

Grodan research whitepaper

Grodan research reveals new insights into optimal irrigation
strategy for large-scale production of medicinal crops





As the pharmaceutical industry's demand for medicinal crops continues to grow, the sector is undergoing a shift towards large-scale, professional cultivation activities. In comparison with other horticultural crops, however, relatively little research is available about how to successfully and consistently grow medicinal plants commercially. Therefore, stone-wool producer Grodan recently conducted its own research. "Our aim with this study was to contribute to filling the knowledge gap. Our findings can definitely help growers to increase their production while maintaining the exacting standards required by pharmaceutical companies," says Grodan's Ben Nikaj.

Grodan has 50 years of experience in optimizing the performance of its stone-wool growing media for a whole range of plant types, and the company regards medicinal crops as an important emerging market now that the industry is rapidly professionalizing. "We are keen to build the same level of knowledge and expertise for medicinal crops as we have for other crops," states Ben Nikaj, Senior Crop Advisor at Grodan, who has been supporting the company's customers across the globe for more than two decades. "However, because of the history of the industry, there is not a lot of information out there specifically about medicinal plants. Therefore, we decided to help fill that knowledge gap for large-scale producers by conducting research of our own."

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Grodan's research was particularly focused on identifying the optimum irrigation strategy for medicinal crops. "The root zone is often neglected in existing research, yet that is the most important part of the plant in terms of enabling the uptake of the right amount of water and nutrients to support growth and development," he adds. Starting in 2020, Grodan set up a trial in partnership with Wageningen University Research to compare the performance of a cultivar based on three different irrigation strategies: 'dry', 'standard' and 'wet'. "During a full 12-week cycle, including eight weeks of flowering time, we compared the dry strategy as is commonly used in the US against the standard Grodan irrigation strategy that has traditionally been regarded as our most optimal strategy for all types of crops," explains Nikaj. "In addition, we tested a third approach based on a 10% higher water content than our standard strategy."

Coping with the fast pace

A similar trial was then repeated in 2021 and 2022, including with different cultivars. The results conclusively showed that the 'wet' strategy during the day consistently gave significantly higher production with homogeneous growth and uniformity, while maintaining the same level of cannabinoids. For Nikaj, this revelation came as no real surprise: "Commercial production of medicinal crops is a very intense process in which you push the plant to the limits – high temperatures, high light levels, high CO₂ – to maximize the number of cycles. But it's important to ensure that what's going on in the rootzone can keep pace with the demands in the upper part of the plant. Just as a marathon runner needs to rehydrate with energy drinks during a race, you need to give your plants enough water and nutrients so that they have the stamina to produce optimal results."

'Good' stress

Nikaj makes a distinction between 'good' stress and 'bad' stress. "The plants grow fast in controlled-environment cultivation systems (indoors or in greenhouses), which makes them naturally hungry and thirsty – and if they don't get enough food and water, they can become stressed. A little bit of stress can be healthy for plants, just like for humans; it helps us to stay alert and active. But as humans, we also know that it's better to minimize stress on children in their development phase so that they can devote all their energy to maturing into an adult. And it's similar for medicinal crops; in the propagation and vegetative phases, and actually also in the early flowering phase, you should focus on giving the plant everything it needs to grow. That means it's important to provide enough water and minerals – and perhaps more than you might expect – especially during the first six weeks of the eight-week flowering cycle. Otherwise you actually reduce the plant's capacity to achieve maximum production."



Slightly less dry-back

As part of studying the irrigation strategy in the trials, Grodan experimented with various degrees of dry-back. "We know from experience how important night-time dry-back is to replenish the rootzone with oxygen and keep the roots – and the beneficial microbes – happy and healthy," explains Nikaj. "We discovered that reducing the standard night-time dry-back by around 10% in line with the 'extra wet' strategy produced positive results in medicinal crops, probably because it allows the plant to function optimally until the lights are turned off. After all, even though the upper half of the plant is in 'rest mode' at night, the rootzone is working round the clock."

Measure the EC in the substrate

The study also investigated the impact of knowing the EC in the substrate, which is another nuance that Nikaj is keen to point out: "It might seem easier to measure the EC in the dripper irrigation or in the drain rather than measuring the EC in the substrate, but growers should be focused on optimizing the EC in the rootzone because that's the true indicator of what the plant is actually getting," he explains. "The common thinking is that medicinal crops don't like a high EC in the substrate. But as a plant that loves high light levels, it needs correspondingly high fertilizer levels to cope with the speed of growth and development. The trials confirmed what we already knew at Grodan based on our experience: when growing medicinal crops hydroponically, you should actually be starting with a higher EC in the propagation stage and then further increase this gradually as you move into the vegetative stage and then again into the flowering stage," continues Nikaj.

Take one unknown out of the equation

The reason for this is that stone wool is an inert growing medium, so it contains none of the naturally occurring minerals that are present in organic media such as soil or coco. "Because the cation exchange capacity is almost zero, the substrate possesses no negative charge to form chemical bonds with positively charged fertilizers found in nutrient solution. The advantage of this is that you can

control your irrigation strategy with extreme precision because you know that 100% of what you put into the substrate will go directly to the plant, with no interaction with 'hidden' elements. The cultivation of medicinal crops is a complex process due to the diversity of the plants, and the use of stone wool enables you to take one 'unknown' out of the equation," he states. This supports the precision-growing approach which is particularly important in order to guarantee the high standards of uniformity and repeatability required by customers in the pharmaceutical industry. Moreover, Grodan's stone wool products are processed at 1,500°C in the factory, resulting in a near-sterile substrate that minimizes the chance of contamination by pathogens. This enables growers of medicinal crops to assure their customers about the safety of the product.

General rule of thumb

Nikaj cautions that medicinal crops can be very cultivar-dependent, so it is therefore not possible to define a one-size-fits-all irrigation strategy. However, the Grodan team have developed a general rule of thumb about the optimal water content depending on whether the cultivars are naturally generative or naturally vegetative. "These research findings are already helping me to give even better advice when I visit customers. And above all, our trials have demonstrated that commercial growers of medicinal crops can gain real benefits in terms of both production and consistency by adapting their irrigation strategy, providing that they tailor their approach to their own circumstances," he concludes.