

Optimising water and nutrient management:

The advantages of indoor strawberry cultivation in stone wool

Steerable



'Precision Growing' literally translates into growing more, with fewer inputs. In this context Grodan focuses on root zone management solutions, yet understands the need for a holistic approach towards the cultivation especially looking at the water and fertiliser inputs. Therefore the choice of growing media; design and use with respect to optimising the nutrient supply and irrigation during the first weeks of a new crop; the main harvesting period and towards the end of the cultivation cycle are important parameters for a successful and productive crop cycle.

With this in mind, Thomas Peters, Business Development manager at Grodan focused on strawberry cultivation and propagation using Grodan stone wool. Peters explains, "Changes in production practices related to water management and the use of fertilizers can have a massive effect on the overall crop and environmental performance. Of course in respect to fertilizer use this means recycling from day one of the cultivation, operating within a closed hydroponic system whilst working with a structured irrigation strategy and at all times an accurate fertilizer composition." Peters emphasizes the importance of water management, "A targeted water and nutrient supply can improve crop yield and fruit quality. This can be achieved by accurately steering the water content (WC%) and the electrical conductivity (EC) of the growing media in line with the incumbent climatic conditions and generative / vegetative plant balance."

Why stone wool stands out in indoor strawberry cultivation?

The choice for growing media is made prior to the start of each cultivation cycle and is important to achieve the most from a crop, specifically for strawberries. Trials conducted at research centres in the Netherlands concluded that switching to stone wool growing media for high-tech glasshouse cultivation does improve growing results. So why to switch to stone wool? Thomas Peters explains further.

Grodan slabs are made from basalt rock. In our factories in The Netherlands, Canada and Poland the basalt is melted and spun into fibres. During the process, the fibres are coated with a hydrophilic binder which helps to spread the water and nutrients evenly throughout the slab. Peters emphasizes that, "The fibres **have no cation exchange capacity** so they do not lock up any of the added nutrients this means that the drain water can be recycled from the beginning of the cultivation as there is no need to flush or buffer the growing media." The controlled manufacturing process of Grodan stone wool also results in **uniform slabs**. The uniformity of the substrate means that water and nutrients can be accurately targeted to the needs of the crop and do not

need to be applied in excess to compensate for variations between slabs. Stone wool's **irrigation efficiency**, i.e. the ease to which EC is controlled with minimal drain volumes, allows for precise control of water content (WC%) and electrical conductivity (EC) without the need for the grower to go chasing drain. This further protects plant and root quality. Being able **to steer substrate WC% & EC allows** growers to adapt their irrigation strategy quickly and easily in respect incumbent weather conditions, season and stage of crop development. Equally important is that the irrigation and nutrient strategies can be adapted to help facilitate a lower heat input (note: not lower temperatures!). As such when radiant heat input is lowest, full LED crops, extensive screening and low pipe temperatures transpiration and nutrient uptake is still optimised.



From day one: Optimal water management and water recycling strategies

At the start of the cultivation cycle Grodan slabs are saturated with a complete nutrient solution. For example a slab with dimensions 100 x 10 x 10 cm will absorb around 10 litres of nutrient solution. Assuming 6,000 slabs per ha this means that 60 m³ water (with nutrients) will be in the water system per ha.

It is only required to make one drain hole in the plastic foil, in the direction of the drain channel. When this is made, each slab will drain approximately 2 litres of nutrient solution (12 m³/ha). This nutrient solution is perfectly balanced. What you add in the irrigation water is measured in the slab and received back in the initial drain basin. No harmful substances are leached from Grodan slabs. It is therefore perfectly safe to capture and recycle the drain water from the beginning of the cultivation cycle (ensuring that there is no residual cleaning agents in the system).

Drain is no longer the goal but the outcome of a structured irrigation strategy

As Peters explained us, "In indoor strawberry cultivation on stone wool growing media drain should no longer be a goal but rather the result of a structured irrigation strategy." With a structured irrigation strategy, drain volumes can be significantly reduced, for example in tomato the average drain volume in the first 30 weeks of a cultivation has been recorded at 8%. Moreover, drain can be collected, cleaned and recycled in order to reduce the input of fertilizer and contribute to a sustainable cultivation. It is recommended to disinfect the water before re-using it and regularly monitor the total concentrations of individual nutrients and their ratios in the drain water so the input of new nutrients can be optimised. There are various techniques to disinfect the drain water such as filtration, heating, UV-radiation or advanced oxidation. Most common is UV but choose what fits your situation.

Nutrient recovery makes sense economically and environmentally for strawberry cultivation

"Why would you discharge valuable nutrients when they can be used again?", Peters questioned. "By accurately managing nutrient levels growth disorders can be avoided, crop growth and yield optimised and we can help minimise post-harvest rots due to Botrytis infection. The individual nutrient elements are essential nutrients for crop growth and it is important to know what the role of each element has in plant development in order to adapt the nutrient mixture to the needs of the plant." The uptake of nutrients depends on plant growth, plant development and the balance in the nutrient mixture. For example, in the phase from vegetative growth to fruit set, the uptake of potassium increases and the uptake of calcium and magnesium decreases. An overdose of one nutrient can reduce the uptake of other nutrients. To ensure that plants have an adequate and balanced supply of each element frequent sampling of both the slab and drain water is necessary. Analysis of the samples will give you an overview of the concentrations of the nutrients that are present in the slab and drain water.



EC monitoring: Your first step in nutrient management in stone wool slabs

The electric conductivity (EC) is a measure of the total amount of nutrients present in a solution: the more nutrients present in a solution, the higher the conductivity of electricity. "A grower can measure the EC levels in the Grodan stone wool blocks and slabs by using the GroSens sensors", explains Peters. "When the EC-value is too high, the osmotic pressure around the roots becomes too high, preventing the uptake of water by the roots. The optimal EC value depends on the growth stage of the plant, and the climatic circumstances." Note that the EC in the drain water can be significantly higher than the EC in the growing media, especially when drain volumes are low. As with high drain volumes what you are measuring in the drain is a proportionally higher influence of the irrigation EC. Knowing this enables better management decisions to be made.

In conclusion, water and nutrient management is a fundamental part of hydroponic greenhouse crop production. Stone wool equips greenhouse strawberry growers with a very efficient and sustainable way of growing, helping them achieve higher production, use less fertilizer and at the same time comply with stricter environmental legislations on drain water emission where these apply.



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