Coping with water shortage – make the most *efficient* use possible of the water available

Getting water to the growing crop – either rainfall or irrigation water - is, of course, essential to its survival and if it is irrigation water, there are methods of doing this that are efficient and those that are less so.

Having got the water to the crop it is important to do all possible to *ensure that the vegetation is able to utilise that water as efficiently as possible.*

There are 4 ways in which water can be lost to the substrate:

Run-off; percolation; evaporation; transpiration.

Run-off happens because the water is applied too quickly to infiltrate the growing medium. This is exacerbated if its structure is compacted and is deficient in macro-pore spaces.

Percolation is a natural phenomenon, by which water filters down through the substrate profile to reach the roots. Once the substrate has absorbed and is holding onto (by capillarity) as much water as it can against the pull of gravity, surplus water drains away down beyond the reach of roots and is lost to the vegetation, taking dissolved nutrients with it. This can be wasteful and inefficient, especially where a high value crop is involved and watering restrictions prevail. Percolation takes place most rapidly when the water-holding capacity of the substrate is low due to having too much macro-pore space, such as is the case if there is too high a sand, bark or grit content.

With **evaporation**, water at the surface is taken away in its vapour form by the drying atmosphere. Water lower down in the substrate profile is then drawn to the surface by capillary movement to fill the pore-spaces emptied of water by evaporation, from where it, too, evaporates.

Transpiration is the one way in which water is beneficially taken from the growing medium because that means the crop is making efficient use of the water and the nutrients dissolved in it.

If the growing medium happens to be soil and it has a low water-holding capacity, this can be ameliorated with organic matter such as peat or farmyard manure (FYM). Peat may be unacceptable for environmental reasons and good FYM can be hard to obtain and costly to transport and apply because of its bulkiness. There is always the concern, also, that it may contain residual herbicide that could damage the crop.

One very cost-efficient alternative that is tailor-made for the job of ameliorating soil and soilless substrate structure (to create a more nearly perfect balance between air-filled or macro-porosity and water-filled or micro-porosity and increase the water-holding capacity of substrates without being detrimental to drainage of surplus water beyond field-capacity) is Super-Absorbent Polymer (SAP), such as *Broadleaf P4*. This is a man-made, granular product that can absorb hundreds of times its own weight of water and hold that absorbed water at a binding tension which prevents percolation and evaporation loss but which allows plant roots to withdraw the stored water on demand.

These granules are incorporated into the mix at the desired rate and as water infiltrates the substrate, the granules actively grab the water, absorbing and storing it, swelling into rubbery, water-charged gel fragments that act as millions of tiny reservoirs of plant-available water right where it's needed – at the plant roots. Roots grow toward the source of plant-available water – attracted by a natural phenomenon called '*Hydrotaxis*' – and grow right through the gel particles, colonising them and tapping the water supply only as leaf transpiration creates the suction force at the roots that enables the plant to extract the stored water.

This is a highly efficient mechanism for increasing the water-holding capacity of the growing medium without flooding all the air-pore spaces. In fact, as the granules absorb water and swell up – to typically 100 times their original, dry volume – they force the substrate open, creating an open-structured, friable, permeable growing medium. The polymer can repeatedly absorb, store and then release water to plant roots an indefinite number of times over a working life of about 5 years. As the water is released the particles shrink back toward their original dry size, creating enhanced air-filled porosity in the substrate profile. Newly infiltrating water can permeate more efficiently and more readily be absorbed and stored by the gel, rather than running off and being lost to the crop.

Water-holding capacity of growing media can typically be doubled by the addition of superabsorbent polymers (depending on the water-holding capacity of the untreated substrate) but efficiency of water use by the plants will be increased by much more than that because of the dramatic reduction of loss by run-off, percolation and evaporation.

At recommended rates of application, Broadleaf P4 super-absorbent polymer costs about £4.20 per cubic metre of growing mix (£0.0042/litre) and because in its dry form (as supplied) is very low bulk for incorporating, it is easy to store, transport and use. It is environmentally compatible and after years of working in the substrate, biodegrades harmlessly, with no noxious residues.

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Trial to assess the effect of Broadleaf P4 on watering frequency requirement of hanging baskets.

Application rates	Frequency of watering requirement
0 (Control)	Every day
1 gram/litre	*Every 2nd day*
1.75 grams/litre	Every 3rd day
1.75 grams/litre + 2 cms of gel in the base of the baskets	*Every 5th day*

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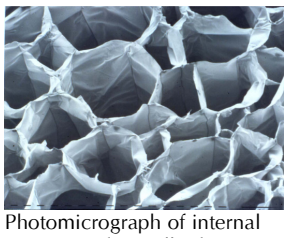
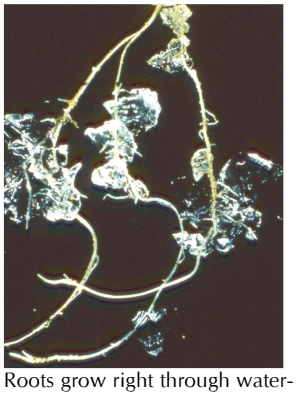


Photomicrograph of internal Structure of Broadleaf P4 water-storing polymer showing honeycomb water-holding formation



Roots grow right through water-charged Broadleaf P4 gel, to extract over 95% of the stored water, as required.

Floral display of Impatiens with Broadleaf P4 in the substrate to ensure efficient supply and use of water to this thirsty species.

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Brian Longhurst is founder and Managing Director of Agricultural Polymers International Ltd, pioneers of the use of super-absorbent polymers in horticultural crop production and suppliers of Broadleaf P4 to users in the UK and many countries around the world.

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