Imperial County Agricultural Briefs

University of California Agriculture and Natural Resources
UC Cooperative Extension

Features from your Advisors

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A PRELIMINARY ESTIMATE OF OLIVE CROP WATER USE IN THE IMPERIAL VALLEY

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Khaled M. Bali, Irrigation Water Mgmt Specialist, Kearney Ag Research & Extension

Olive (*Olea europaea L.*) trees require a well-drained soil and are considered among the most drought tolerant crops once established. California is the only significant olive growing state in the US. California's olive acreage remained stable at about 30,000 acres for most of the past century, although it has increased to over 40,000 acres in recent years. The San Joaquin and Sacramento Valleys are the major olive production areas, although some acreage is reported throughout California. Tulare, Tehama, Glenn, Butte, and San Joaquin Counties are the leading olive producer counties in California.

Figure 1. A mature olive tree

Most table olives are grown in lower-density orchards, while oil olive orchards now mostly favor super high-density systems. California's olive oil has begun to compete with imported oils. Oil olive orchards also have a relatively lower water requirement than table olives. In 2015, about 60% of California's olive production was for oil, up from an average of about 4% prior to 2000.

Weather parameters (solar radiation, air temperature, humidity and wind speed), crop characteristics, and management practices (soil, crop, and water) as well as environmental aspects are factors affecting olive crop evapotranspiration (ET_c) or crop water use. Full ET_c is reached once canopy cover exceeds 50% of the orchard surface. In young orchards with less than 50% canopy cover, crop water use is reduced but not by the amount of the canopy reduction.

Figure 2. ET measurement equipment installed at a young olive orchard in the Imperial Valley

We conducted a one-year ET measurement at a young commercial olive orchard in the Imperial Valley (Figure 2). A combination of ET methods (surface renewal and eddy covariance equipment) was used to measure actual crop water use. Actual ET values for young olives versus CIMIS ET_o values for grasses for the period of early June through late December are shown in Figure 3. The results clearly reveal much lower daily crop water use of young olives compared with grass ET. A maximum daily ET of 0.16 inch was observed for the orchard during this period. Using the ET measurement data, the actual crop coefficient of the olive orchard was determined. We obtained an average actual crop coefficient value of 0.21 which is in agreement with what researchers reported as young olive K_c in the southern area of Spain.

A crop coefficient (K_c) value of 0.75 was reported by Goldhamer et al. (1994) for fully irrigated mature olive orchards. Significant olive oil yield can still be achieved when deficit irrigation is held at 70% ET_c (30% less water applied than crop water requirements), however yield reduction of olive trees may occur only when crop coefficient is reduced to 0.55 or less. As a preliminary estimate of olive crop water use in the Imperial Valley, we used a long-term average ET_o (reference evapotranspiration) values from Meloland CIMIS station (1996-2015). Crop ET was estimated by multiplying reference evapotranspiration (ET_o) by crop coefficient (K_c). Considering the K_c value of mature olive trees between 0.55 and 0.75, olive crop water use in the Imperial Valley could be anywhere from 3.5 ac-feet/ac to 4.5 ac-feet/ac. Further field measurements are greatly needed to verify this estimation and provide more accurate water use information for olive trees.

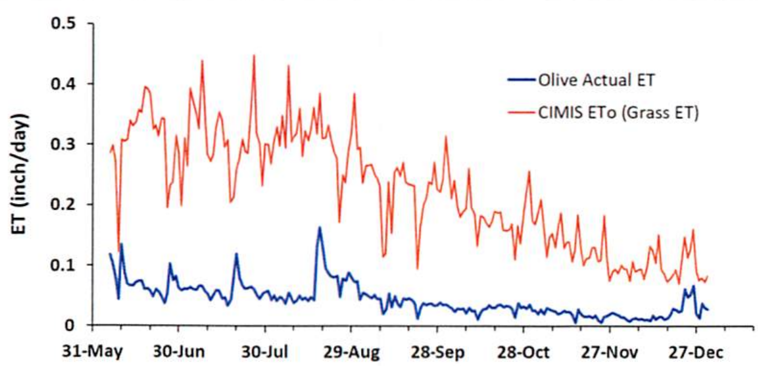


Figure 3. Daily actual olive ET versus CIMIS ET_o at young olive orchard in the Imperial Valley

We plan to continue and expand these ET measurements and to conduct irrigation trials at mature commercial olive orchards in the Imperial Valley (Figure 4) and at the UC Desert Research and Extension Center over the next couple of years. We expect that these studies will provide more accurate estimates of crop water use for mature olive orchards in the Imperial Valley.

Figure 4. A mature olive orchard in the Imperial Valley under drip irrigation

For more information on olive water management, please visit the link and reference below:

1. http://ucmanagedrought.ucdavis.edu/Agriculture/Crop_Irrigation_Strategies/Olives/.
2. Goldhamer, D. A., J. Dunai, and L. Ferguson. 1994. Irrigation requirements of olive trees and responses to sustained deficit irrigation. Acta Horticulture 356: 172-176.

AUTOMATED WEEDERS: THE FUTURE PROSPECT FOR WEED CONTROL

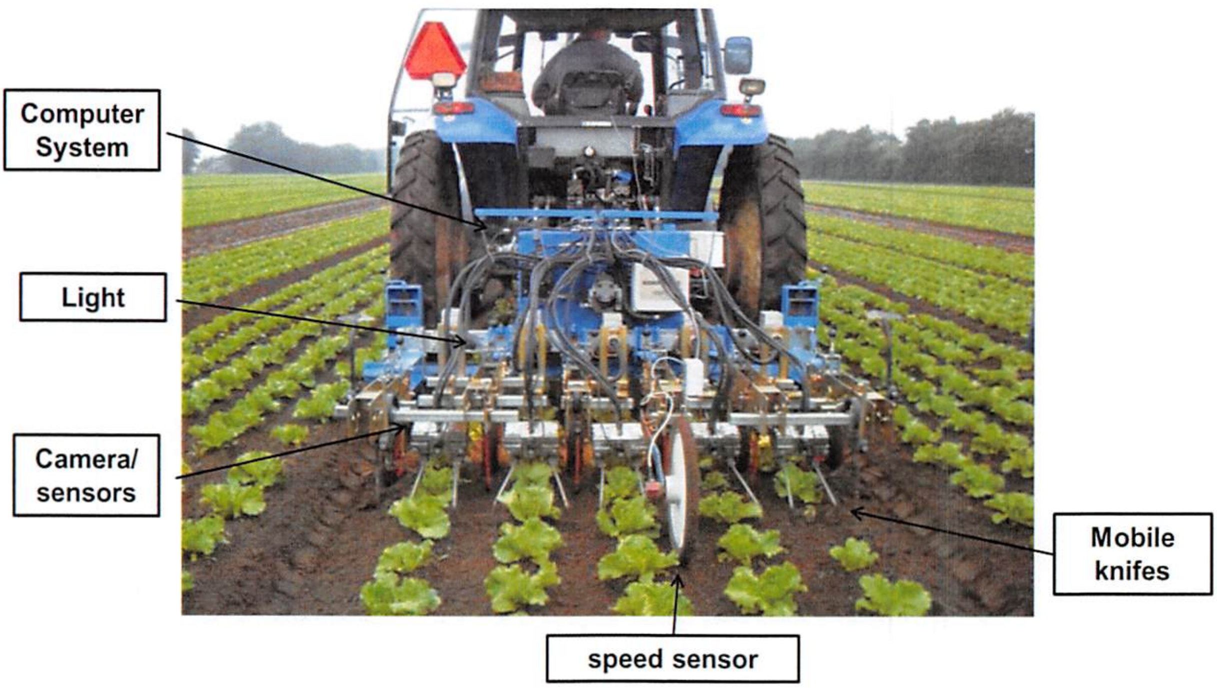
Pratap Devkota, UCCE Weed Science Advisor, Imperial and Riverside Counties

Weed control has always been a challenging practice in vegetable and specialty crops. There are limited numbers of herbicide products registered on these crops compared to other large acreage agronomic crops. In recent years, newer herbicide chemistries are barely introduced to the market which suggests there might be none or very few new herbicide products developed for vegetable and specialty crops. The lack of new herbicide products could be well attributed to the herbicide development process which takes several years (>10 years) and the cost has skyrocketed, i.e. a company has to invest about $250 million dollars or more for bringing a product to the market. On the other hand, the existing herbicide chemistries are at risk because of the development and spread of herbicide resistant weeds across many herbicide modes of action. In past years, weed management in vegetable and specialty crop production used to rely heavily on hand weeding. The situation is different in recent years because of limited availability of farm labor and increased cost. Therefore, potential options are being explored for weed control in the vegetable and specialty crops.

The use of machines and precision technology is not new to US agriculture production. However, the automated weed control technology is a recent development in US agriculture and it is getting attention from multiple agencies. Automated technology for weed control has been an important topic among growers, weed scientists, and agriculture technology industries. With the increase in production acreage and shortage of farm labor, there is a growing demand for non-chemical weed control in the organic vegetable and specialty crops system. There is also no doubt that the automated weeders could be implemented in the conventional production systems. For the weed science community, there is always an interest in research on mechanical weed control and incorporating it as a viable tool for the integrated weed management system. Additionally, numerous US and international companies are interested in this technology and have invested for the development of automated weeders as an alternative to the conventional herbicides for weed control. The major reason for the growing interests are relatively low cost (< $20 million) and less regulatory process for developing automated weeding machines compared to new herbicide products.

The automated weeders are the combinations of machines with 1) vision technology & data processors, and 2) actuators for weed control. These combinations enable the machine to distinguish keeper plants versus unwanted plants and proceed with removing unwanted plants or weeds. In the first phase, machine identifies certain patterns in the field such as crop rows, spacing, leaf morphology, and plant sizes for separating crop versus weeds. In the second phase, the machine removes the plants (or weeds) which fall outside the desired parameters.

The weed detection and removal processes can be variable because weeders are developed based on different principles. The first phase of the automation process is based on technologies such as GPS guidance (considering GPS coordinates), ray sensing (absorbing certain radiance), and hyperspectral imaging (taking high resolution pictures of the crop rows). The weed control phase is designed based on certain techniques such as mowing, using laser technology, flaming, and inter- and intra-row cultivation. In addition, some machines are designed to spray the unwanted weeds/areas, very close to the desired plants/crop, in a precise manner using small spray volume in small grids.



An intelligent cultivator (robovator) with sensor and knives that can remove weeds between lettuce plants in the same row (Photo courtesy of Dr. Steve Fennimore, CE Weed Specialist, University of California Agriculture and Natural Resources).

At present, the crop production system that utilizes high labor is likely to benefit from the automated weed control machines. Some of the automated weed control technologies are commercially available and vegetable growers in California, particularly lettuce growers in the Salinas Valley, are already using automated thinners in their operation. In the near future, an automated weed control system is likely to be introduced in row crops such as cotton and corn. The agriculture sector is embracing new technologies day by day, and automated weed control technology has the potential to be implemented as an effective weed control tool in the near future. There is still much research and many improvements needed for the development of an effective automated weeding machine which could be implemented in various vegetable and specialty crop systems. The developments of a machine, which can be used for various crop systems, could be accomplished by improving machine learnings, preciseness on weed control, and crop production practices (pattern for crop rows, spacing, canopy) that facilitates automated weed control.

For more information on automated weed control, please refer to the following publication.

1. Steven A. Fennimore, David C. Slaughter, Mark C. Siemens, Ramon G. Leon, and Mazin N. Saber (2016) Technology for Automation of Weed Control in Specialty Crops. Weed Technology 30:823-837.

A MYSTERIOUS SYMPTOM ON ALFALFA FIELDS IN BRAWLEY, CALIFORNIA

Oli Bachie, Agronomy Advisor, Imperial, Riverside & San Diego Counties & Director UCCE Imperial County
Pratap Devkota, UCCE Weed Science Advisor, Imperial and Riverside Counties

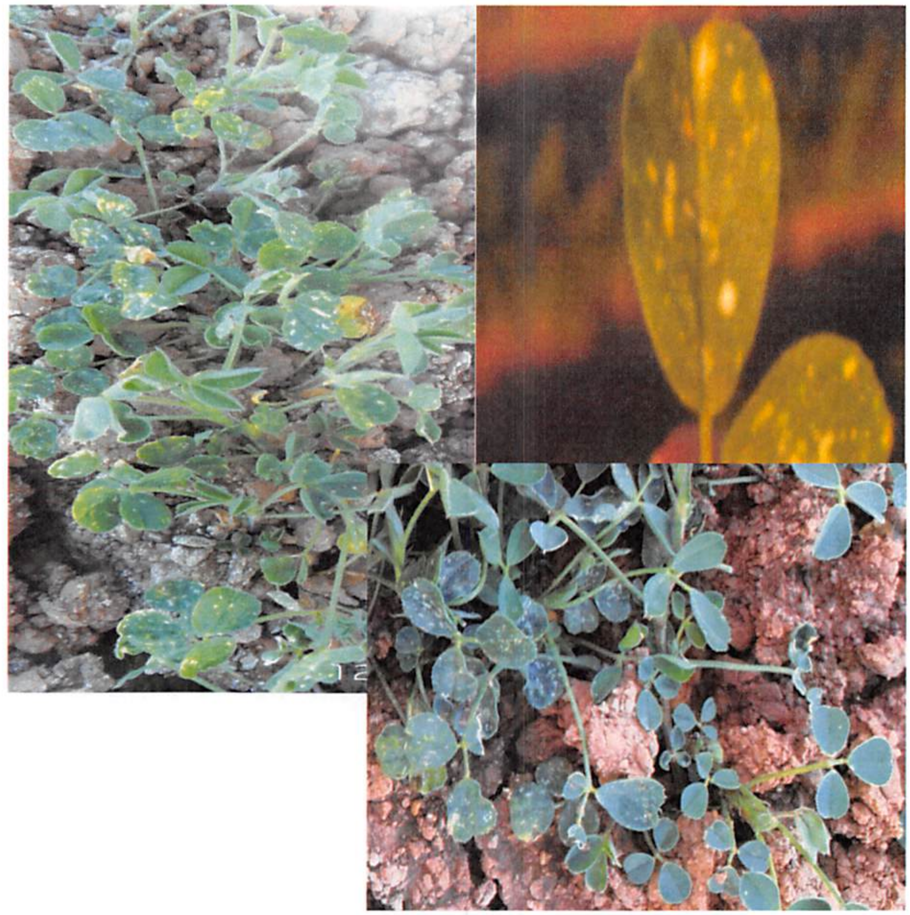
Samples of alfalfa seedlings were brought to our attention by a Pest Control Advisor on December 13, 2017. We visited the field and nearby fields on two subsequent trips; December 19, 2017 and on January 11, 2018.

Figure 1: Alfalfa planting

The newly planted field was initially planted to (not known), harvested and then planted to alfalfa in six lines on a 40" bed (Figure 1). The symptom on the fields were as follows: seedling vigor and stand was poor, there were numerous spots on the leaf, the spots were more in the lower/older leaves compared to newer leaves. Furthermore, seedlings were discolored, wilted, and sporadic death of seedlings (a mix of dead seedlings and relatively healthy-looking plants) with huge alfalfa stand loss. There were healthy-looking crop stands around the center of the field (Figure 2), although some of the healthy-looking seedlings still had leaf discoloration symptoms (Figure 3). Overall, the symptoms were consistent throughout the field. Prior to our first visit, the field was sprinkler irrigated. The only chemical applied in the field was Eptam at the labeled rate through irrigation system. In addition, there was no herbicide application to nearby fields to suspect herbicide or herbicide drift effects.

Figure 2: a mix of dead and healthy-looking seedlings

➤ Figure 3: small whitish spot symptoms on leaf top (left) and bottom side of leaves (right)



Regardless of the spotty whitish leaf discolorations, roots appeared intact even on the partially dead seedlings. Likewise, nodules were intact (picture 4, showing clearly visible nodules on the right).

We looked at the roots under a microscope to see if the swellings on the roots are because of nematodes. Unfortunately, there were no nematodes, suggesting that these are natural nodule formations useful for nitrogen fixation.

➤ Figure 4: roots and root nodules

In the meantime, none of the weeds in the affected field, common lambsquarters, swinecress, goosefoot, and sowthistle (figure 5 in orders from left right), showed any kind of discoloration, infection or death. Therefore, the symptoms were specific to alfalfa.

Figure 5: Weeds found in the field were unaffected

One and half weeks after the initial visit, we went back to the affected field. The alfalfa plants were still showing the same small whitish leaf spot symptoms with a lot dead branches. After our first visit, the grower had applied 2,4-D B herbicide, so alfalfa seedlings and weeds were showing the herbicide response.

Figure 6: The same whitish leaf spots on old stand alfalfa

We also visited other established and older alfalfa crop fields in a nearby area. The symptoms we observed on young alfalfa seedlings (small whitish spot) were also on the older alfalfa stand fields (Figure 6), even at about 2 miles away from the newly planted field. No other crop, except alfalfa, showed any kind of unhealthy symptoms.

Knowing this effect could be something new, we shared our pictures and asked agronomists, weed scientists, and pathologists for suggestions and recommendations. While there were various suggestions from potential environmental factors, nutrient deficiency to pathogenic issues, there were no conclusive diagnosis. We then followed up by sending affected plant samples to the pathology lab of Dr. Cassandra Swett, Vegetable and Field Crop CE Pathology Specialist, at the University of California, Davis. Per Cassandra's lab diagnosis, it appeared that the mature alfalfa plants had crown rot, caused by a mix of *Rhizoctonia solani* and possibly *Fusarium oxysporum* or *F. solani* (see table below).

Date submitted: 1/16/2018

Diagnosis: Seedlings: there was no clear biotic cause associated with the declining seedlings. Seedlings had very little root or crown rot, no vascular discoloration, and no clear foliar disease. Incubations with seedlings revealed Fusarium spp. and various molds. These results are inconclusive and indicate an abiotic cause; there is a very low chance that it could be viral

Larger plants/ old growth: Plants had some minor crown rot, that might be contributing to seedling decline, although typically alfalfa is predisposed to crown rot diseases by other abiotic issues, like flooding. We recovered both *Rhizoctonia spp.* and *Fusarium spp* from the crown rot—these often work in concert to cause crown rot and are likely responsible for the rot.

- Sequence results from isolated fungi revealed *Rhizoctonia solani* and *Fusarium* spp including *F. oxysporum, F. equisetti, F. cicinatum*

- *Rhizoctonia spp.* were the number one fungi isolated from crown tissues, followed by *Fusarium spp.*

- *R. solani* is associated with rot of crowns and buds, stem canker, and may in part cause crown necrosis, but in complex with other fungi such as *Fusarium* spp.

The lab diagnosis further suggested that the presence of pathogens such as *Rhizoctonia* spp. and *Fusarium spp.* often act in concert to cause crown rot, but the crown rot often develops if plants were predisposed to other factors, such as flooding and other biotic factors.

We visited the field for the third time on March 6, 2018 (after about 3 months). By this time, the newly planted alfalfa field was cut and there was re-growth. The re-growth showed poor stand, particularly at the irrigation tail where water logging took place (figure 7). However, the plants do not show the leaf discoloration symptom any

Figure 7: the initial seedling field after cutting and re-growth

more (Figure 8). Similarly, the nearby old/established alfalfa fields do not have the previous whitish leaf spot symptom that was common to the area.

Figure 8: re-growth following first cutting

In summary, alfalfa plants in the area may have been exposed to some kind of abiotic or biotic factors that might have resulted in leaf discoloration and predisposed the plants to opportunistic pathogens as described from lab diagnosis. However, the lab diagnosis could not be certain if the identified pathogens were the cause of the symptoms. Accordingly, there is no firm conclusion on what may have caused the widespread alfalfa leaf discoloration and what could its potential impact on alfalfa yield is. This interesting symptom on newly established and alfalfa old growth remains at large and a mystery until further observation and diagnosis.

We encourage alfalfa growers and Pest Control Advisors (PCAs) to keep an eye on similar crop discoloration appearances and contact the Imperial County Cooperative Extension. Contact us at obachie@ucanr.edu or pdevkota@ucanr.edu or (442) 265-7700 for assistance.

CALIFORNIA'S DESERT AGRICULTURE IS HOT STUFF

Jeannette E. Warnert, Communication Specialist, Kearney Ag Research & Extension

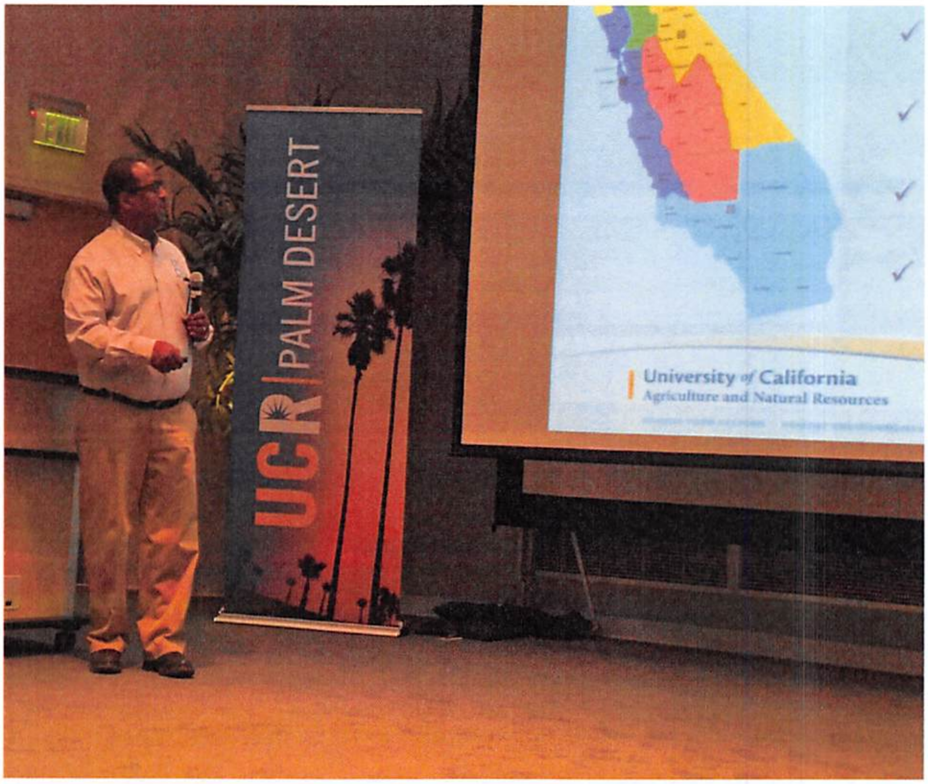
Stretching from the Death Valley to Calexico, California's vast dry desert is home to a unique and important agriculture industry.

It's a place where summertime temperatures often top the 115-degree mark. Where water supplies for irrigation depend on the Colorado River, but upriver states are claiming more of it. Where evapotrasporation – a reference rate of water use in unstressed turf grass – is 72 inches per year, but rainfall is rarely more than 4.

Still, stalwart farmers grow dates, carrots, lettuce, broccoli, cabbage, kale and more, plus plants for landscaping everything from family homes to beautiful and luxurious resorts. The agriculture output of the state's three desert counties – Riverside, San Bernardino and Imperial – exceeds $4 billion annually.

The California desert also impacts the quality of life across the nation. If Americans are enjoying a salad in the winter, the lettuce most likely was grown in the California desert. There are bountiful winter recreation opportunities available on the beautifully manicured golf courses, parks and landscapes.

A group of UC Agriculture and Natural Resources (UC ANR) academics formed a desert workgroup to better serve the state's desert region. The group[organized a symposium in February to bring together representatives from desert farm and natural resources communities, related industry and academics working in the desert.



Director of UC Cooperative Extension in Imperial County, Oli Bachie, is chair of the UC ANR Desert Workgroup.

"The close exchange of information among desert researchers, non-profit organizations, industry and clientele groups will facilitate collaboration among UC ANR, Arizona and Mexico and foster how our programs should be shaped on a regional level," said Oli Bachie, the director of UC Cooperative Extension in Imperial County and the current workgroup chair.

With saline soil, scorching summer temperatures and limited water supplies, the desert could be considered a hotbed of the "wicked problem." A wicked problem isn't evil, said UC Associate Vice President Wendy Powers, the symposium's plenary session keynote speaker.

"The term 'wicked problem' was coined at UC Berkeley," Powers said. "It's a problem with circumstances that resist resolution."

She named climate change and the growth of the global population California must help feed as wicked problems faced by the state. Powers described UC ANR's statewide programs that are working to find solutions to formidable issues faced in California agriculture.

"We're on the verge of some serious breakthroughs as we look at solving wicked problems," Powers said. "They are accelerated by conversations like those we're having today."

UC ANR Associate Vice President Wendy Powers was the symposium's plenary session keynote speaker.

UC Vice Provost Mark Bell said that the potential of UC ANR to reach every single Californian is what drew him to his position in 2017. Bell invoked Star Wars robot R2D2 for an acronym to reflect the characteristics that accurately define UC ANR.

“R2 stands for reach and relevance,” he said. “D2 is diverse and dispersed.”

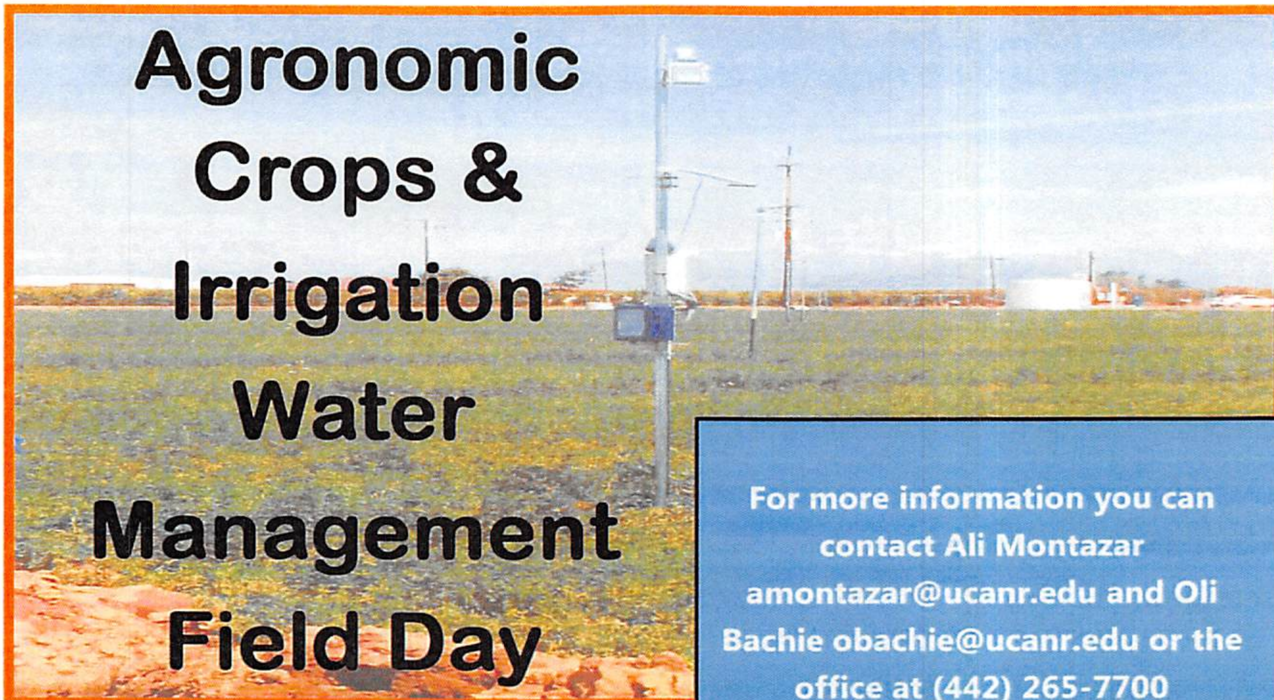
UC Cooperative Extension offices serve 57 California counties and its nine research and extension centers are located in key agriculture ecosystems, including one in the low desert of the Imperial Valley.

The afternoon program of the symposium included breakout sessions to highlight programs and research efforts in three broad areas: irrigation and crop production, landscape management, and livestock and feed quality.

“This was the first attempt to organize such a regional desert-based symposium for the UCANR Desert Workgroup with the collaboration of desert-serving UCCE counties,” Bachie said. “I believe that we have registered a remarkable get-together.”

The symposium had speakers and participants from UC, USDA, California Department of Food and Agriculture, the desert agricultural industry, pest control advisors, non-profit institutions and organizations, agricultural commissioners, farm bureaus, Arizona and Mexico universities and the general public.

“I believe that the symposium is a stepping stone for future desert research and extension meetings, conferences and symposiums among people engaged or interested in desert agriculture and natural resources,” Bachie said.



Agronomic Crops & Irrigation Water Management Field Day

For more information you can contact Ali Montazar amontazar@ucanr.edu and Oli Bachie obachie@ucanr.edu or the office at (442) 265-7700

More Information to follow regarding the event; topics, agenda, CEU's, etc.

No Cost to Attend!!

Wednesday, April 18th,

7am - 12pm

UC Desert Research & Extension Center (DREC)

1004 E Holton Road Holtville, CA 92250

UC
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Presented by the

University of California Cooperative Extension Imperial County

IMPERIAL VALLEY CIMIS REPORT AND UC WATER MANAGEMENT RESOURCES

Ali Montazar, Irrigation and Water Management Advisor, UCCE Imperial and Riverside Counties

The reference evapotranspiration (ET_o) is derived from a well-watered grass field and may be obtained from the nearest CIMIS (California Irrigation Management Information System) station. CIMIS is a program unit in the Water Use and Efficiency Branch, California Department of Water Resources that manages a network of over 145 automated weather stations in California. The network was designed to assist irrigators in managing their water resources more efficiently. CIMIS ET data are a good guideline for planning irrigations as bottom line, while crop ET may be estimated by multiplying ET_o by a crop coefficient (K_c) which is specific for each crop.

There are three CIMIS stations in Imperial County include Calipatria (CIMIS #41), Seeley (CIMIS #68), and Meloland (CIMIS #87). Data from the CIMIS network are available at:
http://www.cimis.water.ca.gov/. Estimates of the average daily ET_o for the period of March 1st to May 31st for the Imperial Valley stations are presented in Table 1. These values were calculated using the long-term data of each station.

Table 1. Estimates of average daily potential evapotranspiration (ET_o) in inch per day

Station	March		April		May	
	1-15	16-31	1-15	16-30	1-15	16-31
Calipatria	0.16	0.19	0.22	0.25	0.27	0.29
El Centro (Seeley)	0.19	0.22	0.24	0.28	0.29	0.31
Holtville (Meloland)	0.17	0.21	0.23	0.27	0.29	0.31

For more information about ET and crop coefficients, feel free to contact the UC Imperial County Cooperative Extension office (442-265-7700). You can also find the latest research-based advice and California water & drought management information/resources through link below:

http://ciwr.ucanr.edu/.