

Switch to clean

Clean, uniform growth for greenhouse lettuce and other leafy greens

Whitepaper



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Hydroponic lettuce and other leafy greens will soon start to dominate sales at supermarkets and chain restaurants. With up to 12 times the number of crops a year than from open fields and twice the crop density, no other production method can compete. Production environments must however be clean. Stone wool is both clean and inert, making it ideal for producing hydroponic lettuce and other leafy greens.

Hydroponic growers of lettuce and leafy greens need a clean, high-yield growing environment to produce a premium quality, profitable crop. The growing medium is key. There can be disadvantages with the currently used growing media, such as peat and coir. Stone wool is much more suited to hydroponic cultivation. It is clean, hygienic, uniform, and inert, which makes it ideal for fast and disease-free cultivation with a low Total Cost of Ownership.

Stone wool helps to ensure that both the cultivation process and the end product are clean. Unlike currently used growing media, stone wool does not discolour or add particles to the hydroponic nutrient solution. The solution remains clear, so the T10 transmission levels for the UV sterilisation units are maintained. Filters also remain clean and free from blockages, and gutters stay free of pollution.

Because stone wool is inert, water and nutrients can be precisely controlled for the growing crops. Stone wool can also absorb as much as 85% of its own volume in water. It therefore has a tremendous capacity for absorbing nutrient solution while retaining optimum root zone oxygen levels for rapid plant growth.



Towards a sustainable solution

Grodan's closely-controlled manufacturing processes produce an exceptionally uniform and consistent growing medium. This is important as it allows for a fast and uniform growth rate of the lettuce. The average growth cycle for whole head lettuce (germination to harvest) is around six weeks. However, this figure is highly dependent on the target fresh weight of the required end product, meaning between 8-12 crop cycles can be produced from the same square meter footprint per year. In the highly-automated turnkey greenhouses that are now in design and production throughout the world, stone wool can be the base for a reliably uniform and healthy crop.

Stone wool growing media produce excellent quality lettuce with high added value to growers. The industry as a whole is, for example, facing a reduction in the number and availability of plant protection products. The whole growing process must therefore be contaminant-free by design. Because stone wool is inorganic, crops grown on it are less susceptible to disease, so it is more suited to 'residue free' growing.

At the end of the growing cycle the used stone wool can be recycled to produce bricks for urban housing: so Grodan's stone wool goes from the greenhouse into 'green houses'.

Clean, productive and reliable growing media

The traditional method of growing lettuce in open fields is an inefficient use of scarce agricultural land and natural resources. It is water intensive and needs a lot of plant protection products. It can also discharge high levels of nitrates and phosphates into rivers and streams. Hydroponic greenhouse lettuce production suffers from none of these problems. It uses 8% of the water, since the water system is totally closed. It is these environmental and production benefits that have been the key drivers for the huge growth in hydroponic lettuce production, especially in deep water culture and nutrient film systems. The drive has been led by the USA, but is being seen increasingly worldwide.

Peat is a limited and valuable natural resource. Coir is a by-product from coconut production. There's a need for a sustainable alternative for these products.

A clean and inert growing medium is essential for hydroponic lettuce production as strong root growth is required to prevent diseases like Fusarium and Pythium. In deep water culture and nutrient film systems the roots hang permanently in the water, so the water needs to be oxygenated and remain free of contaminants. Compared to current alternative growing media, Grodan with its stone wool has helped customers to minimize failure rates.

Stone wool growing media are uniform, so the lettuce growth is consistent across the crop (Picture 1). This means that at harvest the final head weight of each lettuce is also uniform, which is ideal when producing to precise supermarket specifications (Picture 2).



Picture 1

Uniform growing conditions ensure consistent germination results, essential for consistent final products.

Picture 2

Uniform lettuce crop in a deep water culture system with healthy root system.



“The use of stone wool makes manual watering ideal. In addition, cultivation in the sheets is labour efficient as the Grodan plugs no longer need to be separated into trays and go directly from the sheet onto the water. In propagation, we therefore have a much higher plant density, which is much more efficient in our propagation set up.”

Arthur Marck, Marck Hydroponics

3-phase production for whole-head lettuce

For whole-head lettuce, Grodan recommends a 3-phase crop growth model and has researched temperatures, moisture content (in phases 1 and 2) and EC and pH irrigation values for fastest growth.

Phase 1

Seeding and germination in individual cells takes 2-3 days.

Phase 2

Propagation takes a further 8-18 days.

Phase 3

Cultivation takes another 15-21 days depending on head weight required.



For phase 1 the pre-drilled seed holes in the stone wool plugs provide the perfect air/water ratio around the seed for a high germination percentage. As the stone wool is uniformly saturated with water and nutrients, each seed has the same germination environment. This encourages uniform emergence and initial growth rate.

For phase 2 the moisture content of the growing medium must be maintained above 70% in order to keep the lettuce growing in the vegetative state. The temperature will depend on the required specifications of the end product and propagation times.

For phase 3 the young plants are moved to the main greenhouse for cultivation and harvesting. The air/water ratio needs to be closely controlled to avoid diseases. The greenhouse temperature needs to be kept between 18 and 21 °C, and the temperature of the deep water culture basin between 15 and 18 °C. However, the higher the temperature the weaker the crop, which will ultimately influence the shelf life of the end product.

Growing a better future

Grodan is the global leader in supplying innovative, sustainable stone wool growing media solutions for the professional horticulture industry, based on Precision Growing principles. These solutions are applied to the cultivation of vegetables and flowers, such as tomatoes, cucumbers, sweet peppers, egg plants, roses and gerberas.

Research shows that high-tech greenhouses have the biggest positive impact on the UN Sustainable Development Goals compared to all other growing systems and score highest within water and nutrient efficiency. The use of stone wool Precision Growing media in a greenhouse can produce higher yields with significantly less resources than other cultivation methods. The key is precision. The essence of Precision Growing is use of less soil, less water, less fertiliser, lower CO₂ emissions, and gaining a higher yield. Combined with stone wool growing media, Grodan enables Precision Growing by offering a MultiSensor system, a software platform and personal advice to help maximise crop potential with data-driven cultivation.

Grodan's innovative growing media solutions facilitate the sustainable production of healthy, safe, and fresh food produce. Furthermore, it creates the possibility to use biocontrol and reduce, or even eliminate, the use and risk of chemical plant protection products.

Sustainability plays a prominent role within Grodan, from the manufacture of stone wool substrates to end-of-life solutions. Grodan was founded in 1969 and is active in more than seventy countries worldwide. The head office is located in Roermond, the Netherlands.



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