases the survival
rate during the
establishment of crops

Reduces surface water
runoff and soil erosion

Enables reducing the frequency
of irrigation and consequently
the costs with irrigation

Enables strong and healthy
growth of plants and roots,
growth under hot and dry conditions

Prevents loss of water and
nutrients by deep percolation and
nutrient leaching

Increases the quality
and quantity of the crop
production

It has available
potassium for the plant
(~20% K₂O)

Improves soil structure, water
retention capacity available in
the plant, aeration balance and
soil structure

Increase of CEC
(Cation Exchange Capacity) in
the micro-region where it is
applied (3.100 – 5.100 μcm^3)



Responsible Care®
OUR COMMITMENT TO SUSTAINABILITY



GREEN SOLUTIONS AG LTD
AGRICULTURE & HORTICULTURE SOIL SOLUTIONS

Hydrogel:

An efficient tool
to achieve high
productivity



GREEN SOLUTIONS AG LTD
AGRICULTURE & HORTICULTURE SOIL SOLUTIONS