Precision Irrigation

Quality plants need many things, particularly the right combination of the ideal substrate or growing media and using an optimal watering strategy for your system and growing environment. Following these proven irrigation techniques will help you achieve the high quality product while optimizing your use of water and nutrients.

Crop Steering

Crop steering can be achieved in part through irrigation helping the plant grow leaves (vegetative growth) or flowers /fruits (generative growth). The amount of irrigation solution applied and the frequency influences the plants response and steers the growth. Adjusting the irrigation strategy specifically for the environment, genetic, and stage of plant growth will keep the plant growth at the optimum and improve final product quality.

Vegetative Stage

- Vegetative growth focuses on early root and plant development so it is critical to maintain proper water content in the root zone without over or under saturating the growing media.
- Every irrigation event creates a vegetative response in the plant so you should apply multiple small irrigations throughout the day without oversaturating the block (At least once per day).
- Irrigating with large volumes of solution oversaturates the growing media, slowing down plant growth.
- A lower EC both in the irrigation water and the substrate will allow for easier water uptake and also help with vegetative steering.

Generative Stage

- Generative growth focuses on maximizing flower, resin, and flavor production.
- In this state, water content is generally maintained at lower levels than in the vegetative stage even though more irrigation events are applied throughout the day.
- A higher EC within the irrigation water and the substrate will control water uptake contributing to a more generative response from the plant.

The below chart outlines recommend irrigation start and stop times specific to Vegetative and Generative growth stages. These would be adjusted to fit the specific environmental and genetics.

IRRIGATION VOLUMES

Shot Size	% of Substrate Volume
Small	2%
Standard	3%
Large	4-6%

*For drip irrigation. Suggested flow rate = 0.5gph (2 lph)

CROP STEERING

Irrigation Start and Stop Times		
Start	0-1 hr after sunrise/lights-on	Vegetative
Start	1-2 hr after sunrise/lights-on	Neutral
Start	2-4 hr after sunrise/lights-on	Generative
Stop	0-2 hr before sunset/lights-off	Vegetative
Stop	2-3 hr before sunset/lights-off	Neutral
Stop	3-4 hr before sunset/lights-off	Generative
	Vegetative	**Generative**
EC	Lower	Higher
Water Content	Higher	Lower
Drybacks	Smaller	Larger

How much water should I give the plant during each watering event?

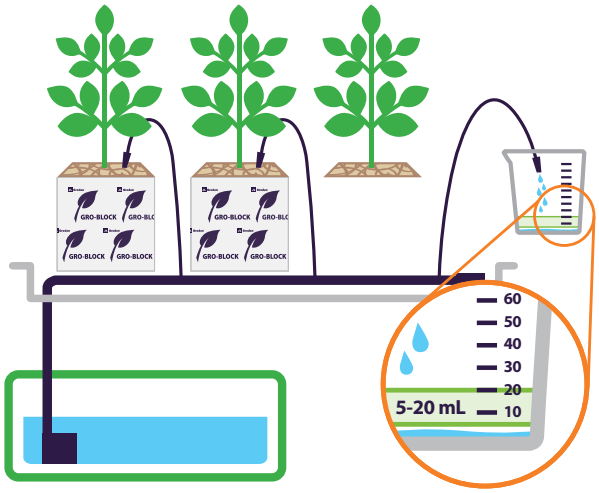
- The volume of the irrigation event should be equal to 3% to 6% volume of the stonewool that you are watering. For example a Delta10 (4"x4"x4") has a total volume of 1 liter, 3% would be 30mL. When stacking blocks on slabs or other blocks add the volumes together to determine the proper irrigation volume.

Plant Volumes and Irrigation Shot Size

Grodan Product	Real Volume (L)	Shot Size (mL)	Shot Size (mL)
		3%	6%
Small 3" (D4)	0.37	11	22
Large 3" (D5.6)	0.56	17	34
Small 4" (D6.5)	0.65	20	40
Medium 4" (D8)	0.80	24	44
Large 4" (D10)	1.00	30	60
Jumbo	2.36	71	142
Hugo	3.38	101	202
Mama	8.00	240	480
Uni-Slab	4.80	144	288
Gro-slab 6"	10.13	304	608
Gro-slab 6" fat	13.50	405	810
Gro-slab 8"	13.50	405	810
Gro-slab 12"	20.25	608	1215

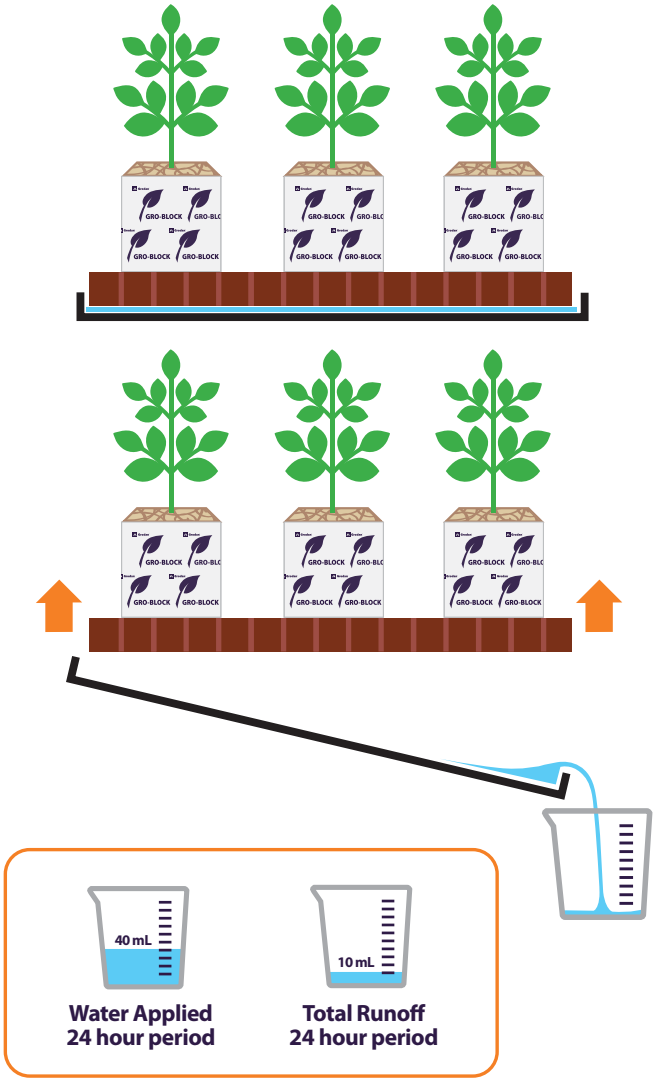
* When figuring out shot size per plants on each slab, divide by total number of plant per slab and add the size of the block you are placing on the slab. I.E. When transplanting (3) Delta10 Block onto (1) slab the 3% shot size would be 304 / 3 = 101 +30 (Delta10) = 131ml per plant on the slab.

- Using a measuring cup record the amount of time it takes the dripper(s) to achieve the 3% to 6% watering volume. That time is your PUMP ON time.
- The use of pressure compensated drip emitters (0.5 gph to 1 gph) can help ensure that all your plants receive the same volume of irrigation.
- Regular measuring of flow rates from multiple emitters will help ensure consistent watering across your farm.
- When using pressure compensated drippers, you need to ensure that your pump can meet the minimum flow rate and pressure requirements. Contact manufacturers before purchasing pumps.
- Filters, lines, and drippers should be flushed and cleaned properly between crops.



How many times a day should I water?

- Many factors drive the amount of water a plant will consume. This includes plant genetics, size of canopy, amount of light, air movement, temperature/humidity (VPD), etc, not the volume of substrate.
- Rest between irrigation events should be no less than every 30 minutes and in the early stages of growth the rest between irrigation events could be as much as several hours
- Measuring the amount (volume) of runoff can help you determine if you are over or under watering. The total amount of runoff should be about 5% to 20% of the total amount of water applied during the course of the day.
  - You can measure this by placing 1 or 3 plants in a separate tray that allows you to capture the runoff.
- At the end of the day, measure total runoff volume collected and divide by the number of plants being measured.
- You should have 5% to 20% runoff of total volume applied to the plant over the course of the day.
- Increase or decrease watering frequency as needed, but keep the volume of each irrigation event the same (3-6% of substrate volume).



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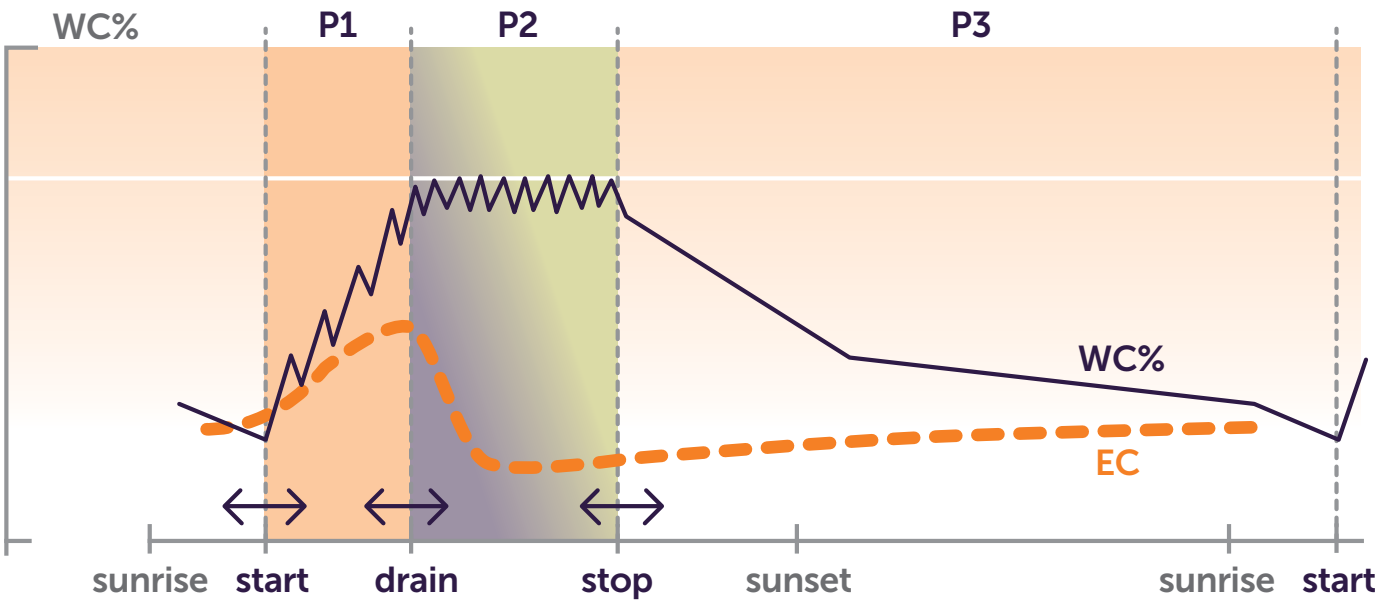
24 Hour Water Content & EC Cycle

- The chart below shows the 'day dynamic' for irrigation. It shows how the Water Content (WC) and Electrical Conductivity (EC) occur in the root zone on a daily basis.
- P1 is where irrigation is started. It occurs after lights have come on and the plants have begun to transpire. Transpiration before irrigation is the important rule in this period. Several irrigations will be applied to building up the water content until the point of first drain.
- P2 is the drain phase. In this period drain is achieved in order to control the nutrient balance and the EC within the substrate and continues until the irrigation is ended for the day.
- P3 is the dry down period of the day. It will begin a few hours before the lights are turned off, whilst the plants are still actively transpiring. The stop time in P3 in combination with the start time in P1 are used to manage and control the total dry down during the night period.

24 Hour Water Content & EC Cycle



Golden rule: "transpiration before irrigation"

EC/PPM CONVERSION

EC = PPM/500
PPM = EC x 500

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 CNB-00012-112017-E

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