growlink™

Precision Irrigation Playbook

A Copilot Crop Steering Guide



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TABLE OF CONTENTS

PAGE 01 **OVERVIEW**

PAGE 02 **FUNDAMENTALS OF CROP STEERING**

02 **Sensors**

- 02 Zone Sensor Placement
- 03 Standardizing Sensor Field Capacity
- 04 Sensor Placement Adjustment
- 05 Multi-Sensor Placement Adjustment
- 06 Comparing EC: TDR vs. Capacitance

08 **Crop Steering: Vegetative & Generative**

09 **Absolute vs. Relative Dryback**

11 **Understanding Runoff Zone**

12 **Introduction to Copilot**

15 **Understanding Copilot Irrigation**

- 15 P0 Phase
- 18 P1 Phase
- 21 P2 Phase
- 24 P3 Phase
- 27 Flush & Failsafe

PAGE 28 **ADVANCED STRATEGY**

28 **Setpoints**

- 28 Environmental Targets
- 29 Irrigation Targets

30 **Steering Breakdown**

- 30 Weeks 1-3 (Stretch)
- 34 Weeks 4-6 (Bulk)
- 36 Weeks 7-8 (Ripen)

OVERVIEW

Crop steering can seem complex, especially as new techniques and technologies continue to evolve. Copilot simplifies that complexity with a clear, step-by-step approach designed to make advanced strategies accessible and repeatable.

This updated guide builds on the original Crop Steering Fundamentals manual, diving deeper into irrigation, EC and dryback management while introducing refined setpoints and control methods powered by Growlink's Copilot. By combining practical steering concepts with Copilot's intelligent automation, growers can translate data into calculated decisions, unlocking consistency and higher performance across every stage of cultivation.

This guide provides a structured framework you can adapt to fit your operation, helping you steer smarter, not harder.

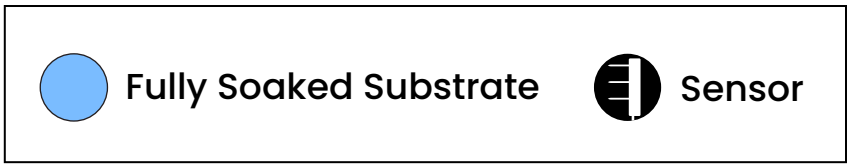


Zone Sensor Placement Strategy

To identify optimal sensor placement within an irrigation zone, refer to the images below. This placement strategy can be applied at any point during a run.

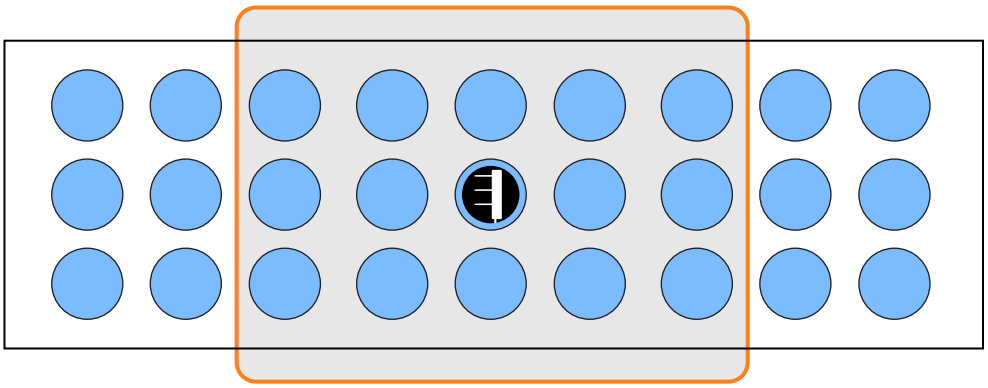
Ideal Sensor Safe Zone

Place Sensor Anywhere Within This Zone

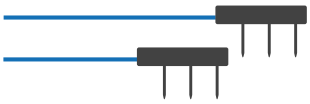


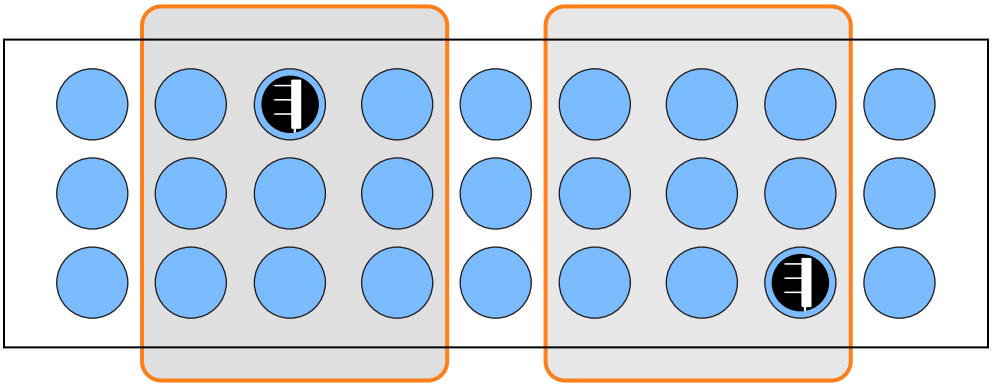
Single-Sensor Placement



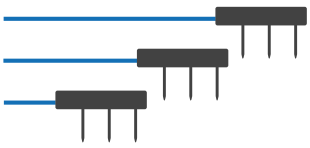


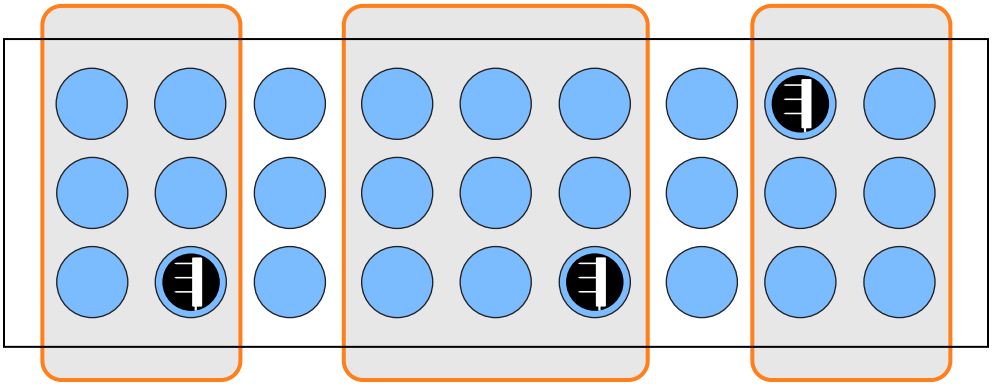
Dual-Sensor Placement





Multi-Sensor Placement





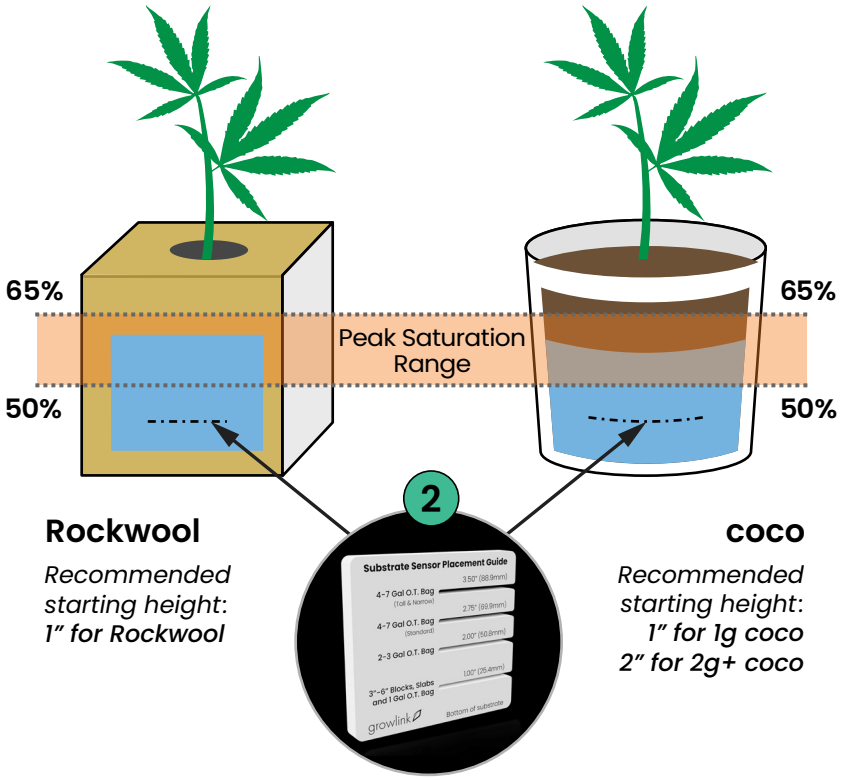
Standardizing Sensor Field Capacity for Absolute Dryback Control

The first step to ensuring success with Growlink's Copilot program is smart substrate sensor placement, which sets the foundation for your field capacity strategy. Aim for 50–65% peak saturation to allow a true 30% dryback without risking skewed readings.

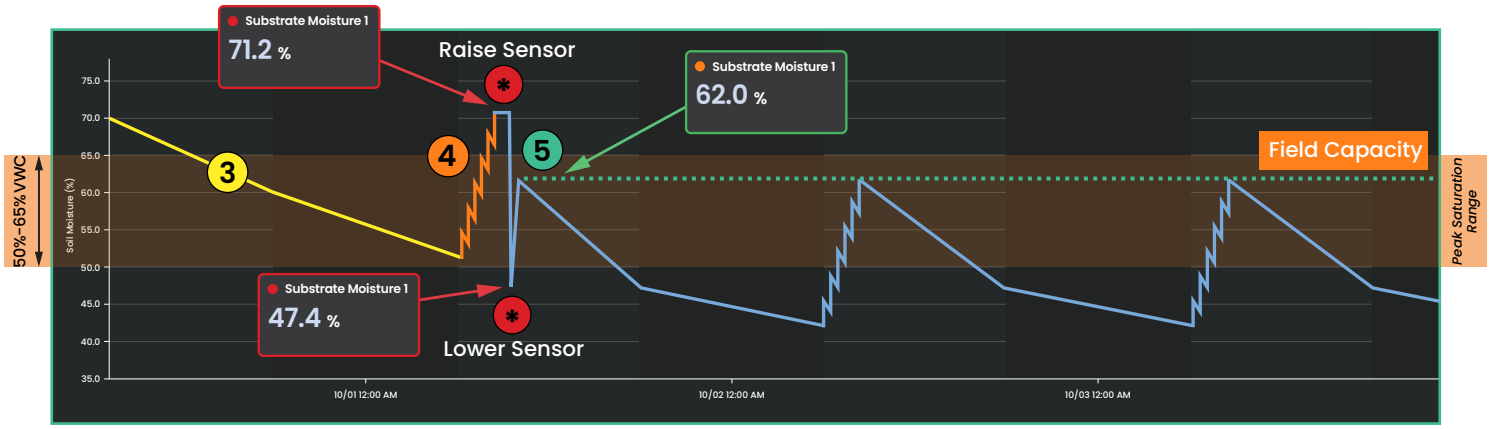
1 Initial Hydration
Fully hydrate the substrate medium.

2 Insert Sensor
For initial sensor placement, refer to the **Substrate Sensor Placement Guide.**

3 Initial Dryback
Monitor for initial 20% dryback target.



** All dryback values in this guide are Absolute.* *(see Relative vs Absolute, p.09-10)*



4 Fully Irrigate the Substrate
Irrigate the substrate to field capacity using drip emitters until VWC stops rising.

5 Observe VWC Reading
Sensor readings define field capacity and indicate if adjustments are required.
If out of range adjust sensor.*

*
If the reading caps out **above 65%, raise** the sensor slightly and check again.

If the reading is **below 50%, lower** the sensor slightly and check again.

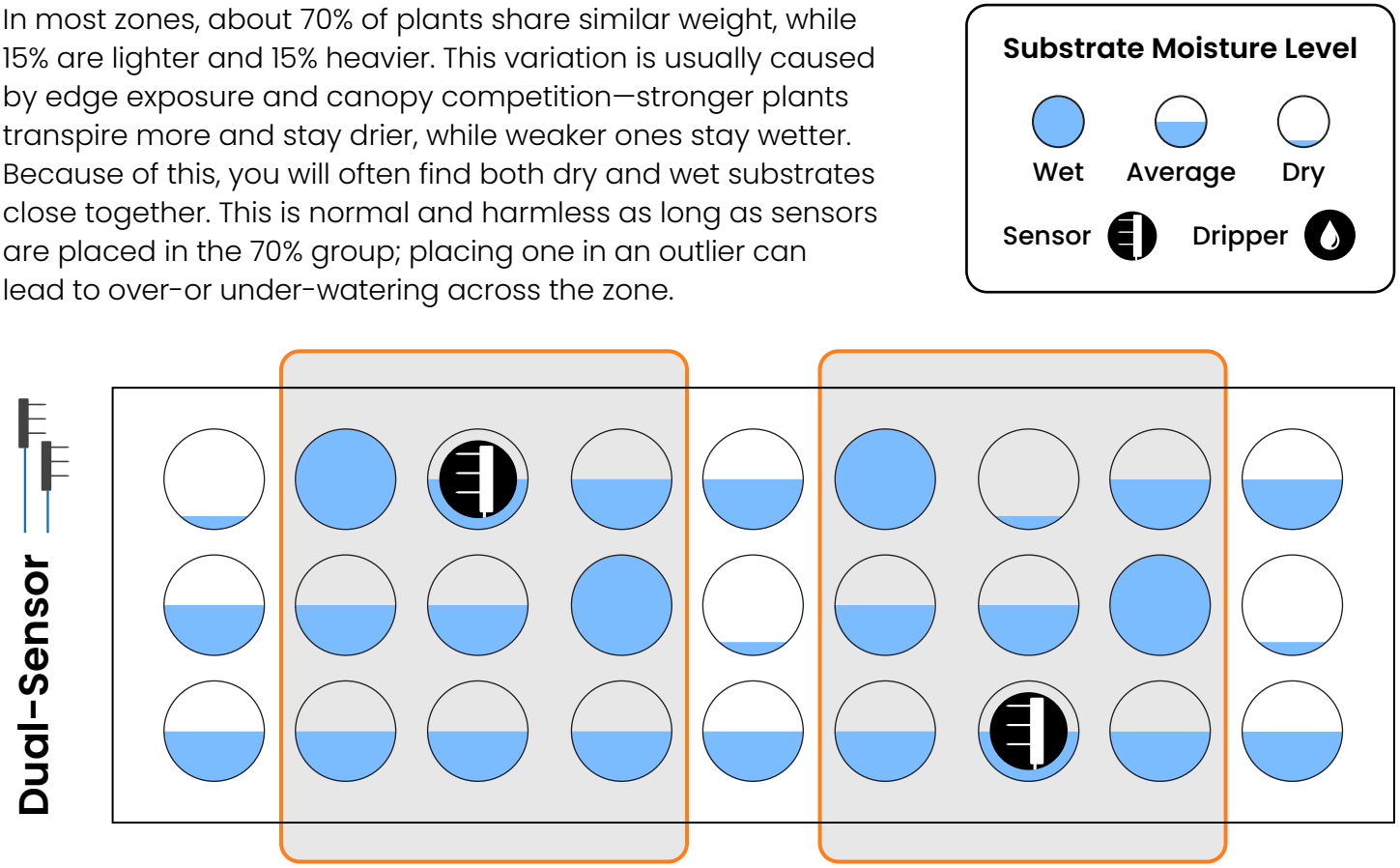
Repeat this process until readings at peak saturation fall within the recommended range.



Sensor Placement Adjustment

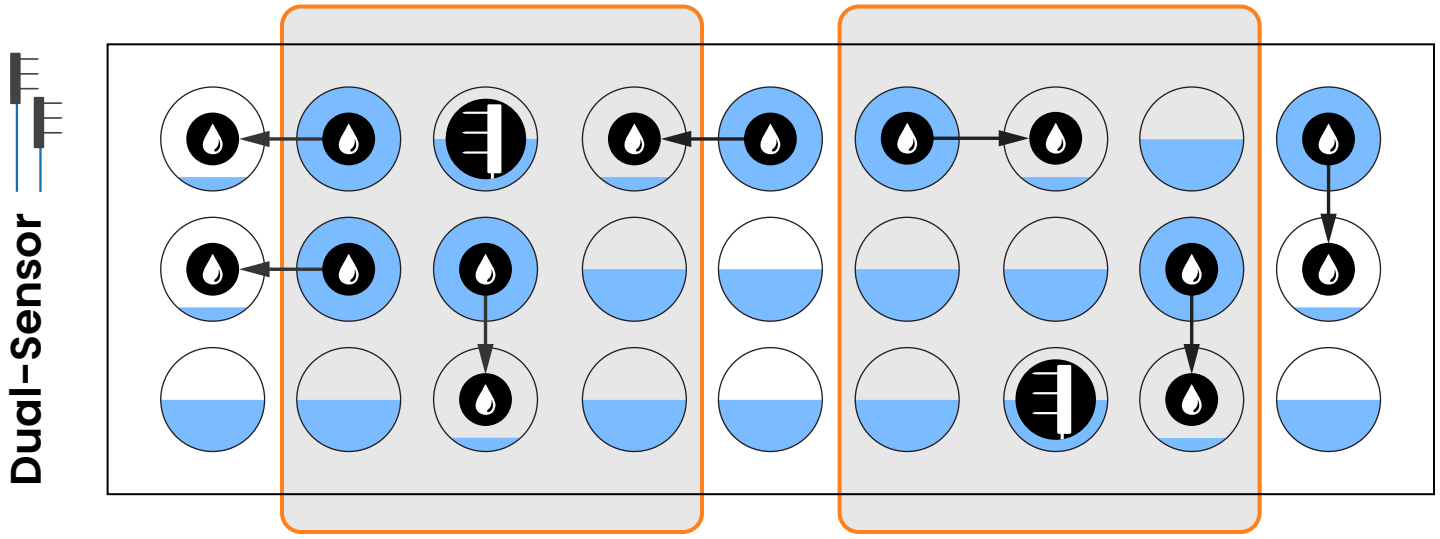
70/15/15 Rule

In most zones, about 70% of plants share similar weight, while 15% are lighter and 15% heavier. This variation is usually caused by edge exposure and canopy competition—stronger plants transpire more and stay drier, while weaker ones stay wetter. Because of this, you will often find both dry and wet substrates close together. This is normal and harmless as long as sensors are placed in the 70% group; placing one in an outlier can lead to over-or under-watering across the zone.



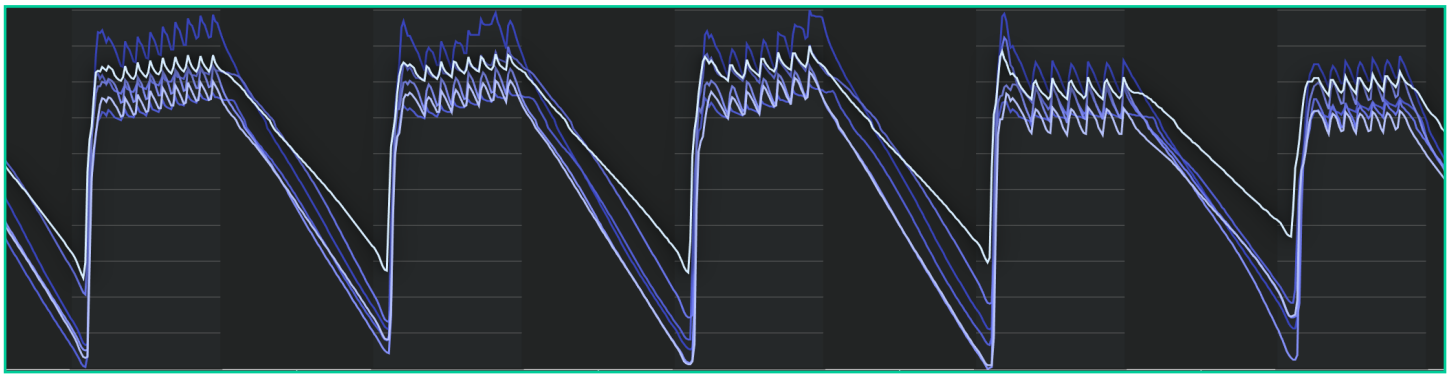
50/25/25 Rule

If the ratio shifts toward 50/25/25 or worse, move drippers from wetter plants to nearby drier ones to help rebalance.

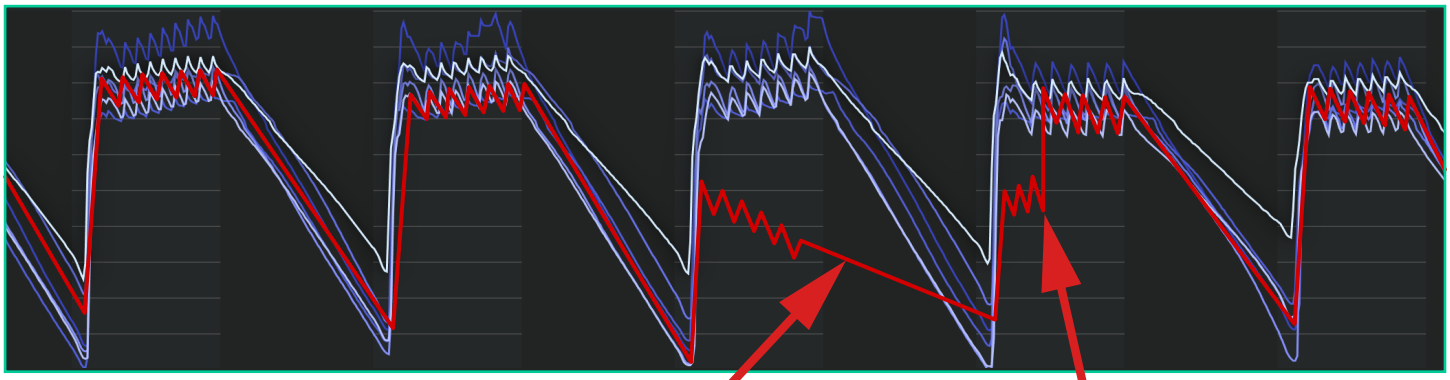


Multi-Sensor Placement Adjustment Strategy

When placing multiple probes in a zone, all VWC% readings should be within **5%** of each other at maximum saturation (Field Capacity) to maintain data accuracy and eliminate outliers when calculating averages.



Sensors may drift during periods of extreme drybacks or low permittivity (weeks 1-3), but usually stabilize once the substrate is consistently rehydrated (weeks 4-6)—monitor readings closely during this time.



Sensor Drift

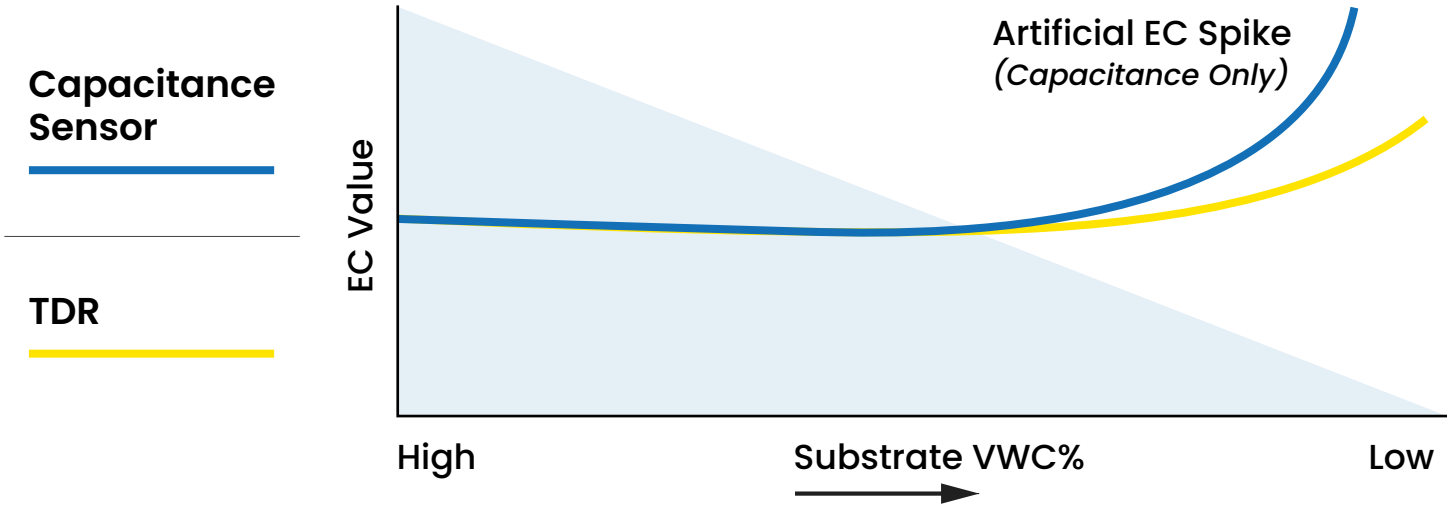
If a sensor drifts, verify the substrates physical weight to confirm it represents what the sensor is reading. If it does not, reinsert the sensor using fresh holes in the same, or nearby substrate with similar weight.



Comparing EC: TDR vs. Capacitance

Capacitance (Terralink) and TDR (Acclima 310/305/Terralink+) sensors measure EC differently. Capacitance sensors often show artificially higher EC during periods of low permittivity (low VWC%), while TDR sensors record EC and VWC separately—avoiding this spike.

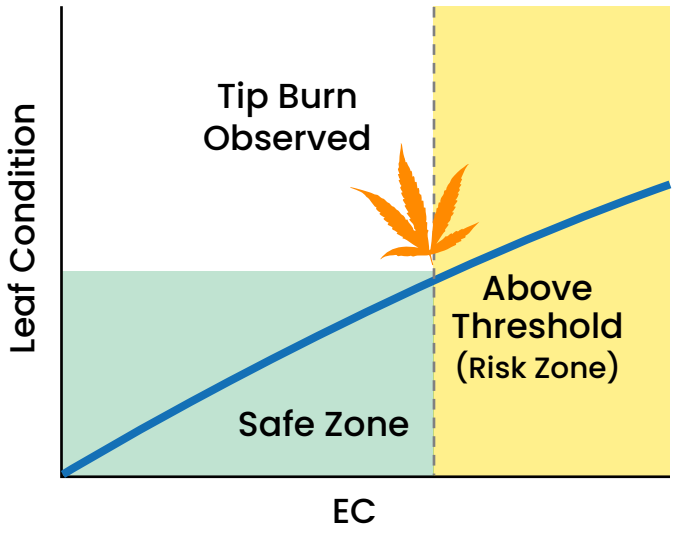
For example, the same pot may read 12 EC with a capacitance sensor but only 6–8 EC with a TDR. Because of this, EC targets should be adjusted based on the sensor type.



Important Note: EC targets aren't universal. Genetics, substrate type and sensor technology all affect readings, so there's no single "correct" target.

The most reliable method is to watch the plants. When stacking EC, monitor leaf tips for early signs of burn. Once tip burn appears, check your sensor data to find the EC value at that point, this becomes your threshold for that setup.

Use that value to fine-tune EC management for your specific substrate, sensor, and genetic combination.

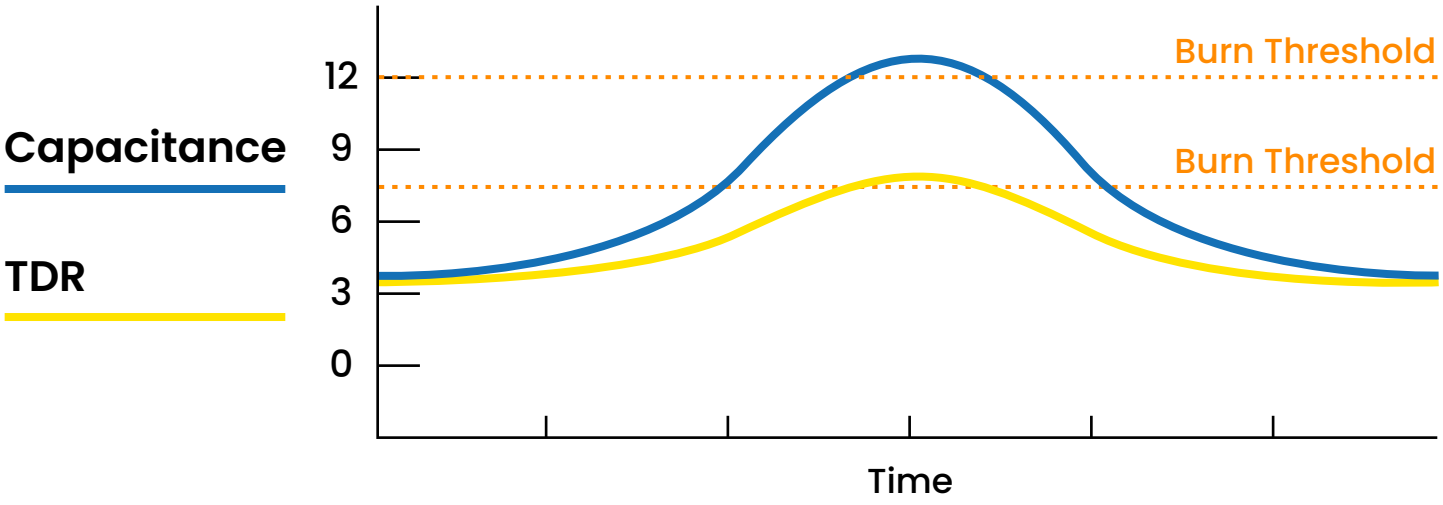


Warning: Exceeding the established EC threshold can lead to irreversible leaf damage, nutrient lockout, and reduced yield quality. Always adjust gradually and confirm plant response before making additional increases.

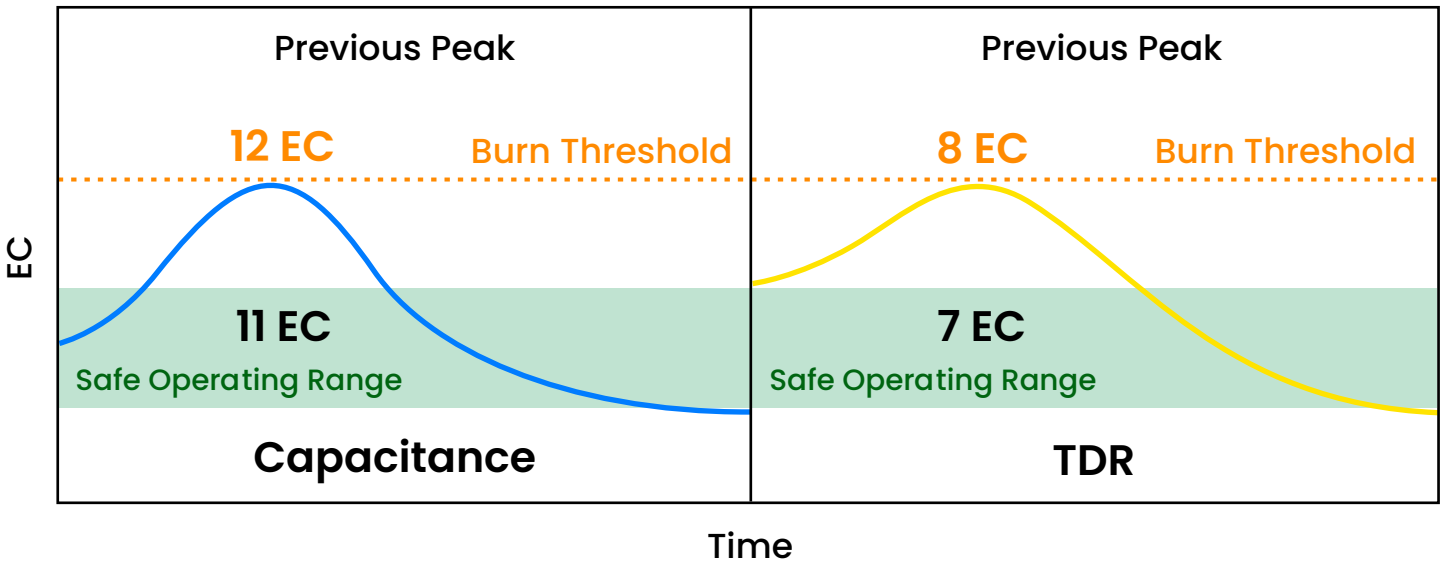
**** For more information, refer to our knowledgebase guide.*** *https://knowledgebase.growlink.com*

Comparing EC: TDR vs. Capacitance

Use leaf tip burn to signal that substrate EC levels have exceeded the plants tolerance threshold. When both sensor types are used in the same irrigation zone, data may show the capacitance sensor reading 12 EC at peak while TDR reads 8 EC.



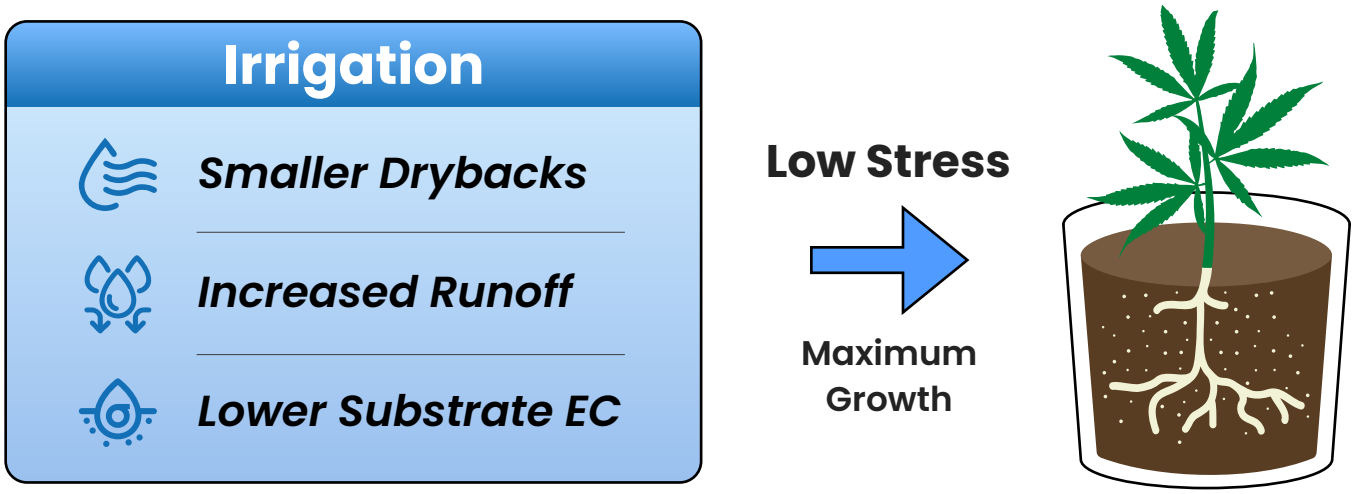
Use this information to adjust your EC strategy by lowering the target by 1 EC to prevent further burn while maintaining the highest safe level. The exact readings—whether 11 or 7 EC—matter less than staying below the burn threshold.



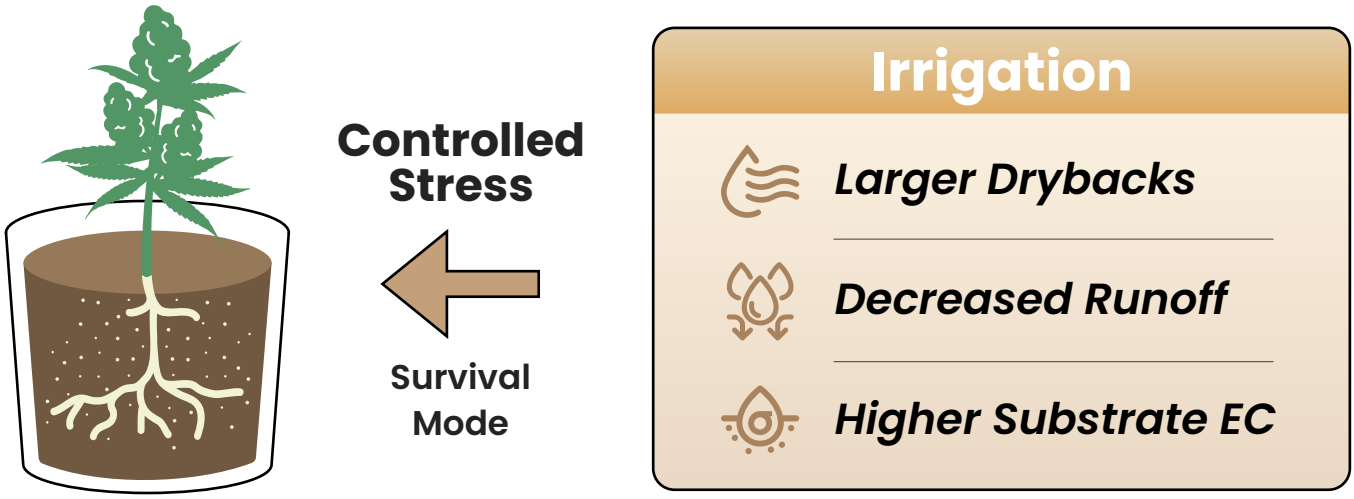
Throughout the remainder of the flower cycle, this data can guide how aggressively EC levels should be stacked when necessary.

Crop Steering: Vegetative and Generative

Vegetative steering creates low-stress, ideal conditions that signal the plant to prioritize rapid leaf, root, and structural growth. This is achieved by dialing in environment and irrigation to optimize conditions and growth.



Generative steering intentionally applies drought and salinity stress to shift the plant into survival mode, triggering a hormonal response that prioritizes reproduction over vegetative growth. By increasing overnight drybacks and substrate EC, the plant prioritizes bud site formation—laying the foundation for higher yields.



Absolute vs. Relative Dryback

Two ways to calculate dryback from the same starting point.

Absolute Dryback

Substract a fixed number of % VWC

Formula:
FC - Dryback%

Relative Dryback

Substract a percentage of the starting value

Formula:
FC x (1 - Dryback%)

Example: Starting at 60% FC

Absolute 30%	Relative 30%
60 - 30=	60 x (1 - 0.30)=
30%	**42%**

1. Endpoint Comparison at Different Starting Points

Dryback Type	Formula	Starting FC = 60%	Starting FC = 40%
		Ending VWC	Ending VWC
Absolute 30%	FC - 30	**30%**	**10%**
Relative 30%	FC x 0.70	**42%**	**28%**

Same dryback % = different ending points with Absolute.
Same % of starting value = different dryback %, same proportion with Relative.

2. How Ending VWC Changes as Dryback % Increases

Starting FC = 60%

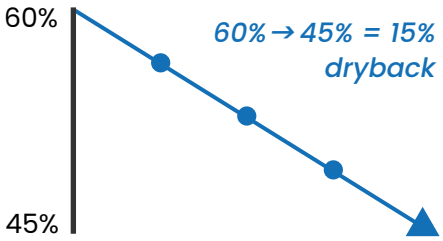
Dryback %	Absolute Ending VWC	Relative Ending VWC
0%	60%	60%
10%	50%	54%
20%	40%	48%
30%	30%	42%
40%	20%	36%
50%	10%	30%

Absolute drops in a straight line.
Relative drops in a curve.

3. Two Ways to Interpret Dryback

Absolute Dryback

Straight subtraction from the number you see on the screen.



This is what your graph is showing you. Simple, direct, no extra steps.

Relative Dryback

Dryback expressed as a % of that sensor's field capacity.



Puts the change in context of the sensor's full range. Useful for comparison.

Quick Reference

30% Absolute Dryback
Think: "Minus X Points"
Example: *60% - 30 = 30%*

VS.

30% Relative Dryback
Think: "Minus X% of what's there"
Example: *60% x 70% = 42%*

Key Takeaway:
Absolute subtracts a fixed amount. Relative substracts a percentage of the starting value.

Absolute vs. Relative Dryback

How to interpret what your substrate sensors are telling you.

When to Use Each

Use ABSOLUTE DRYBACK when:

- You're in a consistent environment
- Sensor placement is fixed and repeatable
- FC values are stable
- You want to read graphs, set triggers, and make real-time irrigation decisions

Absolute = Control and Execution

Use RELATIVE DRYBACK when:

- Comparing across substrates (coco vs rockwool)
- Comparing rooms or facilities
- FC baselines are different
- Readings aren't directly aligned.
- You want to understand dryness relative to each sensor's range

Relative = Comparison and Normalization

★ Why Absolute is Preferred Here ★

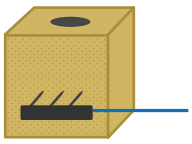
Earlier in this guide, sensor placement was standardized and each sensor adjusted to read a similar field capacity—this is what makes everything else work. Once aligned, all sensors operate on the same scale, so "full" means roughly the same everywhere and the readings are truly comparable.

At that point, normalizing data with **Relative** calculations offers no real benefit.

Absolute Dryback becomes:

- ✓ Easier to read
- ✓ Faster to act on
- ✓ More consistent across your system

Understanding the Signal



Substrate sensors do not measure water volume directly. They measure how the substrate behaves electrically in the presence of water (permittivity), which is then converted into a VWC reading. It's a very useful signal, but it's not a direct or perfectly linear representation of the volume of water that is actually in the container.

What Sensors Are Good At

- ✓ How fast things are drying (slope)
- ✓ When dryback is happening
- ✓ Where you are between wet and dry
- ✓ How the root zone is behaving over time

Great for timing irrigation, spotting stress early, and keeping your system consistent.

What Sensors Are Not Good At

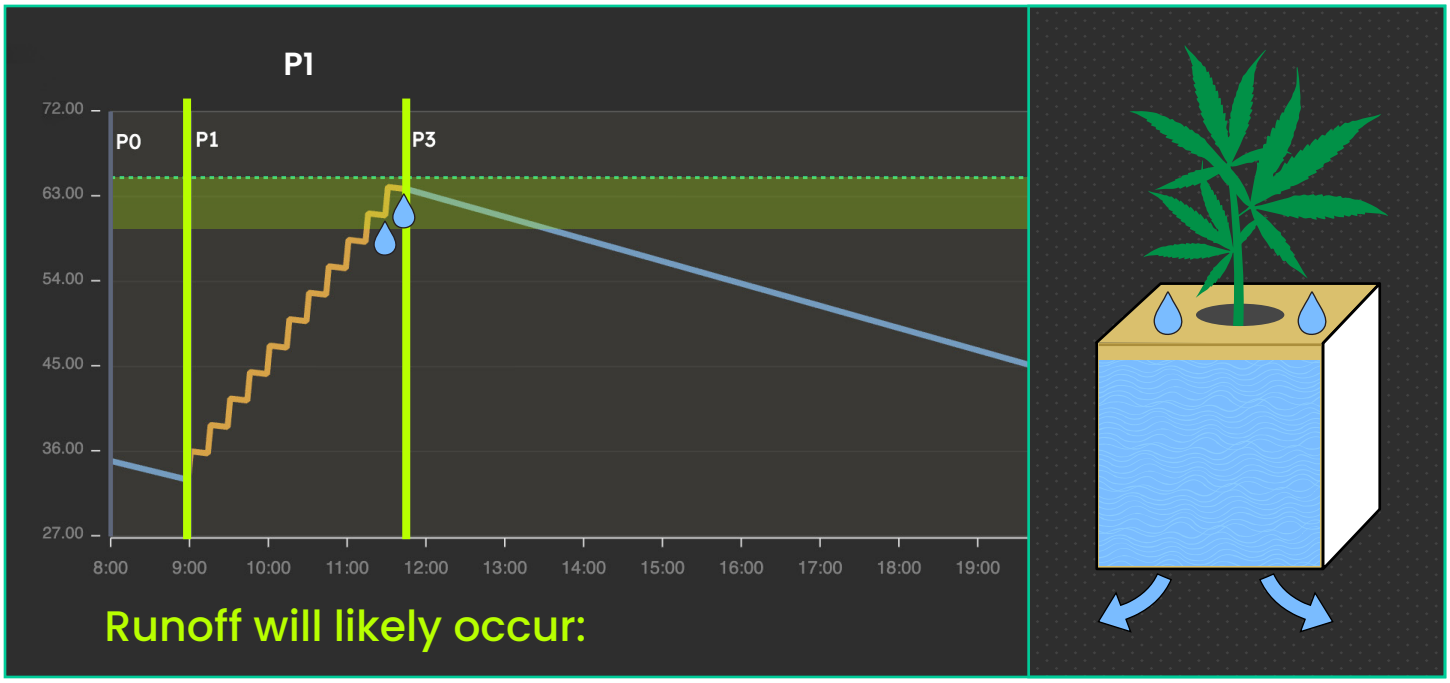
- ✗ Calculating exact water loss
- ✗ Confirming precise shot sizes
- ✗ Comparing true water content between different setups

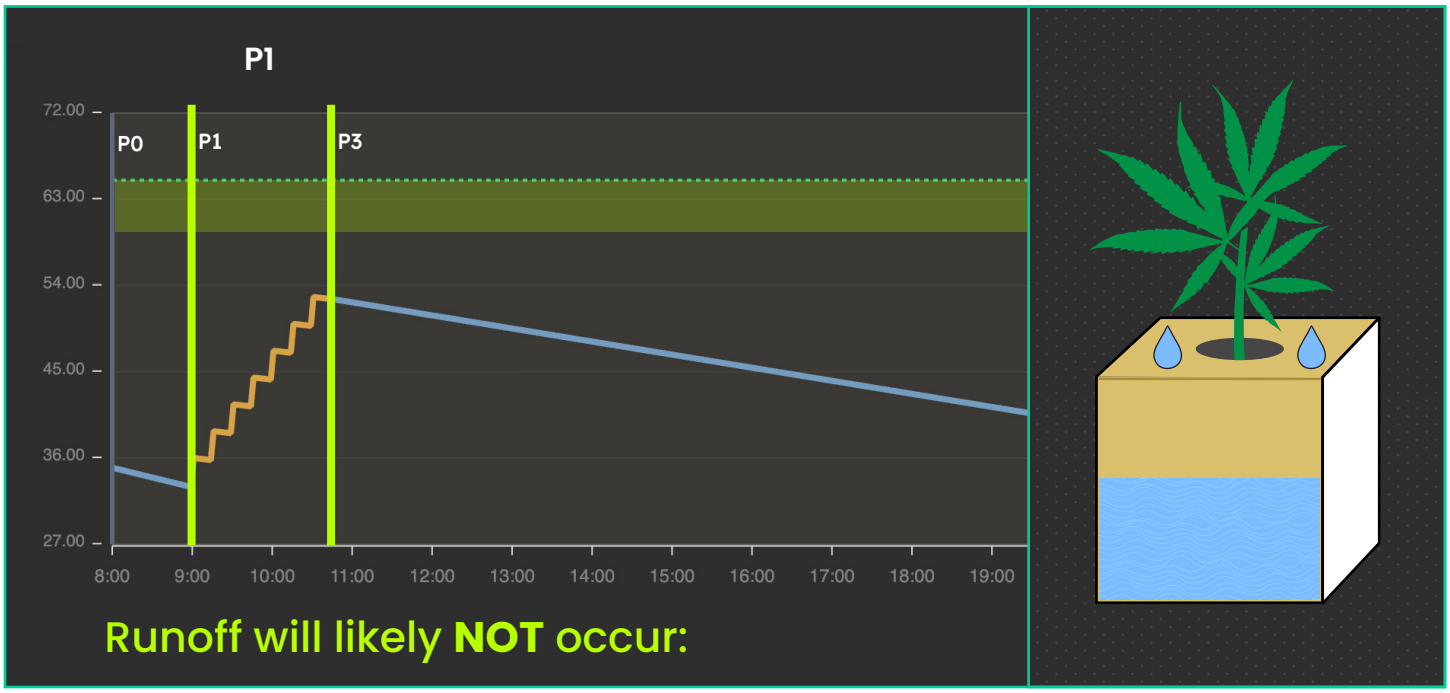
Think of it as a signal not a measuring cup.

Remember: **Sensors measure local moisture status, not exact water volume.**
Stay consistent, use good data, and let the plant be your ultimate guide.

Understanding Runoff Zone

Runoff occurs when a shot is given at or close to the field capacity of a given substrate. If **Runoff** occurs when irrigating far below the runoff zone, this is an indicator that your shot size is too large and is causing channeling.

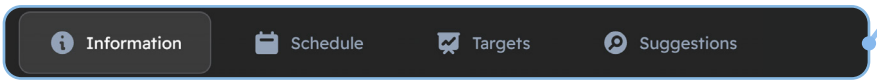


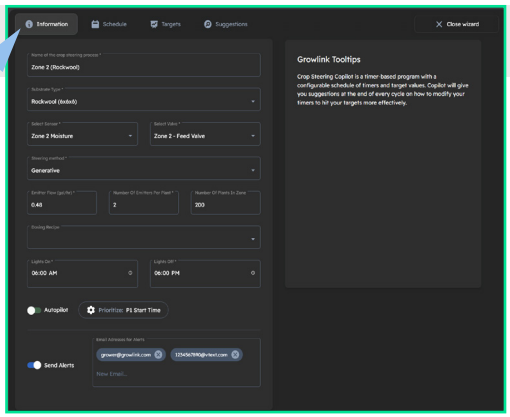


Introduction to Copilot

Copilot is a timer-based program with a configurable schedule and defined setpoints, providing daily suggestions to help fine-tune irrigation events and better reach defined targets. The program utilizes four tabs: **Information**, **Schedule**, **Targets**, and **Suggestions**.

Information Tab

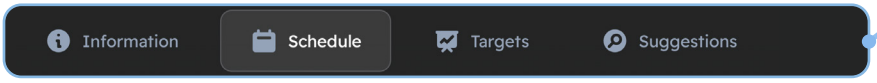


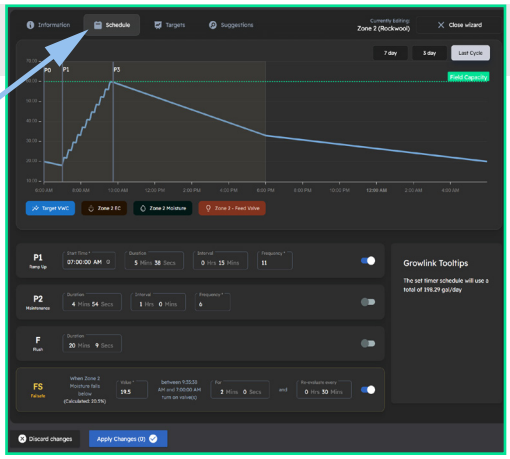


The **Information Tab** defines the grow setup, including substrate, valves, sensors, emitters, starting **steering method***, photoperiod, alerts, and optional Autopilot enable, helping prepopulate target setpoints and provide totalized flow data.

** Steering method is used to prepopulate target values upon initial creation. Any target setpoint changes made within the active program will override these values. Once active, changes made here will not impact the program.*

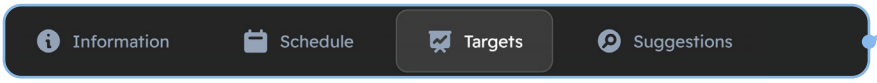
Schedule

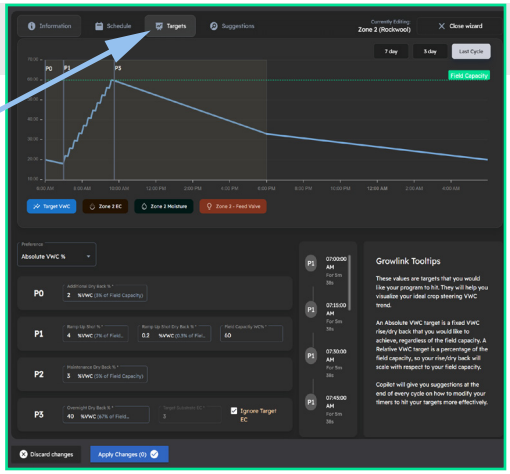




The **Schedule Dashboard** is where Irrigation timers are configured, broken down into P1 Ramp up, P2 Maintenance and Flush phases, along with optional Overnight Failsafe. All changes made on this page will be reflected in the interactive graph at the top of the page.

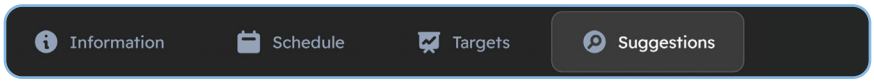
Targets



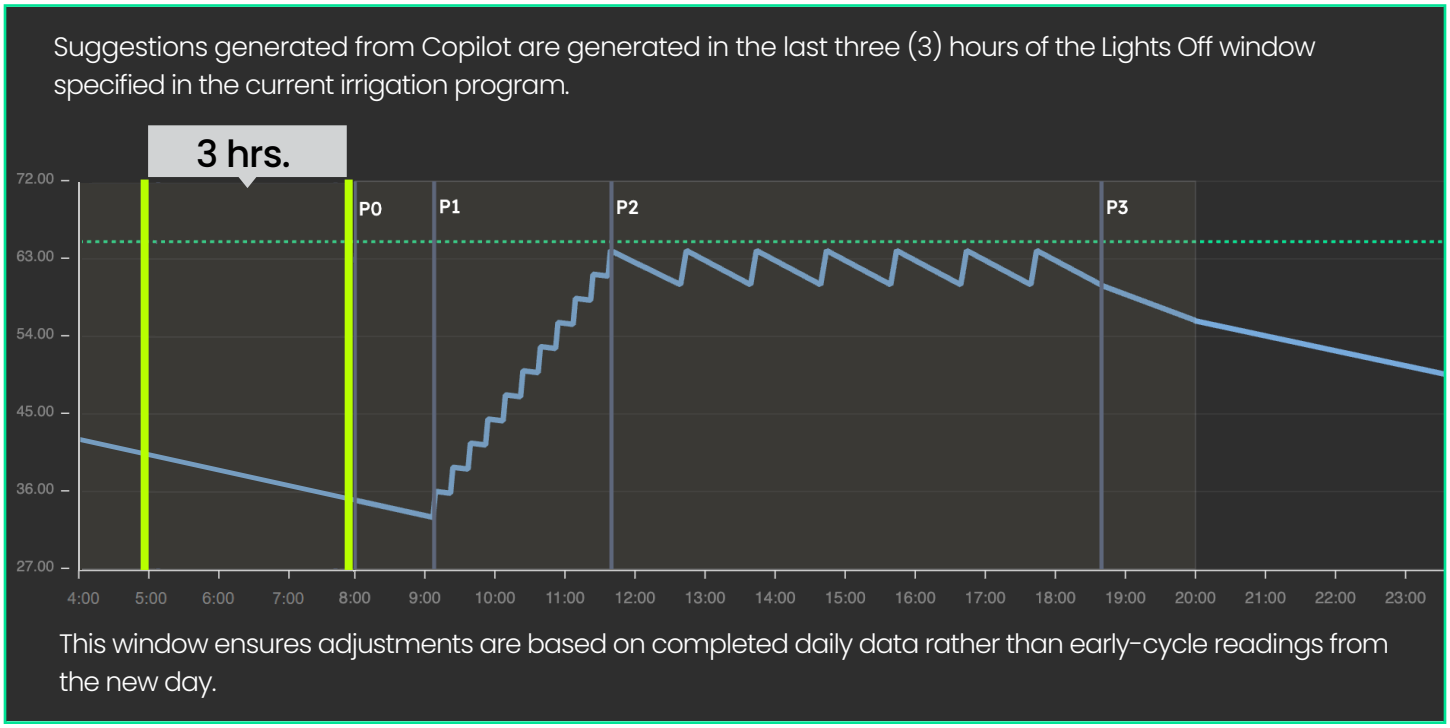


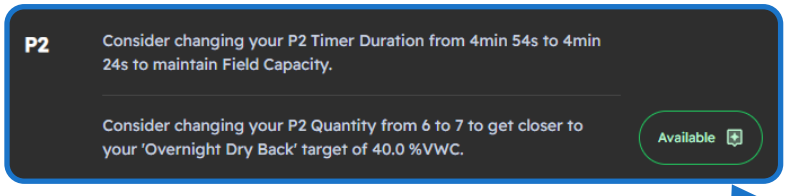
The **Targets Dashboard** is where users can define the exact Crop Steering targets they would like to achieve. Copilot will use these targets to help generate suggestions to help you reach your goal.

Suggestions

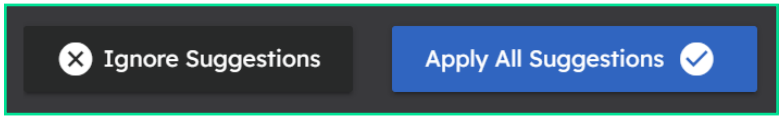


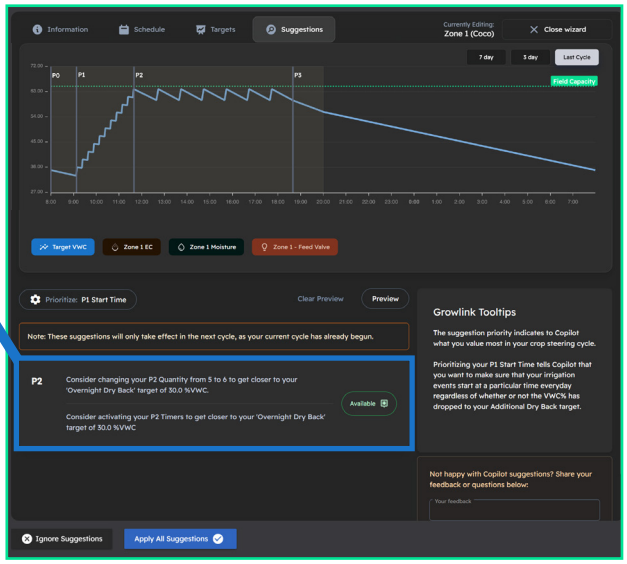
The **Suggestions Dashboard** is where you can view the daily recommendations generated by the AI Copilot program. These suggestions can be previewed on the interactive graph, allowing you to easily see and evaluate the recommended changes. Copilot keeps you in full control, allowing you to appy or ignore suggestions.





Suggestions can be applied or ignored using the "Apply Changes" or "Ignore Suggestions" buttons.





Note: *Not applying Suggestions within the three hour window will result in Suggestions being a day behind.*

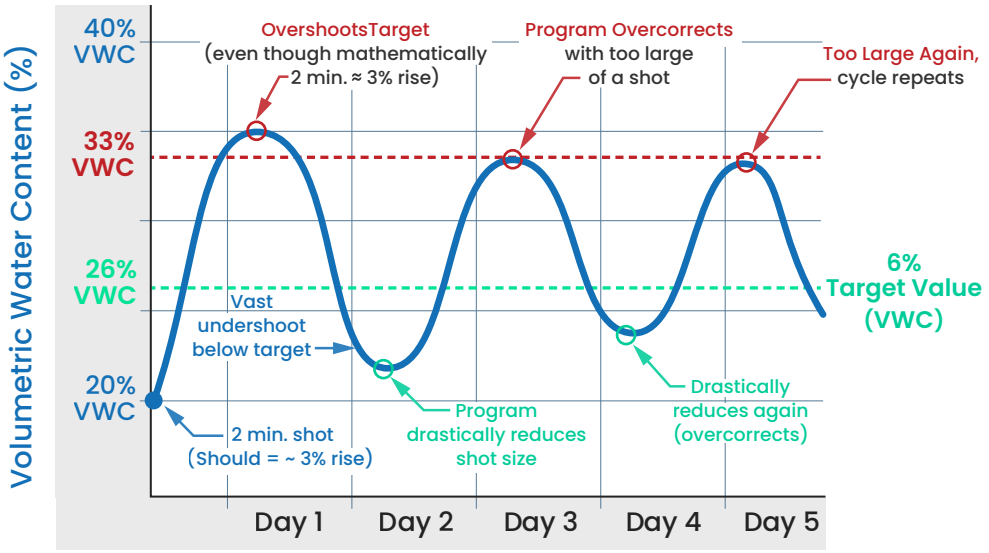
Suggestions

Copilot operates on a sliding scale to gradually make changes over time to hit targets exactly. This approach ensures you are not drastically swinging.

Going from 3% (2 minute) shot size → 6% shot size

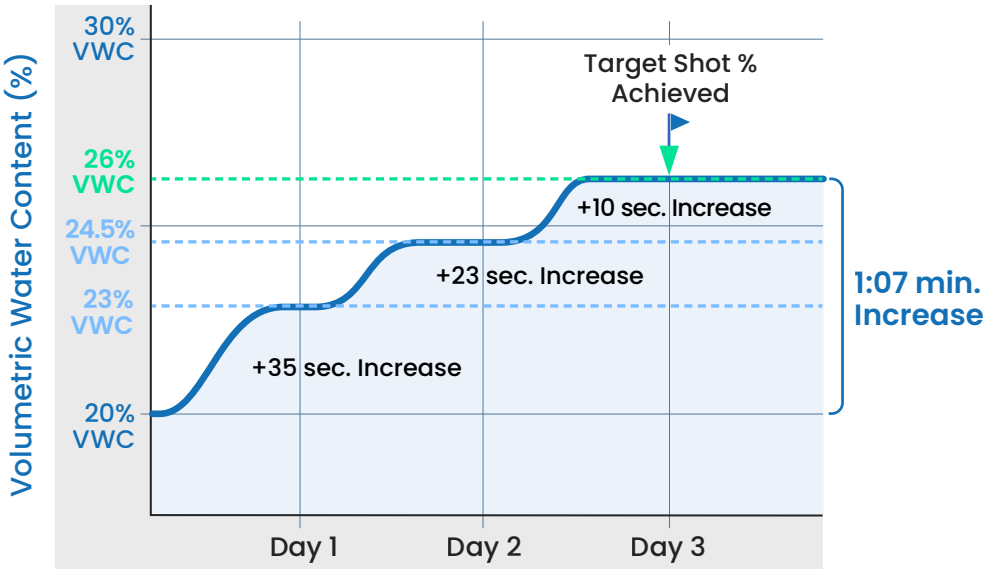
Aggressive Strategy: Sharp Increase

Constant overcorrection causes VWC to oscillate above and below target. The system never settles and remains inconsistent.



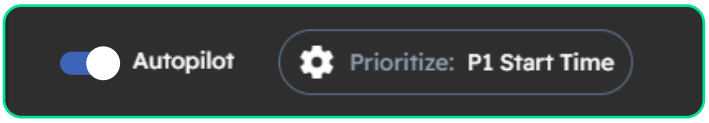
Controlled Strategy: Gradual 3-Day Increase

Gradual approach avoids rapid fluctuations. Each day's adjustment is followed by reevaluation before the next incremental change is applied.



Autopilot

Enabling **Autopilot** allows the program to automatically apply suggestions each day so you never fall behind.

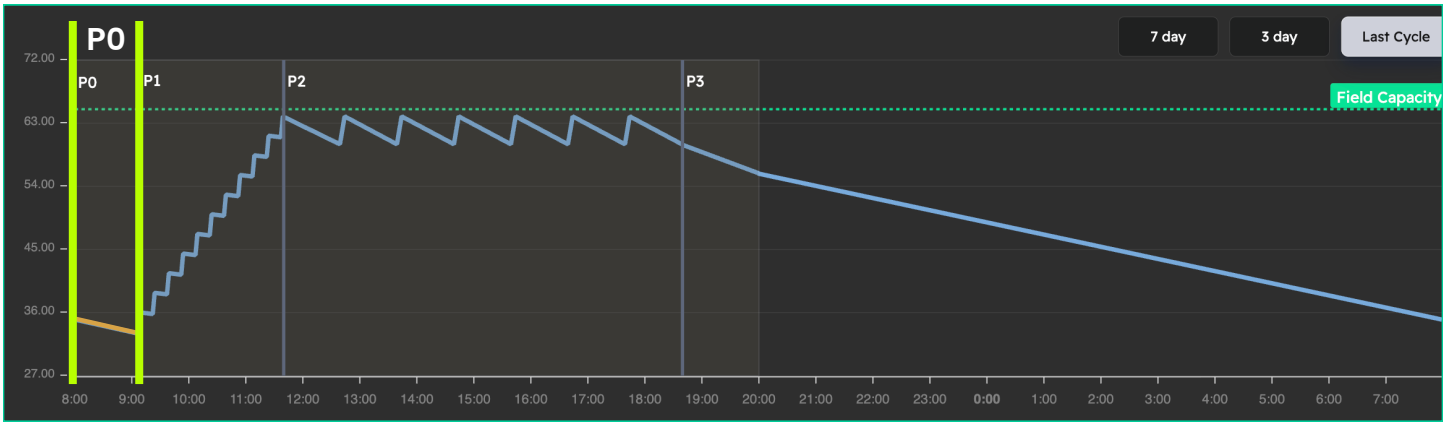


Understanding Copilot

In this section we'll break down the **Four Phases of Crop Steering** and how to configure them using the Copilot program.

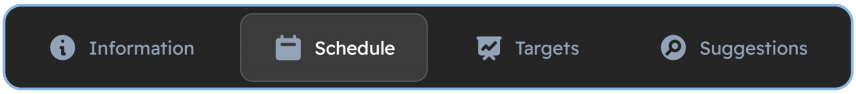
P0 Phase - Additional Dryback

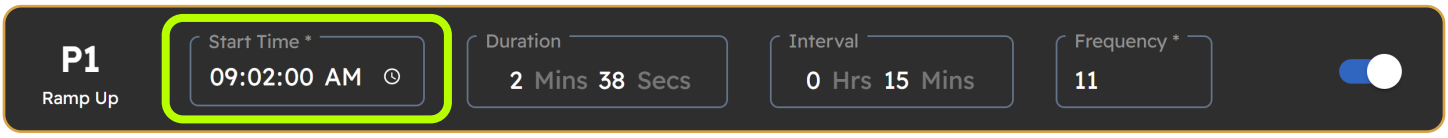
P0 or **Phase 0** is the time period between lights on and the first P1 irrigation event of the day.



Typically, a **1-hour delay** from lights-on is used when steering vegetatively, while a **1–2 hour delay** is used when steering generatively.

P1 Start delays are configured by setting the P1 Start Time under the Schedule Tab.





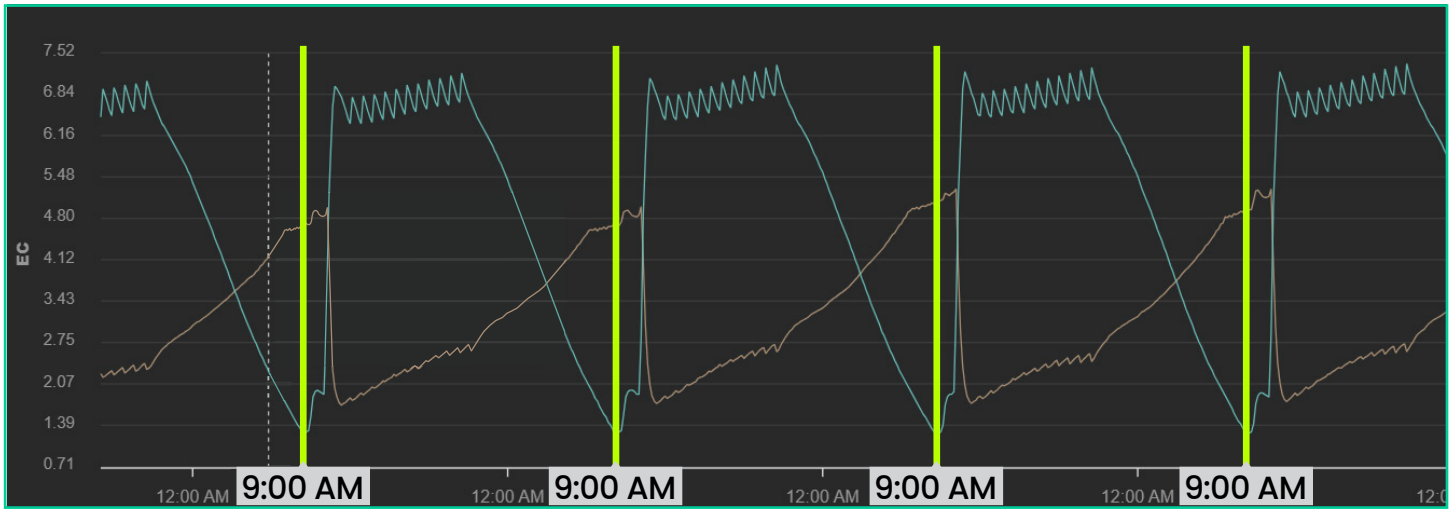
During this phase, additional drybacks of **1–3%** are commonly applied for vegetative steering, whereas drybacks in the **2–5%** range are more often used when steering generatively.

Additional Dry Back % is configured under the Targets Tab.





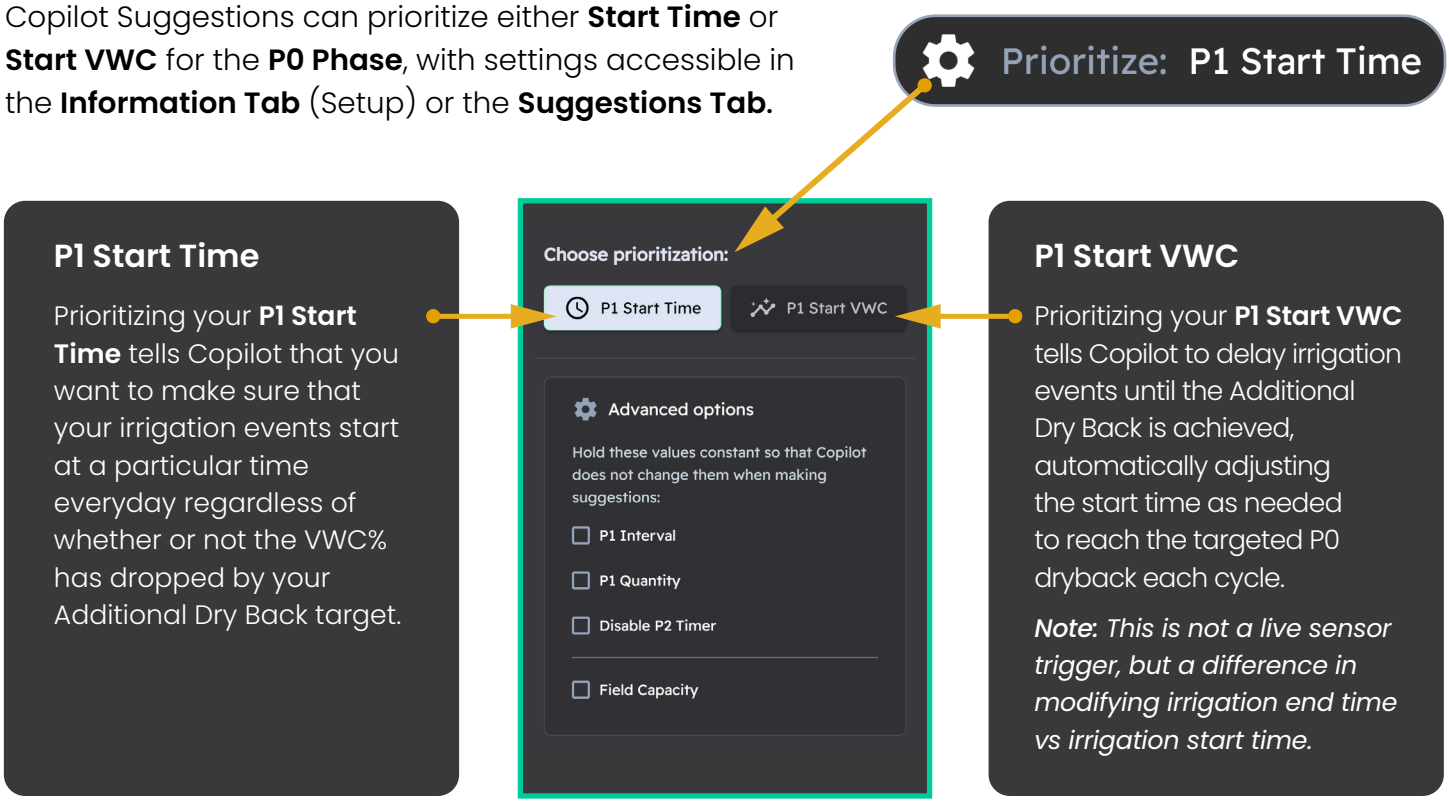
By default, Copilot prioritizes a fixed **P1 Start Time** to maintain a consistent ***circadian rhythm***, which plants generally respond to more effectively.



Circadium Rhythm: *An internal, self-sustaining biological clock that regulates physiological and metabolic processes-such as photosynthesis, flowering, and leaf movement—to align with the 24-hour day-night cycle.*

Advanced Prioritization (Start Time vs. VWC)

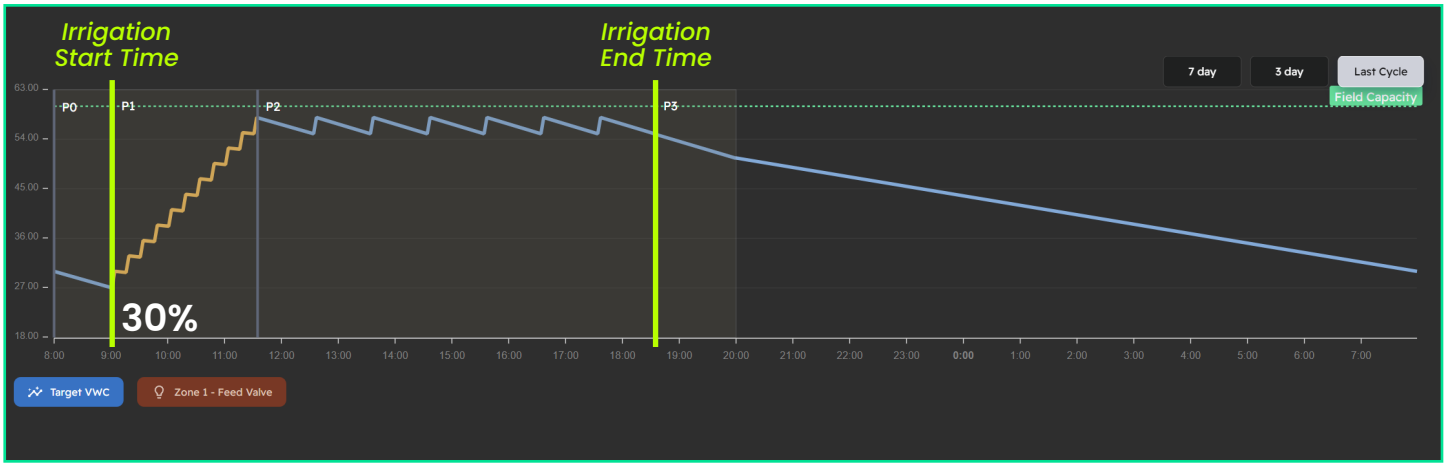
Copilot Suggestions can prioritize either **Start Time** or **Start VWC** for the **P0 Phase**, with settings accessible in the **Information Tab** (Setup) or the **Suggestions Tab.**



When **P1 Start Time** is selected, the algorithm adjusts the irrigation end time to ensure the desired starting VWC% is reached at the specified 'Start Time' the following day, providing the benefits of both fixed timing and adaptive control.

***Note: P1 Start Time** adjusts irrigation end time - **Start VWC** adjusts irrigation start time*

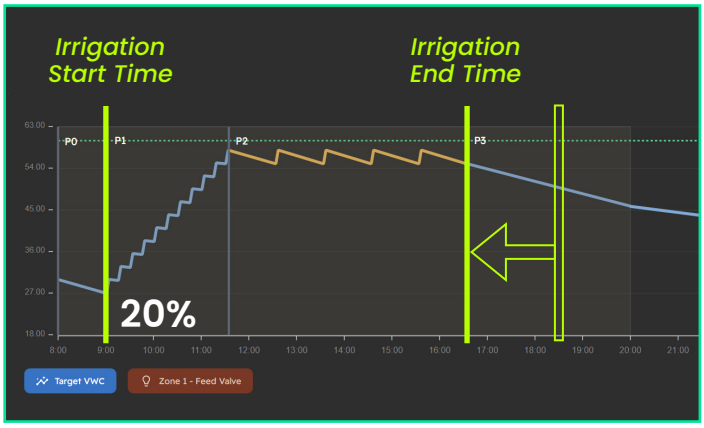
Example 1: Baseline Model



P1 Start VWC value at 9am = 30%

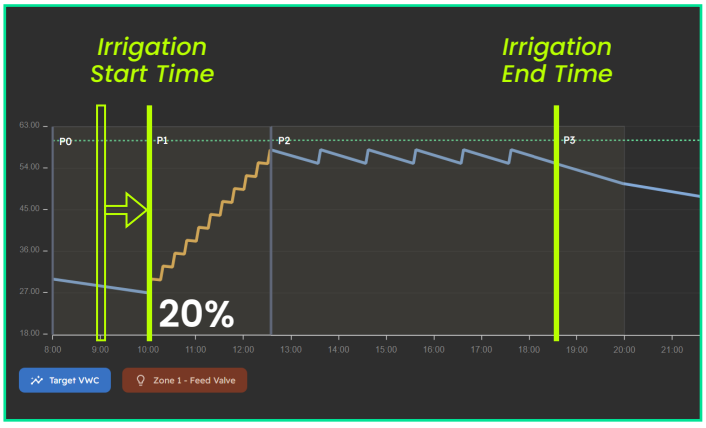
In **Example 1**, we are starting P1s at **30% VWC**. If we wanted to change this to start our P1s at **20% VWC**, the examples below demonstrate how the program would adjust setpoints based on which prioritization is selected. Notice how the same results are achieved in both examples, the only difference is in the way they are achieved.

Example 2: Start Time Model



P1 Start VWC value at 9am = 20%

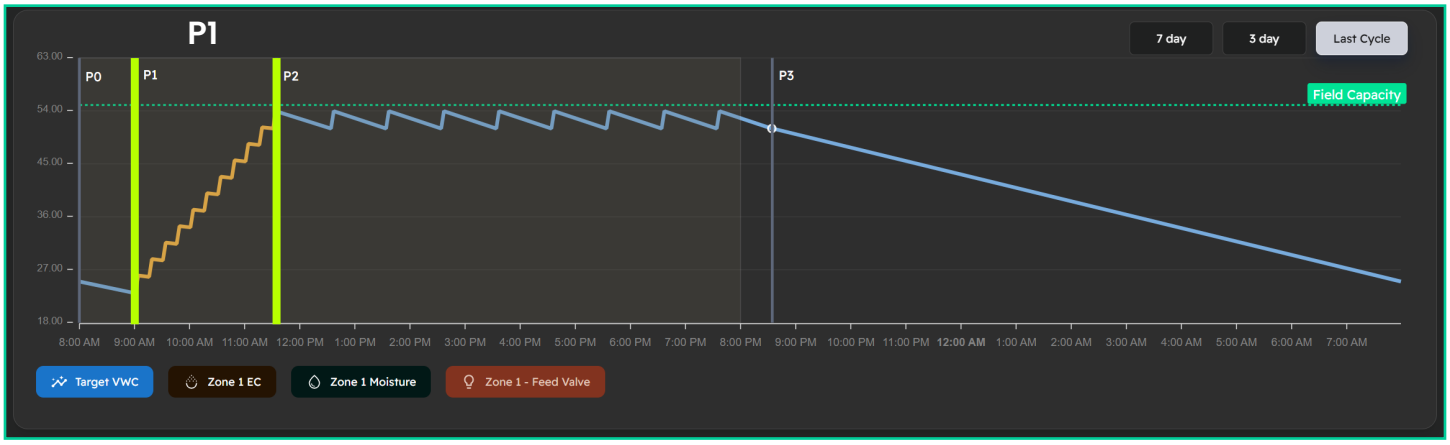
Example 3: Start VWC Model



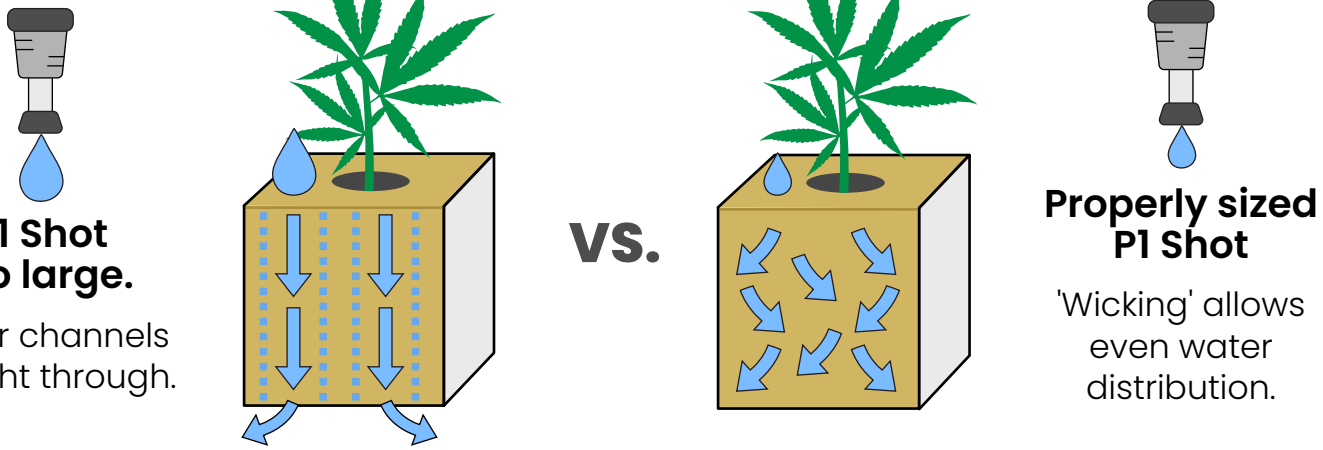
P1 Start VWC Value at 10am = 20%

P1 Phase - Ramp Up

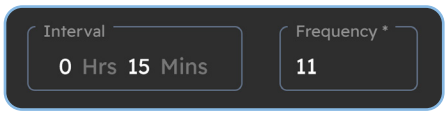
P1 or **Phase 1** is defined as the time between the first irrigation event of the day and when the substrate reaches its maximum target VWC%, also known as the **"Ramp Up"** phase.

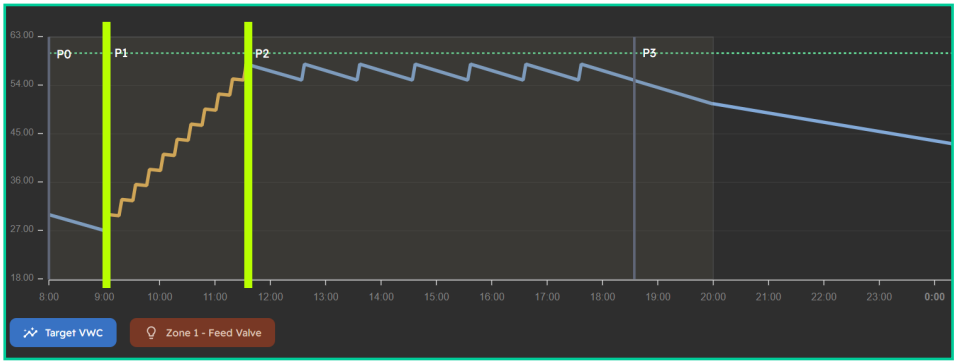


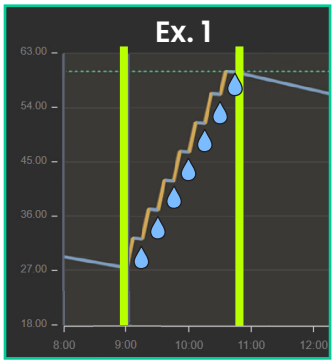
The main purpose of the P1 Phase is to rehydrate the substrate as fast as possible without causing excess channeling. This means small shots, given frequently.



In an ideal scenario, no more than a **3% shot** is typically needed, with intervals ranging from **15–30 minutes**.







Duration
5 Mins 33 Secs

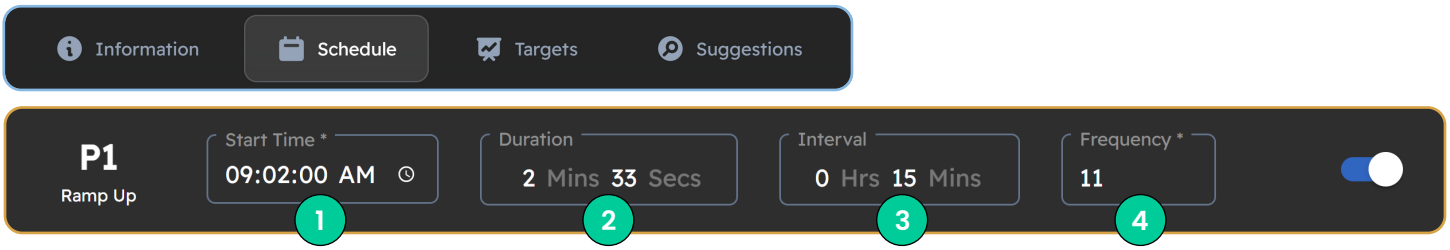
Duration
3 Mins 33 Secs



If significant runoff occurs during the P1 phase **(Ex.1)**, this indicates the shot size should be reduced. It is normal to see small amounts of runoff during the final P1 shots as field capacity is approached. Once an ideal P1 shot sequence is established **(Ex. 2)**, it can be maintained throughout the entire flower cycle.

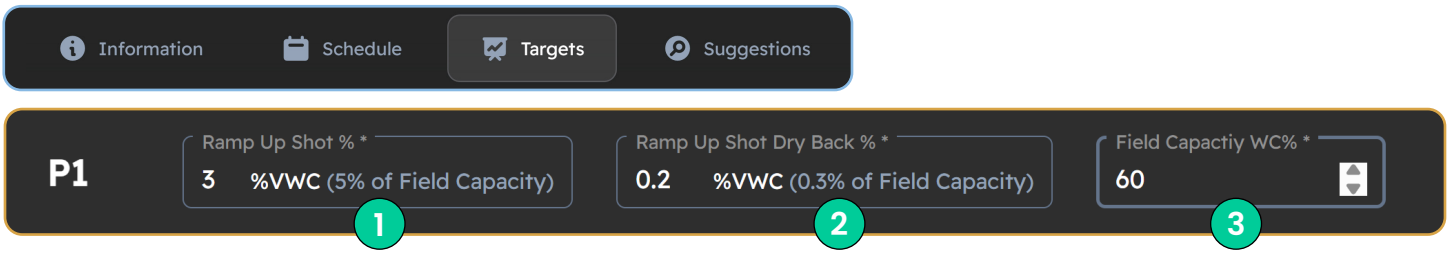
The fields below will be pre-populated based on the information you entered in the Information tab, but you are free to edit them or enable/disable the entire sequence if desired.

P1 Phase Schedule



1. **Start Time**
   The specific time you want your Ramp Up to begin.
2. **Duration**
   The length of each irrigation event during Ramp Up.
3. **Interval**
   The length of time between each irrigation event during Ramp Up.
4. **Frequency**
   The number of times an irrigation event will occur during Ramp Up.

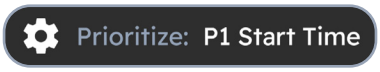
P1 Phase Targets



1. **Ramp Up Shot %**
   Enter the percentage rise in VWC you would like to target with each irrigation event during your P1 Phase.
2. **Ramp Up Shot Dry Back %**
   Enter the percentage dryback you would like to target between irrigation events during your P1 Phase.
3. **Field Capacity WC %**
   Enter the percentage at which your substrate is fully saturated.

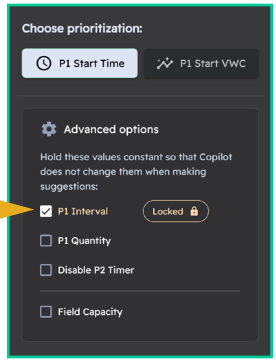
Advanced Options for P1 Lock

The **P1 interval** can be locked under **Advanced Options** to prevent it from being increased by Copilot algorithm.



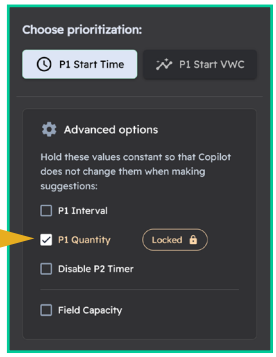
Locking your **P1 Interval** tells the program not to change your P1 shot interval on your schedules page. Without locking this, the algorithm will try to change this to match the P1 dryback % target you set on your targets page.

Note: *Maintaining a consistent duration between ramp-up shots may be preferred, in which case this setting can be locked.*



Locking your **P1 Quantity** will ensure the program does not increase or decrease the amount of P1 shots you give in a day.

Note: *This should not be used in conjunction with P1 Interval Lock, as doing so fixes both shot count and timing, leaving duration as the only adjustable variable and limiting the program's ability to optimize performance.*

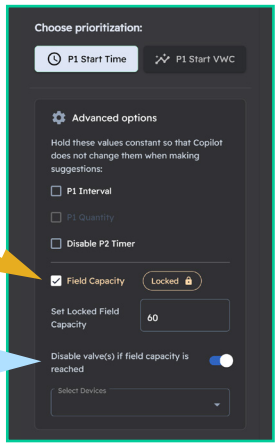


The P1 phase should remain unchanged even when switching between **Generative and Vegetative steering**, unless field capacity locks are needed to stack EC. Once an ideal P1 shot sequence is established, it can be maintained throughout the entire flower cycle. ***When using Advanced Lock features, only one P1 lock (Interval or Quantity) should be applied at a time to preserve sufficient adjustment flexibility.***

Field Capacity Lock

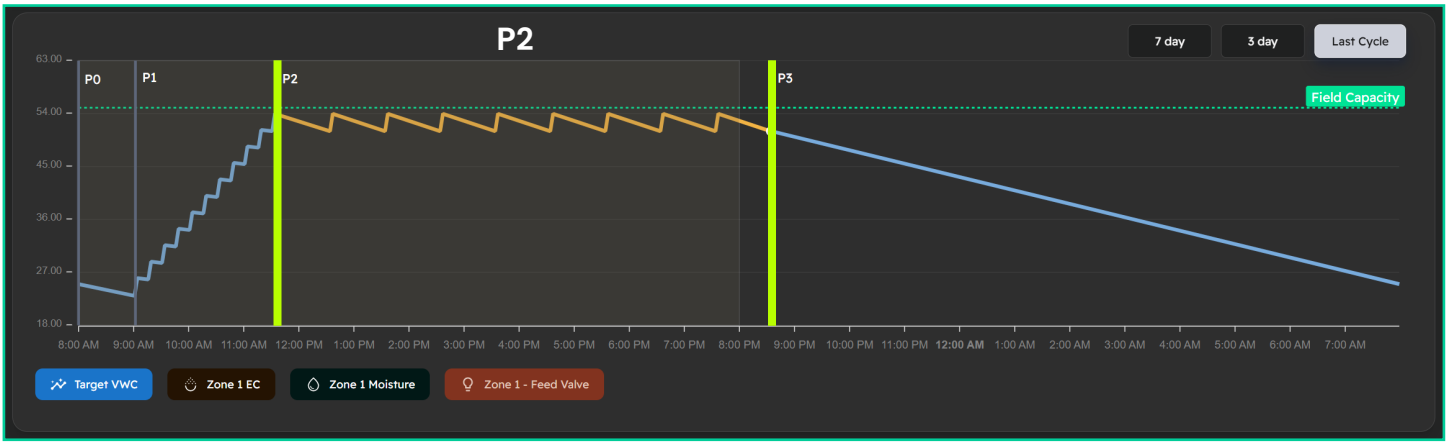
Locking your **Field Capacity** ensures that your VWC% never goes above the value that you set here. Once the VWC% reaches the target locked field capacity, the valve will force itself off until the VWC% reading drops below the target locked field capacity value.

Note: *It is recommended to enable the "Disable valve(s) if field capacity is reached" toggle to ensure the valve is shut off immediately when triggered. If it is not, it will only take note of the time it triggered and decrease your P1 shots to end around that time the following day.*

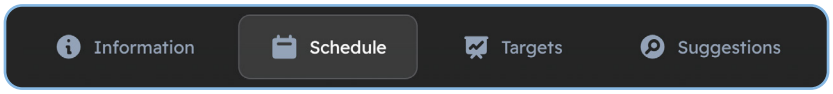


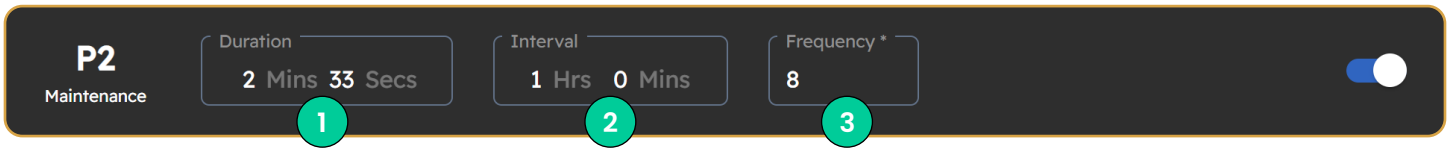
P2 Phase - Maintenance

P2 or **Phase 2** is the time between when the substrate reaches its maximum VWC% and the last irrigation event of the day. This phase is used to manage overnight dryback percentages and to regulate EC.



P2 Phase Schedule





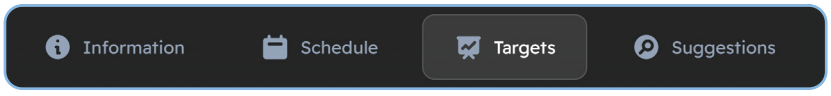
1 Duration
The length of each irrigation event during Maintenance.

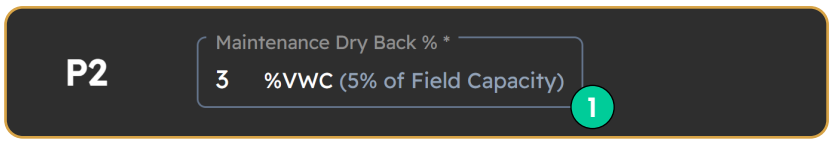
2 Interval
The length of time between each irrigation event during Maintenance.

3 Frequency
The number of times an irrigation event will occur during Maintenance.

By default, this field will be disabled until it is deemed necessary, either by you or Copilot suggestions.

P2 Phase Targets

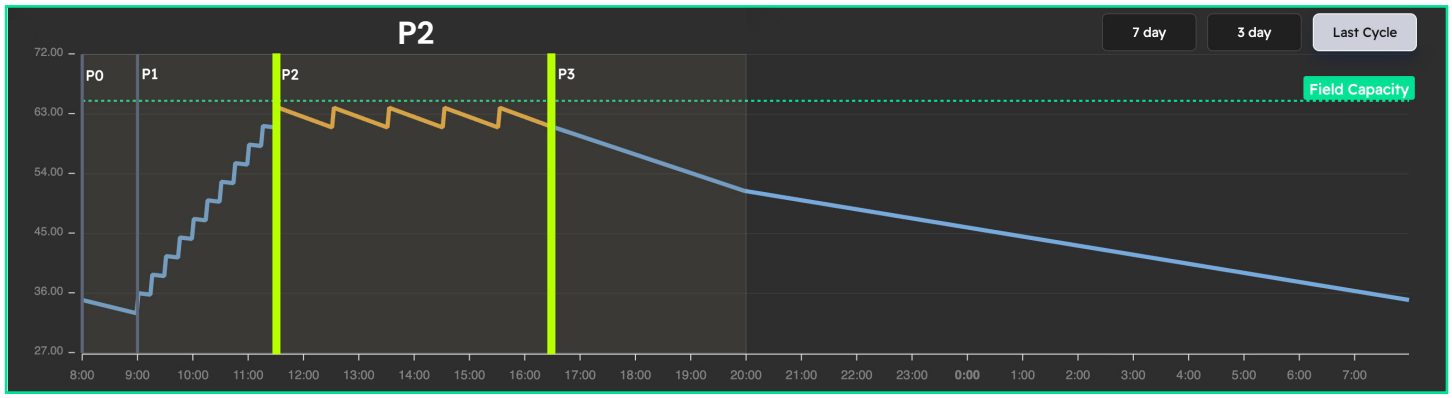




1 Maintenance Dryback %
Enter the percentage dry back you would like to target between every irrigation event during your P2 phase. The dryback % will equal the shot size during this phase in order to maintain targeted field capacity.

Managing Dryback Amounts

P2s are used for two primary reasons: To manage dryback amounts and to regulate EC. Adding and subtracting P2s throughout the day moves your "Irrigation End Time" forward and backwards.



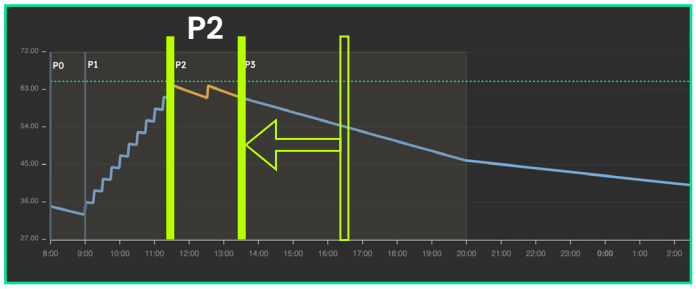
Extend Irrigation End Time

When you add P2s and move your Irrigation End Time forward, you decrease the remaining time allotted to dry out, decreasing you overall dryback percentage.



Decrease Irrigation End Time

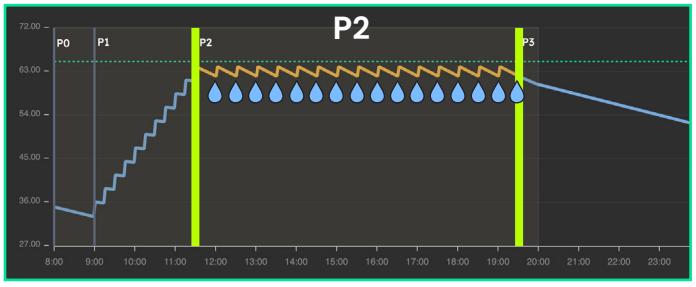
When you remove P2s and move your Irrigation End Time backwards, you increase the remaining time allotted to dry out, increasing your overall dryback percentage.



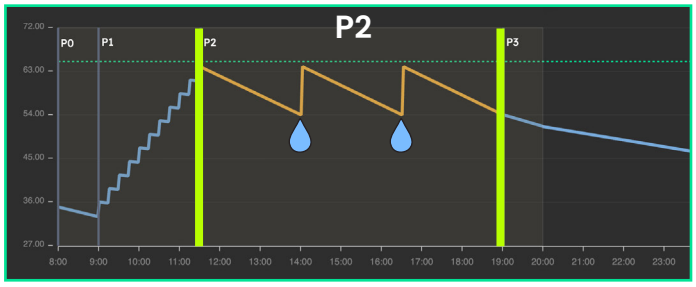
Regulating EC

P2s are meant to maintain a set VWC%, which is usually your Field Capacity%. This means your P2 dryback percentage should equal your P2 shot size target %. The closer to that runoff line you give a shot, the more likely it is to push runoff, so when giving small, frequent shots, you will be pushing runoff frequently, flushing out your substrate EC.

More Shots = More Runoff = Lower EC



Less Shots = Less Runoff = Higher EC



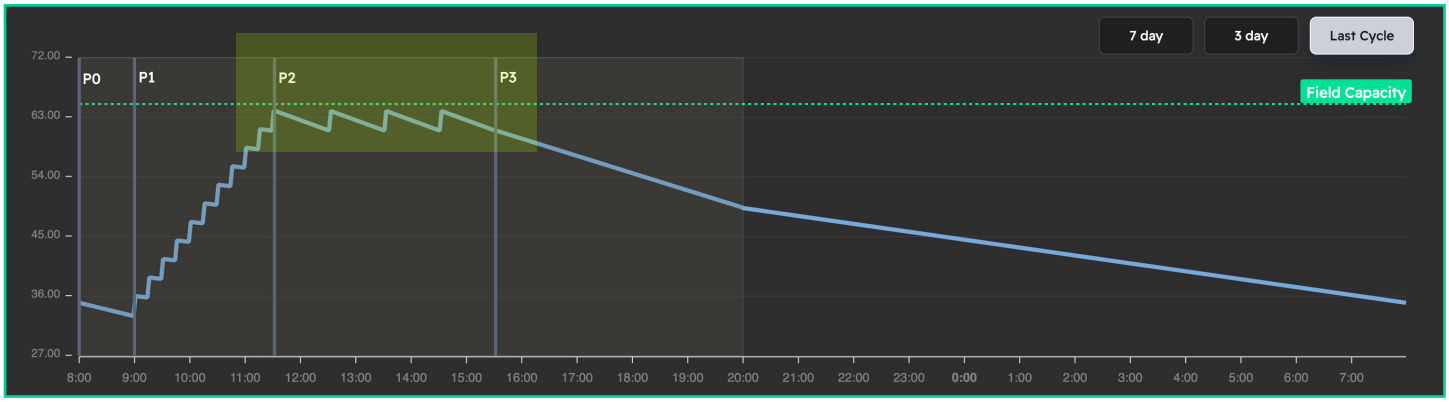
The farther you are from that runoff line you give a shot, the less likely you are to push runoff, which is why larger more spaced-out shots tend to help increase EC.

Advanced Options

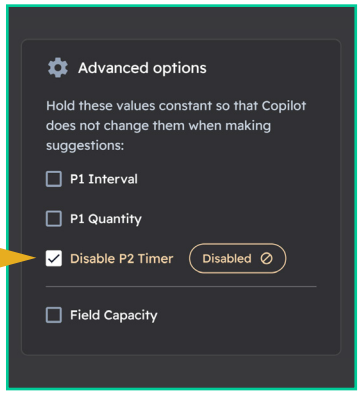
Disable P2 Timer

When steering generatively in early flower, it is best to prioritize as much time without water as possible during lights on. In the event you exceed your dryback target %, Copilot will prioritize adding P2 shots instead of just maintaining your minimal failsafe value. This can result in unwanted irrigation events occuring during the day.

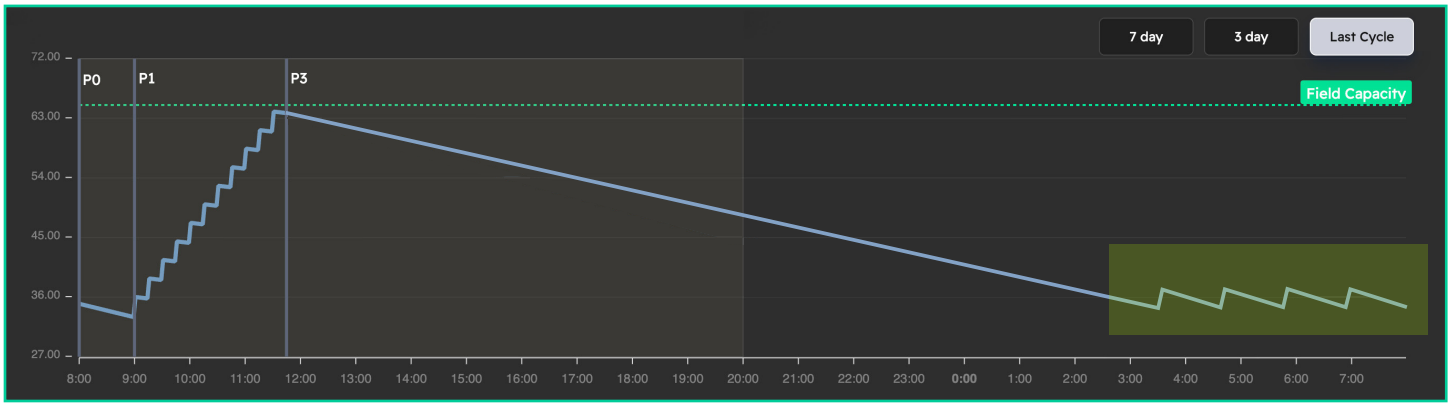
Without P2 Disable Timer



To prevent this from happening, **Disable P2 Timer** in advanced settings to tell Copilot that you would rather prioritze overnight Failsafe shots instead of adding P2 shots. Moving these irrigation events to the nighttime will prevent unwanted runoff from occurring, which can lower EC. This also preserves time under drought stress while lights are on, which aids in achieving generative stress

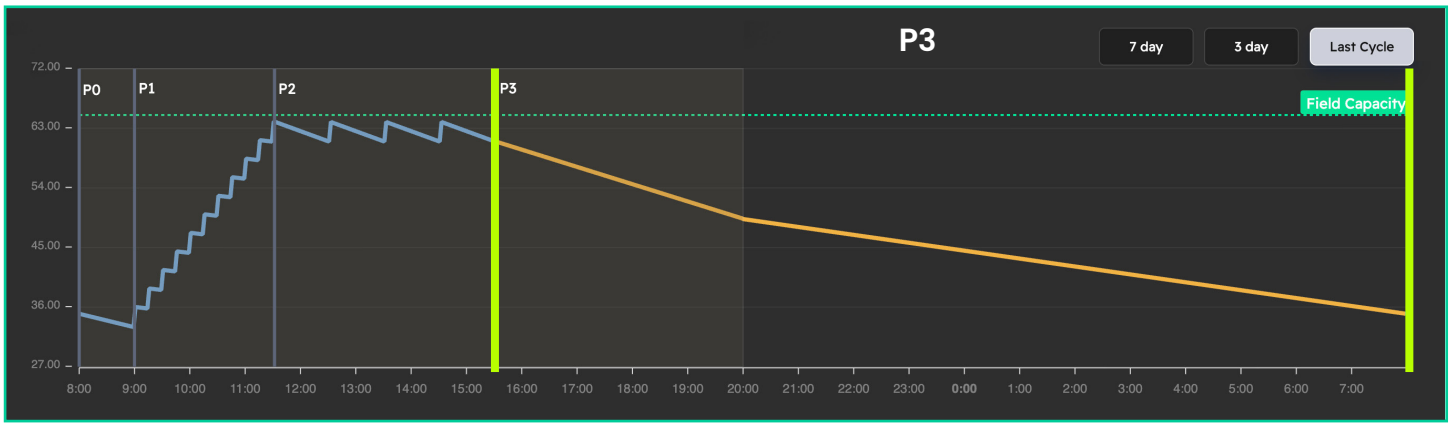


With P2 Disable Timer

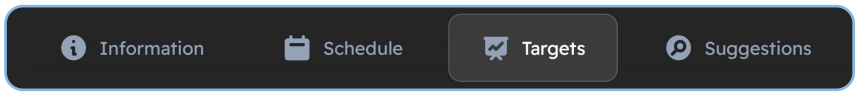


P3 Phase - Overnight Dryback

P3 or **Phase 3** is the time period immediately following your irrigation end time and your lights on time the following day. No scheduled irrigation events are given during this time apart from emrgency overnight failsafe shots if required. These will only occur in the event that your substrate VWC% falls below the threshold that you set in your Copilot program *(See Emergeny Overnight Failsafe section for more information).*



P3 Phase Targets



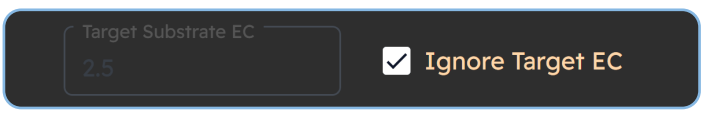


1 **Overnight Dry Back %**
Enter the percentage dry back you would like to target between your final irrigation event and when your lights turn back on at the start of the next cycle.

EC Target

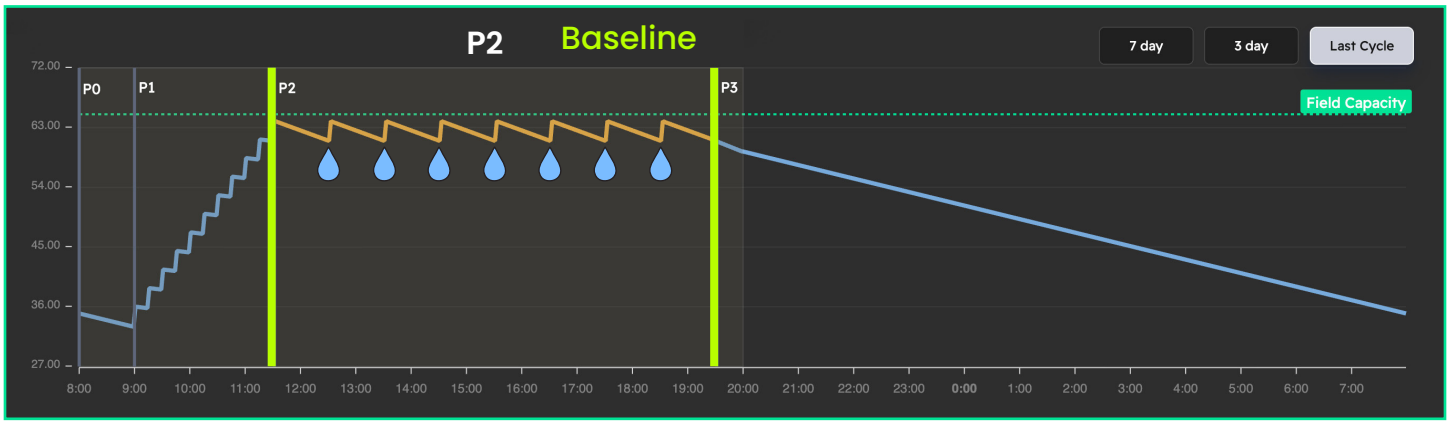
Under the Targets tab in the P3 section, you will find **Target Substrate EC** along with a checkbox to **Ignore Target EC.** The Target EC form field is where you can enter you desired target substrate EC so Copilot can help you achieve your goal. If you do not want Copilot to generate suggestions to balance your EC, simply check the **Ignore Target EC** box.



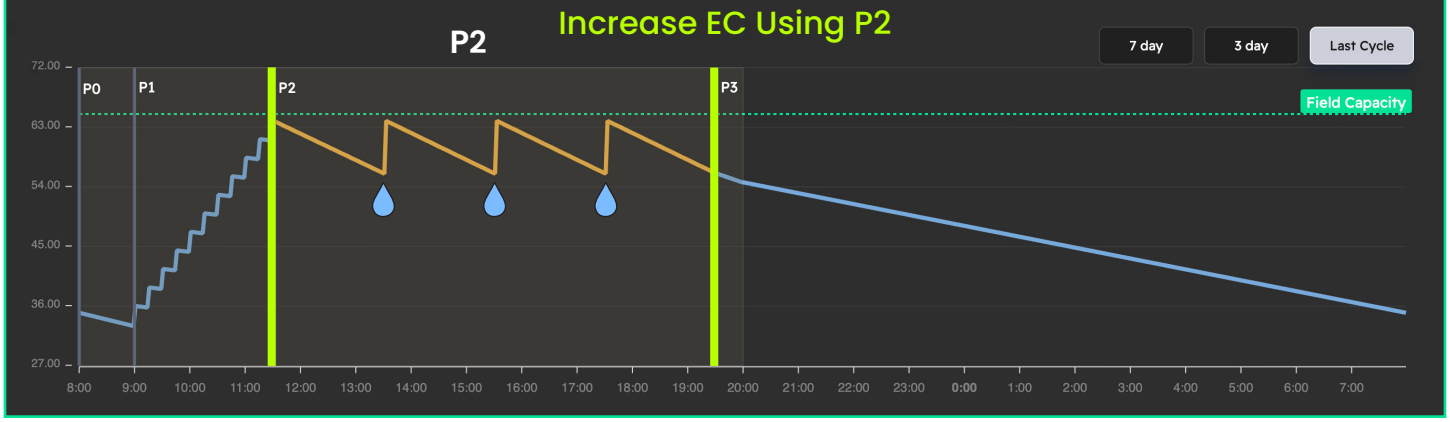


How EC Targeting Works - Example: With P2s

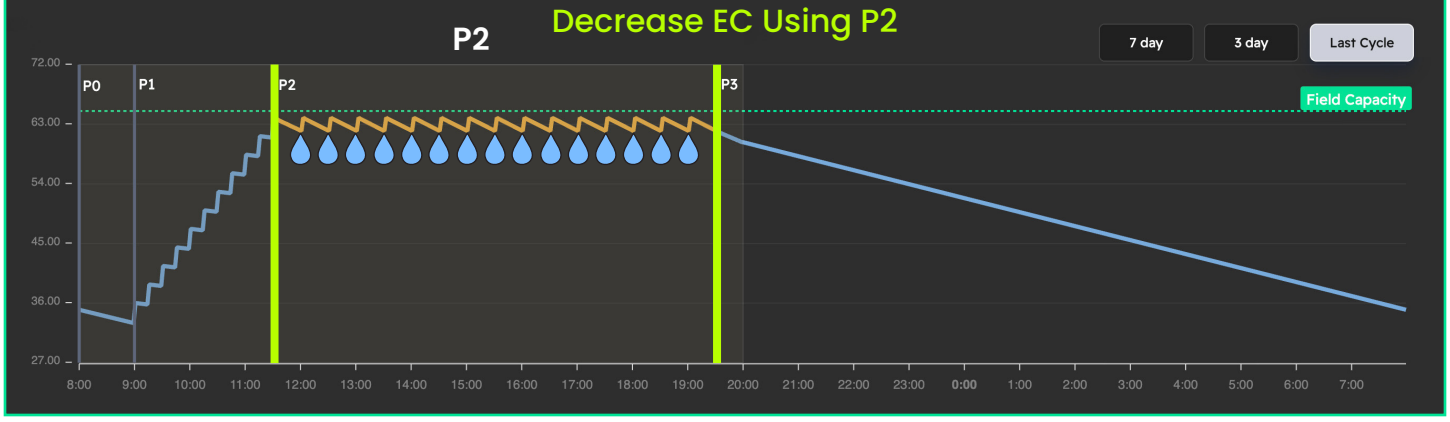
When you enter a value greater than your current reported EC reading, Copilot will attempt to decrease your total runoff by reducing irrigation events. When you enter a value less than your current reported EC reading, Copilot will attempt to increase your total runoff by increasing irrigation events.



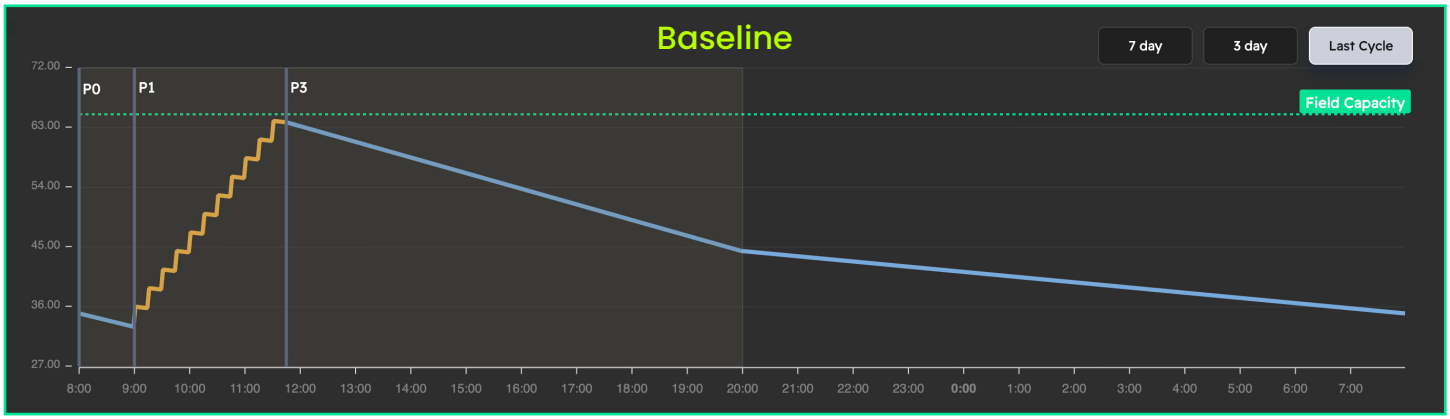
This graph demonstrates Copilot decreasing runoff by reducing the number of P2 irrigation events.

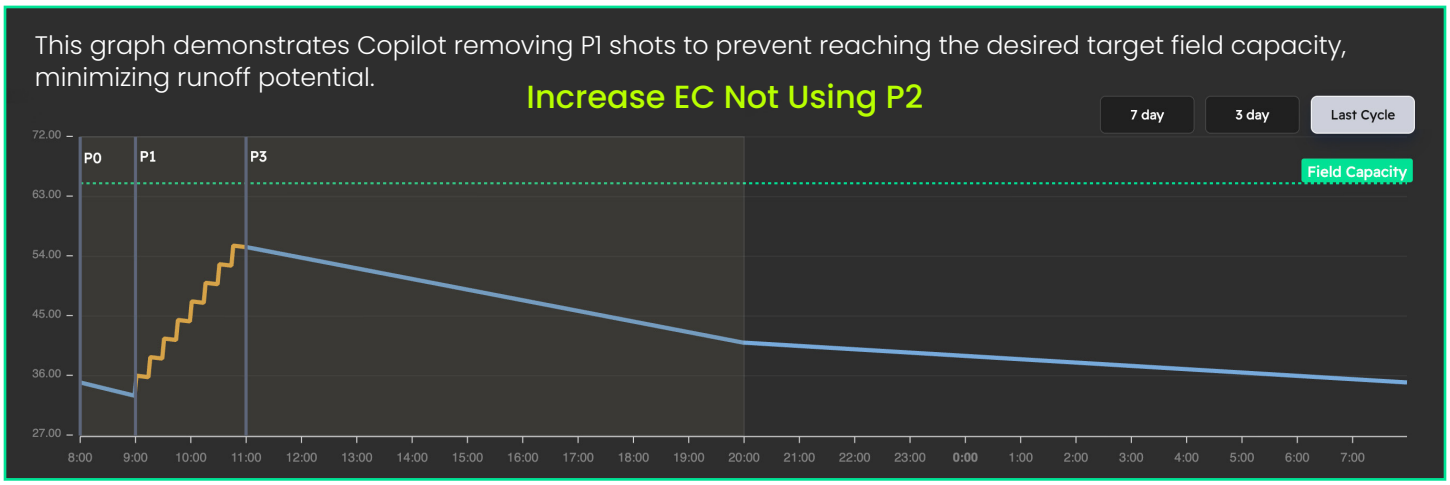


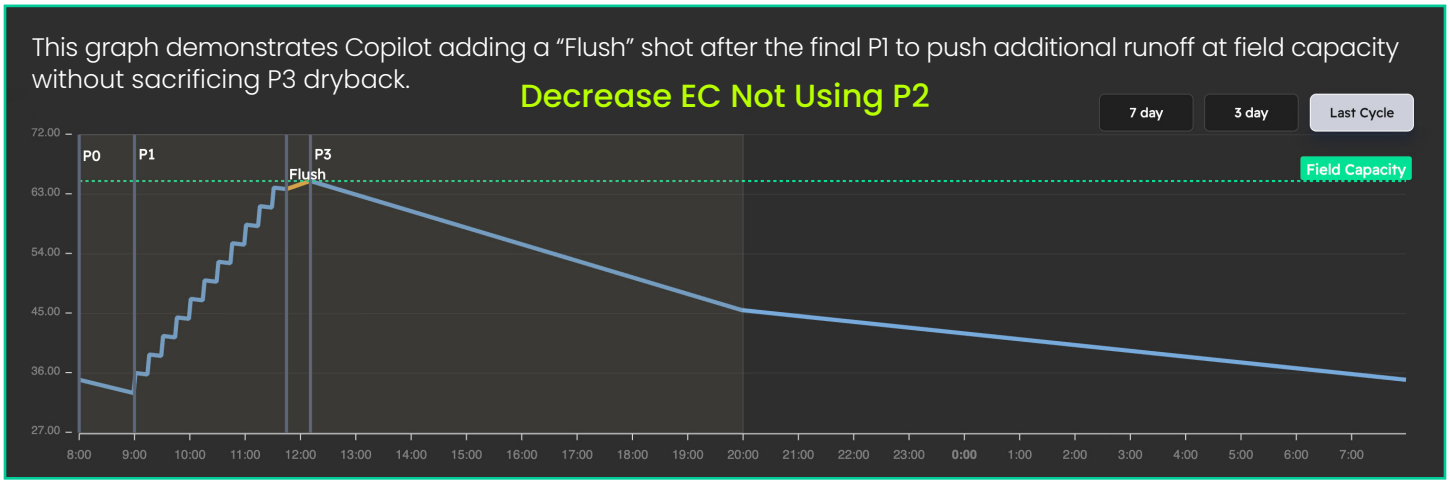
This graph demonstrates Copilot increasing runoff by adding the number of P2 irrigation events.



How EC Targeting Works - Example: Without P2s







Notes:

- Copilot uses the highest EC reading from the last 24 hour cycle to base its actions on.
- All of the above changes adjust on a sliding scale of intensity, so the farther you are from your desired target setpoint, the more aggressive Copilot will be with its adjustments.

Flush



The **Flush timer** is a custom configurable P1 shot that occurs after the P1 sequence completes.

This is done for 2 reasons:

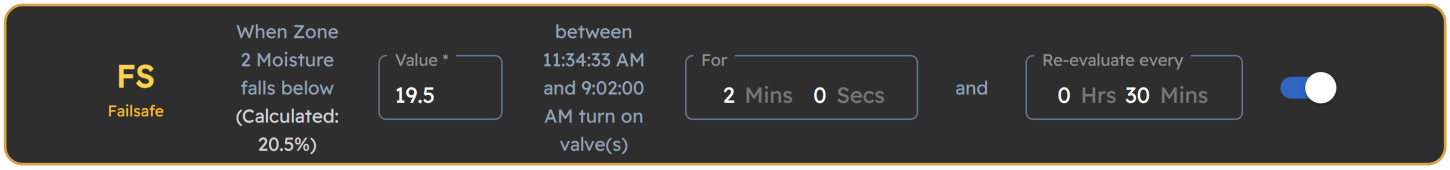
1. To maximize the amount of runoff that it will achieve since it is being given once the substrate reaches its field capacity.
2. To allow for maximum runoff to occur without eating into the P3 dryback time.

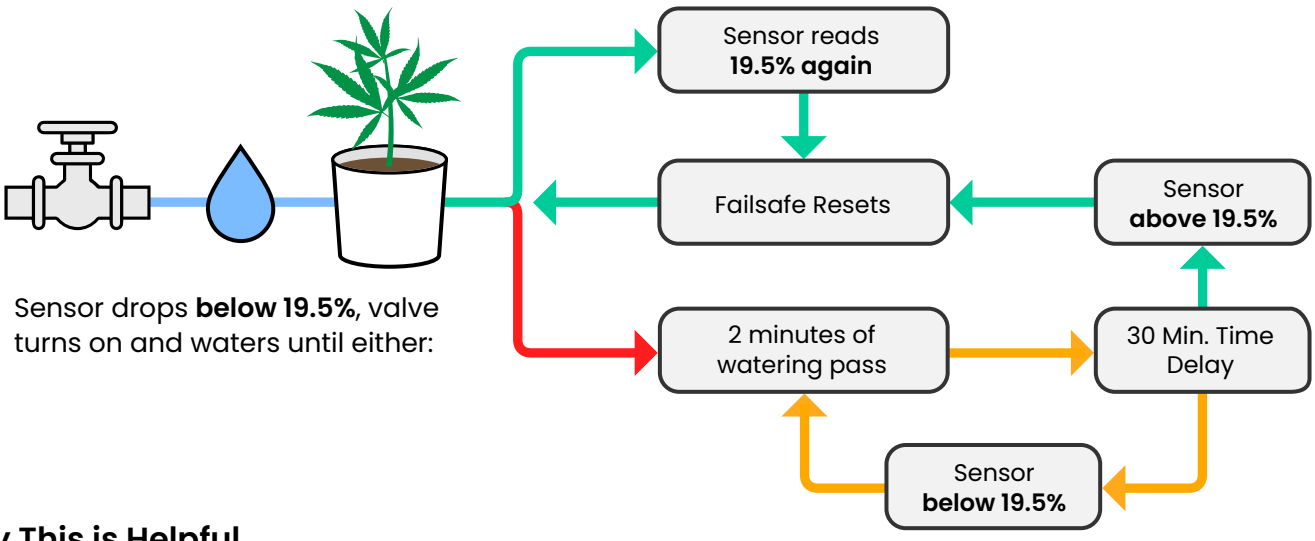
***Note:** Flush timer is typically only used when P2s are not enabled, such as in early flower when EC climbs too high and needs to be corrected without sacrificing dryback.*

Failsafe

Copilot Failsafe is more than a simple sensor trigger—it combines sensor-based control with configurable timer safeguards to prevent overwatering.

** These values are fully configurable for precise customization.*





Why This is Helpful

Some substrates and irrigation setups take time to show changes on a sensor. For example, with coco in a large pot or when using low-flow emitters, it can take a while for the water to spread through the media and reach the sensor. If you relied only on a normal sensor trigger, the valve would keep running until the sensor caught up—leading to overwatering. The 2-minute cap plus 30-minute delay avoids this problem by preventing endless watering while still ensuring the plant eventually gets what it needs.

Setpoints: Reference Guide

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Environmental Targets

Stage	Lights On Targets	Lights Off Targets	CO_2	PPFD
Veg	LST 82 / 0.8–1.0 kPa	75°F / 55% RH (1.2kpa)	1000 ppm	500–700
Flower Wk 1	LST 82 / 0.8–1.0 kPa	72–82°F / 55% RH (1-1.5kpa)	1200–1500 ppm	800–1200
Flower Wk 2	LST 82 / 0.8–1.0 kPa	72–82°F / 55% RH (1-1.5kpa)	1200–1500 ppm	800–1200
Flower Wk 3	LST 82 / 0.8–1.0 kPa	72–82°F / 55% RH (1-1.5kpa)	1200–1500 ppm	800–1200
Flower Wk 4	LST 82 / 0.8–1.0 kPa	75°F / 55% RH (1.2kpa)	1200–1500 ppm	800–1200
Flower Wk 5	LST 82 / 0.8–1.2 kPa	75°F / 55% RH (1.2kpa)	1200–1500 ppm	800–1200
Flower Wk 6	LST 80 / 1.0–1.2 kPa	75°F / 50% RH (1.3kpa)	1200–1500 ppm	800–1200
Flower Wk 7	LST 78 / 1.2–1.4 kPa	75°F / 45% RH (1.5kpa)	1200–1500 ppm	800–1200
Flower Wk 8	LST 76 / 1.2–1.4 kPa	73°F / 40% RH (1.5kpa)	1200–1500 ppm	800–1200

⚠ **Note:**

Only attempt these targets if you can maintain stable temperature and humidity. Significant environmental swings—especially high Relative Humidity during Lights Off—will create unfavorable conditions.

Environmental Target Considerations

- **Leaf Surface Temperature (LST)** should be the primary focus during lights on. Ambient air temperature should be raised or lowered to dial in LST. LED usually means higher ambient air temperature/HID usually means lower ambient air temperature.
- **Lights-off temperature** should be similar to ambient air temperature so no need to focus on LST.
- **Daytime humidity** should be adjusted based on VPD, using temperature as the constant. **Nighttime humidity** can be fixed since plants are not photosynthesizing, provided temperature swings are under control.
- **Day/Night temperature** differential should be adjusted in flower weeks 1-3 based on the cultivar and the amount of stretching desired (a higher differential = more stretch).
- **Light intensity** is dependent on genetics and what the plants can handle under ideal conditions. Lower the intensity if symptoms of light toxicity exhibit.
- If you cannot adequately lower **lights-off humidity** during the final weeks of flower, raise ambient air temperature to help minimize pathogen risk.

Setpoints: Reference Guide

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Irrigation Targets

Stage	Dryback %	EC Target	Copilot Targets*
Veg	20% initial, then 10%-15%	Slightly above Feed EC (3-4)	Vegetative
Flower Wk 1	30%	Slightly below Tip burn (6–12)	Generative
Flower Wk 2	30%+	Slightly below Tip burn (6–12)	Generative
Flower Wk 3	30%+	Slightly below Tip burn (6–12)	Generative
Flower Wk 4	10-15%+	Slightly above Feed EC (3-5)	Vegetative
Flower Wk 5	10-15%+	Slightly above Feed EC (3-5)	Vegetative
Flower Wk 6	10-15%+	Slightly above Feed EC (3-5)	Vegetative
Flower Wk 7	30%	1-2 EC lower than Wk 1-3 (5-10)	Generative
Flower Wk 8	30%	1-2 EC lower than Wk 1-3 (5-10)	Generative

*Copilot Targets

Vegetative – **P0:** 2%
P1: 3% shot, 0.2–0.5% dryback
P2: 3% (adjust per EC)
P3: 10–15%+

Generative – **P0:** 2%
P1: 3% shot, 0.2–0.5% dryback
P2: 5% (adj. per EC) ***(no P2 Wks 1-3)***
P3: 30%+

*** This strategy performs best with heavy feeding cultivars, exercise caution and scale back as needed for sensitive cultivars. ***

Irrigation Targets Considerations

- **Initial dryback** refers to post transplant dryback. This number can be adjusted as desired, though it should be large enough to determine drip emitter Field Capacity value. *(see: Standardizing Sensor Field Capacity for Absolute Dryback Control)*
- Depending on sensor type, **EC readings** can vary greatly, which is why optimal targets should be determined based on your physical plant observations. For example, if you notice tip burn at 8 EC, your target should be 7 EC.
- Smaller substrates, paired with extended veg times can result in aggressive dryback capacities exceeding 30%. As long as you do not go below the 20% VWC minimum threshold, increasing dryback is perfectly fine, given your plants do not exhibit issues.
- During **Bulk Flower**, as long as you are irrigating up until lights off, there is no danger in running larger drybacks than whats listed above.
- When used correctly, **night time failsafe irrigations** are not harmful to the plants or your strategy.

Flower Weeks 1-3 (Stretch)

Environmental Targets

Stage	Lights On Targets	Lights Off Targets	CO_2	PPFD
Flower Wk 1	LST 82 / 0.8–1.0 kPa	72–82°F / 55% RH (1-1.5kpa)	1200–1500 ppm	800–1200
Flower Wk 2	LST 82 / 0.8–1.0 kPa	72–82°F / 55% RH (1-1.5kpa)	1200–1500 ppm	800–1200
Flower Wk 3	LST 82 / 0.8–1.0 kPa	72–82°F / 55% RH (1-1.5kpa)	1200–1500 ppm	800–1200

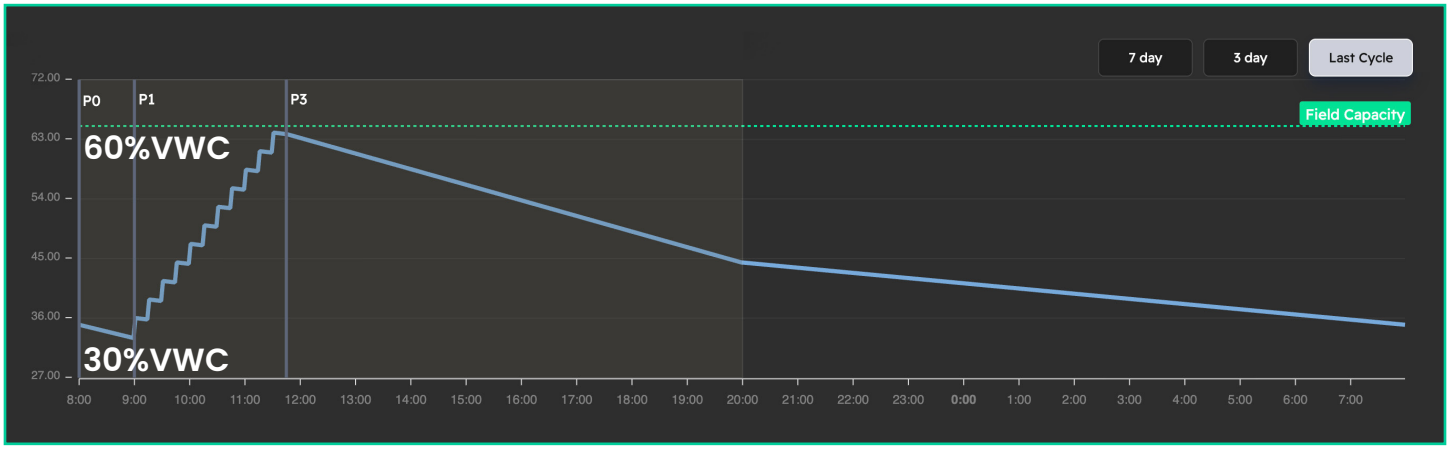
Irrigation Targets

Stage	Dryback %	EC Target
Flower Week 1	30%	Slightly below Tip burn (6–12)
Flower Week 2	30%+	Slightly below Tip burn (6–12)
Flower Week 3	30%+	Slightly below Tip burn (6–12)

* Copilot Targets

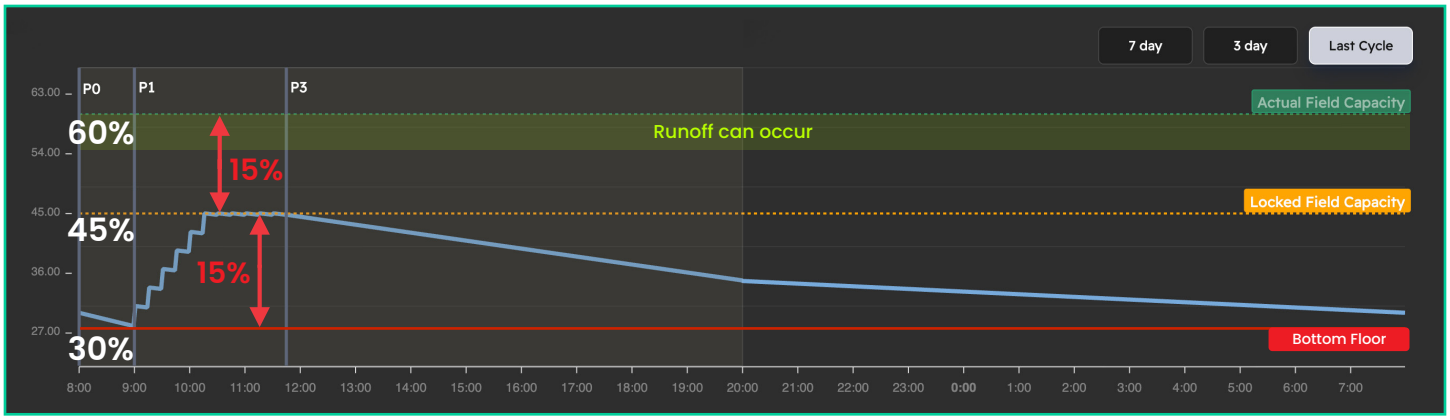
Generative – **P0:** 2%
P1: 3% shot, 0.2–0.5% dryback
P2: NO P2s Weeks 1-3
P3: 30%+

Example:



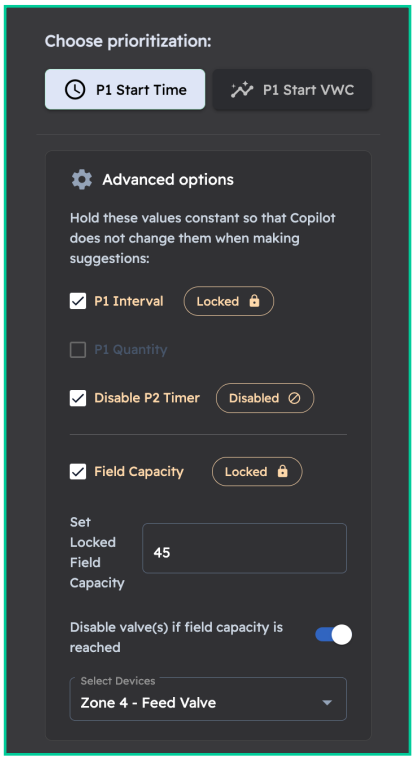
Using Copilot to Maximize Generative Steering

When steering generatively during weeks 1-3, the main priority is to **maximize both drybacks and substrate EC**. The goal is to raise the substrate EC as fast as possible so that we can maximaize the amount of time the plants spend in that environment. Depending on veg time and substrate size, 30% dryback can be difficult to achieve in early weeks of stretch. To help with this, you can temporarily reduce your field capacity target by up to 50% (relative) to avoid any chance of runoff. This in turn, decreases the dryback % needed to achieve the same minimum floor by up to 50% (relative) while also stacking substrate EC quickly.



Advanced Copilot settings used to accomplish this.

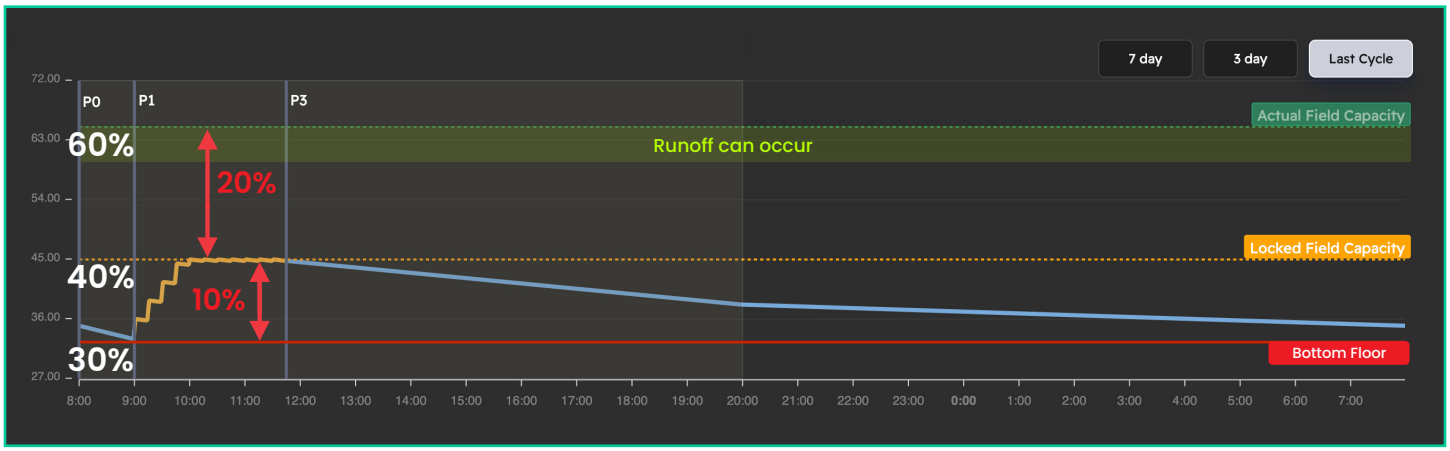
For example, if field capacity VWC is 60% and the target is a 30% absolute dryback, the minimum floor would be 30% VWC. Now if we reduce the total target dryback to 15% and build upward from that same 30% floor, the new operating range becomes 30%–45%, meaning only a 15% dryback is required to achieve the same level of drought stress — an outcome that is far more achievable during this stage of growth. Depending on feed EC, substrate EC can stack extremely fast when not pushing any runoff for days on end.



Tailoring to your specific cultivar

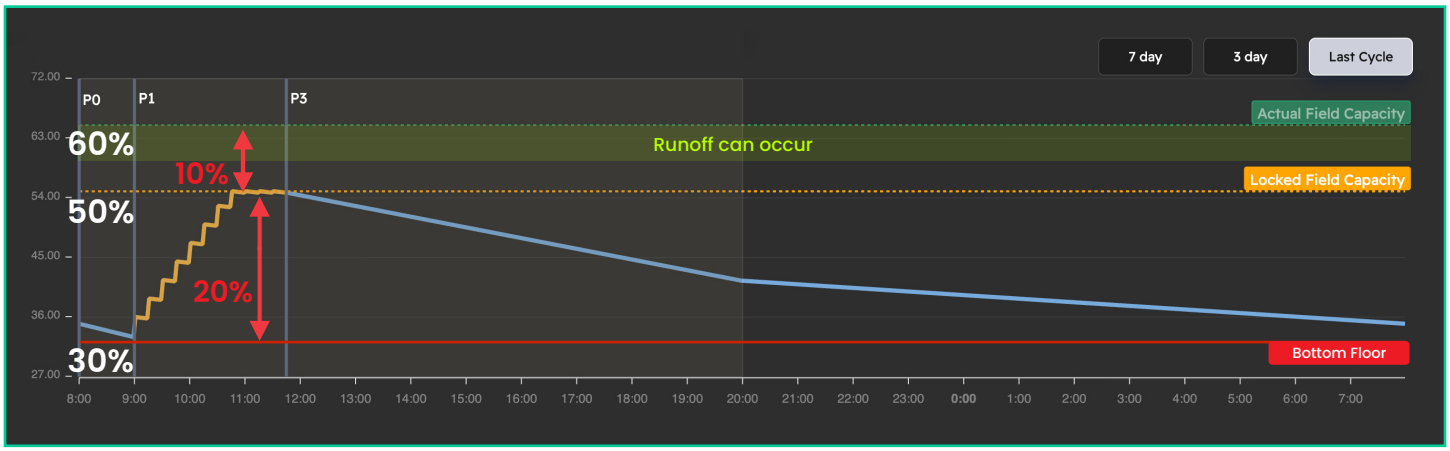
This strategy can be applied to any cultivar you are running by matching the overall dryback target to what your plant is currently able to achieve, thus avoiding multiple days between irrigations and ensuring your plants get fresh nutrients daily *(see examples on pg. 32)*. By working up from the minimum target VWC% floor, the root zone is able to experience the same drought conditions and oxygenation as if you actually dried down a full 30%. Since this strategy eliminates runoff altogether, the fresh nutrient feeds entering daily also help expedite EC stacking even further.

Example: 1



***Cultivar A** only drying back 10% over 24 hour period.*

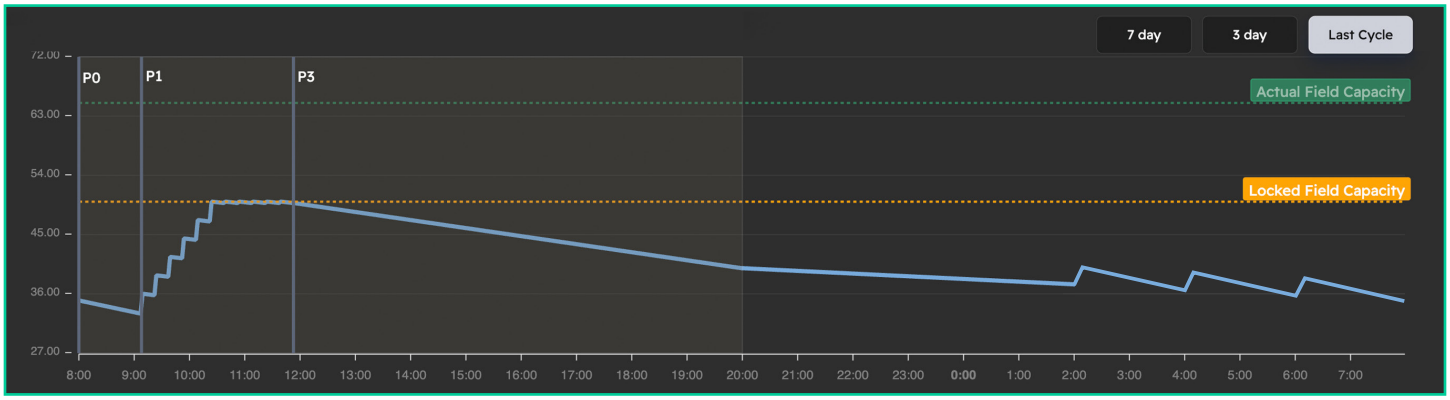
Example: 2



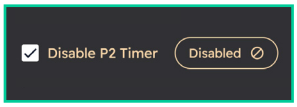
***Cultivar B** able to dryback 20% over a 24 hour period.*

As you can see in the examples above, we are operating in a very tight window of VWC%. This irrigation strategy is only recommended because we have the 'Overnight Failsafe' safeguard in place, constantly monitoring and if necessary, giving emergency shots to maintain our bottom floor VWC% target, preventing wilting or extreme hydrophobic conditions from occurring. The combination of both safeguards (Overnight Failsafe and Field Capacity Lock) make this entire process extremely simple to manage. Even if your timer schedule was set incorrectly, the live safeguards will ensure you are operating within the ideal minimum and maximum VWC ranges you set, preventing both overwatering and underwatering simultaneously.

What happens if overnight failsafe shots occur during the night?

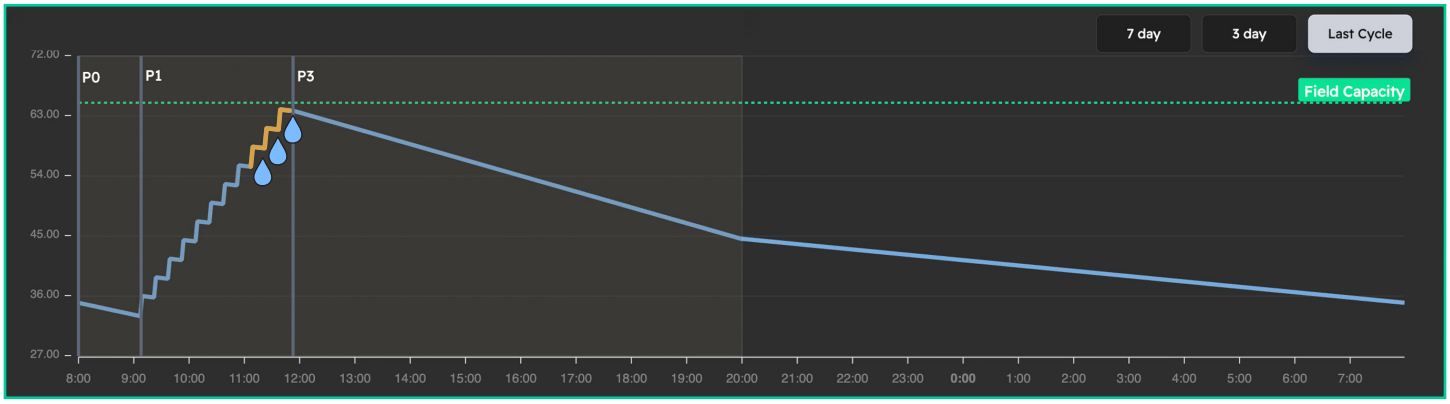


Do not panic if night shots are occurring during this time. Since we are trying to stack EC by not pushing runoff, any irrigation events that occur far away from our Field Capacity will not push runoff, and therefore will not interfere with stacking. Think of it as deferring some of the P1 shots that would typically fall within runoff territory, to a time where there is no risk of runoff.



Note: *Keeping the "Disable P2 Timer" locked under advanced options is highly recommended during the entire stretch phase (weeks 1-3) to prevent Copilot from attempting to add P2s during lights on to prevent these night shots.*

This strategy is not meant to be used for long periods of time, only until we have stacked our EC to satisfactory levels (typically 4-7 days). In the event that it takes longer than a week to stack, typically due to low feed EC or nutrient composition, be sure to increase your feed pH slightly to account for the pH dropping in the root zone.



Once desired substrate EC is reached, you can disable the field capacity lock, which will raise your field capacity target back to the original value of 60%, allowing for just enough runoff during last few P1 shots to help stabilize EC and keep it from climbing higher. This will also free up the full 30% dryback window, thus eliminating the need for any more night shots. Thanks to the field capacity lock, there is no need to edit your P1s at all during this entire process, and simply unlocking it will reset your irrigation strategy back to its original configuration, allowing you to continue throughout the remainder of stretch with peak EC held.

Note: *When field capacity lock is enabled, your target EC is overridden temporarily until the field capacity lock is disabled again. Autopilot will enact this same strategy to raise your substrate EC if only target EC is used without locking field capacity, just at a much more gradual rate.*

Weeks 4-6 (Bulk)

Environmental Targets

Stage	Lights On Targets	Lights Off Targets	CO_2	PPFD
Flower Wk 4	LST 82 / 0.8–1.0 kPa	75°F / 55% RH (1.2kpa)	1200–1500 ppm	800–1200
Flower Wk 5	LST 82 / 0.8–1.2 kPa	75°F / 55% RH (1.2kpa)	1200–1500 ppm	800–1200
Flower Wk 6	LST 80 / 1.0–1.2 kPa	75°F / 55% RH (1.3kpa)	1200–1500 ppm	800–1200

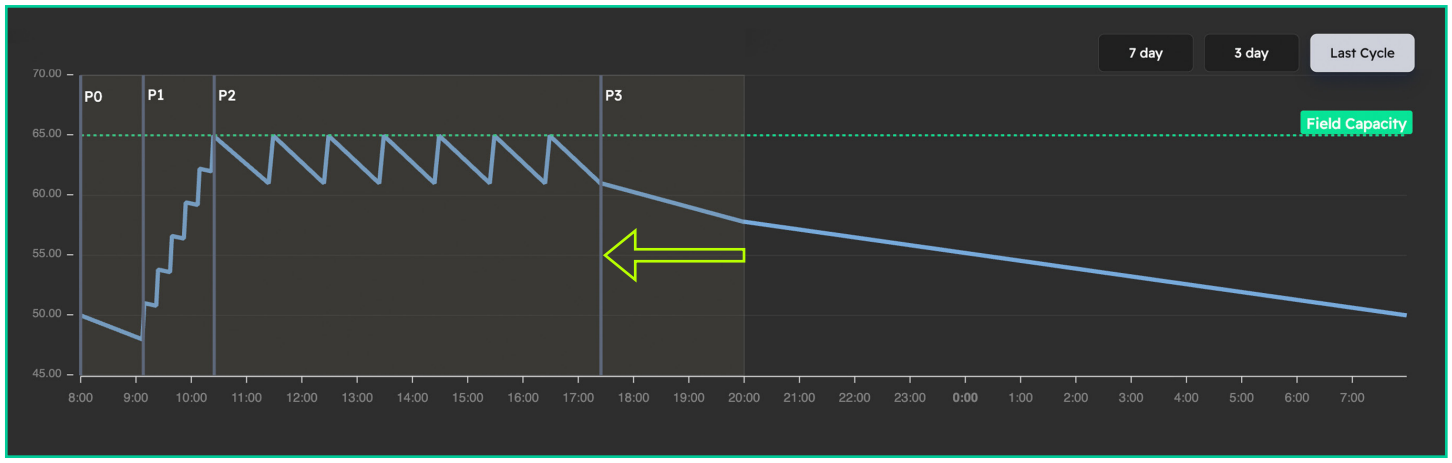
Irrigation Targets

Stage	Dryback %	EC Target
Flower Week 4	10–15%+	Slightly above input EC (3–5)
Flower Week 5	10–15%+	Slightly above input EC (3–5)
Flower Week 6	10–15%+	Slightly above input EC (3–5)

* Copilot Targets

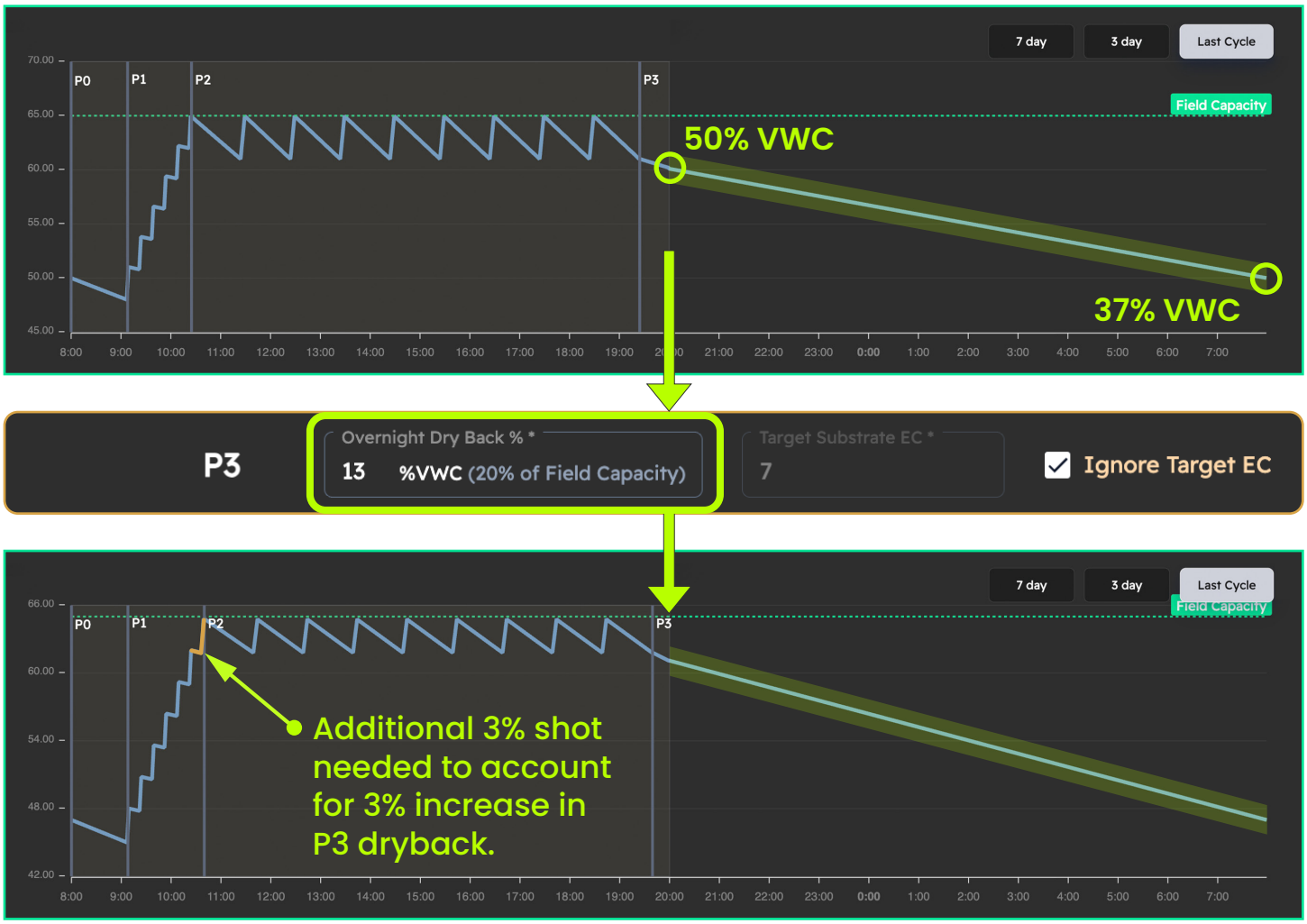
Vegetative – P0: 2%
P1: 3% shot, 0.2–0.5% dryback
P2: 3% (adjust per EC)
P3: 10-15%+

Once stretch is done, we move back to vegetative steering, which essentially translates to simply adjusting our overnight dryback and our EC targets. During bulk, use P2s to extend the irrigation end time all the way up until lights off, then allow the substrate to dryback as much as it can during the lights off period.



The minimum dryback to look for is 10%, which is almost always achievable after executing the generative EC stacking strategy during weeks 1-3. If it is not, which is rare by this time, simply remove P2s to pull irrigation end time back until you can achieve at least a 10% dryback.

If running **Autopilot**, you can set the P3 target dryback to 10% and the following day it should add P2 shots up until lights off. If running **Copilot**, you can manually add P2s up until lights off. Keep the overnight failsafe value the same as during stretch to allow the plants the opportunity to dryback further if needed without getting failsafe shots. As week's 4-6 progress, pay attention to the rate of dryback that occurs overnight and adjust the overnight dryback target to match this periodically. This helps Copilot ensure you're giving the appropriate number of P1 shots each day, since the total P1 ramp up % has to match the total P3 dryback % in order to reach field capacity. For example, if the substrate VWC% drops from 50% to 37% by the time the lights come back on, then update the overnight dryback target value to 13%.



It is not uncommon for nighttime drybacks to exceed 15+%. If you find your plants are drying back more than 30% in the 12 hour lights off period, this is usually a sign that you either need to decrease your veg time, or increase substrate volume. By irrigating until field capacity and then pushing P2s throughout the entire lights on period each, adequate runoff should occur to stabilize EC down to slightly above our input feed EC. You can either increase or decrease your P2 target maintenance dryback % during this time to raise or lower your EC gradually *(see P2 section explained)*.

Weeks 7-8 (Ripen)

Environmental Targets

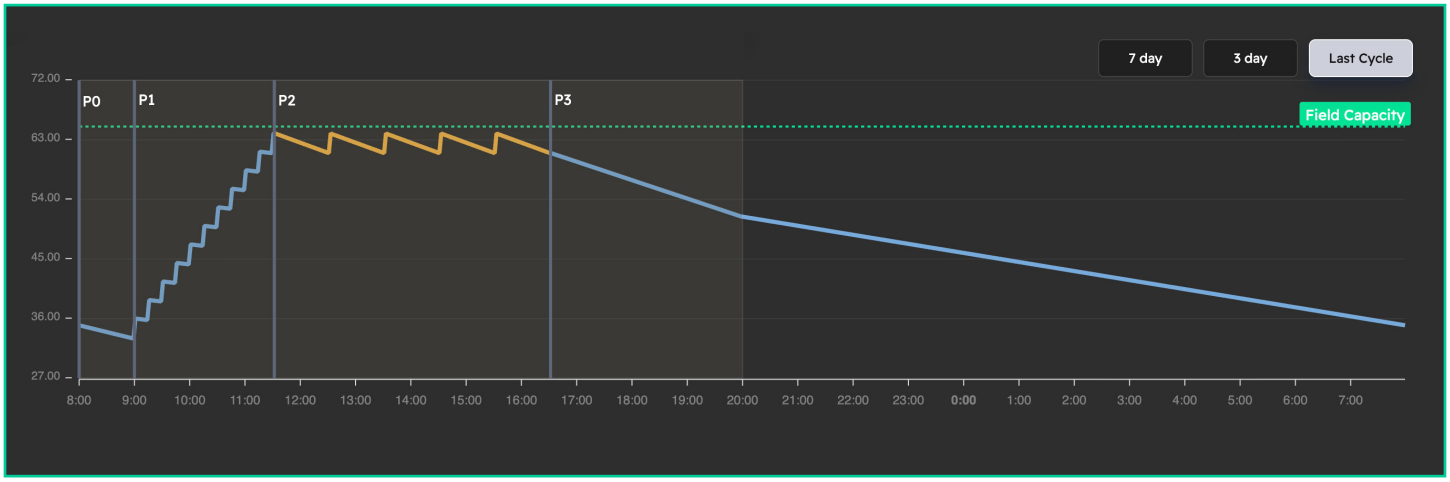
Stage	Lights On Targets	Lights Off Targets	CO_2	PPFD
Flower Wk 7	LST 78 / 1.2–1.4 kPa	75°F / 45% RH (1.5kpa)	1200–1500 ppm	800–1200
Flower Wk 8	LST 76 / 1.2–1.4 kPa	73°F / 45% RH (1.5kpa)	1200–1500 ppm	800–1200

Irrigation Targets

Stage	Dryback %	EC Target
Flower Week 7	30%	1–2 EC below 1–3 (5–10)
Flower Week 8	30%	1–2 EC below 1–3 (5–10)

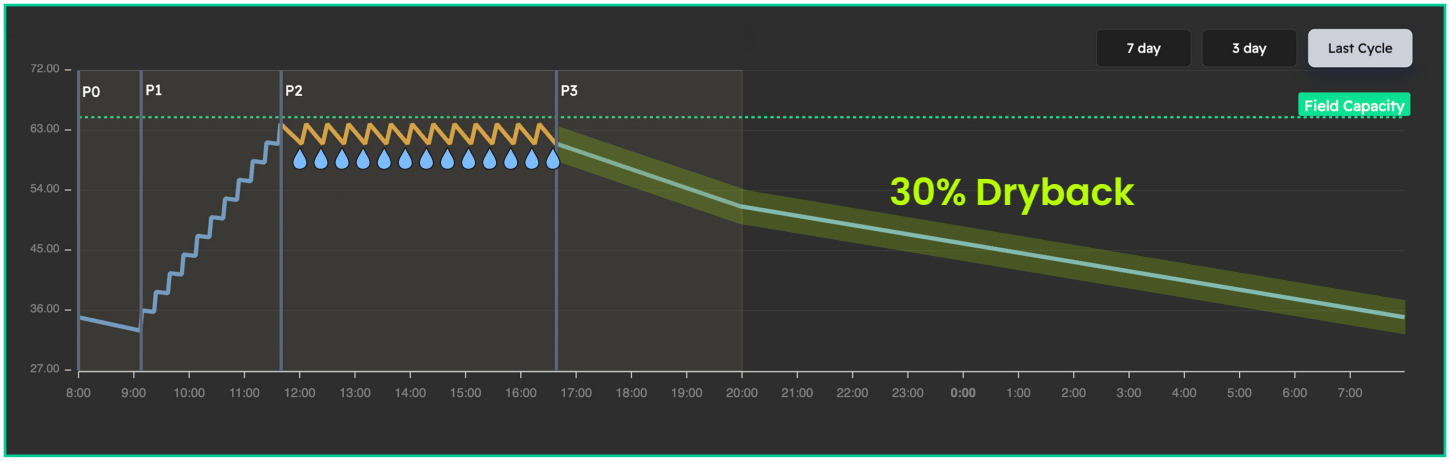
* Copilot Targets

Generative – **P0:** 2%
P1: 3% shot, 0.2–0.5% dryback
P2: 5% (adjust per EC)
P3: 30%+

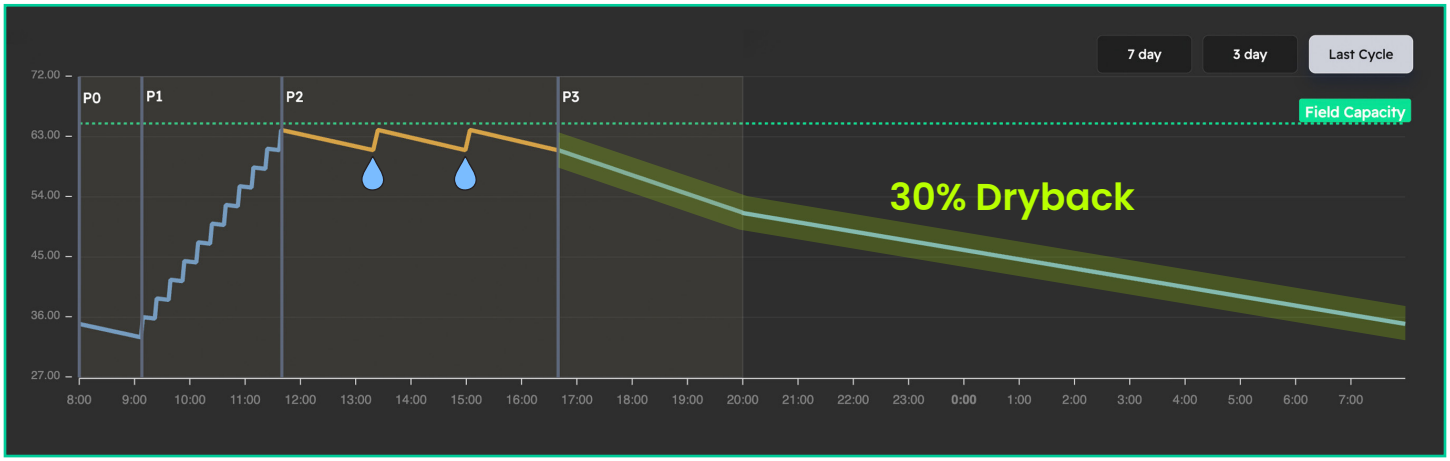


When transitioning back to generative again during the final weeks of flower, you are going to increase the overnight dryback and EC target again like during stretch. By this time, your plants should be drinking quite a bit so you will likely still need some P2s even with a 30% dryback target.

Dialing in the exact amount of P2s needed at this point is achieved by simply increasing your overnight dryback target, which then lets Copilot adjust accordingly based on your rate of dryback. Just like during Bulk, EC can be managed through the duration/frequency of your P2s. The more frequent your P2s, the more runoff will be pushed, lowering your EC since you are irrigating close to your field capacity line. The less frequent P2s you push, the less runoff will be pushed, increasing your EC. This concept can be expedited by artificially lowering your field capacity again like during early flower if desired.



Smaller more frequent shots = more runoff = gradual decrease in EC



Larger more infrequent shots = less runoff = gradual increase in EC

Successful crop steering comes down to consistency, awareness, and small, intentional adjustments over time. Focus on maintaining a stable environment, monitor how your plants respond, and refine your approach as needed. The goal isn't perfection—it's control and repeatability. Use these principles as a foundation, and continue adapting your strategy to suit your system and growth stage.

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