E55 - Irrigation using water retention agents based on biological swelling polymer crystals

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1) What is involved ?

The polymer membrane water retention agents are **small granules that once incorporated into the ground when sowing swell up when rained on or watered and retain the water**. This technology improves harvest yields tremendously whilst saving on water resources.

2) Who use this means and since when ?

This is **very recent technology** which is mainly used by farmers in developed countries for very thirsty crops and/or in areas with difficult conditions (irregular water resources, poor soil quality).

3) Who is primarily concerned ?

Farmers. They use it in obtaining good yields in many areas of plant production :
Agriculture, Arboriculture, Horticulture, Landscape gardening, Nurseries, Reforestation, Planting, etc. and in a variety of use conditions. It can in fact be used for all types of crop and climate.

4) What does this process involve ? How is it applied ?

Traditional water retention agents were **small grains varying in size from 3 mm to 1 cm in diameter**. They were sold in jars or bags of differing contents. These granules are **incorporated directly into the ground** with the seed (see Chapter 9 for the doses).

Water retention agent contained by bio-inov

Each particle has a semi-permeable wall allowing it to **absorb the water to 160 to 500 times is initial dry weight**. The liquids are absorbed very quickly, but the granules then release them very slowly and in very small quantities. Water retention agents therefore form storage reservoirs for water and nutritive and treatment substances, thereby **saving at least 50% of water and 30% of fertiliser or treatment inputs** and optimising strongly the effects on the plant of these reduced inputs. These essential elements fixed in the water retention particles are mainly restored to the plant. The release into the growing medium is infinitesimal and depends on the local conditions (type of soil, temperature, evapotranspiration).

5) Special difficulties and precautions to be taken

The **technology** is very simple to use and there is no special difficulty in setting it up.
It is, however, **very recent**. There may be secondary effects that are not yet known. It should also be considered that the local populations could find it difficult to renew their stocks of water retention agents.

6) Main advantages and drawbacks

a) Advantages

There are many, in several areas :
Combating desertification and restoring the ecological equilibrium :
- saves at least 50% of water inputs
- limits losses through evaporation and percolation
- works in the soil for three to five years according to the number of bacteria present
- acts as a thermal regulator for the plant’s roots, by encouraging a soil temperature several degrees lower than the ambient air
- develops plant productions in climatically-interesting areas for their early maturity but technically difficult (no or irregular water, sandy soil, etc.)
- controls erosion, deterioration and desertification of soils by replanting arid areas
- helps with reforestation and planting of areas with poor or badly exposed soils
- encourages the fixing of dunes in coastal or desert areas
- decompacts and improves the porosity of soils and composts
- aerates the growing medium for improved air circulation and through the ability of the product to release oxygen

Saving water and managing the fresh water resources better :
- saves at least 50% water, through its semi-permeable wall that can absorb 160 to 500 times its initial dry weight
- allows the plant to extract up to 95% of the water contained in the solid crystals according to the level and pace of its needs over time

- reduces water losses through evaporation and percolation, more than 85% made available to the plant
- limits the leaching of fertilisers and surface water pollution
- restricts the infiltration of nitrates and chemical pollution in water tables
- reduces the harmful effects of salinity or unhygienic conditions of wastewater used for irrigation
- reduces the energy costs in pumping the water and conveying the irrigation water
- guards against natural irregular water conditions over time

Encouraging plant development

- reduces the hydric stress and the nutritive shortcomings of plants
- optimises the plant's resistance to diseases
- amplifies the growth of root and leaf masses by three to five times, thereby creating more dry matter and improved resistance to climatic hazards.
- boosts cultivation in soils where the salinity rate can destroy or block plant growth
- optimises the effectiveness for the plant of inputs despite the lower quantities, with time saved in the plant cycle and a faster return on investment
- accelerates the production cycle, thereby allowing very efficient programmes
- increases production volumes in terms of quantity and quality
- lightens the operating account by induced savings in water (50% and more), fertilisation and plant health treatments (30% and more)
- energy savings in pumping equipment (50%) and replacement of dead plants after transport or transplanting

b) Drawbacks

Polymer water retention is a **fairly recent technology**. Its main drawback is therefore its cost, which can quickly become very high if large volumes have to be dealt with (the doses to be used are indicated below).

7) Cost

Cost : about **€40 per kilo in France** for a five kilo bag (larger bags do exist).
The water retention agent should be renewed every three to five years.

8) Places or contexts in which this technique seems to be most suited

Use recommended for crops in glasshouses, nurseries, the open ground, industrial and/or market gardening, green spaces, sports grounds, parks, golf courses, sown and turf lawns, flower borders in open ground, planting of trees and shrubs, pricking out young seedlings, reforestation of arid areas (dunes), forest repopulation, substrates of all types intended for sowing, plants in pots or containers, soil-less crops, planting sloping areas (banks, hillside, slag heaps).

9) Recommendations and suggestions for use

The recommended use doses below for some applications can be modulated to take account of the local climate, the nature, the size and age of the plant, the soil type or the growing medium, the water retention rate of the water retention agent used (this variable value based on the pH of the water will be established in the cultivation area), the water stock necessary to the plant in terms of its needs, the irrigation intervals and method, targeted production goals and, of course, the available budget.
Important : These values are a guide only and must be taken as such. They can differ between brands and are stated on the product sheets.
Substrates (used in the propagation and development of fruit, vegetable, floral and ornamental species for crops in nurseries, sowing seeds, pots, containers, planters and soil-less) :
2 g per litre of substrate incorporated uniformly.

Pricking out (young forest, flower, fruit, market gardening and ornamental seedlings) : about 5 to 10 g per plant in the planting hole.
Planting tall standard trees (having calculated the planting hole volume and the necessary water stock) About 2 g per litre of earth (only count the useful earth for the tree's root development).
Open ground crops where the application is made by hand or with a mechanical spreader for the sown species : 20 to 100 g per m2 **applied with the seed, broadcast or placed in the growing furrow.**
For the planted species, annual, biennial, perennial, rootstock and forest plants **2 to 5 g per seedling** in the planting hole.
Puddling bare root plants, an application technique recommended to protect the roots against drying out during storage and transport and to improve the recovery of the plant after transplanting, **1 kg of water retention agent mixed with 150/200 litres of water (depending on the pH)** will form a gel into which the bare roots of the young plant will be plunged. The water retention dry is sprinkled dry on the bare roots after wetting them.

10) Where to obtain further information - Bibliography

- **Canalblog** : article on the characteristics and the price of one water retention agent example - Biosup http://hydroretenteur.canalblog.com/