INTRODUCTION TO CROP STEERING

Indoor cannabis cultivation has several benefits, including the ability to control our climate, light intensity, and irrigation, which significantly regulates how our plants grow. Every action we take, from the adjustment of day/night temperature, humidity, light intensity, day length, irrigation volume, and frequency to the timing and way we defoliate our plants, steers the plant's physical and chemical growth response.

So, it's essential to understand how these factors affect a plant's development and how to use them to your advantage. By taking regular measurements of climate and rootzone conditions in combination with tracking plant growth, you can determine how to get the best performance out of your crop.

What is Crop Steering?

Crop steering is a method of managing plant growth by adjusting irrigation and climate to achieve a desired response from the plant. By adjusting environmental and root-zone conditions, growers can steer plant growth vegetatively or generatively. Vegetative and generative steering can be used at every growth stage to keep the plants in balance throughout their lifecycle.

Vegetative Growth is when the plant produces roots, leaves, and shoots for a strong structure.

Generative Growth is the development of fruits and flowers reproductive organs

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Crop Steering Using Irrigation

Crop steering can be achieved in part through irrigation. The volume, frequency, and timing of irrigation events are applied to influence the plant's response and steer the growth. Adjusting the irrigation strategy specifically for the environment, genetics, and stage of development will optimize the plant's growth and maximize final product yield and quality.

ROOT ZONE	VEGETATIVE	GENERATIVE
WC	↑	↓
WC DECREASE NIGHT START - STOP TIME	→ ←	→ ←
IRRIGATION FREQUENCY	↑	↓
EC	↓	↑
TEMP SUBSTRATE	↑	↓

This chart shows examples of irrigation steering. These are specific to certain crops and varieties, so in some cases, something that creates a generative action in one type of plant might be a vegetative action in another. So, it's important to test them and measure how the plants react.

If you want your plants to grow more vegetatively, you can implement a vegetative irrigation strategy by:

- Maintaining a higher overall WC in the root zone
- Having smaller dry backs between daytime irrigation events and smaller dry backs from the last irrigation of the day until the first irrigation the following day.
- Using small shot sizes at a high(er) frequency of irrigation
- Lowering the EC at the dripper and in the root zone
- Maintaining higher root zone temperatures

These actions will help the plants grow and recover from transplant faster while maintaining vigor. If you want your plants to be more generative, you might:

- Decrease the overall WC in the root zone
- Increase the dry backs between each irrigation and overnight by delaying the first irrigation of the day and increasing the time between the final irrigation event and the dark period.
- Decrease irrigation frequency while increasing the volume of each shot
- Increase the dripper and rootzone EC
- Maintain lower substrate temps

To figure out how each cultivar would react, it's important to try out these strategies while performing regular crop registration of plant height, node spacing, root development, overall plant development, and health. This will help determine how each cultivar will respond to the irrigation steering.

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Crop Steering Using Climate

Like irrigation, climate has a profound effect on how plants grow and can be used as a tool to steer growth. Climate steering techniques shown in the next chart should be tested to see how they affect each individual cultivar. For photoperiodic plants like cannabis, switching the day-night cycle to 12 hours on and 12 hours off is used for induce flower. Just like the change in photoperiod, there are many other climate parameters that can be manipulated to steer the plant's growth vegetatively or generatively.

Maintaining higher ambient temperatures is more vegetative, keeping the plant more active in developing roots, shoots, leaves, and stem, while overall lower temperatures slow growth rates and mimic the natural seasonal changes that the plant might experience towards the end of its lifecycle in many outdoor climates, thus steering it more generatively. That said, even subtle shifts in ambient temperatures can signal plants to shift their energetic expenditures from vegetative production to generative production. Changes in the difference between day and night temperatures can potentially control stretching, with large differences increasing inter-node spacing and small differences decreasing inter-node spacing and creating a more sturdy and compact plant structure.

The speed of the temperature change from day to night/night to day, increasing or decreasing relative humidity, the number of air exchanges in the room, and in greenhouse, the heating temperature used (pipe temperature) also helps to steer the plant. So, it's important to keep track of climate parameters and correlate them to crop development.

CLIMATE	VEGETATIVE	GENERATIVE
TEMPERATURE 24 HOURS	↑	↓
DIFFERENCE TDAY-TNIGHT	↔	⟷
SPEED TEMP CHANGE	↗ ↘	↗ ↘
VAPOR PRESSURE DEFICIT (kPa)	↓	↑
VENTILATION / AIR CHANGE	↓	↑
PIPE TEMPERATURE (IF USING)	↑	↓

This chart shows examples of climate steering. These are specific to certain crops and varieties, so in some cases, something that creates a generative action in one type of plant might be a vegetative action for another type. It is always important to test new climate strategies and measure how the plants' response.

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Knowing How and When to Steer Plant Growth

Most indoor gardeners know how much they grow per light and their general potency levels, but knowing how they achieved that result and how to repeat the result time and time again is key.

> "The more you know, the better you grow."

Having a thorough understanding of how your plants develop is a critical step to growing a consistent and quality crop time after time. Notes on how the plants develop and react to climate and irrigation conditions will be critical in helping determine which steering strategies should be deployed in each phase of growth. At every growth stage, you should take detailed notes on the root development speed and root-system architecture, plant posture, plant height, stem diameter, leaf/stem color, and node spacing.

You should also note the time it takes for flower sites to develop as well as how rapidly they fill out. Important rhizosphere conditions to track daily over the life-cycle of the crop include substrate water content, substrate electrical conductivity, substrate temperature, irrigation volume, drip electrical conductivity, drain volume, drain electrical conductivity, and drain pH. All these parameters will help you determine the optimum irrigation and climate strategies to apply to your plants at the right time throughout the crop's lifecycle.