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Introduction from our County Directors

Dear Readers:

We hope summer is treating you well and you are having time to engage in some activities that are unique to our area! Our office just completed outreach activities at the San Diego County Fair. We had an excellent response from the public for our demonstrations from both the Master Gardeners and the Master Food Preservers.

The UC Master Food Preservers (UCMFP) are our newest group of dedicated volunteers who provide public service and community outreach on food safety and safe food preservation at home. Volunteers are trained and certified by UC ANR, and they extend up to date research-based information to the public. The UC Master Food Preservers in San Diego County were very well received at the San Diego County Fair and provided numerous demonstrations and other information throughout the duration of this year's fair.

We would also like to welcome two new advisors to our staff: Dr. Matt Fatino, who recently completed his Ph.D. at UC Davis, is the new Avocado, Citrus and Subtropical Horticulture Advisor. He will be housed in San Diego but will also serve Riverside County. Our second new addition to the Advisor group is Dr. Maricela Chavez. She will be working in Indigenous Food Systems and comes to us after working in Minnesota and completing her Ph. D. at the University of Montana. We are happy to have these new faces in the office and hope you will find time to introduce yourselves to them when the opportunity permits.

Thanks for your continued interest in our programs, and we hope you enjoy the rest of the summer!

Regards,

Val Mellano and Ramiro Lobo
Co-County Directors

Cultural Strategies for Managing Turfgrass Diseases in Southern California Landscapes

Written By: Ana M. Pastrana, UCCE Plant Pathology Advisor, Imperial, Riverside, and San Diego Counties

Turfgrass plays a vital role in public parks, residential areas, and recreational facilities across Southern California, offering aesthetic value, functional space, and important environmental benefits. However, maintaining healthy turf can be challenging due to the diversity of diseases that affect both cool and warm season grasses. Successful disease management begins with an understanding of the fundamental elements of the disease triangle. Plant diseases emerge when three factors align: a susceptible host, a virulent pathogen, and favorable environmental conditions (Figure 1). By disrupting any one of these components, the risk of disease can be significantly reduced. Understanding this interaction is essential for implementing effective management strategies.

General Cultural Practices: Your First Line of Defense

A proactive turf management plan tailored to local site conditions is essential for preventing disease outbreaks. Key cultural practices include:

- Selecting the appropriate grass species and cultivar suited to your site's microclimate.
- Preparing and testing soil before planting to ensure optimal growing conditions.
- Irrigating in the early morning to reduce prolonged leaf wetness that favors disease development.
- Using clean, sharp mowing equipment to avoid wounding turf and spreading pathogens.
- Applying fertilizers wisely, based on seasonal needs. Avoid over-fertilizing during dormancy periods, as excess nutrients can benefit pathogens more than the turf.
- Aerating and topdressing to improve soil structure and health.
- Minimizing soil compaction and enhancing drainage, especially in high-traffic zones where turf is more vulnerable.

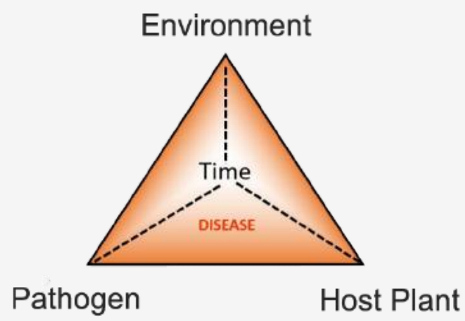

Figure 1. *Components of the disease triangle. Photo: UC ANR.*

Common Turfgrass Diseases in Southern California

1. Leaf Spot and Melting-Out Complex

Pathogens: *Bipolaris, Drechslera, and Curvularia* species.

Affected grasses: Kentucky bluegrass, perennial ryegrass, fescues, bermudagrass.

Symptoms: Small purplish to brown leaf lesions that may coalesce. In advanced stages (melting-out), crown and root rot occur, leading to thinning (Figure 2).

Favorable conditions: These diseases thrive under warm, humid conditions in cool season turfgrasses, particularly during periods of intense heat and moisture. In warm season turfgrasses, outbreaks are more likely during cool, wet weather combined with high humidity.

Cultural management: Leaf spot outbreaks can occur under both low and high nitrogen fertility levels, but excessive nitrogen tends to promote disease development by encouraging dense, succulent growth. Maintaining balanced fertility is key. For example, in Bermudagrass, apply nitrogen at a rate of 1 lb. N per 1,000 ft^2 per growing month to support healthy growth without predisposing turf to disease.

Figure 2. *Leaf spot and melting out complex symptoms. Photos: Pete Landschoot, Penn State Extension.*

Figure 3. *Gray leaf spots symptoms. Photos: NC State Extension.*

2. Gray Leaf Spot

Pathogens: *Pyricularia grisea.*

Hosts: Perennial ryegrass, tall fescue, St. Augustinegrass.

Symptoms: Gray or tan lesions with purple borders; rapid turf thinning.

Cultural management: Gray leaf spot susceptibility varies significantly among cultivars of tall fescue and St. Augustinegrass, making cultivar selection an important consideration in disease management. To reduce disease development, it is essential to irrigate early in the morning to minimize prolonged leaf wetness. In St. Augustinegrass, frequent mowing can also help reduce leaf moisture levels. Additionally, excessive shade can increase humidity and leaf wetness, creating favorable conditions for gray leaf spot to thrive. When symptoms are present, collecting clippings during mowing is recommended to limit the spread of the pathogen.

Figure 4. *Large patch symptoms. Photos: NC State Extension / Texas A&M AgriLife Extension.*

3. Large Patch

Pathogens: *Rhizoctonia solani.*

Hosts: Zoysiagrass, St. Augustinegrass, centipedegrass, and bermudagrass.

Symptoms: Gray leaf spot symptoms often begin as circular to irregular brown or tan patches, frequently bordered by orange or reddish-brown margins (Figure 4). As the disease progresses, leaf sheaths rot at the base of the plant, leading to thinning or collapse of the turf (Figure 4). In the early stages of infection, affected areas may appear greasy or water-soaked, especially under humid conditions.

Cultural management: In regions where cool season turfgrasses can be maintained, fescues and bluegrasses are typically immune to the disease. To support healthy turf and reduce disease risk, avoid nitrogen applications within six weeks of dormancy or within three weeks after spring green-up, as excessive nitrogen can promote disease development. Avoid planting in saturated or low-lying areas; if necessary, install subsurface drainage to improve water movement. Irrigate conservatively in the fall and spring, just enough to prevent drought, while avoiding excess moisture. Finally, reducing soil compaction enhances root health and drainage, further limiting conditions favorable to disease.

4. Take-All Patch

Pathogens: *Gaeumannomyces graminis* var. *graminis*

Hosts: Primarily St. Augustinegrass and bermudagrass, also occasionally affects zoysiagrass, and centipedegrass.

Symptoms: Symptoms of turf decline caused by root and crown rot diseases often begin as irregular patches of thinning or dead turf (Figure 5). Affected plants typically exhibit blackened or rotted roots and stolons, indicating damage below the surface (Figure 5). Chlorosis (yellowing) of the leaves is a common early sign and often precedes dieback. As the disease progresses, patches may coalesce into larger areas, particularly under warm, moist conditions that favor pathogen activity. Notably, affected turf usually fails to respond to fertilization or irrigation.

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Cultural management: Improving drainage and avoiding overwatering is critical to reducing the moist conditions that favor disease development. Limit excessive nitrogen applications in the spring and avoid the use of plant growth regulators. Manganese supplementation has shown efficacy against other Gaeumannomyces species and may contribute to disease suppression in affected areas. Additionally, take steps to minimize plant stress, particularly during periods of cool, wet, and cloudy weather, which can weaken turf and make it more vulnerable to infection.

Figure 5. *Take-all patch symptoms. Photos: LSU Ag Center*

5. Pythium Diseases

- Pythium Blight – the most common and damaging, especially in cool-season grasses.
- Pythium Root Rot – common in both cool and warm season turf under wet, compacted, or poorly drained conditions.
- Pythium Damping-Off – affects seedlings in overseeded or newly planted turf.

Symptoms: Pythium diseases typically present as greasy, water-soaked, or matted turf, especially during periods of high humidity. In the early morning, cottony white mycelium may be visible in affected areas (Figure 6). The disease progresses rapidly, causing blighting and collapse of turf (Figure 6), often appearing in streaks that follow patterns of water movement or mower traffic. Below ground, roots may show signs of rot with little or no root hair, compromising the turf's ability to take up water and nutrients and leading to further decline.

Cultural management: To manage Pythium diseases effectively, it is crucial to reduce prolonged leaf wetness by irrigating during the early morning hours, preferably before sunrise. Avoid applying excessive nitrogen, as it promotes lush, succulent growth that is highly susceptible to infection. When establishing turf, avoid low-lying areas prone to water accumulation. If such areas cannot be avoided, install subsurface drainage to prevent persistently wet soil conditions. Refrain from mowing or irrigating when mycelium is visible on the foliage, as this can easily spread the pathogen. Additionally, always collect and dispose of clippings from infected areas and thoroughly clean mowing equipment before moving to healthy turf to prevent contamination.

Figure 6. *Turfgrass symptoms caused by Phythium spp.*

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Julie Aguilar's 27-Year Journey of Health Education with EFNEP

Written By: Sabina Padilla, EFNEP Youth Educator

University of California Cooperative Extension, San Diego's Expanded Food and Nutrition Education Program (EFNEP) is proud to collaborate with teachers, organizations, schools, food pantries and more to bring vital nutrition education workshops to communities across the county. Our work could not be possible without the support of our outstanding partners, like Julie Aguilar, who is retiring this June after 27 years of service in education. Julie Aguilar graduated from San Diego State University in the School of Exercise and Nutritional Sciences, with a Bachelors in Applied Arts and Sciences in Food and Nutrition with a didactic emphasis. Although SDSU is an accredited didactic program in dietetics, Julie chose public service as an educator. "I have always wanted to teach. I was happy to make an impact on my student's health."

Julie Aguilar has been a cornerstone of student learning at Rincon Middle School in the Escondido Union School District, where she taught Family and Consumer Sciences and Physical Education. Since 2001, she has focused on equipping students with lifelong skills from cooking and meal planning, to goal setting and understanding nutrition. Julie's partnership with EFNEP began thanks to a colleague, Ms. Josephsen, who first introduced her to the program. From that point forward, Julie enthusiastically incorporated EFNEP's EatFit and Hunger Attack curricula into her classroom. These programs help students understand the difference between short-term and long-term fitness and nutrition goals, and how to make informed decisions about their health.

Thanks to her commitment to teaching, an estimated 300 students per year (spanning more than 7,200 students total) have graduated from EFNEP workshops in her classroom. Her influence extends well beyond the numbers, shaping healthier habits and a deeper understanding of nutrition among generations of Escondido youth.

"The biggest change I have seen with my students is that they really are interested in their health and nutrition. Plus, they love cooking items that are made from scratch." says Julie. Julie's classes became a place where nutrition education was practical, engaging and personal. Through EatFit, students learned how to interpret food labels, set achievable health goals, and make everyday choices that align with long-term wellness. Even as EFNEP evolved through curriculum updates, staff changes, and a shift to virtual learning, Julie remained a consistent champion of nutrition education.

"I initially used the program with 7th and 8th graders. My classes rotate every 12 weeks and sometimes I have students for multiple years. So I needed engaging programs for students every year they returned to my classroom. EFNEP's EatFit program is very engaging. And this year I started using the program with all grades, even 6th grade," she shares. Julie's commitment didn't end with her final class. Passionate about continuing the program's legacy at Rincon Middle School, she worked closely with EFNEP to ensure the workshops would live on within the Physical Education Department after her retirement. As Julie Aguilar closes this chapter, we at EFNEP San Diego extend our deepest gratitude for her years of partnership, passion, and service. Her impact is lasting, and her legacy will continue to thrive in the classrooms of tomorrow.

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Responsibility, Leadership, and Lambs: 4-H Youth Thrive Through Animal Science

Written By: Rebeca Manzo, 4-H Program Coordinator

In celebration of **National Farm Animal Day**, UC Cooperative Extension San Diego is proud to highlight the vital role that 4-H plays in helping young people grow into responsible leaders—often with animals by their side.

Thomas Woliung, a dedicated member of the Manzanita 4-H Club, is one of many youths in San Diego County participating in 4-H animal projects each year. His involvement in 4-H runs deep. With a family history that includes his mother, aunts, and cousins, Thomas grew up watching his older siblings care for animals—a sight that sparked his own interest from an early age. By the age of five, he had already taken on the responsibility of raising his first goat, affectionately named Flapjack.

Today, Thomas is preparing a lamb for the fair, and he values the connection he builds with the animal over time. "It's important to gather feedback so I can improve and develop my skills," he shared. Competitive and driven, Thomas commits to the process, from early morning feedings to afternoon training sessions. His daily routine begins around 6 a.m., when he feeds and waters his animals, checks or cleans the pens, and makes sure everything is in order before heading to school. Afterward, he trains with his lamb before repeating the care routine in the evening.

While working with animals isn't without its challenges—especially when a lamb isn't in the mood to cooperate—Thomas has learned to stay calm and take a break when needed. This mindset has taught him patience, consistency, and respect for the animals he works with. These values show up in other areas of his life, too. As president of his 4-H club, Thomas participates in leadership activities and supports other members in their learning. He finds meaning in helping others succeed and values being part of a community that encourages personal growth.

Some of Thomas's favorite memories include helping with the birth of lambs and watching young animals take their first steps. He recalled a humorous moment when one of his lambs jumped up and did a backflip. And before every competition, he carries a cross from his father—a small tradition that keeps him grounded and focused.

Thomas is part of a much larger story. Every year, hundreds of 4-H members across San Diego County raise and care for animals ranging from rabbits to swine and cattle. They participate in local and county-wide fairs, including the **San Diego County Fair**, **Ramona Junior Fair**, and **Eastern San Diego County Junior Fair**, where they demonstrate not only their animal husbandry skills but also their growth as confident communicators, leaders, and community stewards.

At UC Cooperative Extension San Diego, we recognize the profound impact these youth programs have—not just on the lives of 4-H members, but on the future of agriculture and animal stewardship. On **National Farm Animal Day**, we celebrate the youth who care deeply for their animals, rise to new challenges, and carry forward a legacy of learning and leadership.

To learn more about 4-H animal science programs in San Diego, visit https://ucanr.edu/sites/4HSanDiego/.

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Organic Kratky: grow hydroponic organic vegetables in urban areas with excellent water and nutrient efficiency

Written By: Gerry Spinelli, Chris Shogren, and Derrick Robinson

Introduction

The "Kratky method" is a passive form of hydroponics developed by the legendary Emeritus Horticulturist at University of Hawaii and YouTube star Bernard Kratky. Originally developed for small and medium-scale commercial growers, the system became extremely popular with hobbyist and backyard growers for its simplicity and low costs. The Kratky method is a suspended non-circulating hydroponic system mainly used in leafy green production, although vine crops such as tomato and cucumber can also be grown with this method (Kratky, 2004; 2010). Non-circulating is unique in that neither water nor air are pumped through the system, in contrast with other hydroponic methods such as the Nutrient Film Technique (NFT), Deep Water Culture (DWC), Dutch Bucket or Aeroponics. Instead, the nutrient solution is placed in a tub and a cover is placed on the rim of the tub where it remains suspended for the whole crop cycle. Slit pots are placed in holes in the cover, supporting the plant above the nutrient solution and allowing plants roots to grow "chasing" the water; as the water recedes, more air space is created for oxygen exchange.

One of the biggest advantages of the Kratky method is that the initial hydroponic nutrient solution is designed to last for the entire plant cycle, providing water and nutrients to the plants until they are ready to harvest, and this also leads to high water and nutrient efficiency. Very little evaporation occurs, since the holes in the covers are small compared to the tub area, so water use essentially equals plant transpiration. No drainage or leaching occurs from the tub, which is a great advantage compared to vegetables grown directly in the soil. Very little, if any, water and nutrient are left in the tub at harvest, so there is also little or no environmental impact associated with disposal of used nutrient solution, common with NFT and Dutch Bucket systems.

Additionally, the Kratky system allows for high labor efficiency, since the only labor required is to set up the tub and to harvest. No labor is required for operations like tilling, weeding, and watering, that are normally required in a soil-based system. No electricity is required to run the system, and there is no risk of plant dying in case of a power blackout (this is a big issue in NFT, and to a lesser degree in Dutch Bucket and Aeroponic systems).

The concept of organic hydroponics has been around for many years and has been quite controversial. Many commercial companies grow organic leafy greens in NFT systems or tomatoes in Dutch Bucket systems. USDA certifies these vegetables as organic, as long as OMRI-listed fertilizers are used (additionally, in California, fertilizers also need to be approved by CDFA Organic Input Materials Program). Some practitioners are against this idea so they created the Real Organic Project (https://www.realorganicproject.org/) arguing that only soil-based systems should be called organic. The authors of this article are neutral in this debate since their only goal is to support urban food production and the horticultural industry through scientific experimentation.

Small and medium-scale urban farmers could greatly benefit from a technique like this that allows for the efficient growing of organic vegetables that can be sold at a premium price at various local outlets, such as farmers markets or farm stands. The technique is particularly well-suited for urban agriculture, since it does not require soil and can be used on paved surfaces, rooftops, and asphalt. Schools, community gardens and non-profit organizations could also adopt such a technique to grow organic vegetables, increasing food security and access in smaller system settings.

To the best of the authors' knowledge, the current industry standard liquid fertilizer for hydroponic organic leafy green production is Pre-Empt, a liquid water-based fertilizer OMRI-listed and commercialized by Hort Americas. The product results from fermentation of molasses, a byproduct of Florida's sugarcane industry, and therefore is heavy. This also makes it expensive, mainly due to high freight costs. The product's notable advantages are that little or no biofilm develops in the hydroponic system, a common problem with other liquid organic fertilizers such as fish emulsion. Another advantage is that a large fraction of nitrogen in the product is present in nitrate and ammonium form and hence is immediately available for plant uptake, while other organic fertilizers need to be mineralized by microbial activity before nitrogen becomes available to plants.

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For those fertilizers, it is common to install a biofilter or a bioreactor and pump the hydroponic solution through it to facilitate microbial activity and mineralize organic matter to ammonium. This is also common in aquaponic systems to transform fish waste into a form of nitrogen that the plants can uptake.

The manufacturer of Pre-Empt does not provide an analysis for the product (which is unusual for fertilizers), so the authors analyzed a sample and reported the results in Table 1. A notable disadvantage of the product, apparent from the nutrient analysis, is the unbalanced composition in terms of nitrogen, phosphorous and potassium compared to typical plant uptake. This is common in other organic fertilizers, such as fish emulsion and pelletized chicken manure, that also contain higher contents of phosphorus compared to nitrogen. Given this nutrient imbalance, to satisfy the crop's nitrogen needs, a grower would need to overapply phosphorous and potassium if they relied only on Pre-Empt for their hydroponic crop; in circulating systems after a few crop cycles, this would lead to an excess of phosphorous and potassium, which would require disposal of the nutrient solution. Additionally, there are cheaper commercially available and highly soluble organic sources of nitrogen, such as soy hydrolysate products.

Due to its non-circulating nature, the Kratky system's Achilles' heel is the low concentration of dissolved oxygen in the nutrient solution since its oxygenation relies solely on passive oxygen diffusion. Therefore, one challenge of using Kratky with organic fertilizers is the risk of developing anaerobic conditions in the nutrient solution limiting root growth. This risk is higher for an organic fertilizer because it requires oxygen-consuming microbial activity to mineralize nitrogen from protein and aminoacid form into ammonium. Dr. Kratky does not recommend organic fertilizer given the risk of the development of anaerobic conditions (pers. comm.).

In this study, the authors grew vegetables using the Kratky method with organic fertilizers in Southern California in small (20 gal) and medium (120 gal) tubs, with 12 and 60 plants per tub respectively. The goal of the study was to: 1) record yields, crop cycle length, nutrient and water use efficiency in an organic Kratky system; 2) compare these parameters with conventional Kratky and with conventional soil-based lettuce production; and 3) experiment with low-cost balanced organic fertilizer recipes for organic Kratky systems.

Materials and Methods

This study was conducted at the South Coast Research and Extension Center (Irvine, CA) and in a private field lot in Southeast San Diego. Two sizes of tubs were used in this study. A 20-gal Black Large PVC Concrete Mixing Tub (Plasgad) with dimension 2' x 3' and 6 inches deep; and a 120-gal rectangular tub 4' x 8' and 7 inches deep made of fiberglass (Botanicare model GT96x48x7B). The 20-gal tubs were placed on a leveled concrete surface, while the 120-gal tubs were set on 29-inch tall wooden sawhorses to facilitate planting and harvesting operations. Tub covers were built from Henry R-Tech expanded polystyrene 4' x 8' panels, 1" thick for the 20-gal tub and 1.5" thick for the 120-gal tubs. For the 20-gal tubs, the panels were cut into 2' x 3' pieces while one entire panel fit on the 120-gal tub.

Bib lettuce, oakleaf lettuce, kale, bok choy, and basil were planted in the tubs using 2" or 3" slit pots made by Teku. Seeds were placed in Grodan A-OK 1.5" rockwool plugs in 10"x20" germination trays and transferred into slit pots in the tub cover 2 to 5 days after seeding. Since the rockwool is not OMRI-listed we experimented with 1.25" Riococo wrapped coco coir plugs and Jiffy Organic Peat Pellet 30x65mm in 105 cell trays (Item 70001432).

We experimented with different organic fertilizer solutions by using only Pre-empt and or by mixing Pre-Empt with high-N organic water soluble fertilizers. This fertilizer solution was made by mixing Pre-Empt and either Ferticell Explorer 16-0-0 or Grower's secret 16-0-0. Ferticell Explorer 16-0-0 and Grower's secret 16-0-0 are powdered highly soluble organic high-nitrogen fertilizers derived from hydrolysis of soybean meal. For a 20-gal (75.7 liters) tub with 12 plants we assumed a dry weight of 20 grams per plant and employed the sufficiency ranges in dry weight for basil from Bryson (2014) namely 5% of N, 1% of P and 2% of K leading to a requirement of 12 grams of N, 2.4 grams of P and 4.8 grams of K per 20-gal tub.

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Nutrient	% in Pre-Empt	Notes	% in Grower's Secret 16-0-0	Notes	% in Explorer 16-0-0	Notes
NO3-N	0.71	About 32% of total	0.3	About 2% of total	0.3	About 2% of total
NH4-N	0.38	About 17% of total	0.9	About 5% of total	0.9	About 5% of total
Org. N	1.12	About 50% of total	15.3	About 93% of total	16.7	About 93% of total
Total N	2.2		16.5		17.9	
P_2O_5	1.81	Equals about 0.8% P	0		0	
K_2O	2.56	Equals about 2.1% K	0		0	
S	0.1		0.73		1.07	
Cu	0.0141		0.001		0.001	
Zn	0.0153		0.005		0.005	
Mn	0.032		0.001		0.001	
Fe	0.0358		0.054		0.011	
B	0.005		0.005		0.005	
Mo	0	Below detection limit	0.002		0.003	
Al	0	Below detection limit	-	Not measured	-	Not measured
Ca	0.19		0.8		0.6	
Mg	0.06		0		0	

Table 1. *Results of nutrient analysis for PreEmpt, Grower's Secret 16-0-0 and Ferticell Explorer.*

To meet this requirement, we added 10 fl. oz. (i.e. 291 grams) of Pre-Empt, corresponding to 6.4 grams of N, 2.3 grams of P and 6.2 grams of K; and 1.76 oz (i.e. 50 grams) of 16-0-0, corresponding to 8 grams of N; Therefore, the total quantity of nutrients were 14.4 grams of N, 2.3 grams of P, and 6.2 grams of K. In the same fashion, for a 120-gal tub with 60 plants, we calculated a requirement of 60 grams of N, 12 grams of P and 24 grams of K and applied 60 fl oz (1748 grams) for Pre-Empt and 6.2 oz (175 grams) of 16-0-0, leading to a total quantity of nutrients of 66.4 grams of N, 13.8 grams of P and 37.1 grams of K. .

Compared to using solely Pre-Empt for a 20-gal tub, with this recipe, we used half of the quantity of Pre-Empt otherwise needed (10 fl oz instead of 20 fl oz) by supplementing nitrogen with the more affordable 16-0-0. This recipe drove down the costs of fertilizer from $5.12 to $3.13 per 20-gal tub. Similarly, our fertilizer recipe cost $20 for a 120-gal tub, compared to $31 using only Pre-Empt.

The number of plants per square foot of tub and per gallon of water in the tub were calculated from the ranges recommended in Kratky (2010), namely 1.5 to 2 gallons of nutrient solution per plant. In the 20-gal tub ,we had 1.6 gallons per plant, and in the 120-gal tub, we had 2 gallons per plant. Similarly, Kratky recommends 1.5 and 1.9 plants per square foot. We had 2 plants per square foot in the 20-gal tub and 1.875 plants per square foot in the 120-gal tub.

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After planting, the electrical conductivity in the 20-gal tub was 1.9 dS/m and the pH was 6.5. In the 120-gal tub the EC was 2.1 and the pH was 6.3.

Results and Discussion

The 20-gal tubs were planted on 4/7/23 and harvested between 5/22/23 and 5/29/23. The cycle lasted about 50 days (Table 2). A second cycle was planted on 2/19/2024 and harvested on 4/18/24. This winter cycle lasted 59 days. The 120-gal tubs were planted on 7/25/23 and harvested between 8/30/23 and 9/6/23. The cycle lasted between 36 and 43 days. Kale and bok choy suffered from nutritional deficiencies and were harvested on 9/29, 66 days after planting.

Yield data is reported in Table 2 for bib lettuce, oakleaf lettuce, basil, kale and bok choy. Taking bib lettuce as an example, or the 2'x3' tubs, the average yield per plant was 267, while for the 4' x 8' tub, it was 332 grams or 0.73 pounds. Aligning four 2'x3' tubs side-to-side, one obtains a footprint of 8'x3'. Considering 1 ft walkways around the tubs for access, the footprint becomes 10'x5'= 50 ft^2 to grow 12x4= 48 plants. Similarly, in the 4'x8' tubs, one uses 6'x10'=60 ft^2 to grow 60 plants. Assuming a 5% plant loss, the number of plants produced becomes 45 and 57, respectively. Thus, the average yields obtained in this study were for lettuce (45 x 0.73)/50 = 0.66 lbs/ft^2 in 20-gal tubs and (57 x 0.73)/60 = 0.69 lbs/ft^2 in 120-gal tubs. Although we did not design the study to test for this variable, no difference in yield or quality was observed between the Ferticell Explorer and the Grower's secret 16-0-0.

	20-gal tub, yield in grams per plant				120-gal tub, yield in grams per plant			
	Average	Minimum	Maximum	Cycle length, days	Average	Minimum	Maximum	Cycle length, days
Bib Lettuce	267	140	358	59 (winter cycle)	332	176	399	43
Oakleaf Lettuce	279	122	389	50	313	128	433	43
Basil	126	86	170	50	163	108	231	43
Kale	-	-	-	-	145	96	254	66
Bok Choy	-	-	-	-	132	63	193	66

Table 2. *Yields (fresh weight at harvest) of lettuce and basil obtained in the study*

Assuming a 5% plant loss, the water use efficiency for the 3'x2', 12-plant, 20-gal tub, that produced 11 lettuces or (11 x 0.73)/20 = 0.40 lbs of lettuce per gallon of water. Similarly, the 120-gal tub produced 57 lettuces or (57 x 0.73)/120 = 0.35 lbs of lettuce per gallon of water. In the 20-gal tub, we applied 12 grams of nitrogen (0.0264 pounds of nitrogen) and produced on average 0.73 lbs of lettuce per plant. Considering 11 plants, the nitrogen use efficiency was (11x0.73)/0.0264 = 304 lbs of lettuce per pound of nitrogen. In the 120-gal tub, we applied 66.4 grams of nitrogen (0.146 pounds of nitrogen) and produced on average (57x0.73)/0.146 = 285 lbs of lettuce per pound of nitrogen.

For comparison, the 2023 UC Davis cost study for conventional romaine lettuce reports an average yield of 850 22-lbs cartons per acre or 18,700 lbs per acre or 0.43 lbs per ft^2, that is an average yield for soil grown conventional lettuce in the Salinas valley (Table 3). The same study reports a "seasonal total of 12 acre-inches per acre" of irrigation applied. Since the Kratky tubs used in this study were 6 inch deep, we used half the water on a per-acre basis. On a yield basis, the water use efficiency of one acre of Salinas valley lettuce is 18,700 lbs of lettuce per 12 acre-inches of water, or 325,851 gallons of water, equaling 0.06 lbs of lettuce per gallon of water (about one order of magnitude less than in our study). Finally, the same study reports a "total of 178 pounds of N per acre applied during the season", so the nitrogen use efficiency on fresh weight is (18,700/178=) 105 lbs of lettuce are produced with a pound of nitrogen (about a third than in our study).

Similarly, in Table 3, are reported values of yield, fresh-weight Water Use Efficiency and Nitrogen Use Efficiency obtained from UC Davis cost studies for leafy greens and from Kalamartzis et al., 2020 for basil. Efficiencies obtained for lettuce in this study are generally higher than in the UC Davis cost studies, except for conventional Iceberg lettuce that showed similar Nitrogen Use Efficiency but lower Water Use Efficiency. Yields and efficiencies obtained by Kalamartzis et al., 2020 for field-grown conventional basil were similar or higher than those obtained in this study, although in this study Water Use Efficiency was calculated solely on applied irrigation water and does not include rains. For comparison, we used the variety x irrigation treatment obtained by Kalamartzis et al., 2020 that resulted in the highest water use efficiency.

In the 120-gal tub, we observed interveinal chlorosis in young leaves in kale and bok choy. This is a tell-tale symptom of iron and manganese deficiencies that appeared to be associated with low micronutrient availability at high pH. Although we did not employ it in this study, OMRI-listed citric acid is commercially available to reduce pH in organic systems. At harvest, a low amount of leftover nutrient solution was observed in the 120-gal tubs, explaining the slightly lower resource use efficiency calculated for the 120-gal tubs compared to the 20-gal tubs.

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Study	Vegetable	Yield	Water Use Efficiency	Nitrogen Use Efficiency	Notes
		lbs of crop/ft^2	lbs of crop/gal	lbs of crop/lbs of N	
Lettuce					
This study, 20-gal tub	Organic Bib lettuce	0.66	0.40	304	
This study, 120-gal tub	Organic Bib lettuce	0.69	0.35	285	
UC Davis Cost study 2023	Conventional Romaine hearts	0.43	0.06	105	
UC Davis Cost study 2024	Conventional Iceberg lettuce	0.87	0.11	300	
UC Davis Cost study 2015	Organic Spinach	0.15	0.03	65	
Nicholson et al., 2020	Conventional Butter lettuce in greenhouse		0.4		Calculated from 20.9 liters/Kg from Harbick & Albright, 2016
Nicola et al., 2020	Conventional Indoor lettuce		0.62		Calculated from 75 grams fresh weight/liter
Basil					
This study, 20-gal tub	Organic Basil	0.32	0.20	150	
This study, 120-gal tub	Organic Basil	0.34	0.17	141	
Kalamartzis et al., 2020	Conventional Basil	0.35	0.2	172	Calculated from highest dry-weight WUE: 72 kg/(ha mm)
Pennisi et al., 2019	Conventional Indoor basil		0.37		Calculated from 44.5 grams fresh weight/liter

Table 3. Comparison of yield, fresh-weight water and nitrogen use efficiency obtained in this study and from the literature.

Conclusions

We grew organic vegetables in the Kratky system, obtaining substantially higher yields than field-grown conventional lettuce, as well as high water and nutrient efficiency and a very short crop cycle. However, the yield recorded in this study was lower than the yield observed in a similar Kratky system using synthetic fertilizers (data not shown). The organic fertilizer recipe used in this study appears to provide nutrients to a variety of leafy greens and is cheaper than the industry standard used in organic hydroponic systems that employs only Pre-Empt fertilizer. The expected low oxygen availability in the nutrient solution did not seem to limit plant growth during the season and in the conditions of this study. It appears that available ammonium and nitrate from Pre-Empt was sufficient to support plant uptake at the beginning of the cycle, while additional nitrogen was mineralized from the 16-0-0 fertilizer for later uptake. Further work could involve: experimenting with OMRI-listed plugs or substrates for the germination phase; testing pH correction in the nutrient solution at the beginning of the cycle o later with citric acid; and investigating dissolved oxygen and nitrogen availability dynamics from mineralization and uptake throughout the crop cycle.

Continued Pg. 13

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Front row from left, Rachael Callahan, Darlene Ruiz, Karen Ross and Paul Towers, executive director of Community Alliance with Family Farmers. Standing from left, Ramiro Lobo; Caroline Beteta, President and CEO of Visit California; Jan Gonzales; Danna Stroud, Go-Biz Associate Deputy Director of Regional Engagement & Development; and Glenda Humiston

Agritourism Programming in Full Swing!

Written By: Janis Gonzales, Project Coordinator, and Darlene Ruiz, Small Farms Staff Research Associate

The UC Cooperative Extension San Diego (UCCE San Diego) Agritourism Program has had an exciting and productive first half of 2025! From networking events and webinars to an in-depth online course and a statewide summit, the program has been actively supporting local growers and agritourism stakeholders.

During one of the farm tour visits, Neva Day talks about dragonfruit production and marketing at Wallace Ranch.

Responding to Grower Needs

Based on feedback from past events, growers expressed a strong interest in learning more about business costs, regulations, and marketing. In response, UCCE San Diego curated a series of educational opportunities centered around business planning—designed to support both new and existing agritourism ventures.

Spring Kickoff: Networking Gathering

The season began with a hybrid Networking Gathering at the Farm Bureau Farm Hub in Escondido, a shift from the usual on-farm setting. This format allowed for both in-person and virtual participation. Attendees explored business planning fundamentals, were introduced to a new online planning tool, and heard directly from representatives of the County of San Diego Planning & Development Services.

March Webinar Series

In March, UCCE hosted a four-part webinar series, each session diving into key aspects of business planning. Topics included:

- Record keeping essentials
- Utilizing AgPlan tools from the Center for Farm Financial Management
- Legal, tax, and insurance self-check-ups
- Food safety practices on and off the farm

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Online Business Planning Course

For those seeking deeper engagement, UCCE partnered with Joe Molina of the National Veterans Chamber of Commerce to offer a six-week online course focused on agricultural business planning. Participants received personalized guidance and feedback as they developed or modified their own business plans.

California Agritourism Summit

The highlight of the season was the California Agritourism Summit, held May 14–15, 2025. Co-hosted by UCCE San Diego and the statewide UC ANR Agritourism program, Sustainable Agriculture Research and Education Program (SAREP), the summit brought together over 150 participants from across the state.

Day 1: Workshop on Wheels
The first day featured two bus tours showcasing successful agritourism and direct sales operations in San Diego County. Tours began and ended at the iconic Flower Fields in Carlsbad, where attendees learned about the site's history, U-pick blueberries, and UCCE's urban agriculture research. The day concluded with a festive reception hosted by California Grown, featuring local food, wine, and a warm welcome from California Secretary of Agriculture Karen Ross.

Day 2: Presentations & Panels
The second day offered a full schedule of expert panels, roundtable discussions, and networking. After opening remarks from program coordinators Rachael Callahan (UC SAREP) and Jan Gonzales (UCCE San Diego), Secretary Ross set the tone for the day with an inspiring keynote. A standout panel moderated by UC ANR Vice President Glenda Humiston featured leaders from Visit California, GO-Biz, and the Community Alliance with Family Farmers (CAFF). Additional sessions covered topics such as:

- Agritourism development and support
- Marketing strategies
- Liability and visitor safety
- Collaborative marketing models

North County Coastal Workshop participants enjoyed wine, lunch, networking, and scenic views at Beach House Winery.

Looking Ahead

A full summit report will be released in the coming months, but early feedback has been overwhelmingly positive. With eight farms visited and strong participant engagement, the event was a resounding success. For more key takeaways and highlights: view this brief event summary, "California Agritourism Summit 2025" and highlights video, "Planting Profits: How Agritourism is Growing California's Farms."

Stay tuned for upcoming local events and opportunities! To receive the latest updates, be sure to subscribe to the UCCE San Diego Agritourism Program email list.

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Growing Tomatoes in San Diego

Timing and Varieties: Tomatoes can be planted from mid-March through early July. Early plantings yield fruit by late May or June, while a second planting in June can extend the harvest into fall. Opt for disease-resistant varieties like 'Ace', 'Better Boy', 'Celebrity', or 'Early Girl', which are well-suited to San Diego's conditions. With the right techniques, San Diego gardeners can enjoy a bountiful tomato harvest and savor the fruits of their labor throughout the year.

Planting Tips:

- **Sunlight:** Ensure plants receive at least 6–8 hours of direct sunlight daily.
- **Spacing:** Space determinate varieties 18–24 inches apart and indeterminate varieties 24–36 inches apart to promote airflow and reduce disease risk.
- **Watering:** Water deeply at the base of the plant to encourage strong root development and prevent foliar diseases. Mulching helps retain soil moisture and regulate temperature.
- **Support:** Use cages or stakes to support plants, especially indeterminate types that grow taller and produce fruit over an extended period.

Container Gardening: For those with limited space, tomatoes thrive in large containers (5-gallon or larger) filled with potting soil. Regular watering and fertilization are crucial, as container soil dries out faster.

Companion Planting: Enhance tomato growth and deter pests by planting companions like basil, borage, and sweet alyssum nearby. These plants attract beneficial insects and can improve success of a bountiful harvest.

Preserving Your Tomato Harvest

Freezing: A simple method involves roasting halved tomatoes with olive oil and garlic, then freezing them. This technique concentrates flavors and is convenient for winter meals.

Canning: Preserve tomatoes by canning them whole, as sauce, or as roasted puree. Ensure safety by adding lemon juice to maintain proper acidity levels, following a scientifically tested and approved recipe from the UC Master Food Preserver Program.

Dehydrating: Drying tomatoes intensifies their flavor and extends shelf life. Dehydrated tomatoes can be stored in airtight containers or infused in oil for added taste.

Local Resources: The San Diego Master Food Preserver Program offers workshops and guidance on various preservation methods, including canning and dehydrating. Come see our volunteers at the San Diego County Fair preserve whole tomatoes, make tomato sauce, and our favorite tomato marmalade. See our tomato marmalade recipe here:

https://ucanr.edu/sites/default/files/2025-05/Tomato%20Marmalade_Fair%20Checked.pdf

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Meet the Academics

Get to know the people behind Cooperative Extension San Diego!
Each issue we like to highlight some members of our amazing team.

Meet our Advisor

Matthew Fatino

Area Subtropical Horticulture Advisor

Matt joined UC ANR in July as the Cooperative Extension Subtropical Crops Advisor in San Diego and Riverside Counties.

He is based San Diego and is excited to develop an applied research and extension program to serve subtropical crop growers in Southern California. Matt grew up in San Diego and Orange counties before pursuing a degree in Fruit and Crop Science at Cal Poly San Luis Obispo, where he worked as a student assistant in the citrus and avocado groves on campus. After graduating from Cal Poly, he pursued an MSc followed by a PhD at UC Davis in the Horticulture and Agronomy program. During the past 6 years at UC Davis, Matt has been focused on developing an applied research and extension program for the management of an invasive parasitic plant called branched broomrape in California processing tomatoes. He is excited to return to Southern California and subtropical cropping systems and to develop a research and extension program to address issues faced by his clientele. Although he has spent the past 6 years focused on weed science, he is excited to sharpen his plant pathology, entomology, and horticultural skills to meet the needs of his stakeholders.

Matt can be reach by email at mfatino@ucanr.edu and by phone at (949) 466 6288.

Meet our Advisor

Marisela Chávez

Indigenous Food Systems and Food Sovereignty Advisor

Marisela Chávez is joining UC-ANR in July as the Indigenous Food Systems and Food Sovereignty Advisor for San Diego and Riverside Counties. She will develop an applied research and extension program in partnership with Native American Tribes, Tribal communities, and Tribal-serving organizations in Southern California.

As a Chicana environmental social scientist, Marisela is passionate about work centered on the revitalization of Native and Indigenous ancestral foodways, biocultural heritage stewardship, and advancing social and environmental justice by reconstructing our food systems. She's worked in environmental conservation projects and conducted research across the Américas, from México to Brazil, to deepen her understanding of how food connects us, the relationships that are ingrained in all of the ways that food is produced, acquired, eaten, and shared, and community-centered food sovereignty initiatives. Most recently, her research in southern México focused on understanding how Indigenous communities are navigating climate change impacts on the production and availability of native crops and wild foods. She earned a B.A. in Spanish from the University of Wisconsin-Milwaukee, an M.A. in Latin American & Caribbean Studies from the University of Kansas, and a Ph.D. in Forest and Conservation Science from the University of Montana.

Marisela can be reached by email at mvez@ucanr.edu and by phone at (406) 215-7906.

CALENDAR

Stay up-to-date with seminars, webinars, trainings, events, and more!

JULY

IRRIGATION SYSTEM DESIGN BASICS

July 25, 7:30 AM to 8:30 AM

San Diego County Farm Bureau/Hybrid

https://bit.ly/LastWednesdayMeeting625

AUGUST

LAST WEDNESDAY GROWERS MEETING

August 30, 7:30 AM to 8:30 AM

San Diego County Farm Bureau/Hybrid

SEPTEMBER

CALIFORNIA NURSERY CONFERENCE

September 10-11, 8:00 AM

Museum of Ventura County, Agriculture

https://bit.ly/nurseryconferenceregistration

MASTER GARDENER FALL PLANT SALE

September 20, 9:00 AM to 3:00 PM

Balboa Park, Casa Del Prado, Room 101

https://www.mastergardenersd.org/plant-sale/

Extension Connection

We hope you have enjoyed this issue of the Extension Connection!

We will continue bringing you the latest news from UC Cooperative Extension San Diego, and we would also like to hear from you.

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