HORTAU

SIMPLIFIED IRRIGATION®

A Guide to Irrigation Management in Celery

With Hortau Precision Irrigation Management

A GUIDE TO IRRIGATION MANAGEMENT IN CELERY

Mid- to late-summer irrigation management in cool season vegetables can be fairly tricky with most of the Salinas Valley's acreage planted and water demand at its peak. These high production months seem to be a never ending juggle between keeping up with crop water demand and providing the right conditions for tractors to breaking bottoms, side dress fertilizers and spray.

During this time, growers face the concern of drying out the shoulder and seed line of their beds, losing their irrigation bubble and having to save the day with sprinklers. Celery in the Salinas Valley is a good example of how important it is to manage irrigation within the capacity of the crop and the soil profile that it's grown in. From establishing transplants using sprinklers, to finishing the field with drip, there is a vast change in water demand. By monitoring the root zone using soil tension, growers can make the correct irrigation decisions, reduce crop stress and avoid preferential flow.

The Salinas Valley is broken down into two major soils with an adobe clay and sandy loam. The clay soil seen in Salinas and Castroville, Calif., has on average an Available Water Holding Capacity (AWHC) of 17.75 percent that holds 2.13 inches of water per foot of soil. This clay is able to retain water much easier than the sandy loam, but holds serious challenges if it dries out. The clay soil will generally create large cracks and macropores under dry soil conditions that cause serious issues of preferential flow.

The sandy loam seen in areas like Chualar, Calif., have an AWHC of 15 percent or 1.8 inches per foot of soil. This soil is notorious for crusting over and requiring cultivation before irrigation. Despite crusting issues, this soil absorbs water fairly rapid and is easier to rehydrate than clay soil. With both of these soils there is a fine line between maintaining moisture for the crop and providing the needed accessibility for equipment.

"Simply put, we need to maintain moisture where the roots are and where they will be."

The first week of establishing celery plugs is fairly common as is the case with most transplants. Just like broccoli or cauliflower, these plants have a shallow root structure bound to the dimensions of the coco perlite that they were grown in. During the first irrigation it's important to look at the soil's AWHC. Taking into consideration of the type of soil being farmed, a grower can estimate that the listed beds will not require the full AWHC value. When applying water, the objective is to rehydrate the profile to 10-foot and provide the transplants with enough moisture to promote root development to extend out of the plug.

Most irrigations apply ¾-inch to 1-inch of water to the new transplants using sprinklers. Irrigations that exceed 1.5 inches pose issues of over-saturating the root profile and longer wait period to break furrow bottoms. Because these plants have minimal root and leaf structure, it's important to ensure that the 4- to 6-inch profile does not dry out or become over-watered. Over watering at this stage can facilitate hypoxic root conditions that lead to slower root uptake of nutrients with stunted and staggered plant growth. On the opposite side, growers that dry out their soil profile too much can cause the same results because of a desiccated root zone.

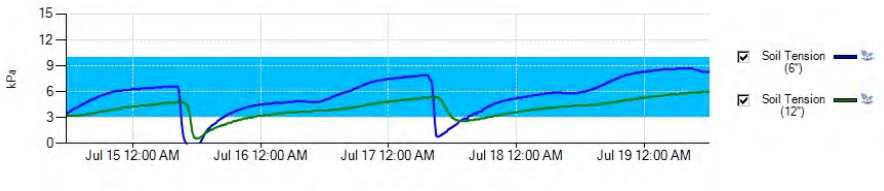

Figure 1

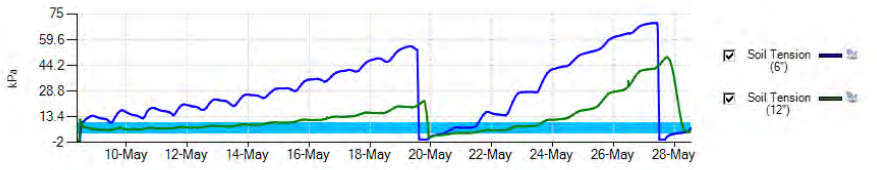

Figure 2

The tough love method of making transplants seek water poses issues in crop uniformity, but also exposes the genetic diversity within the phenotypes of your transplants. Simply put, it's imperative to maintain moisture where the roots are and where they will be.

Figure 1 shows how frequent the irrigations are for establishing celery transplants. After the July 15 irrigation the grower made a quick change of reducing his runtime for the next irrigation on July 17. **Figure 2** shows the method of drying out the soil in order for the transplants to "seek water." It's easy to see that for several days the plant line at 6 inches is dry and is above the plant's physical ability to uptake water and nutrients causing crop stress. In this field there was a significant amount of chlorosis.

After transplants have been established with sprinklers, the crop transitions to using single line drip tape. At this stage of the crop fibrous roots are moving into the deeper profile and expanding horizontally within the bed. These more robust roots allow the plant to remove water from higher tension levels than at a younger stage of growth. This rapid development of roots will require growers to irrigate every third day to keep up with water loss in the shoulder and root uptake throughout the bed. Knowing that the soil profile can only hold so much water, it's critical to be precise on water applications as to not over water or underwater.

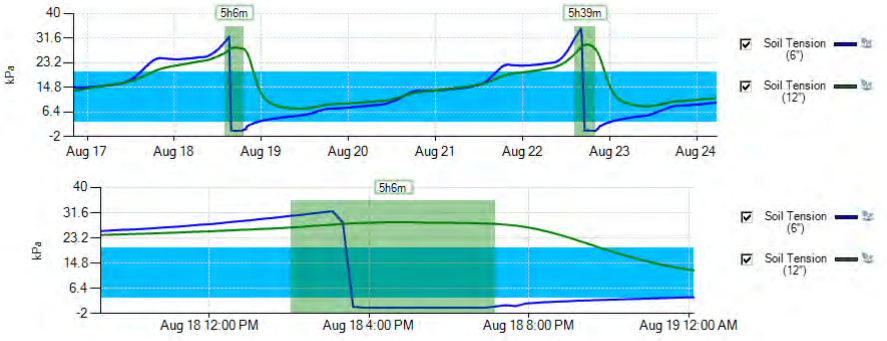

Figure 3

Monitoring soil tension lets growers know exactly when to turn the water on and off. In **Figure 3,** the transparent green band identifies when water was applied and for how long. This graph shows the applied water using drip is moving laterally into the plant line and then percolating down to 12 inches in the center of the bed. Post-irrigation, there is optimal available water conditions, which is complemented by healthy and uniform root activity throughout the root zone.

Over watering with drip can leave plants in a hypoxic or even anaerobic root environment. The blue transparent band in the graphs identify irrigations applied to the same growth stage of celery in the previous example. The root zone at 12 inches is left waterlogged, offsetting the root uptake of the plant to the shallower root zone. Zooming into **Figure 3 (bottom)** shows that the water reaches the center of the bed at 12 inches before moving laterally toward the root zone at 6 inches. Test augers in this field showed water well into the 36-inch range with a similar saturated soil profile. Nutrient deficiencies were also identified in the crop because of over watering.

Water will naturally seek the path of least resistance and travels through the center of the bed because of the saturated band below the drip tape. The wetting pattern in this field resembles more of an icicle than a bubble, but it can be fixed. Running more frequent and shorter irrigations, every 2 days for 3 hours, gives the deeper root zone a break and replenish water uptake in the plant line and shoulder of the bed.

The root structure of celery in its final 4 weeks looks like a Halloween wig. Just below the crown is a massive ball of fibrous roots that cling to the soil for every last drop of water. As celery matures so does its root mass and demand for water. Closer to harvest the optimal tension range decreases to our initial comfort zone during establishment.

Depending on weather, some fields will receive water every two to three days. Keeping the soil hydrated helps maintain a uniform wetting pattern that moves laterally toward the plants as well as gravitationally toward the deeper roots. Preventing dry shoulder conditions during this rapid plant growth stage will continue to promote vegetative growth. Plant stress at this stage will lead to pith or stringiness as the plant flips its biological switch to a reproductive stage. The concept that celery naturally likes to be wet is partially true but has its limitations.

Growing celery in saturated and muddy conditions contradicts the plant's physiological ability to uptake nutrients should be avoided at all costs. Years ago, field workers would often bring high boots or waders with them if they were checking on celery, as the soil tended to be soaking wet to the point that they would sink calf-deep into a furrow when walking the fields. The anaerobic growing conditions can lead to nutrient deficiencies, like a lack of calcium, in turn, causing black-heart and thin cell walls. These fields would require

days and sometimes an entire week to dry out enough for a tractor to get into the field — a harvesting crew's nightmare. Water applications in the 10 days of celery should also not exceed the limitations of the plants or the soil. Simply applying water to the field to add weight only works when the crop is able to uptake water. The best recommendation to growers in the final week is to irrigate every other day for 3 to 4 hours prior to harvest.

Figure 4 shows that applying twice as much does not get twice as far with the crop. The soil can only hold so much water until it returns to field capacity identified with the red arrows. By cutting irrigation applications in half, the grower would have saved 14 hours of applied water and freed up 14 hours to be applied on different blocks.

Today, growers have stepped up to grow more with less by investing in technology and practices that conserve water, energy and resources. Through Hortau's plant-centric based approach they have been able to add a layer of confidence and transparency that both new and experienced growers can rely on for management decisions. These decisions have resulted in production numbers and water saving increases because they are simply listening to what the plant requires.

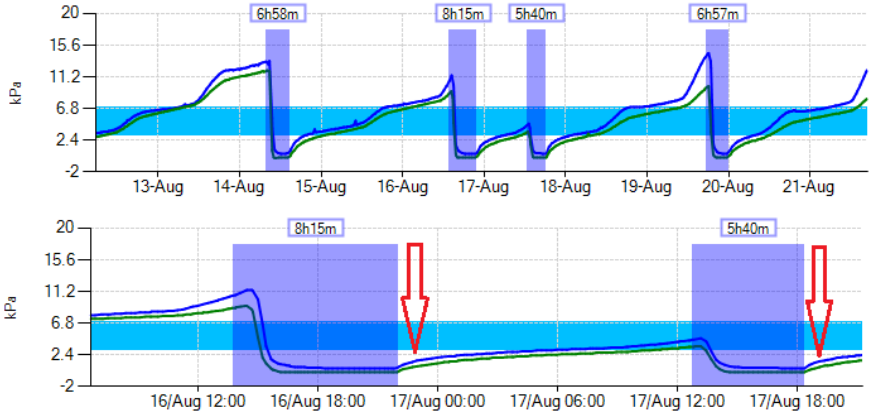

Figure 4

By optimizing crop growing conditions growers can maximize the genetic potential of that variety. Growers on average have saved between 10-30 percent on water and energy by simply applying what the crop requires at the correct time. Quality and boxes per acre have increased because of reduced crop stress and the ability to keep fertilizers within the root zone. With the shrinking margins in the agriculture industry, growers are making the switch to grow more with less by utilizing Hortau's precision irrigation management platform.