Evaluation of Herbicide Carryover Sub-Surface Drip Irrigated Tomato

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Poor Root Development; Fresno Co. 2008-2013

Few fibrous roots

Field Observations

- Permanent beds with buried drip to depth of 10” (top 6-8” of soil is tilled between crops)
- Prowl H2O applied (w/in the previous 12 months)*
- More damage reported following dry winters
- Severity of damage is generally consistent within rows
- Following cotton in some fields
- Shallow planting depth in some fields

* In one field, no Prowl was used, but Treflan was used every year for 5 years before the report of symptoms.

Project Initiated in 2013

Objective: Quantify dinitroaniline herbicide carryover in processing tomatoes with sub-surface drip over 3-years and determine crop injury potential.

Experimental Design: 4 rep split-plot

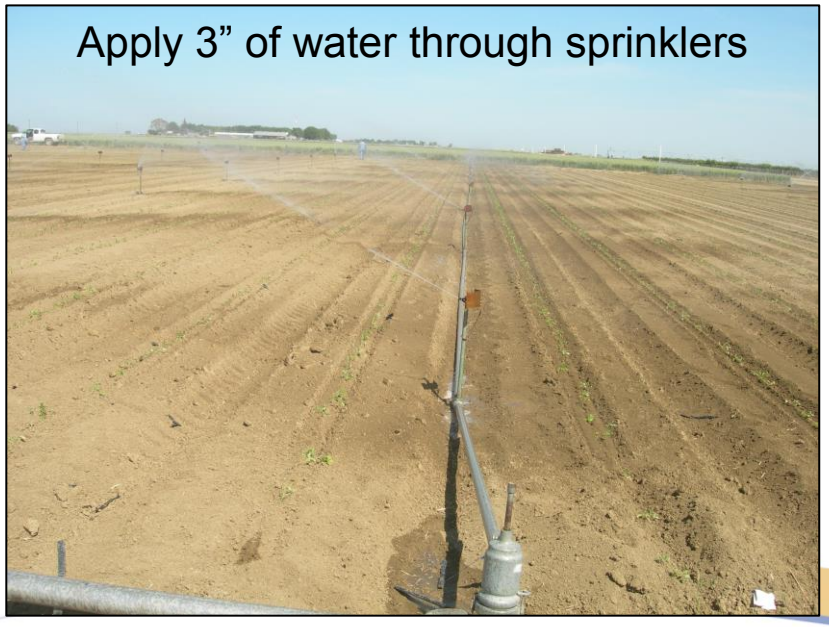
Main plot: Sprinklers for 3 weeks, then drip drip throughout the season

Sub-plot: PPI Treflan or Prowl and no herbicide

PPI on 4/22 and sample soil on 4/23

Transplant 3.5” to 4.5” deep on 4/24

Apply 3” of water through sprinklers



- High winds the day of transplanting and the day after resulted in poor early appearance of sprinkler-irrigated plants

Experimental Details:

- Pre-plant herbicides were applied on 22 Apr
- Plants (cv. H 5608) were transplanted mechanically on 24 Apr
- Soil from each plot was analyzed for Treflan and Prowl after incorporation (23 Apr) and again before harvest (25 Aug) at depths of 0-3” and 3-6”
- Root and shoot dry weights were recorded from samples taken in May
- The number of plants expressing curly top symptoms were recorded and soil temperature and moisture were monitored
- 40 row ft per plot were hand-harvested on 6 Sep

High winds resulted in poor uniformity in sprinkler irrigated plots and reduced stand.

Over 48.8 % of the plants expressed curly top symptoms

Sprinkler/drip treatments were similar in quantities of herbicides detected.

Soil herbicide levels (ppm) in 2013 using HPLC

		4/23	4/23	4/23					
Irrigation	Herbicide	Treflan (0-3”)	Treflan (3-6”)	Prowl (0-3”)	(3-6”)	(0-3”)	(3-6”)	(0-3”)	(3-6”)
Drip	None	0.00 b	0.00	0.00 b	0.00 b	0.00	0.00	0.00 b	0.00
Sprinkler/drip	None	0.00 b	0.00	0.00 b	0.00 b	0.00	0.00	0.00 b	0.00
Drip	Treflan	**0.21 a**	**0.00**	0.00 b	0.00 b	**0.00**	**0.00**	0.00 b	0.00
Sprinkler/drip	Treflan	**0.18 a**	**0.00**	0.00 b	0.00 b	**0.00**	**0.00**	0.00 b	0.00
Drip	Prowl H2O	0.00 b	0.00	**1.85 a**	**0.21 a**	0.00	0.00	**0.20 a**	**0.04**
Sprinkler/drip	Prowl H2O	0.00 b	0.00	**2.28 a**	**0.31 a**	0.00	0.00	**0.21 a**	**0.05**
	CV (%)	*73.89*	*0.00*	*73.70*	*122.32*	*0.00*	*0.00*	*70.92*	*293.94*
	$LSD_{0.05}$	*0.116*	*n.s.*	*1.29*	*0.192*	*n.s.*	*n.s.*	*0.131*	*n.s.*

Soil herbicide levels (ppm) in 2013 using HPLC (by irrigation)

	4/23	4/23	4/23	4/23	8/25	8/25	8/25	8/25
Irrigation	Treflan (0-3”)	Treflan (3-6”)	Prowl (0-3”)	Prowl (3-6”)	Treflan (0-3”)	Treflan (3-6”)	Prowl (0-3”)	Prowl (3-6”)
Drip	0.07	0.00	0.62	0.004	0.00	0.00	0.07	0.01
Sprinkler/drip	0.03	0.00	0.71	0.10	0.00	0.00	0.07	0.00
$LSD_{0.05}$	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*

Herbicide/Irrigation Practice on Early Development

Sprinkler patterns related to high winds caused stand loss and less shoot growth

Tomato dry weight and stand (by irrigation)

Irrigation	Shoot (g) 30 DAT	Root (g) 30 DAT	Stand (no./plot)
Drip	36.37 a	9.34	68.5 a
Sprinkler fb drip	24.07 b	5.99	61.6 b

Herbicides did not significantly influence plant development.

Tomato dry weight and stand (by herbicide)

Herbicide	Shoot (g) 30 DAT	Root (g) 30 DAT	Stand (no./plot)
No herbicide	32.66	7.95	64.83
Treflan	30.57	6.05	64.75
Prowl H2O	27.44	4.99	65.50

Herbicide/Irrigation Practice Influence on Yield and Quality

No differences among treatments were documented: Curly top virus had substantial impact on yield, which was extremely variable.

Fruit yield, 50 count, and quality (by irrigation)

Irrigation	T/A Red	50 count weight (lb)	color	solids	pH
Drip	42.87	7.80	23.11	4.08	4.41
Sprinkler/drip	45.43	7.93	24.22	4.13	4.41

Fruit yield, 50 count, and quality (by herbicide)

Herbicide	T/A	50 count weight (lb)	color	solids	pH
No herbicide	38.60	7.77	24.17	4.15	4.42
Treflan	48.05	7.97	23.67	4.11	4.40
Prowl H2O	42.79	7.86	23.17	4.05	4.42

Summary

- Herbicides were not detected, or detected at extremely low levels deeper than 3” in the soil profile and did not negatively affect tomato shoot or root growth.
- Approximately 10% of the Prowl H2O detected before planting remained in the upper 3” by the end of the season; Treflan was not detected.
- Sprinkler irrigation did not influence depth of herbicides.

Project Outlook, 2014

- Additional sampling in March is scheduled to assess contribution of additional 6 months toward herbicide breakdown (rainfall levels will influence on results)
- Follow treatments imposed in 2013 with the same treatments on the same beds in 2014 and conduct similar assessments for plant development and yield as well as soil levels of herbicides
- CSU Fresno student will conduct greenhouse studies to quantify sensitivity of tomato to Treflan and Prowl H2O

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