


Imperial County *Agricultural Briefs*

UC CE | UNIVERSITY OF CALIFORNIA Agriculture and Natural Resources

Features from your Advisors

July 2022 (Volume 25 Issue 7)

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POST-HARVEST NEMATICIDE TREATMENT AND TILLAGE SHOWED PROMISE IN REDUCING THE INITIAL ROOT-KNOT NEMATODE POPULATION ON BELL PEPPER

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Introduction

California is ranked number one for the value of bell pepper (*Capsicum annuum*) production nationwide, generating an annual average income of $217 million from 2018-2021 (CDFA, 2021; USDA NASS, 2022). In California, bell peppers are produced in four main areas. These include the Central Coast (Santa Clara, San Luis Obispo, Monterey, and San Benito), Central Valley (Kern, Fresno, and San Joaquin), Southern Coast (Ventura), and Southern Desert Valleys (Riverside and Imperial). On average, the desert production, especially in the Coachella Valley contributes more than a third, 32.3% or $70.1 million, of California's bell pepper value annually in the last four years (CDFA, 2021; Table 1).

In the desert valleys, bell pepper plantings occur from late December-February for harvesting from mid-April-June (Waisen, 2022). They are grown with plasticulture and drip irrigation in the desert valleys (Hartz et al., 2008). Bell peppers are transplanted in double rows on polyethylene-mulched raised beds using drip irrigation (Fig. 1a). The use of polyethylene mulch or black plastic is necessary for spring planting because it absorbs the energy from the sunlight and warms up the desert sandy soil quickly. This practice favors plant growth as peppers are warm-season crops. In addition, plastic mulch suppresses weeds and conserves soil moisture among other benefits.

Root-knot nematodes (*Meloidogyne* spp.) are among the major biotic challenges of pepper production in low desert growing conditions (Fig. 1b-c). Root-knot nematodes cause galling on roots, severely impeding water and nutrient uptake, and predispose plants to other diseases. Management of these nematodes relies primarily on the use of nematicides. Nimitz (fluensulfone), Telone (1,3 dichloropropene), Vapam (metam sodium), and Velum One (fluopyram) are nematicides registered to use on bell peppers in California.

The objective of this study was to examine the post-harvest treatment effects of nematicide, tillage, and irrigation treated sequentially against root-knot nematodes on bell peppers in low desert growing conditions.

Materials and methods

One week prior to a crop termination or disking crop residues, three 10-acre crop fields were treated with either Nimitz, Vapam, or field left untreated. Each treatment was replicated four times (160 ft × 130 ft per block). Each nematicide was delivered through driplines at recommended rates. Four soil cores were collected from each block following a systematic zig-zag sampling pattern. Soil samples were collected from the top 8 inches (20 cm) using a Lakago Soil Probe, placed in quart-size zip lock bags, and transported to the laboratory for further processing. Four soil cores from each block were composited, homogenized, and an aliquot of

Table 1. Bell pepper production for fresh market and processing in California from 2018-2021.

Time	Harvested	Yield	Value	Percent (%) value contributed by the top 5 counties				
Year	Area (acre)	(tons/acre)	($1,000)	Riverside	Ventura	Kern	Fresno	Santa Clara
2018	13,500	22.5	236,085	33.4	18.4	17.5	7.9	6.2
2019	13,500	18.0	230,860	31.7	18.6	16.8	12.1	5.2
2020	13,500	18.6	216,545	32.6	27.5	19.0	8.7	8.2
2021	9,000	23.8	184,707	n/a	n/a	n/a	n/a	n/a

Source: California agricultural statistic review (www.cdfa.ca.gov); n/a= data not available.

100 cm^3 was subjected to the Baermann tray method for nematode extraction. Root-knot nematodes present in each sample were morphologically identified at up to ×200 magnification using an Olympus CK2 Inverted Phase Contrast Microscope (Microscope Central, Feasterville, PA). The above steps were repeated 1 week after tillage or disking crop residues to assess the effects of tillage.

Statistical analysis

The root-knot nematode population data were checked for normality using Proc Univariate in SAS version 9.4 (SAS Institute Inc., Cary, NC), and normalized using log10 (x + 1) prior to analysis of variance. The nematode population data from 1 week after treatment (before tillage) and 2 weeks after treatment (1 week after tillage) sampling were subjected to repeated-measures analysis of variance using Proc GLM in SAS. Since there was a highly significant interaction detected between nematicide and tillage at the significance level of *P=0.05*, data were analyzed separately by sampling date (before and after tillage). Means were separated using the Waller-Duncan *k*-ratio (*k*=100) test, and only true means were presented in column graphs.

Results and discussion

This is an ongoing study investigating the sequential treatment effects of post-harvest nematicide chemigation, tillage, and irrigation for initial root-knot nematode management on bell peppers in Coachella Valley. This progress report only presents nematicide and tillage treatment results. Although Nimitz only numerically reduced root-knot nematode numbers 1 week after nematicide treatment (Fig. 2a), it significantly suppressed the nematode population 2 weeks after the treatment or 1 week after tillage, compared to untreated control (Fig. 2b; $P<0.05$). One possible explanation for this observation could be that the 1-week post-treatment observation was too short to see the treatment effect, which became apparent 2 weeks after the treatment. Another explanation could be related to how Nimitz behaves. Nimitz is a non-fumigant nematicide, which means it is non-volatile, and with 36 days half-life, it can remain longer in the soil (Ludlow, 2015). During this time window, the subsequent tillage after 1 week of nematicide treatment may have exposed nematodes in untreated furrow soil to the nematicide, resulting in the significant suppression of the nematodes observed.

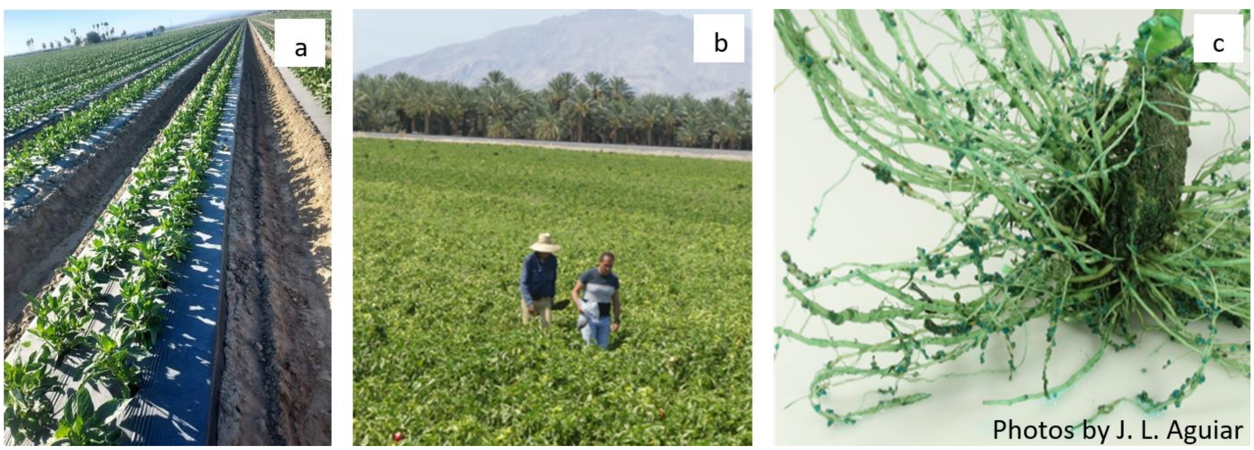

Figure 1. a) Bell peppers transplanted in double rows on polyethylene-mulched raised beds; b) pepper stands exhibiting yellowing symptoms due to root-knot nematode infection in Coachella Valley; c) root-knot infected pepper root showing nematode egg mashes stained with a dye.

Since Nimitz is known to kill plant-parasitic nematodes within 24-48 hours post-treatment, 1-2 weeks was sufficient to provide good nematode control as demonstrated in this study.

When it comes to Vapam, this nematicide behaved slightly differently from Nimitz. Vapam had significantly reduced the soil population of root-knot nematodes 1 week after treatment (Fig. 2a; $P<0.05$). However, tillage appeared to negate the nematicide effect as reflected on root-knot nematode numbers, comparable to untreated control (Fig. 2b). This observation could be explained by the behavior of this nematicide. Unlike Nimitz, Vapam is a fumigant, which means if necessary actions are not taken to contain it, the active ingredient can be lost through volatilization before killing the nematodes. The active ingredient in Vapam, meta sodium, breaks down to methyl isothiocyanate (MITC), and with 7 days half-life, remains relatively briefly in the soil (Ajwa et al., 2002). The volatility of MITC increases with temperature, which can result in 10-34% loss (Van den Berg, 1993). In this study, with high soil temperatures in late spring to early summer in Coachella Valley, it is likely that a huge chunk of MITC had volatilized already within days if not hours of application, resulting in an insignificant suppression of nematodes as observed after 2 weeks of treatment (Fig. 2b).

Tillage by disking crop residues reduced root-knot nematode numbers significantly (data not shown). If you see untreated control treatments before (Fig. 2a) and after (Fig. 2b) tillage, the tillage itself reduced root-knot nematode numbers by 68 folds. This observation is not surprising because tillage is known to reduce soil populations of plant-parasitic nematodes by moving them into deeper soil layers or below the rhizosphere (Neher et al., 2019). There are chances that these nematodes will be resurfacing. However, vegetable crops being annual and with shallow root systems, the chances of getting in contact with these nematodes are low, therefore crops can escape nematode infection. In addition, tillage exposes plant-parasitic nematodes to solar radiation kill, reducing the overall population of nematodes in the soil.

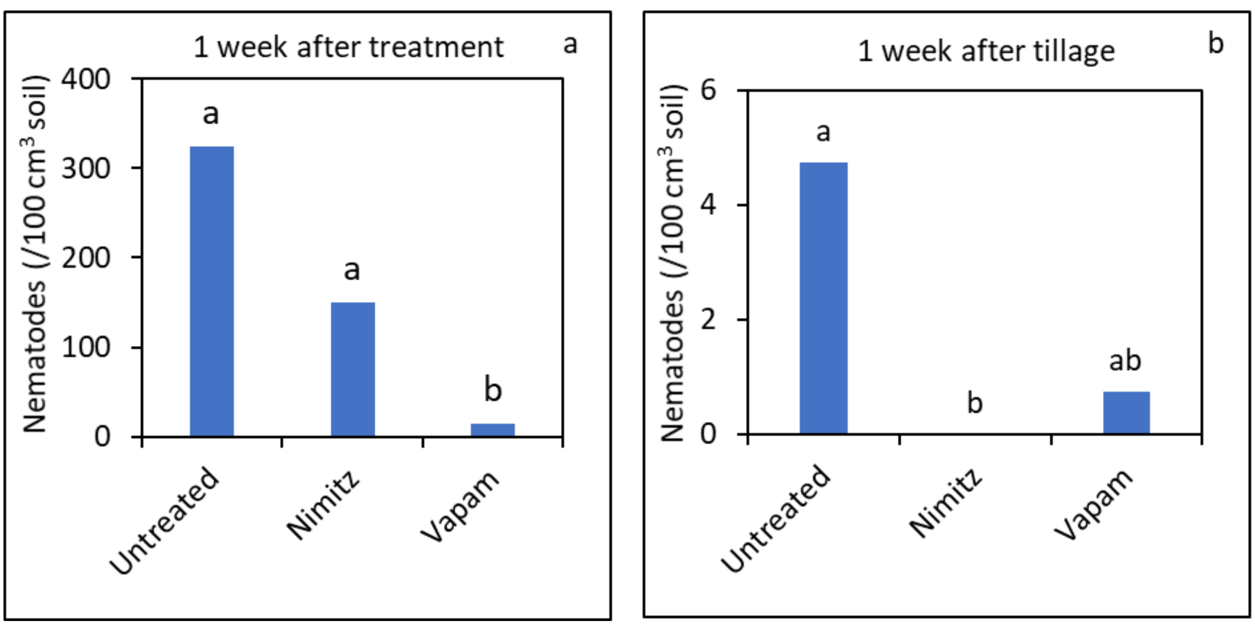

Figure 2. Root-knot nematode population (n=4) affected by post-harvest Nimitz and Vapam nematicide treatment a) 1 week after treatment; and b) 2 weeks after treatment or 1 week after tillage. Bars with the same letter(s) are not different, according to the Waller-Duncan *k*-ratio (*k*=100) *t*-test.

Conclusion

Nimitz demonstrated to be a good post-harvest nematicide to use on vegetable crops. Post-harvest treatment with Nimitz followed by tillage can be beneficial in controlling root-knot nematodes in vegetable crops if this product is registered to use on the crop. This practice reduces the initial root-knot nematode population in the upcoming cropping season. The root-knot nematodes are at their most vulnerable stage when they are infective juveniles. These juveniles are active when the crop is growing, or hosts are present. Thus, the post-harvest nematicide treatment targets these juveniles, and subsequent tillage provide additional control by exposing more nematodes to Nimitz, solar radiation, or burying them deeper below the root zone. Note that root-knot nematodes occur in mixed life stages in the field. These include eggs, which are a hard-to-control stage, even with nematicide treatments. Currently, part of this study is investigating whether irrigation could activate egg hatch.

References

Ajwa, H. A., Trout, T., Mueller, J., Wilhelm, S., Nelson, S. D., Soppe, R., and Shatley, D. 2002. Application of alternative fumigants through drip irrigation systems. Phytopathology 92:1349-1355. doi.org/10.1094/PHYTO.2002.92.12.1349

California Department of Food and Agriculture (CDFA). 2021. California Agricultural Statistics Review. cdfa.ca.gov/Statistics/

Dungan, R. S., Gan, J., and Yates, S. R. 2003. Accelerated degradation of methyl isothiocyanate in soil. Water, Air, and Soil Pollution 142:299-310. doi.org/10.1023/A:1022092907878

Hartz, T., Cantwell, M., Lestrange, M., Smith, R., Aguiar, J., and Daugovish, O. 2008. Bell pepper production in California. University of California, Agriculture and Natural Resources Division. Vegetable Production Series no. 7217. anrcatalog.ucanr.edu/pdf/7217.pdf

Ludlow, K. 2015. Public release summary on the evaluation of the new active fluensulfone in product NIMITZ 480 EC nematicide. Australian Pesticides and Veterinary Medicines Authority. https://sk.sagepub.com/reference/nanoscience/n22.xml

Neher, D. A., Nishanthan, T., Grabau, Z. J., and Chen, S. Y. 2019. Crop rotation and tillage affect nematode communities more than biocides in monoculture soybean. Applied Soil Ecology 140:89-97. doi.org/10.1016/j.apsoil.2019.03.016

USDA, NASS (Unites States Department of Agriculture, National Agricultural Statistics Services). 2022. Vegetable 2021 Summary. downloads.usda.library.cornell.edu/usda-esmis/files/02870v86p/zs25zc490/9593vz15q/vegean22.pdf

Van den Berg, F. 1993. Measured and computed concentrations of methyl isothiocyanate in the air around fumigated fields. Atmospheric Environment. Part A. General Topics 27:63-71. doi.org/10.1016/0960-1686(93)90071-6

Waisen, P. 2022. Vegetable planting and harvesting guide for the Coachella Valley. Imperial Agricultural Briefs 25:100-102. ceimperial.ucanr.edu/newsletters/Ag_Briefs93507.pdf

FINDINGS OF RECENT IRRIGATION RESEARCH IN THE DESERT SOUTHWEST CAN ASSIST ALFALFA GROWERS IN THE ERA OF WATER CONSTRAINTS

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Introduction. In the desert southwest, alfalfa is the dominant water user due to its high acreage and long growing season. Although alfalfa is frequently criticized for its high seasonal water requirements, it has positive biological features, environmental benefits, and greater yield potential than many other crops under water stressed conditions such as deep-rootedness, high yield and harvest index, contribution to wildlife habitat, and ability to survive a drought. The inclusion of perennial forages such as alfalfa in agricultural systems provides an effective solution for sustainable crop production and environmental protection in arid and semi-arid regions. Alfalfa has long been used as a very high-quality livestock feed, and importantly can improve soil fertility and maintain biomass production without needing supplementary nitrogen fertilizer.

In the Imperial and Palo Verde Valleys, alfalfa accounts for about 28% of the crops grown. While more than 95% of desert alfalfa is currently irrigated by surface irrigation systems, various irrigation strategies and on-farm water conservation practices have already been adapted by local growers to enhance the efficiency of water-use.

Fig. 1. An alfalfa research trail field in the low desert of California under furrow irrigation (40-inch bed).

Due to recurring droughts and water shortages in the Colorado River Basin, there are likely to be significant shortfalls between water supply and demand in the Lower Colorado River Basin in the upcoming years. Alfalfa as a high-water user could be the first crop to bring some concerns to the agricultural communities for such limited and impaired water supply. Therefore, implementing impactful water conservation tools and techniques is necessary to sustain alfalfa production and for the resiliency of agricultural systems in the region.

Over the last five years, we have conducted several irrigation research studies in the low desert alfalfa production systems. Most of the research activities were carried out in commercial fields under different irrigation management practices, soil types and conditions. This article will summarize some of the findings of these studies and provide an overview of irrigation tools and strategies that may assist alfalfa growers in coping with the era of water scarcity.

Knowing how much water alfalfa really needs is critical. Knowing the true water requirements for alfalfa is critical as the first step for improving water use efficiency. Weather parameters (solar radiation, air temperature, humidity, and wind speed), crop characteristics, management and environmental aspects are factors affecting crop evapotranspiration (ET) or crop water use. Regardless of the type of irrigation system, accurate estimates of alfalfa crop water needs are essential for proper management of irrigation water, and to maximize the net benefits of alfalfa hay production. Alfalfa seasonal crop water use may be affected considerably by irrigation and other management practices, soil types and conditions. The data of a three-year experiment in ten commercial experimental fields in the Imperial and Palo Verde Valleys showed that alfalfa seasonal crop water consumption (seasonal actual ET) varied from 56.5 to 63.5 inches. An average seasonal crop water use of 60.0 inches (5.0 ac-ft/ac) was determined across the experimental sites.

Fig. 2. A fully automated ET monitoring tower within one of the experimental alfalfa fields in the low desert of California. The actual ET was measured using the residual of energy balance method with a combination of surface renewal and eddy covariance techniques. The ET towers were set up in fields under grower practice, and thus, the data represent true cropping systems and environmental conditions.

Alfalfa crop ET varies widely over time during each harvest cycle and growing season (Fig. 3). Because of frequent harvesting events (28–30-day cycles), alfalfa crop coefficient (Kc) value oscillates over the harvest cycles. The crop coefficient value depends on the alfalfa growth stages, ranging from smallest during initial growth stage, just after each harvest, and reaching the maximum at full canopy development stages prior to each harvest. Alfalfa crop coefficient ranged from about 0.5 after hay is cut, to nearly 1.24 at full canopy over each harvest period (data from our recent study in the low desert).

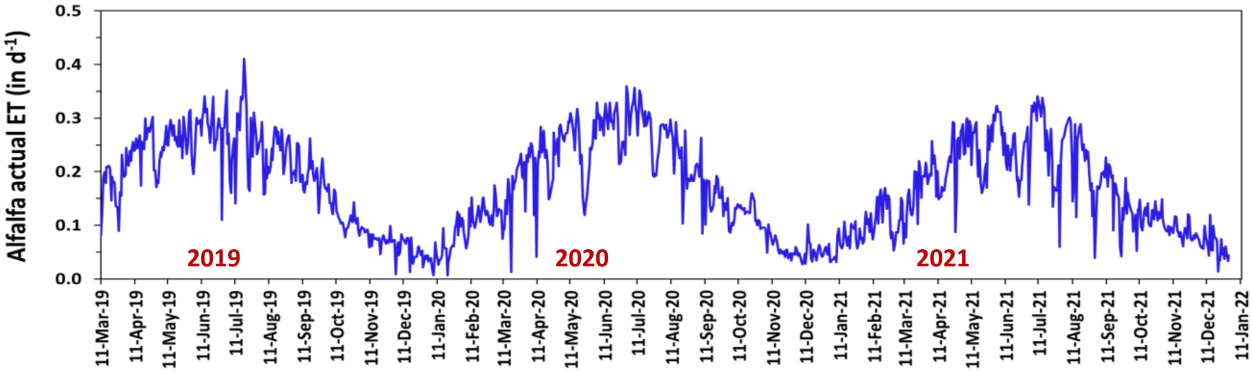

Fig. 3. Daily actual evapotranspiration measured using eddy covariance equipment in an alfalfa field in the low desert of California over a three-year period.

Since alfalfa has seasonality values of crop coefficient, these minimum and maximum values and the average value of harvest cycles may vary over the season. Lower crop coefficient values were found at the early and late season harvest cycles and higher values in mid-season harvest cycles (Fig. 4). The highest alfalfa crop coefficient values were observed during the harvest cycles of April through June. The results showed an average of 0.82 for the March harvest cycle, 0.95 for the harvest cycles of April-May, 0.89 for the harvest cycles of Jun-July, 0.84 for the harvest cycles August-September, and 0.75 for the fall harvest cycles. These crop coefficient values reflect local cultivation conditions in terms of climate, soil, and water and crop management. These values and CIMIS (California Irrigation Management Information System) reference ET/or spatial CIMIS data can be used to estimate alfalfa crop water needs in different periods of growing season.

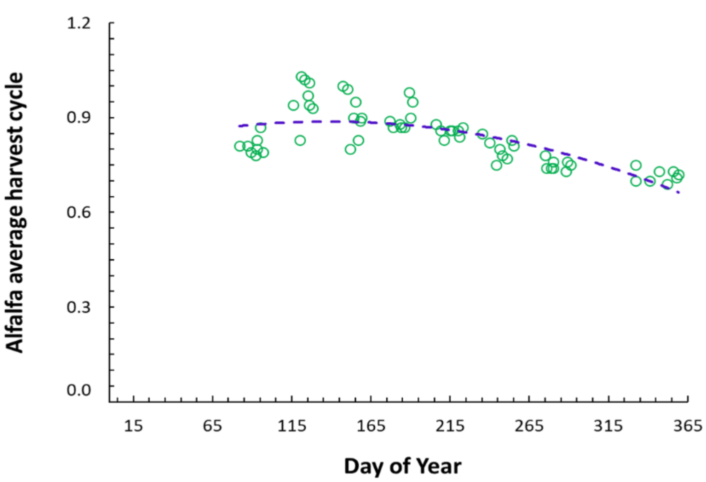

Fig. 4. Seasonal trends of alfalfa crop coefficient values in the low desert. The values of the 2019-2021seasons at four alfalfa fields in the low desert were adopted for this analysis. The values may consider as a guideline to estimate alfalfa crop water needs over growing season.

Excess irrigation for salinity management is necessary. Excess irrigation can be considered beneficial water use for salinity management in the desert region, as the 3-inch annual rainfall of the region is insufficient to leach out soil salinity. In other words, 5.0 ac-ft/ac is just an estimation of seasonal alfalfa crop water use. The amount of additional irrigation water to effectively drain salt from the crop root zone depends on the soil conditions and level of salinity. The irrigation water that needs to be applied in an individual field depends on crop water requirements and the efficiency of the irrigation system. If we assume an average water distribution uniformity of 75% for a particular flood irrigated field, the approximate irrigation water needs per acre of this alfalfa field would be 6.6 ac-feet. Part of this excessive irrigation water may be necessary for salinity management.

Monitoring soil moisture status is critical to avoid water stress or waterlogging/scalding. Soil texture will determine how much water we can store in the crop root zone, and how fast water infiltrates when it moves over the field. Soil-based measurements may be a far more practical and easy method for alfalfa growers to use to schedule irrigations and assess current irrigation practices. In recent years, there has been a proliferation of commercially available soil moisture monitoring systems for agriculture. Many sensors interface with dataloggers and wireless communication systems to provide near real-time status of soil moisture from several depths and locations within a field. Data are automatically uploaded by radio or cell phone communications to cloud-based computer servers and are accessible through apps on smartphones and tablet computers. These communication advancements greatly improve the convenience of accessing data and can be configured to provide timely alerts when crops require irrigation.

Utilizing affordable soil moisture sensing tools is very important in alfalfa fields. A soil moisture sensor such as Watermark, which estimates soil water tension in centibars, may be very useful if it is properly installed and maintained, and the data is effectively interpreted.

Figure 5 illustrates a very clear picture of soil water availability and water depletion in multiple depths within two sections of an alfalfa field with a sandy loam soil texture (Gilman fine sandy loam), one under grower practice and the other one under moderate summer deficit irrigation (two skipped irrigation events, one in July and one in August). Alfalfa could occasionally experience moderate water stress around cuttings (an issue could occur in soils with light texture) at this field, however, additional potential mild water stress could have occurred in the middle of July-August harvest cycles due to halted irrigation water. Soil moisture sensing data from 10 other commercial alfalfa fields indicated that the soil at sites with a silty loam or heavier soil texture were generally not within water stressed range the entire crop season.

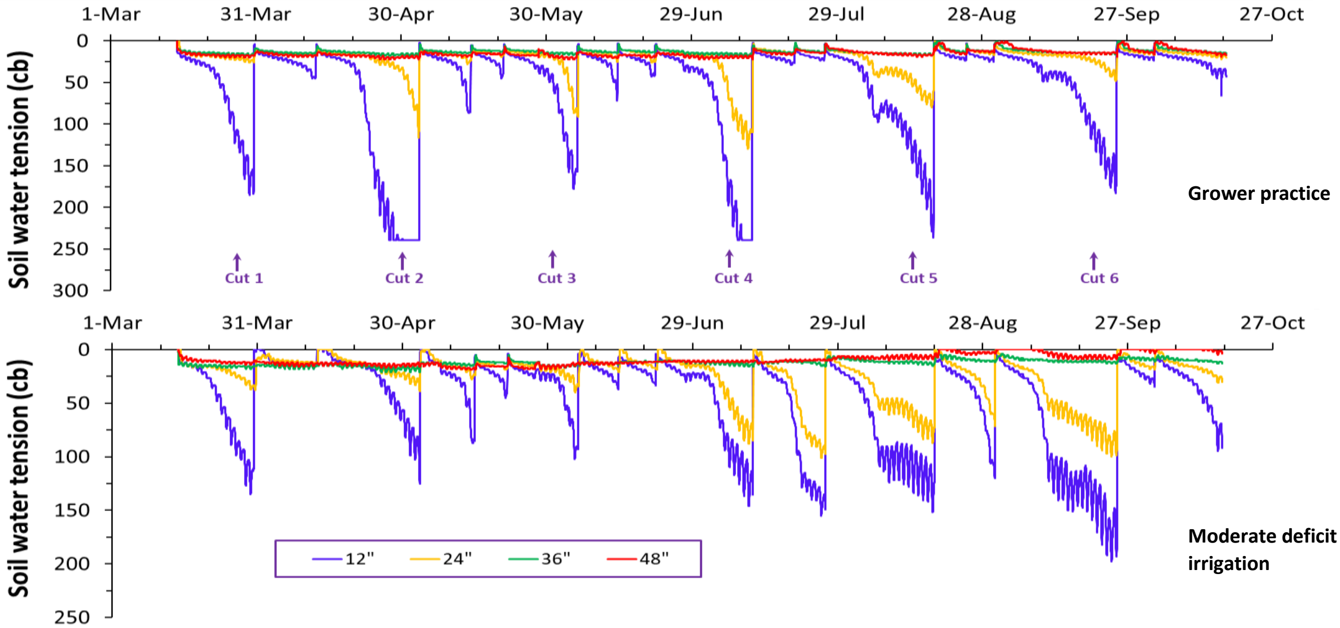

Fig. 5. Half-hourly soil water tension (centibar) measured at multiple depths of 12, 24, 36, and 48 inches in plots under grower practice and moderate deficit irrigation in the low desert. In the moderate deficit irrigation plot, two irrigation events were skipped, one in July and one in August. The spikes at depths of 12 and 24 inches clearly demonstrate irrigation events during the period.

Selecting an appropriate location and correct sensor installation are necessary to collect accurate soil moisture data. If the sensors are placed in an area that is not representative of the field or there are high variabilities within the field, the results of one monitoring site can be very misleading. Follow manufacturer guidelines for installation and to ensure good soil to sensor contact. Proper sensor placement is critical for accurately representing soil moisture in the crop root zone, the top 4 feet.

Daily readings should provide an overall picture of the seasonal soil water status and allow for evaluation of irrigation management practices. Sometimes, a relatively minor adjustment in irrigation practices can pay large dividends in increased yield and/or water savings. The soil moisture data at depths of 1 and 2 feet may clearly demonstrate irrigation events, the level of wetness and dryness of the soil.

Summer deficit irrigation strategies. Alfalfa has unique drought tolerance mechanisms that make it biologically suited to deficit irrigation or reduced water supplies. The ability of alfalfa to sustain temporary droughts without significant stand loss is due to it’s specific characteristics of deep roots, high water use efficiency, salinity tolerance, and ability to grant partial yields with less irrigation water applied than the requited amount.

By following an optimal deficit irrigation strategy, a notable amount of water conserved with a low yield penalty and plant stand losses is achievable. Summer deficit strategies in alfalfa are primarily feasible due to the seasonal yield patterns of the crop, with heavy yields occurring during spring to early summer, and light yields during the summer to fall. Our recent research in the Palo Verde Valley suggested that approximately 73-74% of total desert alfalfa seasonal production occurred by mid-July (Fig. 6). Higher alfalfa water use efficiency was also observed for the cuttings by July than the cuttings later in the season (Fig. 7). The water deficit strategies could affect alfalfa production over three harvest cycles of late July through late September-mid October, the timeframe that desert alfalfa typically produces nearly 21-22% of annual yields.

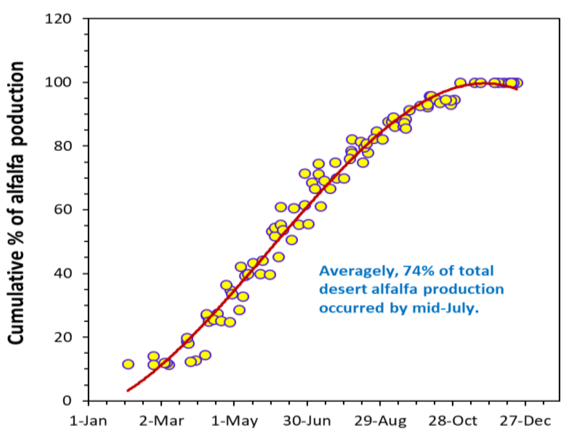

Fig. 6. Cumulative percentage of alfalfa production over the season. A three-year yield data (2019-2021) from four commercial fields in the Palo Verde Valley was adopted for this analysis.

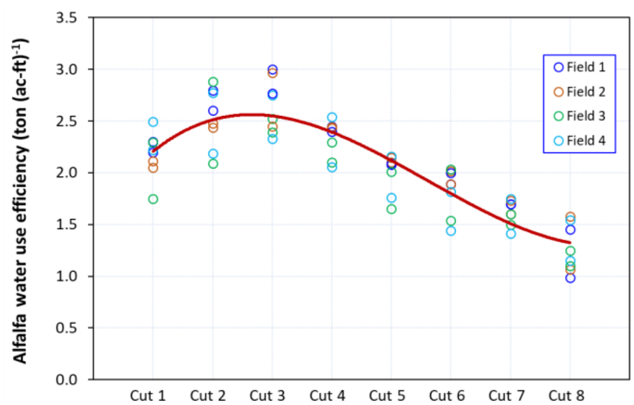

Fig. 7. Alfalfa water use efficiency (the ratio of dry matter yield to crop water consumption) over the cuttings. A two-year data from four commercial fields in the Palo Verde Valley was adopted for this analysis. All fields had eight cuttings during the 2019 and 2020 seasons.

Implementation of moderate summer water deficits (skipping one to three irrigation events) resulted in negligible yield reductions, ranging from 0.2 to 0.65 t ac^{-1} in Palo Verde alfalfa production system. Insignificant soil moisture depletion, noncrucial salt accumulation, and no negative impact on plant stands and hay quality were observed form the suggested moderate summer irrigation. The findings suggest that implementing the deficit irrigation could serve as an effective water conservation tool (up to 1.0 ac-ft/ac) and provide a reliable source of seasonally available water as well as sustain the economic viability of alfalfa production in the region.

Filling the root zone, without exceeding the soil's available water holding capacity, based on soil moisture sensor technology would be an effective early-season alfalfa irrigation strategy. This practice might allow alfalfa to take full advantage of the available water and promote rapid, early season growth, when the yield potential is highest, and when soil and water temperatures are not likely to be high enough to stress the crop and limit crop productivity. Consequently, combining full irrigation in winter-spring with moderate deficit irrigation during summer could be an efficient approach in conserving water across the entire season.

In the desert region, yield and plant stand losses, soil water depletion, and salt build-up due to water deficits can be considerable if one doesn't follow an optimal irrigation strategy or conduct severe deficit irrigation (e.g., cut off irrigation water the entire summer (Fig. 8)). Deficit irrigation strategies may be sustainable as an effective water conservation tool in the desert region if such measures provide adequate economic incentives to participating farmers. Incentive programs to farmers must offset the risk of implementing the proposed practices as a tool to adopt water conservation practices. The results of the deficit irrigation study in the Palo Verde Valley were used to develop a deficit irrigation tool. It is expected NRCS considers the proposed tool to develop an intensive program form growers who adapt summer deficit irrigation in desert alfalfa.

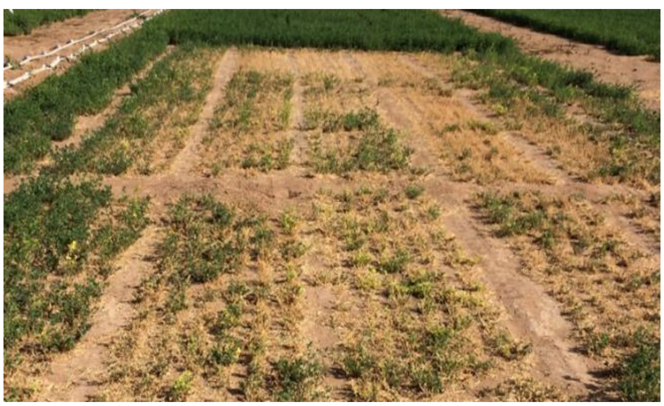

Fig. 8. Alfalfa plant stand status in late October two weeks after first irrigation following severe summer deficit irrigation in the low desert. The plot was under subsurface drip irrigation and received only 25% of crop water needs during summer 2020 (July through September). Significant plant stand loss and soil water depletion were observed in this experimental plot.

Advanced irrigation water delivery systems. One strategy to enhance water-use efficiency and on-farm water conservation in alfalfa fields is utilizing advanced irrigation water delivery systems such as automated surface irrigation, subsurface drip irrigation (SDI), and overhead linear move sprinkler irrigation. These irrigation systems provide more precise control of irrigation water and have greater irrigation efficiency than conventional surface irrigation systems. These technologies were already adapted by local growers in the low desert, although the process of adaption is continuing.

Automated surface irrigation. Various irrigation cutoff methods and practices can be used to reduce surface runoff and improve irrigation efficiency in surface irrigation systems. Automated surface irrigation is considered as an advanced technology that uses automated gates, wetting front advance sensors, and flowmeters to determine the irrigation cutoff time and regulate the flow rate (Fig. 9). Automation of surface irrigation may improve irrigation system efficiency and reduce labor cost, soil erosion, and site movement of pesticides and nutrients.

An assessment was conducted in a commercial field equipped with automated surface irrigation in the low desert over a four-month period. The measurements indicated that the tailwater runoff was reduced to 5.2% of the total applied water on average over the study period. In one of the irrigation events, this measure was reduced to 4.3% of the total applied water (Fig. 10). A comparison between the data of our ET monitoring tower and applied irrigation water over the study period showed that nearly 85.2% and 9.6% of the applied water was used as actual crop ET and leaching/stored at the soil profile, respectively. In other words, the grower was able to improve the irrigation efficiency at this field as high as drip and new generation low-pressure sprinkler irrigation systems.

Fig. 9. An alfalfa field under automated surface irrigation in the low desert of California.

Growers who adapted automated surface irrigation reported significant reduction in labor cost as one of the other advantages of this technology. The CDFA-SWEEP program is going to support automated surface irrigation projects in the upcoming solicitations, and therefore more incentives will be available to adapt this technology.

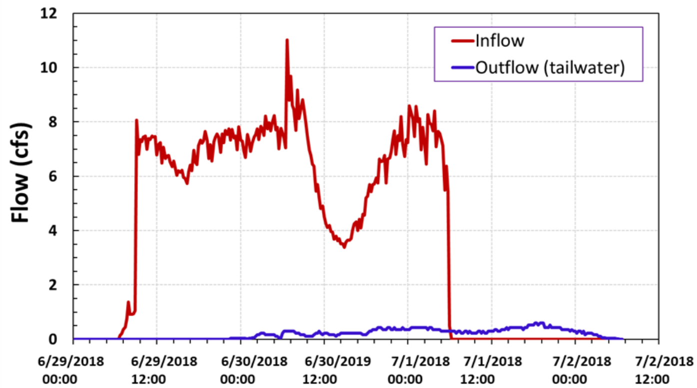

Fig. 10. Inflow and outflow rates at the automated field during one irrigation event (summer 2018).

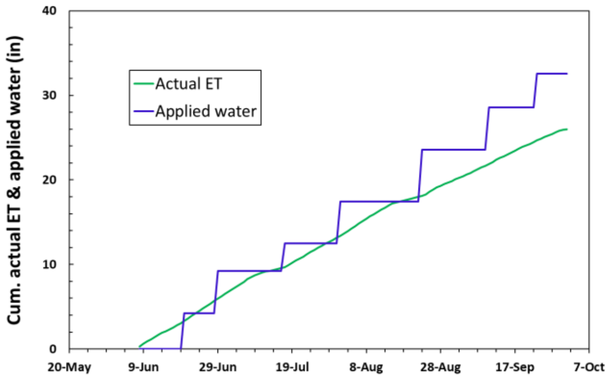

Fig. 11. Cumulative actual ET and applied irrigation water at the automated field over the study period.

Subsurface drip irrigation (SDI). It is quite likely that yields may improve utilizing SDI versus conventional flood irrigation. In the survey conducted in 2018-2020, several alfalfa growers reported enhancement in both yield and water productivity in the low desert (Fig. 12). Our data from several research trials confirmed a better water distribution uniformity over time and space in alfalfa fields under SDI. Salinity may be a key limitation for SDI systems but can generally be managed with an integrated irrigation system. Buildup of soil saline conditions could occur between driplines and above driplines (no leaching occurs above the buried drip lines resulting in an accumulation of salt near the soil surface).

Maintenance and gopher strikes remains the major challenge for using drip at alfalfa (Fig. 13). Extensive rodent infestation and lack of timely maintenance may bring the system to the point that abandonment should be considered if serious rodent issues exist. Setting traps, burrow fumigation, and continual monitoring and removal need to be implemented as effective solutions. In the desert region, integrating SDI and flood irrigation at the early season may have other benefits such as leaching salt and refilling soil profile. There are growers in the desert who use semi-solid set sprinkler system for this task. Growers utilize regular scouting to monitor gopher damage and leaks. Normally, a continuous monitoring by irrigation crew needs to be conducted after each irrigation event.

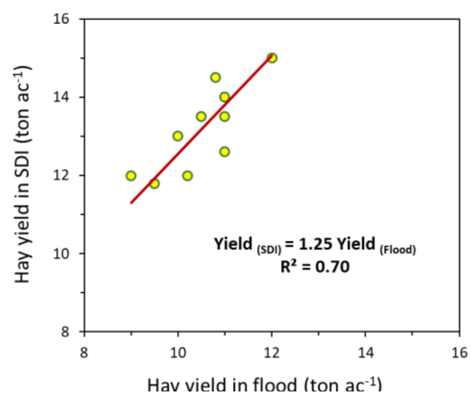

Fig. 12. Yields reported by growers in SDI vs. check flood fields.

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Fig. 13. Experimental alfalfa field under subsurface drip irrigation (left), and a gopher trapped in an alfalfa SDI field in the low desert (right).

Linear Move Sprinkler Irrigation. Linear move sprinkler irrigation systems are an adaptation of center pivot sprinkler systems for use on fields which are not appropriate for center pivot systems due to shape or elevation changes (Fig. 14). It seems that this system is more adaptable in the low desert. This irrigation system is composed of a series of towers that suspend the irrigation system and move laterally in the direction of the rows. Water can be supplied to the towers from an open ditch adjacent to the 1st tower and parallel to the director of travel or by a flexible hose typically 100 to 200 feet in length. It is a low-pressure sprinkler system (with typical pressures at the farthest end of the sprinkler from the water source ranging from 10 to 35 psi) and uses fixed sprinkler applicators/nozzles or drop tubes or a combination of both to apply water. Growers who adapted linear move sprinkler irrigation system in desert alfalfa are more satisfied than other advanced water delivery technologies.

Fig. 14. An alfalfa field under linear move sprinkler irrigation systems in the low desert of California.

More information can be found in the following publications from the author:

Montazar, A. (2021). Field-scale crop water needs and crop coefficients variabilities in the desert alfalfa production system. UC ANR Agricultural Briefs-Imperial County, 24 (5): 73-79.

Montazar, A. (2021). Smart irrigation management decision. Vegetable West Magazine, April Issue, 10-11.

Montazar, A., Bachie, O., Corwin, D., Putnam, D. (2020). Feasibility of moderate deficit irrigation as a water conservation tool in California's low desert alfalfa. *Agronomy*, 10 (11), 1640.

Montazar, A. (2020). Water use efficiency in California low desert alfalfa. UC ANR Agricultural Briefs-Imperial County, 23 (10): 159-163.

Montazar, A. (2020). Subsurface drip irrigation in the desert: what we learned so far in alfalfa & sugar beets. California Dairy Magazine, July 29 (7): 14-17.

Montazar, A. (2020). Subsurface drip irrigation in the desert: what we learned so far. UC ANR Agricultural Briefs-Imperial County, 23 (8): 120-126.

Montazar, A. (2019). Updated Alfalfa Crop Water Use Information: An estimation for spring and summer harvest cycles in California low desert. UC ANR Agricultural Briefs-Imperial County, 22 (11): 202-205.

Montazar, A., Bali, K., Zaccaria, D., Putnam, D. (2018). Viability of subsurface drip irrigation for alfalfa production in the Low desert of California. ASABE International Meeting, July 29-August 1, Detroit, Michigan.

Montazar, A. (2018). Basic principles to attain the most effective use of irrigation water. UC ANR Agricultural Briefs-Imperial County, 21(6): 94-98, Montazar, A., Bali, K. (2017). Subsurface drip irrigation in alfalfa: advantages and disadvantages, UC ANR Agricultural Briefs-Imperial County, July issue.

Montazar, A. (2017). Effective water management practices in alfalfa, California Dairy Magazine, October issue.

Montazar, A. (2017). Effective solution for improving on-farm irrigation efficiency. UC ANR Agricultural Briefs-Imperial County, November issue.

JUNE 2022 CATTLECAL NEWSLETTER UPDATE

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

The June 2022 edition of the CattleCal newsletter covered how the type of fat that should be fed in a feedlot diet, the career and research of Dr. Steve Loerch, senior associate Dean and Animal Science professor at Penn State, and a look at a study examining the relationship between fat supplementation and fatty acid digestion in 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/

June CattleCal podcast episodes:

- **Quiz Zinn**
  In this episode, we asked Dr. Richard Zinn a question from our listeners related to the type of fats used in feedlot diets.

- **Career Call**
  Brooke Latack and Pedro Carvalho called Dr. Steve Loerch, Senior Associate Dean and Animal Science Professor at Penn State, about his lifelong passion to be a cowboy scientist and the path he took to get there.

- **Research Call**
  Brooke Latack and Pedro Carvalho speak to Dr. Dan Schaefer again. In this episode, Dr. Loerch discusses research related to limit feeding beef cattle and the impacts limit feeding has on performance.

- **Feedlot Research Call**
  In this episode, join Pedro Carvalho and Brooke Latack as they discuss research looking at the relationship between fat supplementation and fatty acid digestion in feedlot cattle.

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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Pedro Carvalho (CE Feedlot Management Specialist) - pcarvalho@ucdavis.edu
CattleCal: cattlecalucd@gmail.com

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	July		August		September	
	1-15	16-31	1-15	16-31	1-15	16-30
Calipatria	0.32	0.31	0.30	0.28	0.26	0.23
El Centro (Seeley)	0.33	0.31	0.30	0.28	0.26	0.25
Holtville (Meloland)	0.32	0.31	0.30	0.28	0.26	0.24

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/.