Imperial County Agricultural Briefs

From your Farm Advisors

Features

October, 2011

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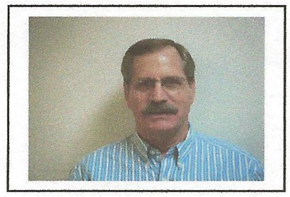
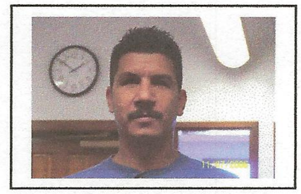
1050 E. Holton Road Holtville, CA 92250-9615 (760) 352-9474

Thrips Control on Iceberg and Romaine Lettuce

Eric T. Natwick and Martin I. Lopez





The western flower thrips, *Frankliniella occidentalis* (Pergande), is a common pest in lettuce grown in the low desert region, and can cause serious economic losses to lettuce growers. Two trials were conducted to evaluate the efficacy of commercial and experimental insecticides for thrips control in iceberg lettuce and romaine lettuce. The immediate objectives were to assess the efficacy of insecticides for management of western flower thrips in lettuce crops. The research was partially funded by the California Leafy Greens Research Board for FY 2010/11. The results of the two studies are summarized in the two Tables below.

Methods:
The research was conducted at the University of California Desert Research and Extension Center at1004 Holton Road, El Centro, CA. The two lettuce crops were planted into raised beds on a 40 inch center-to-center spacing with 2 seed-lines per bed. Plot size was 4-beds by 50 ft. The experimental design was Randomized Complete Block with 4 replicates. Sprinklers were used to irrigate to seedling emergence and establishment and furrow irrigation was used thereafter. The insecticide treatments were applied using a Lee Spider Spray TracTractor 4-row sprayer with three nozzles per row delivering 52.9 gpa at 30 psi. Dyne-Amic at 0.25% vol/vol was added to foliar spray mixture. The insecticide treatments rates and dates of application are listed in Table 1 and 2. The herbicide Kerb 50W was applied at the rate of 4 lb of product per acre via sprinkler chemigation. The iceberg lettuce variety EBLIN was initially watered for germination on 13 October 2011 and the romaine lettuce variety Fresh Heart was initially watered for germination on 14 October 2011.

Evaluations:
Iceberg lettuce evaluations were conducted on 3, 7, 11, 18, and 21 January 2011 and for romaine lettuce on 3, 7, 13, 18, 21, 28 and 31 January 2011. During each evaluation, 10 lettuce plants were examined and the number of western flower thrips found, was recorded (Tables 3 - 6).

Harvest data was collected from 13.1 row feet of each plot (0.001 acre) for each experiment; on 24 January for iceberg lettuce and on 3 February for romaine lettuce. The numbers of marketable naked iceberg lettuce heads and the numbers of whole romaine heads and romaine hearts were recorded, as well as the number of culls caused by extensive thrips damage for both the iceberg lettuce and romaine lettuce experiments. The total numbers and weight of marketable heads was recorded for each experiment. The percent of heads considered marketable due to lack thrips damage was also determined for each experiment (Tables 7 - 9).

Statistical analysis:
Raw data for each experiment were analyzed using ANOVA. Differences among means on each sampling date and in each experiment were determined using Least Significant Difference Test (P=0.05).

Table 1. Thrips Control in Iceberg Lettuce 2010/11.

Treatment	Oz/acre	2011 Treatment Dates
Tolfenpyrad* 15 EC	17.0	4 Jan & 14 Jan
Tolfenpyrad 15 EC	21.0	4 Jan & 14 Jan
Tolfenpyrad 15 EC + Lannate LV	21.0 + 40.0	4 Jan & 14 Jan
Lannate LV + Warrior	21.0 + 1.9	4 Jan & 14 Jan
Lannate LV	40.0	4 Jan & 14 Jan
Radiant	7.0	4 Jan & 14 Jan
MustangMax f/b Lannate LV	4.0 40.0	4 Jan 14 Jan
Hero f/b Lannate LV	11.2 40.0	4 Jan 14 Jan
Assail 30 SG f/b Lannate LV	4.0 40.0	4 Jan 14 Jan
Voliam Flexi f/b Lannate LV	4.66 40.0	4 Jan 14 Jan
Voliam Xpress f/b Lannate LV	9.0 40.0	4 Jan 14 Jan
Water Check	--------	------------

***Tolfenpyrad was not registered for use on lettuce at the time of this publication. f/b = followed by.**

Table 2. Thrips Control in Romaine Lettuce 2010/11.

Treatment	Oz/acre	2011 Treatment Dates
Aza-Direct*	16.0	10 & 19 Jan
Abamectin	8.0	10 & 19 Jan
Azadirect + Abamectin	8.0 + 4.0	10 & 19 Jan
Movento	5.0	10 & 19 Jan
Cyantraniliprole 40WG	7.2	10 & 19 Jan
Radiant	10.0	10 & 19 Jan
MustangMax	4.0	10 & 19 Jan
Hero	11.2	10 & 19 Jan
Assail 30 SG	4.0	10 & 19 Jan
Voliam Flexi	7.0	10 & 19 Jan
Tolfenpyrad 15EC	21.0	10 & 19 Jan
Water Check	--------	------------

***Tolfenpyrad and Cyantraniliprole were not registered for use on lettuce at the time of this publication.**
All plots were treated with Lannate LV @ 24.0 fl oz/acre on 4 Jan and 25 Jan 2011.
Means within columns followed by the same letter are not significantly different LSD; *P* = 0.05

Results and Discussion:
All of the test products were effective in significantly reducing (*P*=0.05) populations of western flower thrips adults and larvae, compared to the water check plots for both the iceberg and romaine lettuce experiments on at least some of the sampling dates (Tables 3 - 6). In the iceberg lettuce experiment, Lannate LV was the most efficacious treatment for control of both adult and larval thrips on iceberg lettuce (Tables 3 and 4). Radiant used alone was the second most efficacious treatment against adult thrips in iceberg lettuce; however, the rotation of Lannate and Radiant was more efficacious against larval thrips. The Tolfenpyrad treatments and Voliam Flexi were among the least efficacious with significantly more thrips than the aforementioned treatments for the overall experiment averages for adults and larvae (Tables 3 and 4). In the romaine experiment, Hero was the most efficacious for control of both adult and larval thrips followed by MustangMax (Tables 5 and 6). Voliam Flexi was the least efficacious treatment for control of adult western flower thrips, with significantly more than all other insecticide treatments except Aza-Direct and Assail for the average numbers of adults (Table 5). Voliam Flexi was the least efficacious treatment for control of western flower thrips larvae, with significantly more than Hero, MustangMax, Radiant, cyantraniliprole and Assail for the average numbers of larvae (Table 6).

None of insecticide treatments had more market quality heads, higher percentages of marketable heads and fewer thrips damaged heads than the water check plots for iceberg lettuce (Table 7). In the romaine lettuce experiment, none of insecticide treatments had more market quality heads, higher percentages of marketable heads and fewer thrips damaged heads than the water check (Table 8). In the romaine experiment, all of the insecticide treatments had significantly (*P*=0.05) more romaine hearts and higher percentages of marketable romaine hearts than the water check (Table 9). In the romaine lettuce experiment, all insecticide treatments except Voliam Flexi had fewer thrips damaged romaine hearts compared to the water check.

Not surprisingly, treatment that included industry standards such as Radiant, pyrethroid insecticides or Lannate performed well against western flower thrips as they have in earlier experiments in 2005, 2006 and 2009. All of the insecticides tested have a fit in a lettuce IPM and IRM program. It is vitally important that rotation of insecticide groups by IRAC group numbers be practiced to slow the development of insecticide-resistant western flower thrips. Two experimental compounds are promising new chemistries that would be helpful to growers in California if they were registered on lettuce, Tolfenpyrad (under development by Nichino) and cyantraniliprole under development by Syngenta is also known as Cyazypyr, under development by DuPont.

We demonstrate that industry standard insecticides such as Lannate, Mustang, Radiant, and Aza-Direct provide control of western flower thrips in both iceberg lettuce and romaine lettuce. We were able to show that new insecticides (Tolfenpyrad, Voliam Xpress, Voliam Flexi and cyantraniliprole) show promise for thrips control in lettuce crops.

Table 3. Western Flower Thrips Adults per Iceberg Lettuce Plant at Holtville, CA 2010/11.

Treatment	Oz/acre	1PT	3DAT1	7DAT1	4DAT2	7DAT2	Avg
Tolfenpyrad 15 EC	17.0	3.88	3.03 bc	5.28 cd	3.30 b	3.85 bc	3.87 cd
Tolfenpyrad 15 EC	21.0	3.40	2.98 bc	8.30 ab	1.93 c	6.50 a	4.62 b
Tolfenpyrad 15 EC + Lannate LV	21.0 + 40.0	3.73	2.43 c	4.10 de	0.63 d	5.00 b	3.18 de
Lannate LV + Warrior	21.0 + 1.9	3.55	2.13 cde	2.93 e	0.58 d	2.13 de	2.26 gh
Lannate LV	40.0	2.70	1.50 de	3.00 e	0.03 d	2.73 cd	1.99 h
Radiant	7.0	3.13	1.38 e	4.08 de	1.85 c	1.63 de	2.41 fgh
MustangMax f/b Lannate LV	4.0 40.0	3.78	2.78 bc	4.28 de	0.10 d	4.08 b	3.00 ef
Hero f/b Lannate LV	11.2 40.0	4.23	2.43 c	4.48 de	0.65 d	0.93 e	2.54 efgh
Assail 30 SG f/b Lannate LV	4.0 40.0	3.48	2.33 cd	6.75 bc	0.03 d	1.70 de	2.86 efg
Voliam Flexi f/b Lannate LV	4.66 40.0	3.50	3.45 b	8.68 a	2.13 c	4.78 b	4.51 bc
Voliam Xpress f/b Lannate LV	9.0 24.0	2.93	2.28 cde	5.15 cd	0.10 d	1.85 de	2.46 efgh
Water Check	--------	3.08	7.58 a	9.45 a	6.10 a	6.38 a	6.52 a
LDS, P= 0.05		NS	0.92	1.81	0.70	1.23	0.73

f/b = followed by

Means within columns followed by the same letter are not significantly different LSD; $P = 0.05$

Table 4. Western Flower Thrips Larvae per Iceberg Lettuce Plant at Holtville, CA 2010/11

Treatment	Oz/acre	1PT	3DAT1	7DAT1	4DAT2	7DAT2	Avg
Tolfenpyrad 15 EC	17.0	0.23	0.25 b	1.90 ab	0.73 b	1.13 ab	0.85 b
Tolfenpyrad 15 EC	21.0	0.18	0.33 b	1.85 abc	0.55 b	1.05 abc	0.79 bc
Tolfenpyrad 15 EC + Lannate LV	21.0 + 40.0	0.23	0.40 b	0.73 e	0.13 c	0.50 bcde	0.40 ef
Lannate LV + Warrior	21.0 + 1.9	0.30	0.35 b	0.60 e	0.15 c	0.43 cde	0.37 ef
Lannate LV	40.0	0.15	0.13 b	0.68 e	0.00 c	0.23 de	0.24 f
Radiant	7.0	0.08	0.28 b	1.18 bcde	0.55 b	0.30 de	0.48 def
MustangMax f/b Lannate LV	4.0 40.0	0.40	0.58 b	1.08 cde	0.00 c	0.88 abcd	0.59 cde
Hero f/b Lannate LV	11.2 40.0	0.20	0.38 b	0.75 de	0.13 c	0.05 e	0.30 f
Assail 30 SG f/b Lannate LV	4.0 40.0	0.15	0.50 b	0.83 de	0.00 c	0.08 e	0.31 f
Voliam Flexi f/b Lannate LV	4.66 40.0	0.75	0.55 b	1.53 bcd	0.55 b	0.65 abcde	0.67 bcd
Voliam Xpressf/b Lannate LV	9.0 24.0	0.25	0.33 b	1.20 bcde	0.00 c	0.38 de	0.39 ef
Water Check	--------	0.50	1.85 a	2.50 a	14.25 a	1.18 a	1.40 a
LDS, P= 0.05		NS	0.57	0.79	0.26	0.66	0.25

f/b = followed by
Means within columns followed by the same letter are not significantly different LSD; $P = 0.05$

Table 5. Western Flower Thrips Adults per Romaine Lettuce Plant at Holtville, CA 2010/11.

Treatment	Oz/a	3 Jan	7 Jan	13 Jan	18 Jan	21 Jan	28 Jan	31 Jan	Avg
Aza-Direct	16.0	8.20	3.28 bc	2.03 d	9.10 bc	12.13 c	8.85 b	4.65 cde	6.89 bc
Agri-Mek	8.0	7.45	2.65 bcde	2.05 d	6.60 de	13.63 bc	8.03 bc	5.75 bc	6.59 cde
Aza-Direct + Agri-Mek	8.0 + 4.0	5.53	2.48 cde	1.78 d	8.88 bc	12.33 c	9.08 b	3.95 de	6.29 ef
Movento	5.0	7.03	2.85 bcd	3.58 bc	10.28 b	12.63 c	6.18 cd	4.65 cde	6.74 cde
Cyantraniliprole	7.2	7.10	2.20 de	4.68 b	9.45 b	8.73 d	4.63 de	3.33 e	5.73 gh
Radiant	10.0	8.08	1.95 e	2.53 cd	8.65 bcd	11.70 c	6.50 cd	3.20 e	6.09 fg
MustangMax	4.0	7.85	1.95 e	20.3 d	7.03 cde	8.75 d	3.73 e	5.55 bcd	5.27 hi
Hero	11.2	7.30	2.60 cde	2.80 cd	5.80 e	7.25 d	5.08 de	4.18 cde	5.00 i
Assail	4.0	7.80	2.38 de	4.375 b	8.65 bcd	13.15 bc	7.35 bc	3.50 e	6.67 bcd
Voliam Flexi	7.0	7.75	3.48 b	1.90 d	8.15 bcd	14.90 ab	7.83 bc	6.78 b	7.25 b
Tolfenpyrad	21.0	6.93	3.05 bcd	4.33 b	8.28 bcd	13.10 bc	4.88 de	4.33 cde	6.41 def
Water Check	-------	7.30	7.88 a	9.18 a	14.30 a	16.40 a	13.45 a	12.75 a	11.61 a
LDS, P= 0.05		NS	0.87	1.41	2.23	1.96	1.95	1.60	0.48

Means within columns followed by the same letter are not significantly different LSD; $P = 0.05$

Table 6. Western Flower Thrips Larvae per Romaine Lettuce Plant at Holtville, CA 2010/11.

Treatment	Oz/a	3 Jan	7 Jan	13 Jan	18 Jan	21 Jan	28 Jan	31 Jan	Avg
Aza-Direct	16.0	1.18	0.85 b	0.45 bc	3.30 bcd	4.28 bc	1.50 bcd	0.43 bc	1.71 bc
Agri-Mek	8.0	1.03	0.53 bcd	0.60 bc	0.31 cd	4.80 b	1.25 cd	0.75 bc	1.72 bc
Aza-Direct + Agri-Mek	8.0 + 4.0	0.88	0.20 de	0.65 bc	0.43 bc	2.73 cde	1.95 bc	1.05 b	1.68 bcd
Movento	5.0	1.13	0.43 bcde	0.85 bc	0.49 b	3.98 bcd	1.28 cd	0.85 bc	1.91 b
Cyantraniliprole	7.2	1.13	0.45 bcde	0.53 bc	0.41 bc	2.33 de	1.20 d	0.70 bc	1.49 cde
Radiant	10.0	1.30	0.30 de	0.78 bc	0.40 bc	2.78 cde	0.88 d	0.30 c	1.47 cde
MustangMax	4.0	1.60	0.15 e	0.38 c	0.31 cd	2.45 de	0.88 d	0.90 bc	1.35 de
Hero	11.2	1.05	0.33 cde	0.70 bc	0.22 d	2.30 e	1.00 d	0.93 bc	1.21 e
Assail	4.0	0.75	0.18 de	1.08 b	0.41 bc	3.18 bcde	0.03 d	0.60 bc	1.56 cd
Voliam Flexi	7.0	1.20	0.80 bc	0.43 bc	0.32 bcd	4.55 b	2.23 b	1.05 b	1.92 b
Tolfenpyrad	21.0	6.25	0.65 bcd	1.05 bc	0.41 bc	3.60 bcde	1.00 d	0.55 bc	1.65 bcd
Water Check	-------	9.75	1.65 a	2.88 a	0.68 a	7.28 a	3.33 a	2.25 a	3.59 a
LDS, P= 0.05		NS	0.49	0.70	1.76	1.66	0.74	0.67	0.34

Means within columns followed by the same letter are not significantly different LSD; $P = 0.05$

Table 7. Numbers of Thrips Damaged, Market, and kg Market Heads per 0.001 acre, and Percentages of Market Heads for Plants in Iceberg Lettuce, 2010/11.

Treatment	Oz/acre	Total heads	Thrips damage	Market heads	Kg market heads	% Market heads
Tolfenpyrad 15 EC	17.0	26.50	6.50	20.00	14.08	75.60
Tolfenpyrad 15 EC	21.0	26.75	6.00	20.75	15.68	78.80
Tolfenpyrad 15 EC + Lannate LV	21.0 + 40.0	29.00	8.25	20.75	12.56	71.50
Lannate LV + Warrior	21.0 + 1.9	27.25	8.00	19.25	14.04	71.30
Lannate LV	40.0	26.50	4.00	22.50	17.31	85.30
Radiant	7.0	28.50	5.75	22.75	16.81	79.60
MustangMax f/b Lannate LV	4.0 40.0	29.00	5.00	24.00	17.31	83.40
Hero f/b Lannate LV	11.2 40.0	26.50	6.50	20.00	15.51	75.50
Assail 30 SG f/b Lannate LV	4.0 40.0	26.50	4.00	22.50	16.05	84.80
Voliam Flexi f/b Lannate LV	4.66 40.0	27.50	11.25	16.25	12.44	60.80
Voliam Xpress f/b Lannate LV	9.0 24.0	29.25	10.25	19.00	13.44	66.10
Water Check	--------	26.25	8.75	17.50	14.20	68.10
LDS, *P*= 0.05		NS	NS	NS	NS	NS

f/b = followed by
Means within columns followed by the same letter are not significantly different LSD; *P* = 0.05.

Table 8. Whole Romaine Heads: Numbers of Thrips Damaged, Market, and kg Market Heads per 0.001 acre, and Percentages of Market Heads, 2010/11.

Treatment	Oz/acre	Thrips damage	Market heads	Total Heads	% Market heads	Kg market heads
Aza-Direct	16.0	26.00	3.00	29.00	9.8	213
Agri-Mek	8.0	23.75	5.50	29.25	18.7	4.15
Aza-Direct + Agri-Mek	8.0 + 4.0	24.25	5.00	29.25	17.2	4.33
Movento	5.0	25.75	4.00	29.75	13.0	3.09
Cyantraniliprole	7.2	25.75	3.50	29.25	11.9	2.64
Radiant	10.0	26.00	5.25	31.25	16.9	4.40
MustangMax	4.0	24.00	5.75	29.75	19.8	4.69
Hero	11.2	24.00	3.50	27.50	13.0	2.78
Assail	4.0	24.25	5.25	29.50	17.8	3.54
Voliam Flexi	7.0	28.50	3.25	31.75	10.1	2.24
Tolfenpyrad	21.0	24.00	3.00	27.00	10.8	2.36
Water Check	-------	27.75	1.75	29.50	5.8	1.36
LDS, P= 0.05		NS	NS	NS	NS	NS

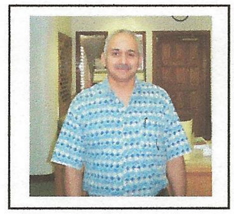
Means within columns followed by the same letter are not significantly different LSD; P = 0.05.

Table 9. Romaine Hearts: Numbers of Thrips Damaged, Market, and kg Market Heads per 0.001 acre, and Percentages of Market Heads, 2010/11.

Treatment	Oz/acre	Thrips damage	Market heads	Total Heads	% Market heads	Kg market heads
Aza-Direct	16.0	6.50 bcd	22.50 b	29.00	75.60 bc	8.08 cde
Agri-Mek	8.0	2.25 d	26.75 ab	29.25	92.29 a	11.67 ab
Aza-Direct + Agri-Mek	8.0 + 4.0	3.25 cd	26.00 ab	29.25	88.96 ab	10.78 abc
Movento	5.0	5.25 cd	24.50 ab	29.75	82.93 abc	9.97 abcd
Cyantraniliprole	7.2	6.50 bcd	22.75 ab	29.25	78.50 abc	9.89 abcd
Radiant	10.0	3.25 cd	28.00 a	31.25	89.81 ab	12.63 a
MustangMax	4.0	3.50 cd	26.25 ab	29.75	88.30 ab	11.51 ab
Hero	11.2	4.00 cd	23.25 ab	27.50	85.49 ab	8.33 cde
Assail	4.0	7.25 bc	22.00 b	29.50	75.16 bc	9.21 bcde
Voliam Flexi	7.0	10.00 ab	21.75 b	31.75	68.71 c	7.50 de
Tolfenpyrad	21.0	3.50 cd	23.50 ab	27.00	87.24 ab	8.73 bcde
Water Check	-------	13.75 a	16.00 c	29.50	53.45 d	6.21 e
LDS, P= 0.05		4.33	5.34	NS	0.15	3.02

Means within columns followed by the same letter are not significantly different LSD;

FLOOD IRRIGATION SYSTEM MANAGEMENT MEASURES



Khaled M. Bali

The advantage of flood irrigation system method is that it is inexpensive, both in terms of system costs and energy costs. The disadvantage is that its performance depends strongly on soil properties such as the infiltration rate and soil type. It is the most difficult irrigation method to manage efficiently because of its dependence on soil properties and its performance characteristics, and thus, a trial-and-error approach is normally used in its management.

Border or flood irrigation designs have several common features. They usually have slopes varying from 0.1% to 0.2% (1 to 2 ft per 1000 ft of run), include small 'border checks' (or small levies) 6-20" high, which confine water to an area from 60 to 200 feet wide so that water moves down the field. Field length in the direction of flow varies, but is usually determined by field constraints and soil characteristics. Sometimes flood systems are combined with 'corrugated' or 'bedded' systems which facilitate water movement and drainage on heavy soil.

Design variables for flood irrigation include slope, border length, border inflow rate, surface roughness, and infiltration rate. The rate at which the water flows down the field depends on the inflow rate of water into the check, slope, and length of the border check, soil infiltration rate, and surface roughness. The flow of water across the field is characterized by the advance curve, which shows the time at which water arrives at any given distance along the field length. The recession curve shows the time at which water no longer ponds on the soil surface at any given distance along the field length. The difference between advance time and recession time at any distance along the check length is the time during which water infiltrates the soil or the infiltration time (Fig. 1). These infiltration times vary along the field length, resulting in more water infiltrating in some parts of the field compared to other areas.

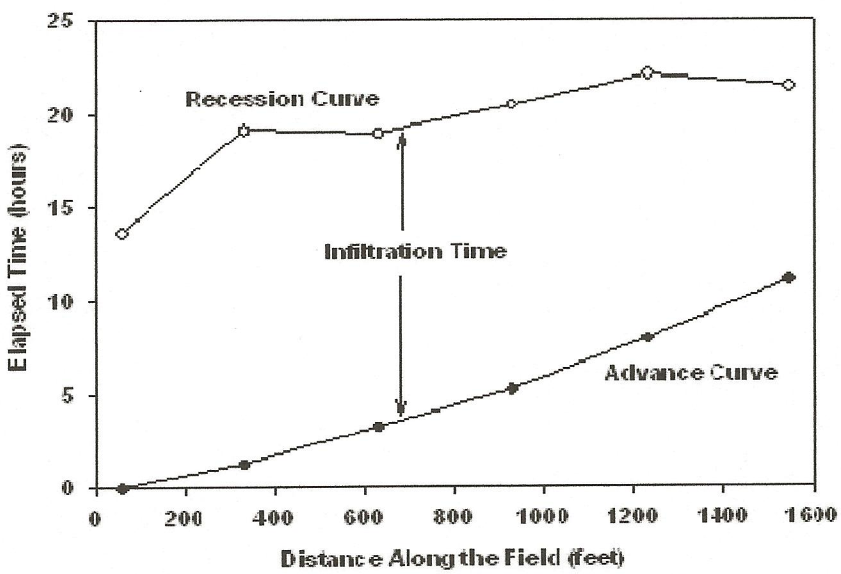
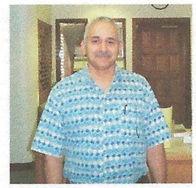


Figure 1. Advance and recession curves for a flood-irrigated field.

IMPROVING FLOOD IRRIGATION SYSTEMS FOR WATER AND NUTRIENT CONSERVATION



Khaled M. Bali

Flood irrigation systems can be improved by reducing deep percolation below the root zone and reducing surface runoff. However, measures to improve flood irrigation can be competitive, i.e. measures that reduce deep percolation can increase surface runoff and vice versa. Some measures commonly recommended to improve irrigation efficiency include the following:

Recover and reuse surface runoff: Recirculation systems (commonly called runoff recovery, tailwater-return systems, or storage-reuse systems), can dramatically improve efficiency of flood irrigation systems. Recirculation systems involve collecting the surface runoff in a small reservoir at the lower end of the field and then recirculation the water back to the "head" of the field during irrigation, using a low lift pump and a buried or portable pipeline. The recycled water should be used to irrigate an additional area of the field or mix it with irrigation water. Simply recirculating the runoff back to the same irrigation set that generated the runoff results only in temporarily storing the water on the field and will result in an increased rate of runoff.

Similarly, a storage/reuse system involves storing all of the surface runoff from a field and then using that water to irrigate another field at the appropriate time. This approach requires a farm with multiple fields, a relatively large reservoir, and distribution systems to convey surface runoff to the storage reservoir and to convey the stored water to the desired fields.

Care should be taken that water quality is not degraded from the storage-reuse systems. Pesticides have been found to infiltrate groundwater on some soil types, primarily from catchment basins, steps to seal basins from subsurface infiltration may be effective at preventing contamination in light soils.

Runoff recovery systems could be used in the Imperial Valley to conserve water and nutrients and improve the quality of drainage water. The majority of the fields in the Imperial Valley are irrigated with surface irrigation systems (furrow and border-strip irrigation) and runoff or tailwater is necessary in furrow irrigation and in some border-strip irrigation to irrigate the lower end of the field and provide sufficient irrigation time at the end of the field for maximum uniformity. The surface runoff water could be collected in a pond at the end of the field and reused in the same or different field. The use of runoff recovery system is practical for almost all field crops in the Imperial Valley and most furrow-irrigated vegetable crops.

Increasing check flow rate: This commonly recommended measure reduces the advance time to the end of the field, thus decreasing variability in infiltration times along the field length. However, caution should be exercised with this approach such that the increased flow rate does not increase soil erosion. This option may not be practical when the on-farm irrigation canals are not designed for high flow rates as it is the case for most fields in the Imperial Valley. In addition, concerns about increased concentration of sediment in runoff water may increase the load of nutrients (mainly P) and pesticides in runoff water.

Reducing field length: This is the most effective measure for improving uniformity and for reducing percolation rate below the root zone. Studies have shown that shortening the field length by one-half can reduce percolation by at least 50 percent. The distribution uniformity (DU) of infiltrated water will be increased by 10 to 15 percentage points compared with the normal field length. The new advance time to the end of the shortened field generally will be 30 to 40 percent of the advance time to the end of the original field length. Thus, the irrigation set time must be reduced to account for the new set time. While this method is effective in increasing uniformity, a major problem with this method is the potential for increased surface runoff, which could be 2 to 4 times more runoff for the reduced length compared with the original field length. This option may not be practical for most fields in the Imperial Valley and requires major and costly modifications to the irrigation system.

Selecting an appropriate irrigation water cutoff time: The amount of surface runoff or tailwater can be greatly reduced by decreasing the cutoff time of the irrigation water. This is the most effective measure for reducing surface runoff. The cutoff time for a given field may need to be determined on a trial-and-error basis. The cutoff time should occur before the water reaches the end of the field except for sandy soils with high infiltration rates. However, the cutoff time should allow sufficient water to infiltrate the end of the field. Some guidelines, however, are to cut off the irrigation water when the water advance is about 60% to 70% of the field length for fine-textured soil, 70% to 80% for medium texture soil, and near 100% for coarse textured soil.

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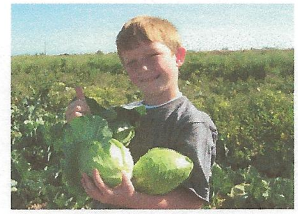

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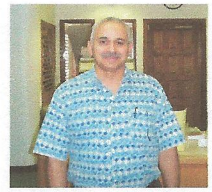

Khaled Bali and Steve Burch*

California Irrigation Management Information System (CIMIS) is a statewide network operated by California Department of Water Resources. Estimates of the daily reference evapotranspiration (ET_o) for the period of October 1 to December 31 for three locations in the Imperial County are presented in Table 1. ET of a particular crop can be estimated by multiplying ET_o by crop coefficients. For more information about ET and crop coefficients, contact the UC Imperial County Cooperative Extension Office (352-9474) or the IID, Irrigation Management Unit (339-9082). Please feel free to call us if you need additional weather information, or check the latest weather data on the worldwide web (http://wwwcimis.water.ca.gov/cimis/welcome.jsp).

Table 1. Estimates of daily Evapotranspiration (ET_o) in inches per day

Station	October		November		December	
	1-15	16-31	1-15	15-30	1-15	16-31
Calipatria	0.23	0.19	0.14	0.10	0.07	0.07
El Centro (Seeley)	0.23	0.17	0.13	0.09	0.06	0.06
Holtville (Meloland)	0.23	0.18	0.13	0.10	0.06	0.06

* Ag Water Science Unit, Imperial Irrigation District.

Link to UC Drought Management Publications

http://ucmanagedrought.ucdavis.edu/

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