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fytoCELL

information

Why an airy substrate

It is common knowledge that plants with chlorophyll absorb carbon dioxide and product oxygen. Unfortunately people do not sufficiently realize that these same plants obtain this oxygen from the air above the ground, the roots must obtain it from the root environment.

Therefore, the root environment should have a good free air exchange; this is only possible if there are sufficient pores in the root environment, which are not filled with water.
It is generally believed that this should be 10%. In our cultivated crops, where high yields are expected, this is quite often insufficient.
Furthermore, these pores are not uniformly spread throughout the substrate and indeed in parts an optimal oxygen supply may not be created.
An insufficient optimum oxygen supply has direct influence on the uptake of nutrients and water.

In the soil-less culture we have a system in the glasshouse available to enable water supply. Due to the small root volume, the possibility of water shortage is the greatest fear for the growers, during the first stage of the substrate cultivation.

The large water buffer in the substrate was reassuring; the amount of air in the substrate was not a matter of discussion.
With a large drip system the demand for water can always be satisfied and often too much water is administered. This mainly occurs during the darker days and most especially in the autumn period, causing the root environment to become too wet and in actual fact, lacking in oxygen.
In recent years the oxygen supply in the root environment is becoming more and more an interesting factor amongst growers because a reduced water buffer has not proved anything, on the contrary.

We must always remember that the grower can keep the substrate wet, but only the plants can keep it dryer, due to evaporation.

We primarily want the substrates to be dryer if evaporation is only slight.

Amount of oxygen required

The amount of oxygen required increases when the temperature in the root environment gets higher. When the temperature is 30 ° C the root environment requires approximately twice as much oxygen for root respiration and for all of the microorganisms in the environment than when the temperature is 20 ° C.

> *Water of 20 ° C can contain 9,3 mg oxygen and at 30 ° C 7,5 mg, a reduction of approx. 20 %, while the required level is at least doubled.*

The oxygen, which the nutrient solution contains, is far from sufficient for the root environment and is also technically unattainable.
Therefore, a good gas exchange is also necessary and this can only be established if there are enough pores in the substrate, which are not filled with water.
The exchange of oxygen in the air goes approx. 10 000 times faster than between air and water. A good gas exchange is also necessary for the transport of CO_2 and volatile root exudations (e.g. ethylene)

A lighter root environment is established only if less pores are filled with water.

The choice is:

Increase supply of water
A substrate with sub optimal oxygen supply

Why give more than necessary for evaporation.

The evaporation, and therefore the water demand between the plant in the glasshouse differ considerably, due to: plant stress, growth and different plant positioning.
For optimal production, the plant with the greatest need must receive sufficient water, therefore the plant requiring less water will automatically receive too much. If the slabs are saturated, the substrate itself must keep sufficient air pores to ensure optimal production.
With present day drip systems it is impossible to control the saturation level of all slabs.

Example: With the present day water drip systems I can easily fill 100 beakers of water. I supply water until they all flow over. The water overflow (drain) is the minimal drain that is necessary to correct the difference between the drips, even without the drain that is necessary for maintaining the correct EC.
As there are continual differences (no matter how small) between the supply of water from drips I can never fill all beakers to precisely 50 or 75%.

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Good water/air ratio

Many finely branched are roots produced resulting in improved uptake of nutrients and water.

Uniform water/air distribution throughout the whole of the slab

Good moisture content in the top of the slab as well as the bottom. Good air content throughout the slab.

Good capillary action

Plants produce roots evenly throughout the whole volume of the slab.

Good re-moistening

Easy to re-wet after drying out.

Maintains structure with low pH

The slab does not collapse in conditions of low pH

Biodegradable

Composed from organic substances

Lightweight

18 kg Dry material Per M^3

Little waste

Biodegradable and little weight.

The product

Fytocell ® is an aminoplast, which is produced with a hardener under a pressure of 5 bars and low pH. This results in a light but very stable spongy substance. The pH is corrected further in the production process.
Depending on the application, the dry matter content of the foam is between 10 and 30 kg/ m^3 . The dry matter content for use as a substrate slab is 18 kg/ m^3 .

Fytocell ® consists of small open cells which are connected to each other. As a result of this structure, a good capillary action is obtained, creating a uniform water distribution throughout the whole slab. This distinguishes Fytocell ® from other substrates.
The substrate is also very stable at low pH's making it very suitable for cultivation where the pH tends to be low at times.
It is also very suitable for conditions where cultivation with a lower pH is preferred.

Large constituents of Fytocell ® are materials with an organic structure. After the slabs have been used, these organic compounds enable Fytocell ® be reduced back to the basic raw materials such as carbon, water and nitrogen by undergoing various biological processes. Furthermore, Fytocell ® may be used for other applications after use.

When growing in Fytocell ®, the plant produces a finely branched root system with a large surface area and therefore only uses a limited amount of assimilates. The numerous root ends ensure a good uptake of nutrients, especially Ca^{2+} which is specifically taken up at the roots tips. In the calculation example below you can see that by halving the root diameter, the length increases fourfold and the surface area doubles with the contents remaining the same.

Calculation example:
Set contents of part of the root system 100 cm^3 .
Contents straight circle cylinder: πr^2.length (surface diameter times the length)
Surface straight circle cylinder: 2 πr.length (circumference diameter times the length)
Radius of the root diameter: 0,5 cm

$$\text{Root length} = \frac{100\ cm^3}{3{,}14 \times (0{,}5cm)^2} = \frac{100\ cm^3}{3{,}14 \times 0{,}25\ cm^2} = 127{,}38\ cm\ (a)$$

$$\text{Root surface} = 2\,\pi r.127{,}38 = 2 \times 3{,}14 \times 0{,}5\ cm \times 127{,}38\ cm = 399.97\ cm^2\ (b)$$

The same calculation for the root with a 50 % smaller diameter:

$$\text{Root length} = \frac{100\ cm^3}{3{,}14 \times (0{,}25cm)^2} = \frac{100\ cm^3}{3{,}14 \times 0{,}0625\ cm^2} = 509.55\ cm\ (4 \times a)$$

$$\text{Root surface} = 2\,\pi r.509{,}55 = 2 \times 3{,}14 \times 0{,}25\ cm \times 509.55\ cm = 799.99\ cm^2\ (2 \times b)$$

Fytocell ®
During the cultivation we used the same nutrition solutions as with other inert substrates. Experience has shown that the nutrient solutions need very little change throughout the growing period of the crop. The pH and EC values in the substrate are very stable.

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Uniform water / air distribution throughout the complete Fytocell slab.

The special cell-structure of the Fytocell slab, results in an extremely uniform water / air ratio from top to bottom throughout the complete slab.

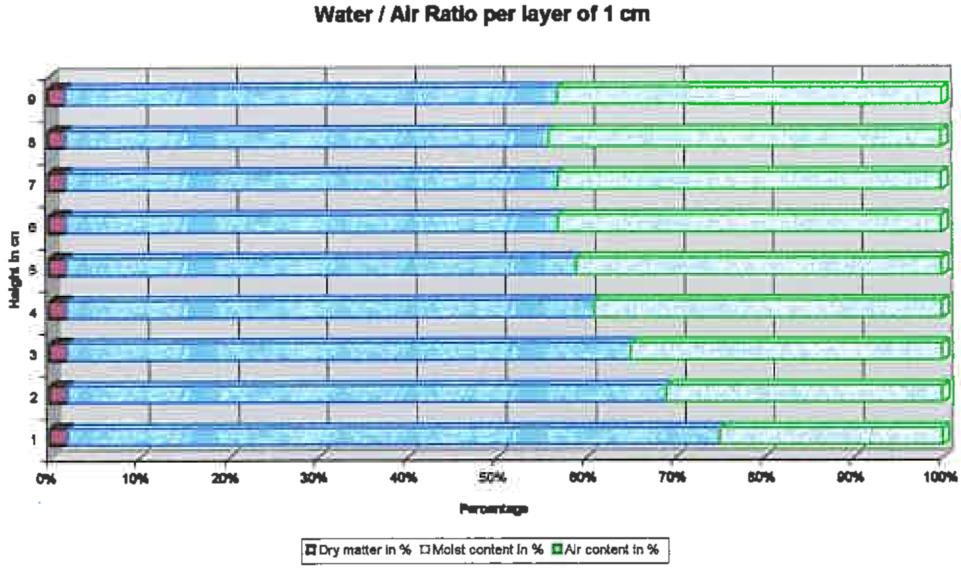
Very often other substrates have a dry (too dry) top layer, while the bottom part of the slab is much too wet. All pores are filled with water, which leaves no space for air (Oxygen).

Good moisture content in the top of the slab is a result of the good capillary action in the Fytocell cell-structure. At the bottom part of the slab, there is always a significant percentage of cells, which contain air (oxygen), even if too much water is given.
These properties result in a thoroughly rooted slab, even in parts where other substrates remain too dry to achieve a good rooting system.

Using the substrate / growing media to the full.

To judge any product, whether it will be suitable as a growing media, one of the main parameters is the water / air ratio, tested in practice.

The table below, indicates the water / air ratio, measured at various heights (per 1 cm) in the Fytocell slab.



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