

CALIFORNIA LEAFY GREENS RESEARCH PROGRAM

April 1, 2010 – March 31, 2011

WEED MANAGEMENT SYSTEMS FOR LEAFY GREENS

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SUMMARY

Field studies were undertaken to expand the number of herbicides available for lettuce and spinach. Dual Magnum, Prowl H₂O and Treflan were applied preplant incorporated (PPI) and post plant preemergence (PRE) in lettuce. Dual Magnum and Prowl H₂O were safe to lettuce applied PPI, but did not control weeds. Dual Magnum and Prowl H₂O applied PRE controlled weeds, but were injurious to lettuce. Treflan was safe to lettuce where applied PPI and PRE, but weed control was poor. We have lettuce germplasm from the University of Idaho that is resistant to sulfonyl urea herbicides. The herbicide resistance gene has been backcrossed into commercial lines of butterhead, redleaf, romaine, and crisphead lettuce. The tolerance of these lines to Harmony (thifensulfuron) applied postemergence at 0.11, 0.19, 0.38 and 0.77 oz/A was tested at Salinas in August to October 2010. All resistant lettuce lines were tolerant to Harmony and herbicide susceptible lines were injured or killed by the herbicide. Burning nettle and chickweed control with Harmony at 0.38 oz was equal to Kerb. Purslane control was better with Kerb compared to Harmony. We are developing urea herbicide tolerant spinach by screening spinach for tolerance to Lorox. From 390 spinach germplasm lines screened in 2009 for tolerance to Lorox, 3 lines were found to be very tolerant to Lorox and 7 more lines were somewhat tolerant of Lorox. In 2010 the most Lorox tolerant spinach lines were screened with Caparol, but there were few survivors and in 2011 we will focus again on Lorox. If this increased urea 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. Evaluate additional herbicides for lettuce.
- B. Screen for new herbicide-tolerant spinach germplasm.

PROCEEDURES – OBJECTIVE A part 1

- A. Evaluate additional herbicides for lettuce.

Evaluate additional herbicides for lettuce. Richard Smith evaluated Dual Magnum 0.5 lb ai/a, Treflan 0.5 lb ai/A, and Prowl H₂O 0.7 lb ai/A applied preplant incorporated (PPI) and post plant preemergence (PRE) for potential use in lettuce. Standards included Kerb 1.2 lb ai/A, Prefar 5.0 lb ai/A and Balan 1.2 lb ai/A. The trial was established at the USDA Spence Research Station on a site with a Chualar gravelly sandy loam. The preplant incorporated materials were applied on June 22, 2010 and mulched into the beds on the same day with a power bed shaper. The post plant preemergence applications were applied on June 24 after planting and incorporated with sprinkler irrigation. All materials were applied with two passes of a single tip wand (8008E) with a CO₂ backpack sprayer at 30 psi applying 72 gallons of water per acre. Each plot was one 40-inch bed wide by 25 feet long. Weed densities were measured on July 8 and 15, 2010 and phytotoxicity on July 16. Harvest evaluations were conducted on September 2 by harvesting all heads in the plots, weighing total yield and trimming to measure mean weight of marketable heads.

RESULTS AND DISCUSSION – OBJECTIVE A part 1

Dual Magnum and Prowl H₂O were much safer to lettuce PPI than PRE, however neither herbicide controlled weeds when applied PPI (Table 1). Treflan was safe to lettuce PPI and PRE but weed control was poor either way. There was no obvious advantage for weed control for Treflan over Balan which is already registered for lettuce. No further work on Dual Magnum, Prowl H₂O or Treflan is recommended in lettuce.

Table 1. Evaluation of several herbicides in lettuce for weed control, lettuce injury estimates, plant number and weight at harvest.

Material	Lbs a.i./A	Material/A	Application	Total weeds July 8 & 15		Injury	Plants at harvest	Yield
				Number (1,000/A)				
						0= safe, 10 = dead	No. 1,000/A	tons/A
Check	----	----	----	92.6	76.2	0.0	22.3	19.4
Hand weeded	----	----	----	59.9	76.2	0.0	25.3	21.6
Kerb	1.2	2.4 lbs	PRE	27.2	59.9	0.0	23.7	20.1
Prefar	5	5.0 qts	PRE	65.3	87.1	0.0	20.4	16.4
Dual M.	0.5	0.52 pt	PPI	57.7	74.1	1.3	23.2	18.5
Dual M.	0.5	0.52 pt	PRE	21.8	30.5	4.5	17.8	7.9
Treflan	0.5	1.0 pt	PPI	68.6	84.9	0.0	24.4	19.0
Treflan	0.5	1.0 pt	PRE	65.3	87.1	0.0	24.1	18.6
Prowl H	0.7	1.5 pt	PPI	68.6	84.9	1.5	24.2	19.5
Prowl H	0.7	1.5 pt	PRE	49.0	41.4	8.5	0	0.0
Balan	1.2	2.0 lbs	PPI	54.5	63.2	0.0	24.4	19.8
Balan	1.2	2.0 lbs	PRE	79.5	90.4	0.0	23.5	18.0
LSD 0.05				37.0	ns	0.5	2.1	0.1

PROCEDURES – OBJECTIVE A part 2

Steve Fennimore, Beiquan Mou and John Rachuy evaluated IDBR1 lettuce germplasm for tolerance to Harmony (thifensulfuron) at 0.11, 0.19, 0.38 and 0.77 oz pr/A applied postemergence in lettuce. The standard backcross procedure was used to transfer the resistance gene into different types of lettuce. The IDBR1 was backcrossed into Buttercrunch, Lolla Rossa, Parris Island, and Salinas 88 and at each generation the progeny were screened for herbicide tolerance. Resistant butterhead, redleaf, Romaine and iceberg lettuce in addition to susceptible parents were seeded at Salinas on August 8, 2010. Harvest dates were as follows: butterhead October 5, redleaf October 18, crisphead October 25, and Romaine October 26, 2010.

RESULTS AND DISCUSSION – OBJECTIVE A part 2

The data indicates that the 0.19 to 0.38 oz rate/A of Harmony controlled most weeds and was safe in resistant lettuce (Tables 2 and 3). Kerb controlled purslane better than Harmony. The susceptible lettuce lines were injured by Harmony which indicates the level of safety that the herbicide resistance gene has (Table 4).

Table 2. Weed densities in ID-BR1 resistant lettuce following postemergence applications of Harmony.

Herbicide	Rate Oz pr/A	Timing	Burning Nettle	Purslane	Chickweed	Total Weeds
			----- Number (1000) / A -----			
Harmony 75DF	0.11 oz	POST	409 b	280 b	71 b	961 b
Harmony 75DF	0.19 oz	POST	376 bc	368 b	39 b	929 b
Harmony 75DF	0.38 oz	POST	151 cd	330 b	31 b	712 bc
Harmony 75DF	0.77 oz	POST	118 d	313 b	5 b	642 bc
Kerb 3.3 SC	0.5 pt	PRE	118 d	44 c	17 b	392 c
Weedy check	---	---	1055 a	717 a	186 a	2312 a
LSD (0.05)			249.9	129.7	112.4	441.4

Table 3. Lettuce fresh weights in sulfonyl urea herbicide tolerant lettuce following postemergence applications of Harmony.

Herbicide	Rate (lb ai/A)	Timing	Butterhead	Red Leaf	Romaine "704"	Romaine "729"	Crisphead
			----- Fresh weight (1000 lbs / A) -----				
Harmony 75DF	0.11 oz	POST	14.3	14.3 ab	41.7	41.7	35.1
Harmony 75DF	0.19 oz	POST	12.4	16.2 a	46.6	46.6	44.3
Harmony 75DF	0.38 oz	POST	10.2	16.0 a	41.9	41.9	34.1
Harmony 75DF	0.77 oz	POST	10.5	12.1 b	42.6	42.6	28.3
Kerb 3.3 SC	0.5 pt	PRE	12.7	15.6 a	47.0	47.0	40.1
Weedy check	---	---	12.8	13.0 b	47.1	47.1	33.3
LSD (0.05)			4.0	2.2	14.3	14.3	13.3

Table 4. Lettuce fresh weights in sulfonyl urea herbicide susceptible and the original herbicide tolerant parent IDBR1 lettuce following postemergence applications of Harmony.

Herbicide	Rate (lb ai/A)	Timing	Susceptible Butterhead	Susceptible Red Leaf	Susceptible Romaine	Susceptible Crisphead	IDBR1
			----- Fresh weight (1000 lbs / A) -----				
Harmony 75DF	0.11 oz	POST	27.8 b	26.5 ab	18.0 b	22.6 b	37.2
Harmony 75DF	0.19 oz	POST	9.1 c	20.0 b	3.7 c	5.9 c	34.0
Harmony 75DF	0.38 oz	POST	3.0 cd	4.6 c	0.4 d	0.0 d	34.6
Harmony 75DF	0.77 oz	POST	0.4 d	1.7 c	0.0 d	0.0 d	35.9
Kerb 3.3 SC	0.5 pt	PRE	37.0 a	33.7 a	28.7 a	33.3 a	34.4
Weedy check	---	---	29.4 b	31.4 a	26.8 a	29.8 a	30.4
LSD (0.05)			6.7	10.6	3.2	5.7	5.5

PROCEDURES – OBJECTIVE B

B. Screen for new herbicide-tolerant spinach germplasm.

Screening for herbicide tolerant spinach germplasm. Our objective is to identify spinach germplasm that is more tolerant to Caparol (prometryn), using conventional breeding. We screened progeny of 18 USDA spinach germplasm accessions that survived the spray of an herbicide (Linuron) with a similar mode of action among 400 accessions in the 2009 screening experiment. Spinach was seeded on August 3, 2010 with 50 seed per line and Caparol was applied post plant preemergence at 1.5 lb ai/A on August 4, 2010. The spinach was irrigated regularly and on Sept. 3, 2010 the number of survivors was counted.

RESULTS AND DISCUSSION – OBJECTIVE B

Of these 7,500 plants, there were 10 survivors. All survivors were removed from the field and grown out for seed in the greenhouse. Seed was harvested to allow them to be screened again for tolerance to Lorox in August of 2011.