CALIFORNIA LEAFY GREENS RESEARCH PROGRAM

April 1, 2009 – March 31, 2010

WEED MANAGEMENT SYSTEMS FOR LEAFY GREENS

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SUMMARY

Field studies were undertaken to expand the number of herbicides available for spinach. In the first series, field studies were conducted to evaluate the tolerance of commercial spinach to Lorox herbicide. The safety of Lorox to spinach was evaluated by visual injury estimates and yield. Weed control was also evaluated. We found that Lorox rates consistently safe for use on spinach were too low to control weeds. We conclude that there is not sufficient tolerance to Lorox in conventional spinach lines. A second set of research was conducted to evaluate a large number of spinach germplasm lines, to try to identify spinach lines with higher tolerance to Lorox. We screened 390 spinach germplasm lines and found 3 lines that were very tolerant to Lorox and 7 more lines that were somewhat tolerant of Lorox. If this increased herbicide tolerance can be bred into commercial spinach lines, then it may be possible to develop higher levels of herbicide tolerance in spinach and to use herbicides which would otherwise be too injurious.

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OBJECTIVES:

A. To evaluate linuron (Lorox) for crop tolerance and weed control in spinach.
B. Screen for new herbicide-tolerant spinach germplasm.

PROCEEDURES – OBJECTIVE A

A. To evaluate linuron for crop tolerance and weed control in spinach.

Research station trials. Previous work found that spinach was tolerant to Lorox applied post plant preemergence at rates of 0.1 to 0.4 lb ai/A (Table 1). Two trials were conducted on the Salinas USDA research station in 2009. Trial A was initiated at the Hartnell USDA farm 6/25/09 and harvested on 7/31/09. Trial B was initiated 8/4/09 at the Salinas USDA station and harvested 9/25/09. Both trials used 'Whale' variety and both were arranged in a randomized complete block with 4 replicates. Treatments were applied with a CO_2 backpack sprayer at 30 PSI in a volume of 40 GPA.

Commercial trials. Four trials were conducted on commercial spinach fields in 2009. ***Trial No. 1:*** The trial was conducted in cooperation with Frank Heffren of Green Valley Farm Supply and Tony Alameda of Top Flavor Farms in Salinas. The trial was planted on 3/24/09 with the variety 'Grinta'. Treatments were applied on the same day and the field was sprinkler irrigated on 3/25/09. The soil type was Metz fine sandy loam. ***Trial No. 2:*** The trial was conducted with Cuco Delgado of Metz Fresh south east of Salinas. The trial was planted on 8/4/09 with the variety 'Renegade'. Treatments were applied on the same day and the field was sprinkler irrigated on 8/5/09. ***Trial No. 3:*** The trial was conducted with Cuco Delgado of Metz Fresh south east of Salinas. The trial was planted on 8/18/09 with the variety 'Bikini'. Treatments were applied on the same day and the field was sprinkler irrigated on 8/19/09. ***Trial No. 4:*** The trial was conducted with Wyatt Duncan of Integrated Crop Management and Rio Farms in San Lucas. The trial was planted on 9/24/09 with the variety 'Renegade'. Treatments were applied on the same day and the field was sprinkler irrigated on 9/25/09. The soil was Mocho silt loam.

Details for trials 1-4: Each plot was one 80-inch bed wide by 10 feet long and the trial was arranged in a randomized complete block design with 3 replicates. All treatments were applied with a backpack CO_2 applicator with 4 passes of a one-nozzle wand pressurized at 30 psi in a volume of 78 GPA.

RESULTS AND DISCUSSION – OBJECTIVE A

Research station trials. In these trials, spinach visual injury estimates and yields suggest Lorox was safe at rates up to 0.4 lb ai/A. Weed control with Lorox at 0.4 lb ai/A was as good as the Dual Magnum + Lorox tank mix (Table 1).

Table 1. Spinach visual injury, spinach yield and total weed densities in two trials conducted in 2009 at the USDA research station near Salinas, CA.

Treatments	**Rate**	Trial A			Trial B		
	Lb ai/A	Injury	Yield	Weeds	Injury	Yield	Weeds
		0=safe	1000 lb/A	# 2.8 ft	0=safe	1000 lb/A	# 2.8 ft
Weedy Check	----	0.0 e	18.2 bc	50 a	0.0 f	16.4	18
Hand-Weeded	----	0.0 e	19.0 abc	0 c	0.0 f	17.0	--
Dual Magnum	0.5	0.9 de	18.8 abc	12 c	0.4 ef	15.3	10
Dual Magnum Lorox	0.5 0.1	0.5 de	22.7 a	5 c	0.0 f	14.7	9
Dual Magnum Lorox	0.5 0.2	0.5 de	22.2 ab	6 c	0.8 ef	16.0	5
Lorox	0.1	0.4 e	18.7 abc	34 b	0.0 f	15.3	16
Lorox	0.2	1.0 de	19.1 abc	26 b	0.9 e	16.0	7
Lorox	0.4	2.9 c	18.5 abc	2 c	2.3 d	17.9	9
Lorox	0.5	5.9 b	15.0 c	3 c	4.1 c	16.4	10
Lorox	0.6	6.7 b	19.0 abc	4 c	5.5 b	15.6	8
Lorox	1.0	9.5 a	9.2 d	1 c	9.1 a	10.4	12
Ro-Neet	3.0	1.8 cd	19.9 ab	11 c	0.8 ef	15.1	7

Commercial trials. Lorox was safe at 0.1 lb ai/A in all trials, and safe in 3 of 4 trials at 0.2 lb ai/A (Table 2).

Table 2. Spinach visual injury and yield in four trials conducted in 2009 on commercial fields in the Salinas Valley.

Treatments	**Rate**	Trial 1	Trial 2		Trial 3		Trial 4	
	Lb ai/A	Yield	Injury	Yield	Injury	Yield	Injury	Yield
		Kg/m^2	0=safe	Kg/m^2	0=safe	Kg/m^2	0=safe	Kg/m^2
Ro-Neet	0.95	3.0	0	2.1	0.7	2.9	0	1.7
Dual Magnum	0.3	2.8	0.3	1.6	0	2.8	0	1.6
Lorox	0.1	3.2	0.3	2.3	0	3.3	0	1.7
Lorox	0.2	3.2	6.3	0.7	2.3	3.0	0	1.6
Lorox	0.4	3.1	9.8	0.2	4.7	1.6	3.0	0.7
Weedy Check	----	3.3	0	2.5	0	3.3	0	1.8
LSD 0.05		NS	2.3	0.8	0.8	0.4	--	0.3

Conclusions for objective A. Lorox does not have sufficient crop tolerance on commercial spinach lines to pursue a registration for commercial use. We conclude that the only way to pursue Lorox for use in spinach is to breed for increased herbicide tolerance in spinach which is the purpose of the research conducted under objective B below.

PROCEEDURES – OBJECTIVE B

B. Screen for new herbicide-tolerant spinach germplasm.

The objective is to identify spinach germplasm that is more tolerant to Lorox (linuron), using conventional breeding. We screened 390 spinach germplasm lines for resistance to Lorox. Spinach was seeded on 8/4/09 with 20 seed per line and Lorox was applied post plant preemergence at 1.0 lb ai/A on 8/6/09. The spinach was irrigated regularly and on 9/15/09 the number of survivors was counted.

RESULTS AND DISCUSSION – OBJECTIVE B

Of these 390 lines, 3 lines had more than 10 survivors, 12 lines had more than 7 survivors and 22 lines had more than 5 survivors. All of these individuals were removed from the field and were grown out for seed in the greenhouse. Further evaluation of the herbicide tolerance of these selected spinach lines is planned for 2010.