Imperial County Agricultural Briefs

UCCE | UNIVERSITY OF CALIFORNIA
Agriculture and Natural Resources

Features from your Advisors

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DRIP IRRIGATION PROMISES SIGNIFICANT POTENTIAL TO CONSERVE WATER AND FERTILIZER AND INCREASE HIGH-QUALITY YIELD IN DESERT SWEET CORN

Ali Montazar, Irrigation and Water Mgmt. Advisor, UCCE Imperial, Riverside, and San Diego Counties

Introduction. The low desert is one of the main production regions for sweet corn in California. Over the past ten years, sweet corn production has fluctuated around 8,000 acres in Imperial County (Fig. 1). Spring sweet corn planting occurs from late December to February for harvest in April through June. Fall sweet corn is planted from late August to September for harvest in November through December. Sprinklers are often used until the seedlings emerge and the fields are then furrow irrigated for the remainder of the season. While furrow irrigation dominates irrigation systems in desert sweet corn, there are growers who adopted drip irrigation.

Sufficient soil moisture is needed during the early stages of germination and plant emergence. Soil moisture is also critical during tasseling and ear development. The water requirements for sweet corn rapidly increase from nearly 30% of potential evapotranspiration (PET) during early growth to 110% of PET at peak growth. This rapid increase in crop water use can occasionally catch growers out and reduce yield. Irrigation management from two weeks prior to silking until harvest is significantly associated with yield. Thus, improved irrigation delivery systems and irrigation scheduling may affect yield and its quality, and water and fertilizer use efficiency in sweet corn. This article presents the findings of my recent study conducted on assessing drip irrigation versus furrow irrigation in desert sweet corn.

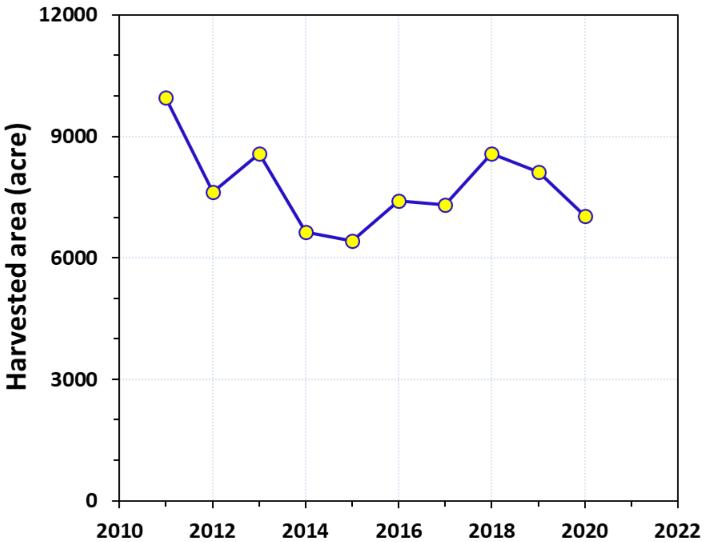

Fig. 1. Harvested acreage of sweet corn in Imperial County over the past decade (Imperial County Agricultural Crop and Livestock Reports).

Fig. 2. A UCCE research staff is taking canopy infrared images to develop canopy growth curve for the desert sweet corn production systems.

Field trials. The field trials were 11 commercial sweet corn fields in the Imperial Valley. The experiment was carried out over the 2021-2022 crop season. Of the 11 fields, five fields were under furrow irrigation and six fields were under drip irrigation (Fig. 3). The drip irrigated fields were established using drip while the fields under furrow irrigation were germinated using sprinklers. Dominant soil textures were sandy loam to loamy fine sand in the experimental sites.

All fields were on an average of 36-inch beds and one plant row per bed. The fields germinated in late December through early January and were harvested in early April to early May. The driplines were installed at an average depth of 1.5-inch. In addition to the marketable yield at harvest, the amounts of applied water and fertilizers were monitored throughout the season in each field. Several soil moisture sensing stations were set up in the fields. Plant density evaluation was conducted in 12 different sub-areas in each field. To develop a crop coefficient model based on canopy development, images were taken on weekly basis utilizing an infrared camera.

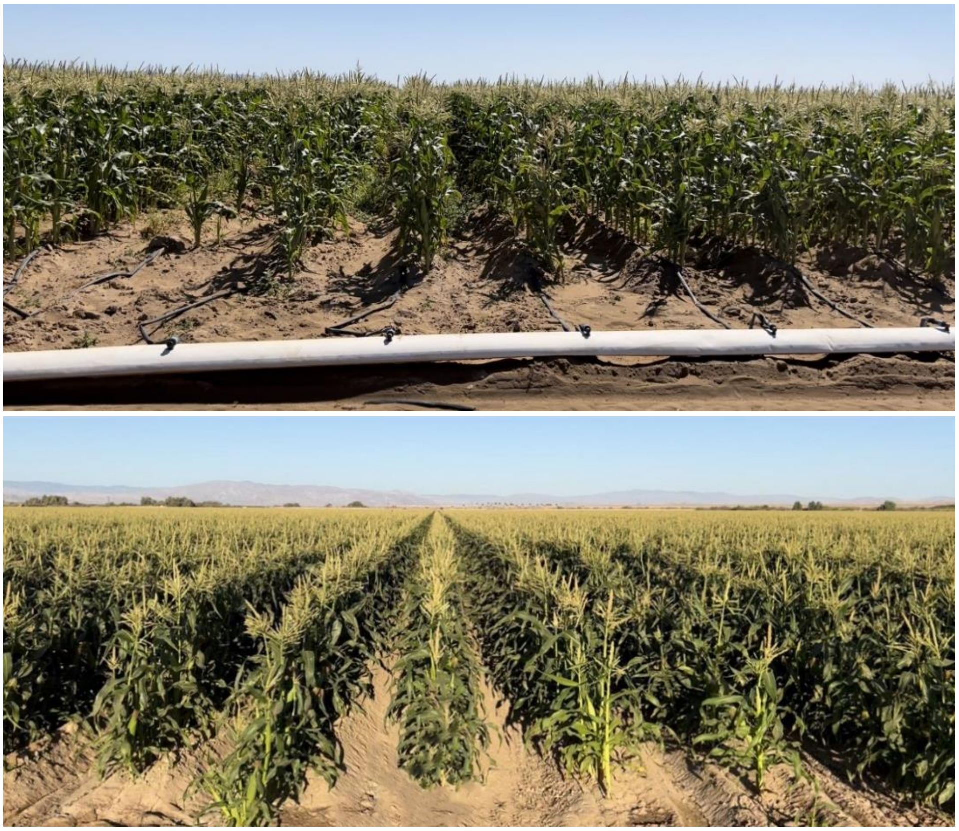

Fig. 3. Two sweet corn trial fields in Westmorland, CA (top: drip irrigated field; bottom: furrow irrigated field). Both photos were taken on April 8, 2022.

Results.

Significant water conserved in the drip irrigated fields. Meaningful differences were observed between the seasonal applied irrigation water in the drip irrigated fields and the furrow irrigated fields (Fig. 4). Across the trial sites, the total applied water varied from 4.2 ac-ft/ac (field F-1) to 6.9 ac-ft/ac (field F-3) in the furrow irrigated fields and ranged between 2.53 ac-ft/ac (field D-2) and 4.41 ac-ft/ac (field D-3) in the drip irrigated fields. Overall, an average of 2.2 ac-ft/ac water was conserved in the fields under drip irrigation compared with the fields under furrow irrigation. It appears that the drip irrigated fields (totaling 400 acres) received nearly 37% less water than the furrow irrigated fields (totaling 365 acres). This conserved water could be sufficient to supply water requirements for more than 300 acres of lettuce fields throughout the crop season in the low desert region.

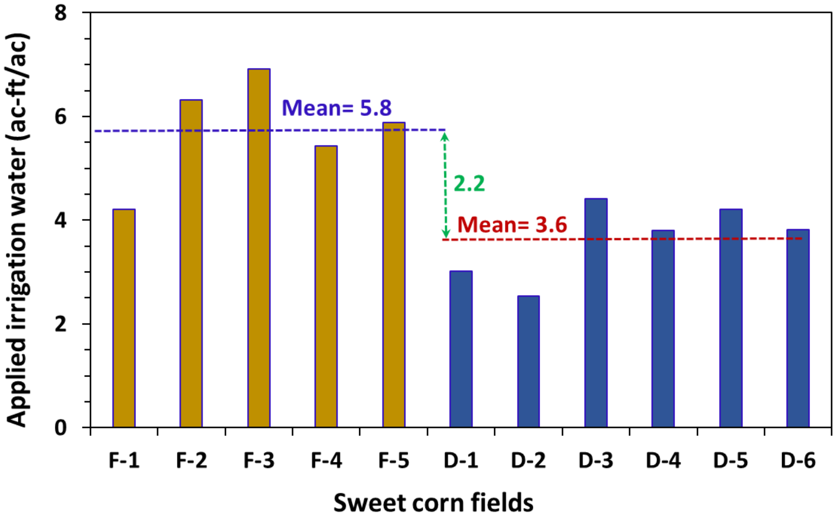

Fig. 4. Seasonal applied irrigation water in the furrow irrigated trial fields (F-1 to F-5) and the drip irrigated trial fields (D-1 to D-6). The mean values of seasonal applied irrigation water in each group of furrow and drip irrigated fields are also demonstrated.

Sweet corn requires frequent irrigation throughout the crop season since the plant root system is shallow and very little water is extracted from soil depth of more than 2 feet. Most of the crop water needed is extracted from the topsoil (18-in). The amount and frequency of irrigation water depends on the irrigation practice, soil type and conditions, and weather parameters. The key advantage of drip irrigation system is to apply irrigation water more frequently and uniformly across sweet corn field over the season. In other words, more soil moisture uniformity over time and space is expected at the drip irrigated fields. Since irrigation events can be scheduled more frequently, soil moisture may be maintained at a desired level (Fig. 5), and consequently the deep percolation is minimized the entire irrigation season. More fluctuations are clearly seen in soil water tension values in the furrow irrigated fields than drip fields.

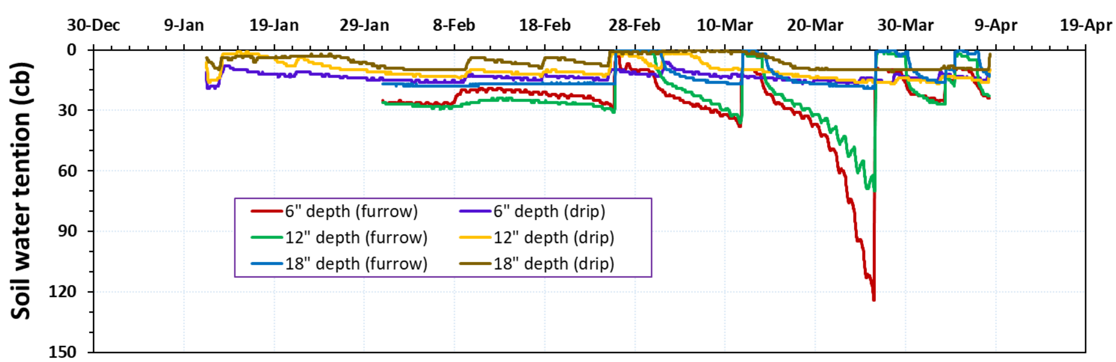

Fig. 5. Soil water tension at one drip irrigated sweet corn field against one furrow irrigated sweet corn field over the 2021-2022 season. The data is reported for the depths of 6, 12, and 18 inches for both fields. Maintaining soil water tension at a range of 20-30 centibars (cb) during mid-January through early-April is recommended for most experimental sites.

Considerable fertilizers conserved in the drip irrigated fields. A combination of Ammonium Polyphosphate, UN32, Dune Superphos, and Mono Ammonium Phosphate was applied at different rates in the experimental fields. As a measure, the total expense of applied fertilizers over the crop season was computed for each of the sites (Fig. 6). The results demonstrated that the total expense of applied fertilizers in the drip irrigated fields were $145.6 per acre less on average than the furrow irrigated fields. This means that because of a higher water-fertilizer use efficiency in drip irrigation system, drip could considerably reduce (nearly 25.7%) the fertilizer costs compared to regular furrow irrigation practice.

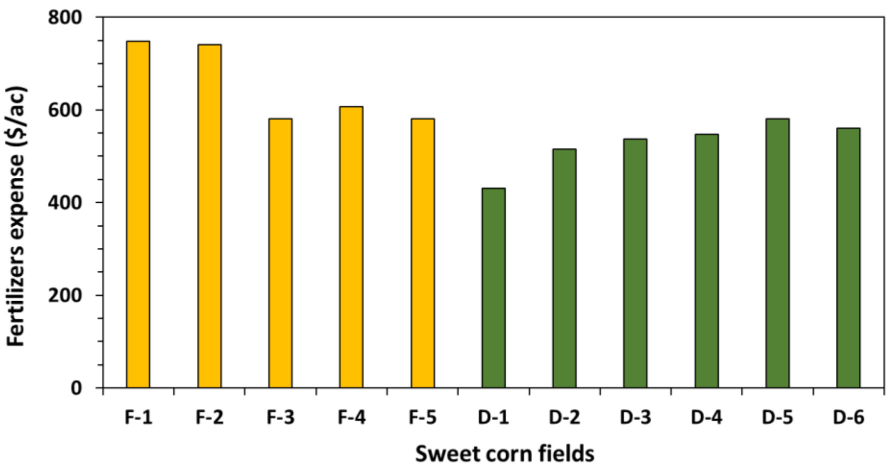

Fig. 6. Total expense of applied fertilizers over the crop season in the furrow irrigated trial fields (F-1 to F-5) and the drip irrigated trial fields (D-1 to D-6).

Higher marketable high-quality yields in the drip irrigated fields. The total marketable sweet corn yield varied from 372 (field F-5) to 459 Ctn/ac (field F-2) across the furrow irrigated sites and from 393 (field D-1) to 486 Ctn (field D-3) across the drip irrigated sites (Fig. 7). A mean yield difference of 21 Ctn/ac was obtained between the drip and furrow irrigated sites in favor of the drip fields. In other words, on average high-quality sweet corn yields were 5% greater in the fields under drip than the fields under furrow. The plant density evaluation conducted 40 days after seeding indicated that the furrow fields had an average of 2,800 plants per acre more than the drip fields. Most likely, using a different planter in these two groups of fields caused this plant population's difference. There is no evidence of losing seed germination due to plant establishment by drip in any of the drip sites. Considering the plant density difference, it needs to be noted that the marketable yields could be likely even more than the yields achieved in the drip irrigated trial fields if the plant density of two groups of fields were similar.

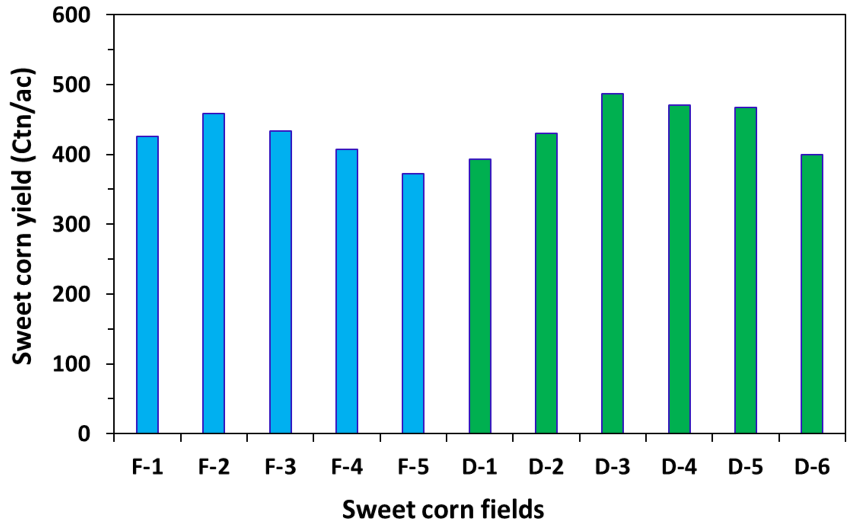

Fig. 7. Total marketable sweet corn yield in the furrow irrigated trial fields (F-1 to F-5) and the drip irrigated trial fields (D-1 to D-6). Ctn/ac stands for cartons per acre.

Conclusions. The findings of this study demonstrated that drip irrigation clearly has the potential to enhance the efficiency of water and fertilizer use, and total marketable high-quality yield in desert sweet corn. Different amounts of water conserved, fertilizer cost reduction, and yield improvement could be expected depending on soil types and conditions, and management practices. Salinity may be a limitation for utilizing drip system in sweet corn fields that are harvested in late May through mid-June. Buildup of soil saline conditions could occur on the topsoil in drip irrigated sweet corn fields. My earlier study illustrated a salt buildup condition in drip irrigated processed onion fields. To maintain salinity over the irrigation cycles, applying sufficient irrigation water at high enough frequencies is required to guarantee adequate leaching in the effective crop root zone. The current salt leaching practices in the low desert region along with an effective drainage system can remove salt from the crop root zone and sustain soil productivity.

Drip irrigation can be considered as an effective and promising on-farm water conservation tool in desert sweet corn. The cooperative farms reported notable reductions on labor costs as a result of switching to drip for plant establishment and throughout crop season. Even though the results suggested economic and environmental promises of drip for sweet corn production, further work is needed to better understand the optimal management practices and strategies to maintain economic viability and sustainability of utilizing drip irrigation in sweet corn.

Acknowledgments. The author gratefully acknowledges the coopeartive farms that contributed to this effort with sincere collaboration during the study and providing data and information, and for allowing the research staff to implement the study in the trial fields.

ROOT-KNOT NEMATODE (*Meloidogyne* ssp.) DISTRIBUTION IN WEEDY FALLOW AND IN-SEASON OKRA FIELDS IN COACHELLA VALLEY

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Introduction

Okra (*Abelmoschus esculentus*) is a fall and spring crop in Southern California. Whereas okra is grown at a relatively low acreage, it is an important cash crop for small-scale farmers (Aguiar et al., 2011). Okra is highly susceptible to root-knot nematode (*Meloidogyne* spp.) infections (Odeyemi et al., 2016). Like other plant-parasitic nematodes, root-knot nematodes often form disease complexes with numerous other soil-borne pathogens such as *Rhizoctonia*, *Fusarium*, *Verticillium*, or *Phytophthora* (Fig. 1; Saeedizadeh et al., 2009). Such disease complexes occur when the root-knot nematodes create wounds with their stylet, exposing the infected plants to opportunistic soil-borne pathogens, thus exacerbating the severity of the disease.

Management of root-knot nematodes in vegetable crops relies heavily on nematicides such as Vapam® (metam sodium), Telone™ (1,3 dichloropropene), Nimitz® (fluensulfone), and Velum® One (fluopyram). The high costs of these nematicides have forced small-scale vegetable growers to use not only non-nematicide and cheap alternatives but also environmentally friendly management approaches like crop rotation and fallow. Especially, fallow, a period when cropland is left uncultivated, is commonly practiced in Coachella Valley to escape pests and pathogens. In practice, fallow breaks life cycles and reduces the build-up of pests and pathogens. Fallow, however, can be unsuccessful at reducing the initial root-knot nematode numbers in the presence of weed hosts.

The objective of this study was to determine the demographic distribution of root-knot nematodes in weedy fallow and in-season okra fields.

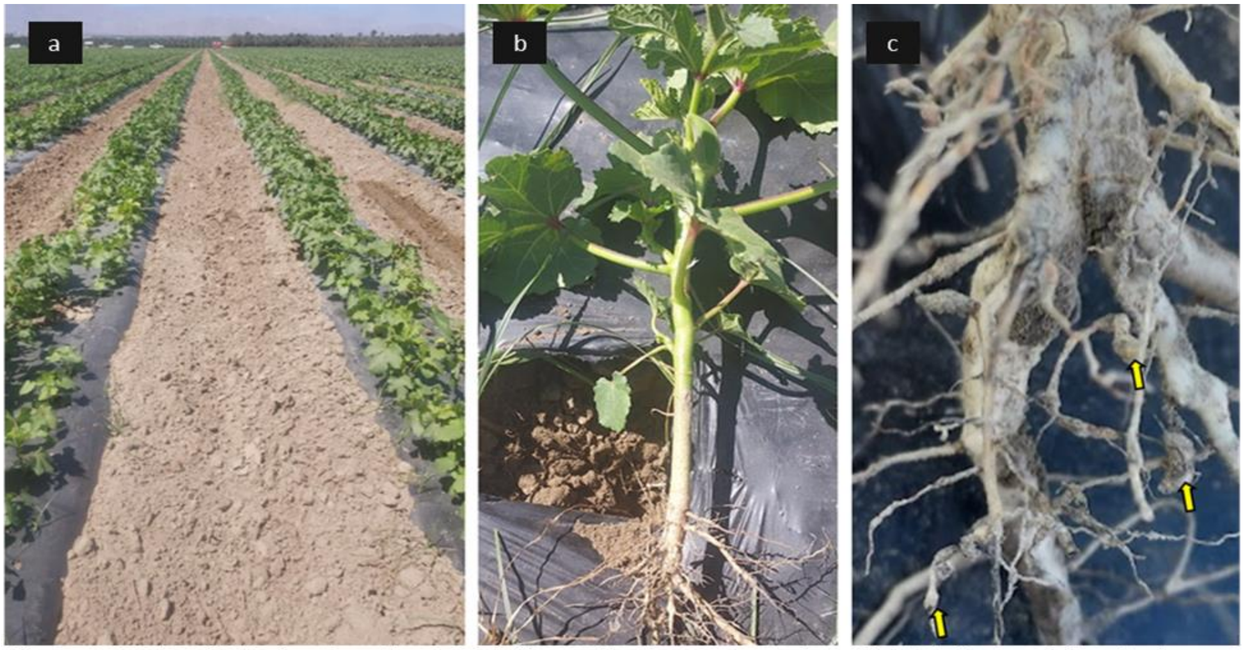

Figure 1a) Okra field showing plants exhibiting yellowing and stunting; b) *Meloidogyne*-infected plant; c) *Meloidogyne*-induced root galls pointed by arrowheads.

Materials and methods

An initial soil sampling was conducted on April 8, 2022, from three in-season okra fields and four 8-month-old fallow fields previously planted with okra. Sixteen soil cores were collected from each field following a systematic 'W' pattern; soil samples from each field were composited and four subsamples were randomly drawn per field for nematode extraction. Soil samples were collected from 8 inches (20.3 cm) deep using a Lakago Soil Probe, placed in quart-size zip lock bags, and transported to the laboratory for further processing. Each soil subsample was homogenized, and an aliquot of 100 cm^3 (100 mL) soil was subjected to the Baermann tray method for nematode extraction. Individual nematodes present in each sample were morphologically identified at ×40-100 magnification using an Olympus CK2 inverted microscope (McBain Instruments). Each identified nematode was placed into one of the major nematode trophic groups (herbivores, bacterivores, fungivores, omnivores, and predators), according to Goodey (1963) or Smart and Nguyen (1988).

Statistical analysis

The abundance of nematode data was checked for normality using Proc Univariate in SAS version 9.4 (SAS Institute Inc., Cary, USA). Wherever necessary, data were normalized using log10 (x + 1). Means were separated using the Waller-Duncan *k*-ratio (*k*=100) test, and only true means were presented.

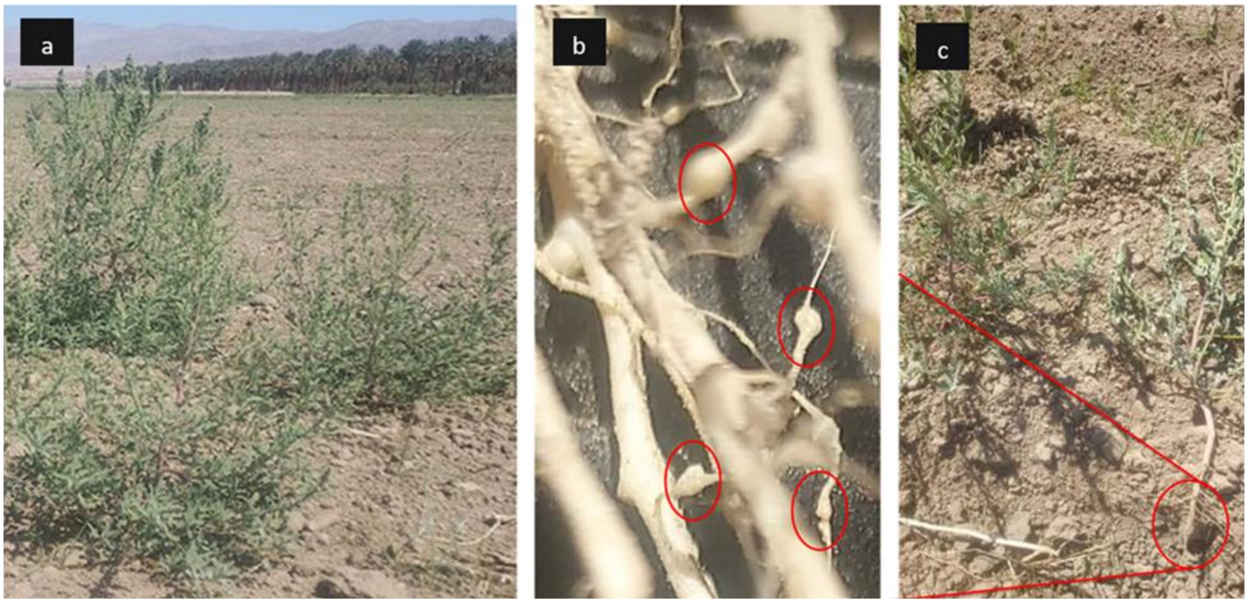

Figure 2. Lamb's quarters (*Chenopodium album*) a) plants colonized in a fallow field; b) roots exhibiting characteristic galls induced by *Meloidogyne* infections; and c) plant being uprooted and observed for *Meloidogyne*-induced root galls.

Results and discussion

The main finding was that fallow fields had a root-knot nematode population (35-45/100 cm^3 soil) significantly higher compared to in-season okra fields ($P \leq 0.05$; Fig. 3A). The fallow fields were dominated by *Meloidogyne*-susceptible weeds, Lamb's quarters (*Chenopodium* spp.), which could be harboring the nematodes during the 8-month fallow period (Fig. 2). Interestingly, the population densities of beneficial nematodes (bacterivores, fungivores, and omnivores) were numerically high which could be indicative of increased microbial activities (Fig. 3B-D). To further support this observation, some nematode specimens had been attacked and disintegrated by natural biological agents only detected in in-season okra fields (Fig. 4A-B). According to this grower, okra crop residues from the previous crop have been regularly used as organic amendments, which are minimally disked into the soil (Fig. 4C). In addition, conservation tillage, as observable in Fig. 4C, could have also contributed to promoting microbial activities which could have been

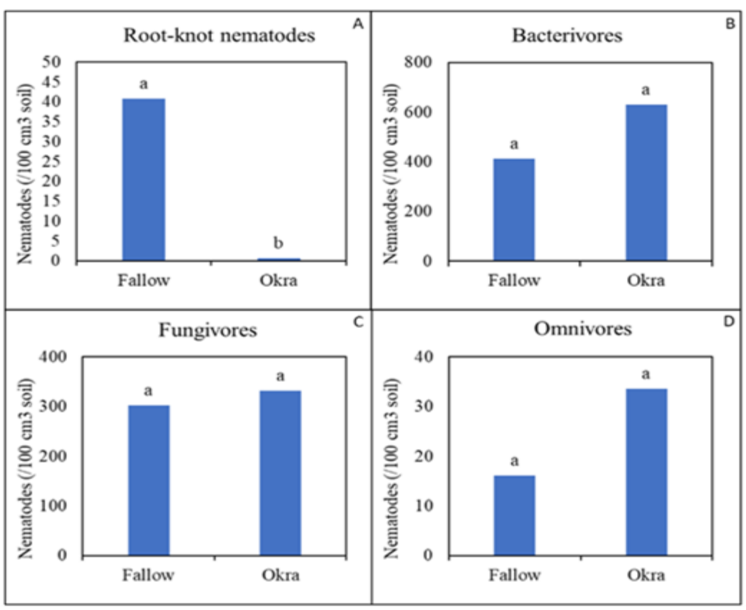

Figure 3. The abundance of A) root-knot; B) bacterivorous; C) fungivorous; and D) omnivorous nematodes.

suppressive to root-knot nematodes; conservation tillage practices are less destructive to the soil food web and thus promotes healthy soil (Cerecetto et al., 2021). These practices may have helped build a better soil health condition suppressive to root-knot nematodes.

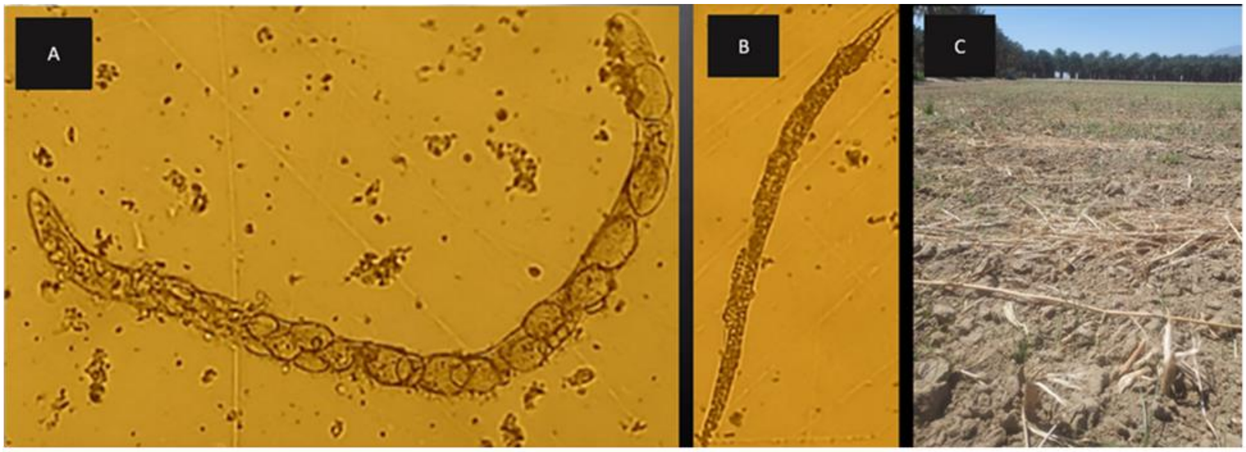

Figure 4. Biological control agents attacked and disintegrated A) omnivorous nematode and B) *Meloidogyne* juvenile (×100 magnification); C) A fallow field showing minimally tilled field and okra crop residue from the previous crop.

Conclusion

Lamb's quarters are among the most common weeds in both fallow and in-season vegetable fields in Coachella Valley. Population density of root-knot nematodes was higher in weedy fallow fields dominated by Lamb's quarters compared to in-season okra fields. Weed-free fallow is recommended to achieve root-knot nematode control by fallow. It is more practical for small-scale okra growers to practice soil conservation practices such as conservation tillage and incorporation of previous crop residues to promote soil microbiological activities antagonistic to root-knot nematodes.

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2022 CATTLECAL NEWSLETTER UPDATE

Brooke Latack, Livestock Advisor – Imperial, Riverside, and San Bernardino Counties

The May 2022 edition of the CattleCal newsletter covered how much fat should be fed in a feedlot diet, the career and research of Daniel Schaefer, an animal science nutrition professor at University of Wisconsin-Madison, and a look at a study examining the effect of free fatty acids in supplemental fat on the performance of feedlot cattle. The newsletter also summarizes our ongoing feedlot research being done at UC DREC.

If you would like to subscribe to the CattleCal newsletter, please visit this site and enter your email address: http://ceimperial.ucanr.edu/news_359/CattleCal_483/

May CattleCal podcast episodes:

- **Quiz Zinn**
  In this episode, we asked Dr. Richard Zinn a question from our listeners related to how much fat should be fed in a feedlot diet.

- **Career Call**
  Brooke Latack and Pedro Carvalho called Dr. Dan Schaefer, an Emeritus Professor in Ruminant Nutrition at the University of Wisconsin-Madison. In this episode, Dr. Schaefer talked about his background in agriculture, and his experience as a professor, mentor, and department head of the Animal Science Department. In the end, Dr. Schaefer gave really good advice to young scientists.

- **Research Call**
  Brooke Latack and Pedro Carvalho speak to Dr. Dan Schaefer again. In this episode, Dr. Schaefer talked about one of the highlights of his career which is the discovery of the use of vitamin E as a tool to enhance color stability in beef cattle. He went thought in how he developed the idea and how this discovery was made.

- **Feedlot Research Call**
  In this episode, join Pedro Carvalho and Brooke Latack as they discuss research looking at the effect of free fatty acids in the diet of calf-fed Holstein steers in the feedlot.

The podcast can be found at https://open.spotify.com/show/6PR02gPnmTSHEgsv09ghjY?si=9uxSj3dYQueTEOr3ExTyjw or by searching "CattleCal podcast" in Spotify. It is free to listen!

If you have burning questions about cattle management and would like your questions featured on our Quiz Zinn episodes, please send questions to cattlecalucd@gmail.com or DM your question to our Instagram account @cattlecal.

If you have any questions or comments or would like to subscribe to the newsletter, please contact:

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Vegetable Planting and Harvesting Guide for Coachella Valley

Philip Waisen, Farm Advisor Vegetable Crops
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Crop	Planted	Harvested	Notes: Culture, Common Varieties
Artichokes	mid-August to mid-September	January to March	Grow using transplants and drip irrigation. Varieties: "Imperial Star", "Emerald" "Green Globe" and grower selections. Susceptible to freezing. Fruit quality deteriorates with high temperatures.
Asparagus	October to March	January to April	Can be direct-seeded or planted with crowns. Furrow irrigated. Grown as a perennial, harvesting lightly the second year. Varieties "UC157", "Brock" Selections. None is currently grown in the Coachella Valley.
Green Beans	Fall crop: August to mid-September ------------------- Spring crop: January	Late October until frost ---------------- March to May	Direct seeded and can be furrow or drip irrigated. Varieties change constantly. Green Beans are susceptible to damping-off fungi during the whole growing season. All are round types.
Broccoli	Mid-September to mid-November	November to mid-March	Mostly direct-seeded, some growers are using transplants, sprinkler irrigated to germinate, then crop is furrow irrigated. Broccoli and Cauliflower have early, mid and late-season varieties. The local seed companies have the recommendations for each time slot.
Cabbage	Late August to mid-October	December to February	Direct seeded and furrow irrigated. Green and Red varieties. This area also grows Napa and Bok Choi types.
Carrots	August to mid-October	December to June	Direct seeded, carrots can be furrow and sprinkler irrigated. Grown for fresh market and lightly processed (baby carrot) market.
Cauliflower	Mid-September to mid-November	Late November to March	Direct seeded, or transplanted, furrow irrigated. There are early varieties, transitional varieties and those considered the main varieties.
Celery	Late August to early September	December to March	Transplants, and drip irrigation. Variety "Tall Utah 53-70" and selections from it.
Eggplant	Fall crop: July to August ----------------- Spring Crop: Mid-January	October until frost ------------- April to June	All transplanted onto plastic mulch and drip irrigated. The main types are: American, Japanese and Italian varieties. Each has its own distinct look and flavor.

Crop	Planted	Harvested	Notes: Culture, Common Varieties
Garlic	September to late November	May to June	Garlic acreage is minor in the Coachella Valley. Planted from cloves. More commonly grown in Imperial Valley.
Leaf lettuce	Late September to Early December	Late November to March	Direct seeded or with transplants. Can be grown using drip or furrow irrigation. The types of growing include Romaine, Loose-leaf, Green Leaf, Red Leaf, and Butter Lettuce.
Melons	Fall crop: July to early August ----------------- Spring crop: January to February	October to November ------------- June to July	Can be grown using plastic mulch and drip irrigation. Includes cantaloupe, Crenshaw, and honeydews. Cantaloupes are susceptible to whiteflies which can transmit Gemini viruses.
Okra	Fall crop: June to July ----------------- Spring crop: January to March	September to frost ------------- May to October	Direct seeded using furrow irrigation. Open-pollinated varieties such as Clemson Spineless 80. Hybrid seed used on a limited scale. Also, some varieties that are from India are being grown in the Coachella Valley. Okra is very susceptible to root-knot nematode damage.
Dry Bulb Onions	Mid-October to midDecember	May to June	Direct seeded using drip or furrow irrigation. Two main types are grown, white and yellow varieties. Onion acreage is declining in the Coachella Valley.
Peppers	July to September ----------------- Late December to February	Harvested October to frost ------------- Harvested midApril to June.	Transplanted on plastic mulch using drip irrigation and staked. Grown as a spring and fall crop. There are two main types, Green and Red Varieties. Other types on smaller acreage include Jalapeño and Yellow or Güerro chili, and Habaneros. Habaneros can be orange, red, and yellow. Lately, a type called mini bell peppers has been planted. These can also be orange, red, and yellow in color.
Potatoes	Late November to December	Late March to mid-June	Grown from seed pieces. Sprinkler irrigated throughout the season. Grown as a spring and fall crop. Coachella Valley grows mostly spring crops.
Spinach	October to December	November to March	Direct seeded, can be furrow or sprinkler irrigated throughout the season. Fresh market and lightly processed use. Varieties change a lot.
Summer Squash	August to September ----------------- Mid-January to May	Mid-September to frost ------------- March to June	Direct seeded, furrow or drip irrigated. Types grown include Crookneck, Straight neck, Zucchini and Summer type varieties. Acreage has decreased due to susceptibility to whitefly vectored viruses.
Sweet Corn	August to early September ----------------- Late December to March	November to early December ------------------- April to July	Direct seeded, furrow or drip irrigated. Primarily a spring crop due to corn earworm pressure in the fall. Types grown include Super sweet white, Yellow and Bicolor varieties.

Crop	Planted	Harvested	Notes: Culture, Common Varieties
Tomato	Late January	May to April	Transplanted using plastic mulch and drip irrigation.
Watermelon	Mid-December to mid-February	Mid-May to early July	Transplanted, using plastic mulch and drip irrigation. Seedless varieties and require a seeded pollinator: Drip irrigated is the most common method to irrigate. All watermelons require bees for pollination. Susceptible to Geminivirus.
Note:	Varieties	are dynamic and	change constantly

Special thanks to Jose Luis Aguiar (Retired UCCE Vegetable Crops Advisor) and Phil Maag (Product Development Specialist, Champion Seed Company).

†Jla 10-24-18”

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Got bacterial diseases of onion?

Help us “**STOP THE ROT**”

WHO We Are: A team of researchers from across the country, working on tools to combat bacterial diseases of onions

WHAT We Are Looking For: Samples of onion plants affected by any of the bacteria known or suspected to cause diseases in onions

HOW You Can Help: If you are a grower and you have a suspected bacterial disease in your onion crop, contact us to survey your field and/or sample the bulbs in storage

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USDA United States Department of Agriculture | National Institute of Food and Agriculture

Nature's Ninja graphic courtesy of the National Onion Association

‘Stop the Rot’ Onion Bacterial Project 2019-51181-30013

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 May 1st to July 31th 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	June		July		August	
	1-15	16-30	1-15	16-31	1-15	16-31
Calipatria	0.31	0.32	0.32	0.31	0.30	0.28
El Centro (Seeley)	0.34	0.36	0.33	0.31	0.30	0.28
Holtville (Meloland)	0.33	0.34	0.32	0.31	0.30	0.28

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/.