



**gro|dan<sup>®</sup>**  
Passionate about Precision Growing

# GROWGUIDE

**Precision Growing with GRODAN**

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[www.grodan.com](http://www.grodan.com)



## Precision Growing

Precision Growing is the most efficient and effective cultivation method that minimizes input costs while maximizing results. This proven, targeted growing approach is the key to reducing the use of diminishing resources while helping growers meet the food demands of an increasing world population, all while minimizing pollution from the growing cycle.

## About GRODAN

The GRODAN Group supplies innovative and sustainable stone wool substrate solutions for the professional horticultural sector, based on Precision Growing principles. These solutions are, amongst others, applied for the cultivation of vegetables and flowers, such as tomatoes, cucumbers, sweet peppers, eggplants, lettuce, roses and gerberas.



### **The Broader Solution**

Stone wool substrates are offered together with tailor-made advice and tools to support Precision Growing and thus facilitate the sustainable production of healthy, safe and tasty fresh produce for consumers.

### **Sustainability**

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



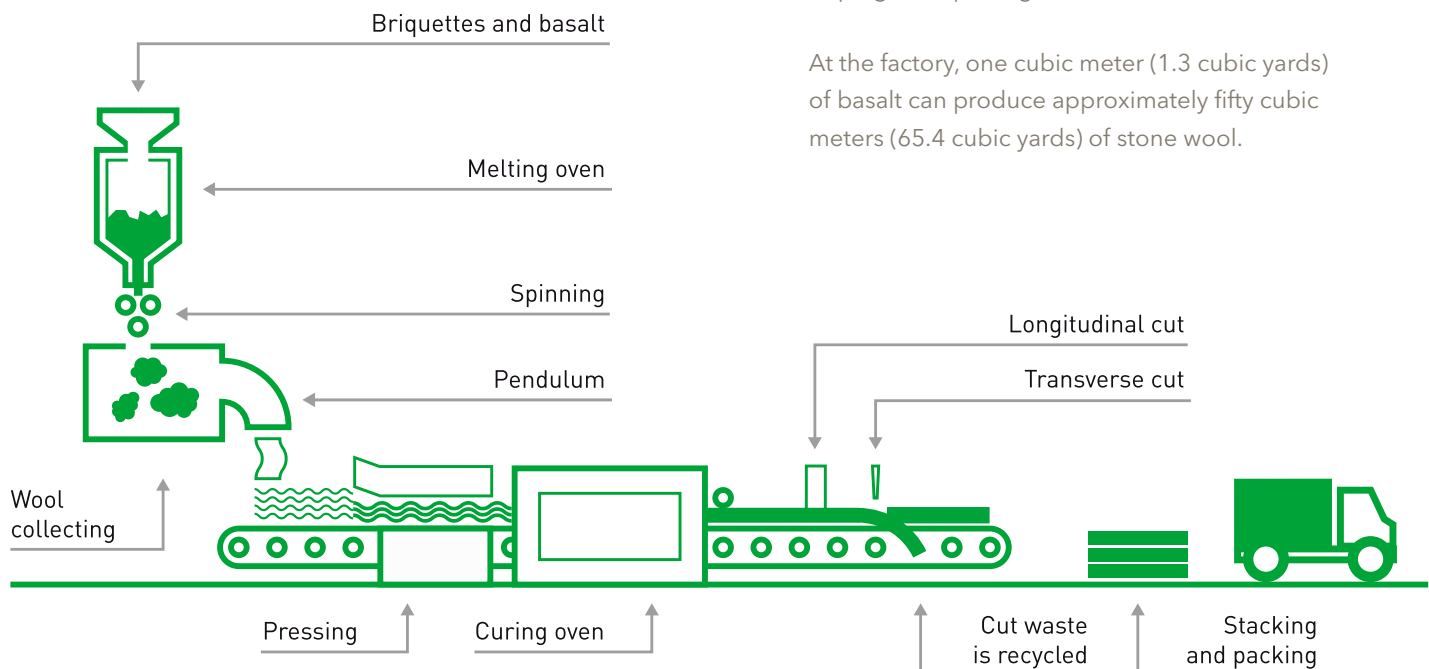
# What is stone wool?

## A Natural Product



Stone wool is a natural product. It is made from basalt, solidified lava spewed from the innermost depths of the earth. To manufacture stone wool commercially, the GRODAN Group duplicated this natural process as closely as possible. Today, extracted basalt is re-liquefied in furnaces at a temperature of 1,500°C (2,732°F). The liquid basalt is then spun into threads in spinning chambers, congealed in a hardening kiln using hot air and then compressed into wool packets. At this point, the product is cut into slabs, blocks or plugs and packaged in film.

At the factory, one cubic meter (1.3 cubic yards) of basalt can produce approximately fifty cubic meters (65.4 cubic yards) of stone wool.





## Recycling

GRODAN stone wool products are an ideal growing media to produce crops in a sustainable way. At the end of the growing cycle, the stone wool can be recycled. Throughout the world there are several options for recycling that have been tested and approved. Here in the United States, one of the most popular recycling methods for the used stone wool is composting.

The stone wool is shredded and added to organic waste to be processed into compost. GRODAN has several benefits in compost such as adding structure to the soil to improve aeration and retaining moisture to speed up the biological composting process. Independent clinical studies have proven there is no risk to human health or the environment when composting GRODAN stone wool products.

## Doing More with Less

All GRODAN substrate solutions are aimed at doing more with less, with respect for people and the planet. This is precisely what is meant by "Precision Growing". It is the most efficient and effective form of growing, focused on using the minimum of input materials to generate maximum output.

Three factors have a profound influence on the impact of precision growing; genetics, the greenhouse climate and the root zone. Within Precision Growing, the GRODAN Group focuses on 'root zone management', or in other words, steering of the root environment. Everything that happens in the stone wool substrate has an impact on the functioning of the root environment and therefore the development of the plant. So, we continually investigate how our products, tools and user advice can respond perfectly to changing circumstances, so that the plant is given the very best care, without wasting resources.

## Key Product Benefits

GRODAN substrates have been designed to be an ideal growing environment. The benefits are grouped into four key features:

1. Inert
2. Irrigation efficiency
3. Uniformity
4. Steerability

Some of the benefits include:

- GRODAN stone wool is a clean and disease-free substrate.
- There is no lock up uncontrolled release of nutrients.
- All water and nutrition within the substrate is available to the plant.
- Easy to control and steer the growth of the crop to achieve higher yields than is seen in soil-bound cultivation.

# Benefits

# 1

Inert

# 2

Uniform crop  
development

# 3

Steerability

# 4

Irrigation  
efficiency

# 5

Optimizing  
production



## 1

### **Inert**

GRODAN substrates are chemically inert. This means it will not bind any nutrients and/or chemicals as can be seen in non-inert substrates. The benefit of GRODAN being an inert substrate is that all of the nutrient solution used to irrigate the crop are available for the crop for uptake, nothing else, nothing more, the grower is in complete control. As a result the amount of applied water, fertilizers and chemicals can be optimized according to the precision growing concept and as a grower you can minimize the input cost. In addition, GRODAN substrates are clean and free of any diseases creating an optimal start for the crop.



## 2

### **Uniform crop development**

The structure of GRODAN substrates ensure a uniform root zone. The uniformity of GRODAN products are critical to the different processes throughout the crop cycle. In the propagation stage, GRODAN will provide uniform germination of seedlings and initial root development of the crop. As the growing cycle continues, GRODAN substrates efficiently distribute irrigation water uniformly throughout the substrate. A uniform root zone environment provides each plant with the same generative or vegetative stimulus in accordance with climate management strategies. The result is a uniform, perfectly balanced crop that will result in higher yields, better quality and less energy usage.



### 3

#### **Steerability**

Due to the excellent properties of GRODAN substrates, growers can steer plant development based on controls of the water content (WC) and electrical conductivity (EC) within the substrate. By steering the WC & EC in the substrate we can influence the crop balance between vegetative or generative. The major benefit of this is that the crop can be balanced with action applied to the root zone. By applying a strategy based on the advice from the GRODAN technical advisors and crop consultants, crop growth can be optimized. The great steerability of GRODAN products will result in earlier production, improved produce quality, improved crop health and increased resilience to pests and diseases.



### 4

#### **Irrigation Efficiency**

Irrigation efficiency is a measure to show how efficient the irrigation water is used within the substrate. The used irrigation water will be partitioned into three parts when applied to the substrate; resaturation, refreshment, and direct drain. The irrigation water is most efficiently utilized when a small amount of the applied water runs direct to drain and the substrate is optimally refreshed. All GRODAN substrates are developed to have excellent irrigation efficiency. As a result, fewer irrigations are needed to refresh the substrate thereby optimizing water and fertilizer inputs.



### 5

#### **Optimizing production**

GRODAN substrates combined with our user advice and tools provides growers with the best conditions for crop production. The inert characteristics of the product with the added benefits of steerability allows growers to improve fruit and produce quality and helps realize maximal yields. In addition to supporting high yields, the ability to use less input materials also keeps production costs minimal which further improves the return on investment.





## The GRODAN Product Line from Start to Finish

**Propagation: Plugs**



**Propagation: Blocks**







## Tools & Services

We at GRODAN are happy to share our many years of experience in Precision Growing with you. Read more about our 6 Phases Email Advice, our water content meter and other valuable tips at [www.grodan.com/precision+growing](http://www.grodan.com/precision+growing)

### 6 PHASES®

The 6-phase model of GRODAN shows you the recommended values – at a glance – for the relevant type of slab and cultivation phase of your crop. You can use these recommended values to make any necessary adjustments to the irrigation strategy, thereby further improving your control of the cultivation process and assuring you of an optimal crop.

### Finishing: Slabs





# The GRODAN Product Line from Start to Finish

## Propagation

Different products may be used during propagation stages of your crop and is generally determined depending on the propagation stage of your crop duration. The product assortment of GRODAN for propagation can be categorized into two groups; plugs and blocks.

GRODAN plugs are known for their homogeneity and reliability. GRODAN plugs will provide a uniform germination and a high succes rate. The shape and firmness of the plugs are of a quality that makes processing significantly easier, whether that processing is mechanical or manual. Every plug has a uniform density, firmness and fibrous structure. This means that distribution of water, nutrients and pH-value is also uniform, which has a beneficial effect on germination results and initial crop development.

GRODAN has many different plugs in various sizes to meet your needs. Each plug has been developed to work ideally with a specific application or crop. To guide you in selecting the best plug for your application, consult the following table.





Item	Description	Dimensions	Quantity	Options
<b>GRODAN AO plugs</b>	<ul style="list-style-type: none"> <li>• Square size plugs connected to each other at the top of the plug forming a sheet fitting a 10/20 tray</li> <li>• Plugs have a tapered bottom, for improved transplanting</li> <li>• Ideal plug for the growth of lettuce, leafy greens and herbs in hydroponic systems</li> <li>• Great to use for germinating any seeds in or starting your cuttings in</li> </ul>	<ul style="list-style-type: none"> <li>• AO 25/40- 25*25*40mm (1*1*1.6")</li> <li>• AO 36/40- 36*36*40mm (1.4*1.4*1.6")</li> <li>• AO 50/40- 50*50*40mm (2*2*1.6")</li> </ul>	<ul style="list-style-type: none"> <li>• AO 25/40, 200 plugs/sheet, 6000 plugs/carton</li> <li>• AO 36/40, 98 plugs/sheet, 2940 plugs/carton</li> <li>• AO 50/40, 50 plugs/sheet, 1500 plugs/carton</li> </ul>	<ul style="list-style-type: none"> <li>• No holes</li> <li>• 10/10 seedhole (10mm diameter, 10mm deep)</li> <li>• Ask your Account Manager about other seedhole sizes</li> <li>• Other height options of plug possible</li> <li>• Plugs loose filled into tray (SBS)</li> </ul>
<b>GRODAN TACO plugs</b>	<ul style="list-style-type: none"> <li>• Same great benefits as the AO plugs, only these plugs will have a straight bottom (straight cut)</li> </ul>	<ul style="list-style-type: none"> <li>• Taco 25/40- 25*25*40mm (1*1*1.6")</li> </ul>	<ul style="list-style-type: none"> <li>• 200 plugs/sheet, 6000 plugs/carton</li> </ul>	<ul style="list-style-type: none"> <li>• 10/10 seedhole (10mm diameter, 10mm deep)</li> </ul>
<b>GRODAN AX plugs</b>	<ul style="list-style-type: none"> <li>• Same great benefits as the AO plugs, only these plugs will be connected to each other at the bottom and are tapered towards the top</li> <li>• Due to the wider bottom gives more stability when placed in a gutter/gully system</li> </ul>	<ul style="list-style-type: none"> <li>• AX 25/40- 25*25*40mm (1*1*1.6")</li> </ul>	<ul style="list-style-type: none"> <li>• 200 plugs/sheet, 6000 plugs/carton</li> </ul>	<ul style="list-style-type: none"> <li>• 10/10 seedhole (10mm diameter, 10mm deep)</li> </ul>
<b>GRODAN Kiemplug</b>	<ul style="list-style-type: none"> <li>• Ideal for germinating crops to be transplanted into a block (ie tomato, pepper, etc)</li> <li>• Ideal plug/tray combination to use in automated seeding &amp; transplanting systems</li> <li>• Strategically placed seedhole to ensure central position of seed in the plug for optimal germination and growth</li> </ul>	<ul style="list-style-type: none"> <li>• Diameter 20mm (.8"), height 27mm (1.1")</li> </ul>	<ul style="list-style-type: none"> <li>• 240 plugs in Styrofoam tray, 13 tray/carton</li> <li>• Kiem plugs loose, 10500 plugs/carton</li> </ul>	<ul style="list-style-type: none"> <li>• Also available as trays are loaded on pallet</li> </ul>
<b>GRODAN Macroplug</b>	<ul style="list-style-type: none"> <li>• Big round plug, ideal for cuttings or crops needing a longer germination stage</li> <li>• The bigger plug, will provide sufficient volume for initial root development</li> </ul>	<ul style="list-style-type: none"> <li>• Diameter 46mm (1.8"), height 50mm (2")</li> </ul>	<ul style="list-style-type: none"> <li>• Loose or in tray, ask your account manager for details</li> </ul>	<ul style="list-style-type: none"> <li>• No hole</li> <li>• 8/12 seedhole (8mm diameter, 12mm deep)</li> <li>• Incision on side plug</li> <li>• V-cut on side plug</li> </ul>

### Technical Practicalities

- GRODAN plugs have excellent uniformity, strength and shape that provides the perfect basis for optimum germination and uniform seedling results.
- The uniformity and reliability of GRODAN plugs provide a solid basis for automatic processing, uniform germination and a crop that can be transplanted successfully.
- GRODAN plugs have a uniform density, firmness and fibrous structure. This means that distribution of water, nutrients and pH-value is also uniform, which has a beneficial effect on germination results.





# The GRODAN Product Line from Start to Finish

## Blocks

GRODAN Delta stone wool blocks are the most uniform block on the market. Optional grooves at the base promote enhanced drainage. Several sizes are available to accommodate different grow configurations and different plants. Depending on the crop grown, crop will be seeded directly into the block (cucumber) or a plug with seedling will be transplanted into the block.

Item	Description	Dimensions	Quantity	Options
GRODAN Delta	<ul style="list-style-type: none"> <li>Suitable for flower and vegetable propagation</li> <li>Block for effortless start-up of propagation</li> <li>Uniform WC and EC distribution</li> <li>Easy WC management</li> <li>Excellent root growth throughout the block</li> </ul>	<ul style="list-style-type: none"> <li>DM4, 7.5*7.5*6.5cm (.3*.3*2.6")</li> <li>DM6.5, 10*10*6.5cm (.4*.4*2.6")</li> <li>Dm9.8, 15*10*6.5cm (.6*.4*2.6")</li> </ul>	<ul style="list-style-type: none"> <li>DM4, 384 per carton</li> <li>DM6.5, 216 per carton</li> <li>DM9.8, 144 per carton</li> </ul>	<ul style="list-style-type: none"> <li>No hole</li> <li>27/35 hole, use to transplant kiemplug</li> <li>42/40 hole, use to transplant AO36/40</li> <li>Position of hole and number of holes</li> <li>Also available per pallet</li> </ul>
GRODAN Delta MM	<ul style="list-style-type: none"> <li>Greater firmness for better handling</li> </ul>	<ul style="list-style-type: none"> <li>MM40/40, 4*4*4cm (1.6*1.6*1.6")</li> <li>MM50/50, 5*5*5cm (1.6*1.6*1.6")</li> </ul>	<ul style="list-style-type: none"> <li>MM40/40, 2250 per carton</li> <li>MM50/50, 1152 per carton</li> </ul>	<ul style="list-style-type: none"> <li>With seedhole</li> </ul>

### Technical Practicalities

- Effortless start-up of propagation. GRODAN Delta is the perfect block for propagating young plants under a wide range of propagating conditions. The block is easy to saturate and water is distributed uniformly throughout the block, so reliable and vigorous plant growth is guaranteed.
- Uniform WC and EC distribution. Newly transplanted plants will benefit thanks from the ready availability of water and the balanced nutrient solution (EC), encouraging the roots to penetrate deeply into the blocks.
- Easy WC management. The water content levels can be easily managed between 55% and 80%. Managing the WC levels in the block, allows the grower to steer the plant effectively. The steering of the crop allow the grower to optimize the plant quality for a good and successful start of the crop.
- Excellent root growth throughout the block. The Delta Technology ensures uniform distribution of water and nutrients throughout the block. Newly transplanted plants will benefit thanks to the ready availability of water and EC, encouraging the roots to penetrate deeply into the slabs.
- Greater firmness for better handling. During the propagation stage, blocks generally will be manually or mechanically handled several times. Due to the greater firmness of the GRODAN blocks, this handling is no problem and the GRODAN Delta block will maintain its shape and structure. The stable firmness of GRODAN Delta becomes particularly important when the blocks are placed, spaced and picked up several times during propagation. An added advantage is greater protection for the roots during transport from the propagator to the grower.





# The GRODAN Product Line from Start to Finish

## Slabs

GRODAN has developed a specialized and comprehensive slab assortment, each one specifically designed and proven to be ideal for specific crop needs. The following table provides a quick overview to help you identify the best slab for your crop.

### Which slab is best for your specific needs?

- Those growers growing tomatoes, who look for maximum control over the crop and generative steering will find great benefits by using the Grotop Master.
- Tomato growers who value more ease of use, would find GRODAN Vital beneficial.
- Growers who want control over the crop growth, such as pepper, cucumber or eggplant crops, will find either Grotop Expert or GRODAN Vital ideal.
- If growing a crop that will last several years like roses and gerbera, the VitaFlor is your slab, specially developed for floriculture crops.





Product Name	Description	Remarks
<b>GRODAN Grotop Master</b>	<ul style="list-style-type: none"> <li>• Excellent root growth and rapid leaf area development</li> <li>• Uniform WC and EC distribution</li> <li>• High re-saturation capacity</li> <li>• Most popular tomato slab world wide</li> </ul>	<ul style="list-style-type: none"> <li>• Common dimensions are (length*width*height): <ul style="list-style-type: none"> <li>- 90*15*7.5cm (35.4*6*3") 128/pallet</li> <li>- 90*19.5*7.5 cm (35.4*7.7*3") 96/pallet</li> <li>- 100*15*7.5cm (39.4*6*3") 128/pallet</li> <li>- 100*19.5*7.5cm (39.4*7.7*3") 96/pallet</li> </ul> </li> <li>• Other dimensions available upon request with or without pre-made plant holes</li> <li>• Slabs are delivered on pallets</li> <li>• Quantity per pallet depends on dimension</li> </ul>
<b>GRODAN Grotop Expert</b>	<ul style="list-style-type: none"> <li>• Ideal slab for cucumbers, tomatoes and peppers</li> <li>• Vertical fibre structure for rapid root penetration and rapid leaf area development</li> <li>• Excellent, uniform WC and EC distribution</li> <li>• Outstanding re-saturation properties</li> <li>• Wide WC control range for optimal steerability</li> </ul>	
<b>GRODAN Vital</b>	<ul style="list-style-type: none"> <li>• Versatile slab for vegetable crops</li> <li>• Uniform WC distribution</li> <li>• Easy root penetration for vigorous uniform crop growth</li> <li>• Excellent irrigation efficiency</li> <li>• High re-saturation capacity</li> <li>• Sustainable water and nutrient use</li> </ul>	
<b>GRODAN Vitaflor</b>	<ul style="list-style-type: none"> <li>• For use with floriculture crops (Multi-year slab)</li> <li>• Easy irrigation for rapid drainage</li> <li>• Long lifecycle</li> <li>• Vigorous, uniform crop</li> <li>• Replenishes fast</li> <li>• Sustainable use of water and nutrients</li> </ul>	

# The GRODAN Product Line from Start to Finish

## Grocubes

GRODAN Grocubes are small cubes of stone wool. They stack on top of each other leaving air space in between them to promote root growth. Due to the surface area ratio, newer growers can control irrigation better.

Special advantages are achieved by adding GRODAN Grocubes to other media. GRODAN Grocubes help spread the water in the container as well as keeping a water buffer in between waterings.



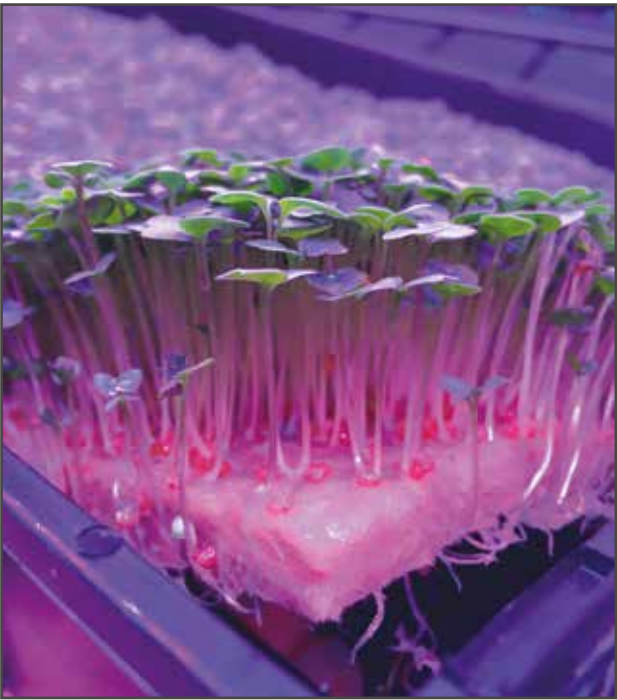
Item	Description	Dimensions	Quantity
GRODAN Grocubes	<ul style="list-style-type: none"> <li>Loose substrate to fill containers with</li> <li>Porous, dry substrate</li> <li>Optimal use of substrate volume</li> <li>Structure retained</li> <li>Fast root penetration, more growing power</li> <li>Sustainable use of water and nutrients</li> </ul>	<ul style="list-style-type: none"> <li>1*1*1 cm (.4*.4*.4")</li> <li>2*2*2 cm (.8*.8*.8")</li> </ul>	<ul style="list-style-type: none"> <li>1.4m³ per pallet</li> <li>Loose in carton (+/- 0.18m³)</li> </ul>

**GRODAN Cress Plate**

The GRODAN Cress Plate is the optimal product for the production of microgreens and in bulk harvested leafy vegetables or culinary herbs in vertical farming set-ups. The thin sheets of GRODAN stone wool are specially developed for those very quick growing crops that need minimal substrate. Using the cress plate will result in an uniform and quick crop development.



Item	Description	Dimensions	Quantity
<b>GRODAN Cress Plate</b>	<ul style="list-style-type: none"><li>• Thinnest GRODAN product on the market</li><li>• Uniform water levels throughout product</li><li>• Quick and easy germination</li><li>• Even crop development</li></ul>	<ul style="list-style-type: none"><li>• 49.5*24*1 cm (19.5*9.4*.4") fits 10/20 tray</li><li>• 60*50*1 cm (23.6"*19.7*.4")</li></ul>	<ul style="list-style-type: none"><li>• 10/20 size, 90/carton</li><li>• 60*50 size, 50/carton</li></ul>







The new GroSens HandHeld is the ideal measuring instrument for growers, that makes precision irrigation possible with pinpoint accuracy and a detailed display of the water content (WC), the electrical conductivity (EC), and the temperature of the stone wool substrate.

# GRODAN Tools

## GroSens® HandHeld

The patented GroSens system is the first wireless measurement tool for growers that makes precision irrigation possible with pinpoint accuracy and a detailed display of the water content (WC), electrical conductivity (EC) and temperature levels in the stone wool substrate.

### Real-Time, Real Data, Real Control

The GroSens HandHeld gives real-time accurate WC, EC and temperature data. With the multi-measurement functionality, measurements can be taken throughout the greenhouse. The GroSens HandHeld makes it so simple and easy to read and analyze the WC and EC averages and distribution of the values per series. The logging function can take up to 2,300 measurements providing reliable insight into the WC, EC and temperature for convenient and ongoing recording of the values over time. Compiled data is easily accessible in graphic Excel format on a PC. The GroSens HandHeld makes it easy and efficient for you to access to the data you need to optimize the irrigation strategy so you have the power to improve the yield and quality of the crops.

In combination with GRODAN stone wool substrates and advice, the GroSens HandHeld gives you the information you need to optimize production and identify solid cost savings - it enables Precision Growing to achieve your greatest results.

The GroSens HandHeld can also be adapted to a GroSens MultiSensor measuring system at a later stage so your investment will continue to deliver, even when your needs or operations expand.



Distributed by:



The GRODAN Group is the preferred supplier of innovative, sustainable stone wool substrate solutions for the professional horticultural industry. Based on expert Precision Growing principles, these advanced substrate solutions help vegetable growers achieve greater yields and crop quality. In addition to its stone wool substrates, the GRODAN Group also provides tailor-made advice and tools to support Precision Growing and thus facilitate the sustainable production of healthy, safe and tasty fresh produce for consumers.

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**grodan**<sup>®</sup>  
Passionate about Precision Growing