

How stone wool and lighting can change the game for strawberry growers

Efficient





Grodan and Fluence, two leading horticultural solution providers, have completed an innovative demonstration trial aimed at exploring the opportunities for year-round cultivation of everbearing strawberries in a controlled environment. The results show that the use of stone wool growing media in combination with cutting-edge LED technology makes it possible to stay out of dormancy and maintain high-quality plants with a high yield throughout the winter. These findings have the potential to redefine the best practices for high-tech cultivation of everbearing strawberries, enabling growers to consistently supply retailers and consumers with fresh, high-quality strawberries all year round.

Summary of the final results for strawberries planted on August 22, 2023 till May 16, 2024.

- The strawberry plants maintained their active growth and stayed out of dormancy during the dark Dutch winter season
- 16.5 kg/m (based on 6 plants per linear metre) and 15 kg/m² (5.2 plants/m²)
- Over 90% of the total yield were class 1 fruits
- Production peaks were flattened, giving a minimum weekly production of 200 g/m
- The heat input was kept to a bare minimum: less than 2 m³ of natural gas was needed to heat the greenhouse

As popular premium fruits among consumers, strawberries are an interesting proposition for growers, especially if they can be cultivated in winter when prices for off-season fresh produce are at their peak. An ever-higher number of strawberry growers are discovering the benefits of Controlled Environment Agriculture (CEA), which helps them to meet market demands by making them less dependent on the outdoor weather conditions.

In Europe, high-tech strawberry growers traditionally use junebearing varieties for lit cultivation in winter cycles because of the dormancy issues that are associated with everbearing varieties. However, junebearers mean that growers see a two month growing period followed by two month harvesting period.

“These strawberry growers are forced to make a choice because the planting time determines the harvesting period, essentially you can only produce two months in the same greenhouse during winter,” says Thomas Peters, Business Development Manager at Grodan.

Exploring everbearers for winter lit production

To help growers find a solution to this problem, Grodan set up a trial with everbearers at Wageningen University & Research (WUR) in Bleiswijk, the Netherlands. “Everbearers are not currently used for lit production in Europe because of the very high risk of them going into dormancy in the winter,” he continues. “We believed that they could offer an interesting alternative to junebearers, if only the dormancy issue could be overcome. As always when doing fundamental research, we were keen to collaborate with a complementary partner who could help us to evaluate the effect of irrigation and root zone management in combination with other factors such as heat and light. Therefore, we reached out to Fluence and invited them to collaborate in this trial.”

“Using LED lighting is a perfect energy-saving solution for year-round crops and fits very well with the use of stone wool. We had previously conducted a number of trials with junebearers, and they had led us to conclude that everbearers were the way forward for winter production,” comments Gert-Jan Goes, Horticulture service specialist at Fluence. “We saw this trial with Grodan as an excellent opportunity for us to draw on those learnings and put our existing knowledge into practice with everbearers.”



Challenging to stay out of dormancy

Favori was chosen as the cultivar, because it is generally regarded as the standard everbearer variety for non-lit production in the Netherlands. “All of Grodan’s non-lit research so far has been done on Favori,” Peters explains. “However, this is well known as a high-chill variety, so we knew it would be particularly challenging to keep it out of dormancy without the traditional period of cold, during storage before planting.”

The trial started at WUR with a 7 weeks propagation period with fresh tip plants, all propagated indoors in Grodan’s stone wool growing media. The reason for using fresh tips is to avoid cold storage and to realize a flat production pattern. An ebb-and-flood system was used with targeted irrigation at three different electrical conductivity (EC) levels: 2, 3 and 4mS/cm. “One benefit of using stone wool from the propagation phase onwards is that it supports a clean and homogeneous system-based approach right from the start. Plus it is easy to transfer the blocks onto the slabs, helping to reduce labour,” states Peters.





Constant monitoring of the root zone

"The ebb-and-flood floors help to maintain the optimum moisture balance in the entire plant, from the root zone to the leaves, and further reduce the risk of pathogens. This risk is already lower in stone wool than in organic substrates, which are more susceptible to soilborne diseases," he comments. "Additionally, stone wool offers growers faster and more precise control over the conditions in the root zone, especially in combination with the data-driven insights from our GroSens sensors. In this trial, we were able to constantly monitor the gift EC, the drain EC, and the water content percentage (WC%) in the slab. This allowed us to adjust the fertiliser recipe to keep a stable pH, fine-tune the irrigation schedule, and adjust the gift EC to keep the EC stable."

Pushing the boundaries of radiation, temperature and EC

During the cultivation trial the following agronomic treatments were investigated: lighting, irrigation and climate management strategies. "Based on our previous trials, we knew that colder temperatures and lower light levels increased the risk of everbearers going into dormancy. Therefore, we gave them sufficient light, an elongated day length of at least 16 hours, a significantly higher average temperature – which was 19.5 °C in mid-winter, and even higher in autumn," says Goes. The target daily light integral (DLI) was 18 mols per day. The LED lamps from Fluence provided a standard high red light spectrum including far red, which is important to support the stretching in strawberries.

The baseline at the start of the trial was a Radiation to Temperature Ratio (RTR) of 12, plus 6 for every 10 mols. As the trial progressed, this was changed to 12 plus 5, and it ended with 12 plus 4. "This RTR strategy would normally be regarded as very high," states Goes.

Grodan similarly pushed the boundaries during this trial. "Compared to other crops, strawberry growers still tend to hold back a little when it comes to the irrigation strategy. We seized the opportunity of our research setting to see which feeding recipe the plants could handle. A general rule of thumb for the drain EC plus Gift EC is normally no higher than 2.8, but we took it towards 5 or more, combined with a gift EC of 2," says Peters.



Higher yield and fruit quality with more efficiency

From the time of planting on 22 August 2023 until the last harvest on 16 May 2024, this trial achieved an outstanding yield. The final results were 16.5 kg/m². "We consider it as a superb achievement that the strawberry plants maintained their active growth and stayed out of dormancy during the dark Dutch winter season. And we are happy with the final results – not just the total production, but also in terms of plant growth, crop speed, fruit size, Brix, shelf life and fruit quality. In fact, over 90% of the total yield were Class 1 fruits," continues Peters.

"One positive side effect of working with higher and minimum and average temperatures, is that the IPM strategy remained highly effective. This significantly reduced the need for spraying with chemicals as extra protection against whitefly and aphids," reflects Goes.

Importantly, higher minimum temperatures do not necessarily mean higher energy bills, he explains: "We grew in line with Next Generation Growing principles, including by keeping the energy screens at least 90% closed at night. This kept the heat input to a bare minimum. In fact, we used less than 2m³ of natural gas to heat the greenhouse. The energy input accompanied with the lighting did the rest of the work."

Another way this approach improves efficiency in the greenhouse is the continuous winter production instead of a production window of only two months. According to Goes: "Whereas Junebearers require growers to work in flushes, this everbearer variety flattened the production peaks and gave us a continuous weekly production of at least 200 g/m². This system provides the highest amount of strawberries in the periods in which there is a very limited or no supply of non-lit production. And needless to say, more predictable production makes it easier to plan and manage your labour requirement, resulting in extra efficiency gains for growers."

Conclusion

The results from this trial show that everbearers have the potential to transform the year-round cultivation of strawberries in high-tech greenhouses, and that this new approach can add significant value for growers. "By making it possible to run a single crop for the whole season, maintaining continuous production right through the winter with a flatter production curve, everbearers open up cost-saving opportunities for growers on multiple levels, ranging from plants and substrates to labour," says Goes. "Additionally, growers can benefit from better quality, larger yields and higher prices, resulting in more profitability."

"As is normal during a research trial, our aim was to go beyond the current limits and redefine the borders. We pushed some of the parameters to the extreme, but we wouldn't necessarily advise commercial strawberry growers to work with these parameters in practice," states Peters. "However, we have shown that a different approach to the combination of temperature, EC and light not only helps the plants to maintain active growth and stay out of dormancy in the dark winter months, but can also actually boost quality, production, efficiency and profitability," he adds.

"We will now incorporate these insights into our practical advice for strawberry growers, and we will continue to conduct research to further expand our knowledge for the benefit of year-round high-tech strawberry cultivation in the future," concludes Peters.

How to find out more

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Designed to grow

Grodan is the global leader in supplying [soilless rootzone management solutions](#) for Controlled Environment Agriculture. These solutions are applied to the cultivation of vegetables, medicinal crops and flowers such as tomatoes, cucumbers, sweet peppers, eggplants, roses and gerberas.

At Grodan, we aim to help feed and treat the world's growing population by innovating solutions from our stone wool growing media to enable 'more-with-less' growing. Through the method known as out-of-soil, our [stone wool substrates](#), [sensor systems](#), [software](#) and [expertise](#) support the reliable, informed growing of healthy, fresh, high quality produce. Our material is 100% recyclable, and supports growing methods that use up to 50% less water, 20% less chemical plant protection products and 75% less land. Sustainability plays a prominent role within Grodan, from manufacturing stone wool substrates to [recycling solutions and services](#).

Grodan has more than 50 years of cultivation experience. We pioneered the development of hydroponic growing methods in the 1960s, and today, our soilless rootzone management solutions are used in large-scale commercial greenhouses and indoor facilities in over 70 countries across the globe. The head office is located in Roermond, the Netherlands.

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