2010 Research Report to the

Agricultural Research Foundation

and the

Oregon Processed Vegetable Commission

Title: *Nutsedge control in sweet corn and other rotational crops*

Project Leader

Ed Peachey (contact), Horticulture Dept., 541-737-3152, peacheye@hort.oregonstate.edu

Background

Impact herbicide was used for the first time in 2006 with great success, and a registration for Laudis was granted in November of 2007. These registrations have significantly reduced wild proso millet populations in the Willamette Valley. Two issues remain that should be resolved, however. Observations over the last two years indicate that there is a possibility of economic injury to sweet corn when these herbicides are applied with Dual Magnum. This is a concern because nutsedge is controlled by Dual Magnum and Outlook, and a reduction of potential to use these chemistries will result in a shift to nutsedge, and because nutsedge is a perennial, to increased difficulties in the rotation. The loss of Eradicane in sweet corn and the control it provides of nutsedge and other grassy perennials may exacerbate this problem even further.

There are several alternatives that should be considered. The first and most obvious is that the chloroacetamides could be applied PPI or PRE, but this requires an additional trip across the field and irrigation to activate the herbicide. Irrigation early in the season should be avoided in sweet corn.

Another option is to tankmix herbicides such as Sandea or Basagran with the HPPD inhibitors to control nutsedge. Tank mixing Basagran with an HPPD inhibitor herbicide capitalizes on the same synergism found in the tankmix of HPPD herbicides and atrazine. Callisto is an HPPD inhibitor and probably the most effective on nutsedge compared to Laudis and Impact. Sandea is an ALS herbicide with postemergence activity on nutsedge, but has not been evaluated for nutsedge control when applied with the HPPD inhibitor herbicide.

Previous work indicates the potential for these tankmixes of HPPD herbicides with soil applied herbicides such as Dual Magnum or Laudis may reduce corn yield, and the potential for injury may depend on sweet corn variety. Research is needed to better understand the effect of application timing on injury potential and the environmental conditions that predispose corn to injury, particularly when targeting nutsedge.

Research Objectives

1. Determine the potential of controlling nutsedge in sweet corn with HPPD herbicides in combination with other products.
2. Determine sweet corn tolerance to HPPD herbicides combined with chloroacetamide herbicides such as Dual Magnum and with other herbicides targeting nutsedge.

Methods

Objective 1. Nutsedge control with HPPD herbicides and tankmixes. A field was identified near Stayton Oregon with a relatively high density of nutsedge. The plot was disked early in the season then strip-tilled before planting. Sweet corn (var. Rogers 2390) was planted on Monday, June 28, 2010 and PRE herbicides applied on June 29. Treatments were applied to plots that were 10 x 30 ft in a randomized complete block design with 4 replications. The HPPD herbicides Laudis and Callisto were applied with or without Dual Magnum, Sandea, Basagran, and Outlook at the V3-4 stage of corn growth (See Table 1) on July 15 when most corn was at V3 (a few at V4). The 2nd Basagran treatments were applied on July 23 to V5-6 corn, one week later.

Results

- The lowest yielding treatment was Callisto tankmixed with all other herbicides tested and produced only 6.6 t/A.
- Corn injury tended to be greater with Laudis than Callisto when comparing similar tankmixes.
- Laudis plus Dual Magnum (but without Atrazine and surfactant) did not injure corn, provided 72% control of nutsedge, and a respectable yield of 8.8 t/A.
- Injury caused by Callisto plus Basagran was less than expected and less than when Basagran was tankmixed with Laudis.
- Callisto+atrazine+Basagran (Basagran applied 2 times) controlled 94% of the nutsedge at harvest, caused little injury to the corn, and produced 8.8 t/A.
- Outlook and Dual Magnum plus atrazine PRE preformed as good as the V3-4 treatments with Laudis or Callisto, but there were few other weed species present in this late planting that competed with the corn. Noticeably missing was wild proso millet.

Table 1. Response of sweet corn to treatments targeting yellow nutsedge, Stayton, OR, 2010.

No.	Code [a]	HPPD [b]	Atrazine	Dual Mag.	Sandea	Basagran	Outlook	Surfactant/ adjuvant [c]	Obs	Phyto-toxicity rating on corn	Corn stunting		Weed control: Nutsedge		Weed control: Composite rating	Harvest (10/18): Ears	Harvest (10/18): Yield	Harvest (10/18): Avg. ear wt.
		V2	0.5	1.43	0.032	1.0	0.95			7/23	7/23	8/4	8/4	10/18	10/18			
			----------lbs ai/A----------							*0-10*	---------- *0-100* ----------					*no./A*	*t/A*	*lbs*
1	LA	Laudis	V3-4					MSO/UAN	4	0.8	0	6	5	23	73	19400	8.2	0.85
2	LAD	Laudis	V3-4	V3-4				MSO/UAN	4	3.3	29	18	75	84	90	18900	7.9	0.85
3	**LAS**	**Laudis**	**V3-4**		**V3-4**			**MSO/UAN**	**4**	**1.5**	**20**	**5**	**85**	**82**	**93**	**21200**	**8.5**	**0.80**
4	LAB	Laudis	V3-4			V3-4		MSO/UAN	3	2.7	33	23	80	57	75	18100	7.6	0.84
5	LASB	Laudis	V3-4		V3-4	V3-4		MSO/UAN	4	3.5	35	19	97	97	91	19900	8.5	0.84
6	LABB	Laudis	V3-4			V3-4/6 (1+1)		MSO/UAN	4	3.5	35	18	98	96	91	19100	8.1	0.85
7	LADS	Laudis	V3-4	V3-4	V3-4			MSO/UAN	4	3.5	35	30	90	90	94	21200	8.7	0.82
8	LADB	Laudis	V3-4	V3-4		V3-4		MSO/UAN	4	3.8	45	28	89	98	97	19700	8.6	0.88
9	LADBB	Laudis	V3-4	V3-4		V3-4/6 (1+1)		MSO/UAN	4	4.0	40	23	98	96	92	19700	8.3	0.85
10	LAO	Laudis	V3-4				V3-4	MSO/UAN	4	3.0	23	15	68	81	83	18100	7.9	0.88
11	LASO	Laudis	V3-4		V3-4		V3-4	MSO/UAN	4	3.0	23	15	89	91	93	19900	8.5	0.85
12	LABO	Laudis	V3-4			V3-4	V3-4	MSO/UAN	4	3.0	45	35	89	88	92	18300	7.4	0.81
13	CA	Callisto	V3-4					COC	4	0.0	5	3	35	40	41	18300	8.3	0.90
14	CAD	Callisto	V3-4	V3-4				COC	4	2.3	25	13	74	75	82	20500	8.4	0.82
15	CAS	Callisto	V3-4		V3-4			COC	4	0.0	10	18	80	90	64	19100	8.0	0.83
16	**CAB**	**Callisto**	**V3-4**			**V3-4**		**COC**	**4**	**0.0**	**0**	**0**	**59**	**84**	**79**	**19400**	**8.7**	**0.90**
17	**CASB**	**Callisto**	**V3-4**		**V3-4**	**V3-4**		**COC**	**4**	**0.0**	**13**	**15**	**95**	**96**	**87**	**20700**	**8.5**	**0.82**
18	**CABB**	**Callisto**	**V3-4**			**V3-4/6 (1+1)**		**COC**	**4**	**0.8**	**5**	**13**	**88**	**94**	**83**	**19900**	**8.8**	**0.89**
19	CADS	Callisto	V3-4	V3-4	V3-4			COC	4	2.8	30	25	88	71	84	18100	7.7	0.85
20	CADB	Callisto	V3-4	V3-4		V3-4		COC	4	2.5	28	23	94	100	94	19100	7.9	0.83
21	**CADSB**	**Callisto**	**V3-4**	**V3-4**	**V3-4**	**V3-4**		**COC**	**4**	**2.8**	**33**	**27**	**93**	**97**	**65**	**18800**	**6.6**	**0.73**
22	CADBB	Callisto	V3-4	V3-4		V3-4/6 (1+1)		COC	4	3.0	33	18	95	90	81	20500	9.4	0.92
23	D		PRE	PRE				-	4	0.0	5	8	71	75	86	20500	8.9	0.87
24	D(II)+glyphosate		PRE	PRE (II)				-	4	0.0	0	5	74	94	80	19700	8.3	0.84
25	O		PRE				PRE	-	4	0.0	5	3	70	96	82	18900	7.9	0.84
26	L	Laudis	-	V3-4				-	3	0.0	3	3	48	72	90	19800	8.8	0.89
27	I	Impact	-	V3-4				MSO/UAN	3	2.0	8	2	50	72	83	17700	7.9	0.89
28	Untreated		-	-					4	-	-	-	-	-	-	18600	7.8	0.84
FPLSD (0.05)										*1.0*	*12*	*12*	*24*	*32*	*23*	*ns*	*ns*	*ns*

[a] Code: L=Laudis, C=Callisto, I=Impact, D=Dual Magnum, O=Outlook, A=atrazine, S=Sandea, B=Basagran.

[b] Laudis applied at 0.082 (3 oz), Callisto at 0.094(3 oz), and Impact at 0.016 (0.75 oz) lbs ai/A.

[c] MSO applied at 0.25%, COC at 1%, and UAN at 2.5%.

Objective 2. Sweet corn tolerance to HPPD and other herbicides.

Two varieties of sweet corn were planted in adjacent rows in 10 by 30 plots three times at the Vegetable Research Farm near OSU in a randomized complete block design with four replications. The three plantings were made on May 26, June 7, and June 26. Atrazine was applied at 1 pt/A after planting to reduce potential injury from cultivating or hand weeding, and activated with ½ in. of irrigation. Plots were kept nearly weed-free with cultivation and hand hoeing. HPPD herbicide and tankmixes treatments were applied near to V2 and V6 growth stages. When a V6 treatment was applied in one Exp, the V2 treatment was applied in the later Exp so that corn would be experiencing the same environmental conditions. Sweet corn injury was evaluated visually 3 d after each treatment was applied, corn ht measured when corn was near silking, and corn harvested.

Results

Injury to corn was apparent 3 DAT on all plantings. Poor planting conditions and corn growth on the first planting made it difficult to discriminate between growth reduction caused by the herbicide and corn response to saturated soil conditions. There were no differences in corn ht at silking in all three treatments (Table 2). Corn yield response to the HPPD herbicides was most significant in Exp. III. All treatments tended to suppress yield compared to the untreated check. Impact + Dual Magnum applied after water had been sprinkled over the corn row caused the most damage whether applied at V2 or V6 and reduced the average yield of Coho and Basin from 11 to 9 t/A (Figure 1). Basin was the most sensitive to Impact and Laudis herbicide whether or not Dual Magnum was tankmixed with the HPPD herbicide (Table 1). Coho was less sensitive, but yield was reduced from 14.2 to an average of 12 t/A when water was sprinkled over the corn just before the herbicide was applied. The only environmental factor that appeared to be correlated with injury was plot moisture. Exp III was watered 2 days before both the V2 and V6 applications (Table 3), and leaf wetness measured in the canopy also indicated longer wetting periods from dew. Sprinkling water over the corn before emergence appeared to further reduce yield of Coho. However, the V6 treatment in Exp II has also been irrigated previously, and a yield reduction was not apparent in the V6 treatment. Abundant soil moisture is known to maximize efficacy of the HPPD herbicides, and may be contributing to the injury noted when Dual Magnum is tank mixed with Impact or Laudis. Options to reduce injury associated with these tankmixes includes reducing or eliminating the adjuvants typically added to improve efficacy, but the impact of applying this tankmix (without adjuvant) on weed control is unknown.

Table 2. Effect of HPPD herbicide, tankmix, time of application, and leaf wetness on corn yield at three plantings, Corvallis, 2010.

Exp	Variety	No.	Herbicide treatment	Obs	Phyto 3 DA V2	Phyto 3 DA V6	Stunting 3 DA V2	Stunting 3 DA V6	Corn ht	Corn yield	Corn ear number	Avg. ear wt.
					------- 0-10 ------		*------ 0-100 -----*		*ft*	*t/A*	*ears/A*	*kg*
I	Basin	1	Untreated	3	0.7	1.0	20	18	5.6	11.0	37500	0.38
I	Basin	2	ImDA v2	4	2.5	0	5	18	5.5	11.7	39500	0.37
I	Basin	3	ImDA v6	4	-	2.0	-	8	6.0	11.5	38800	0.37
I	Basin	4	ImDA v2 + water	3	1.7	0	3	13	5.8	11.2	38300	0.38
I	Basin	5	ImDA v6 + water	4	-	1.3	-	20	5.8	13.0	39500	0.37
I	Basin	6	ImA v2	4	0	0	0	3	5.6	10.8	33100	0.38
I	Basin	7	ImA V6	4	-	0	-	10	5.8	13.7	34400	0.37
I	Basin	8	LDA v2	4	2.0	0.5	10	18	5.7	12.3	39300	0.37
	FPLSD (0.05)				*ns*	*1.4*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*
I	Coho	1	Untreated	4	1.0	0.8	13	20	5.6	17.3	38600	0.37
I	Coho	2	ImDA v2	4	3.3	0	9	10	5.0	18.3	40500	0.34
I	Coho	3	ImDA v6	4	-	2.0	-	30	5.7	17.1	42100	0.34
I	Coho	4	ImDA v2 + water	4	1.8	0.0	4	13	5.5	16.6	40300	0.36
I	Coho	5	ImDA v6 + water	4	-	1.3	-	8	5.7	18.4	41700	0.35
I	Coho	6	ImA v2	4	0.1	0	1	13	5.5	15.5	35600	0.37
I	Coho	7	ImA V6	4	-	0	-	0	5.2	15.3	35700	0.36
I	Coho	8	LDA v2	4	3.0	0.5	14	20	5.3	14.4	35900	0.36
	FPLSD (0.05)				*ns*	*ns*	*ns*	*2*	*ns*	*ns*	*5400*	*ns*
II	Basin	1	Untreated	4	0	0	0	0	6.4	10.2	27100	0.34
II	Basin	2	ImDA v2	4	2.5	0	13	5	6.2	9.9	25800	0.35
II	Basin	3	ImDA v6	4	-	3.0	-	23	6.1	10.5	31600	0.30
II	Basin	4	ImDA v2 + water	4	2.8	0	16	13	6.2	9.8	25800	0.34
II	Basin	5	ImDA v6 + water	4	-	3.3	-	28	6.2	9.4	27600	0.31
II	Basin	6	ImA v2	4	0	0	0	0	6.2	11.6	31300	0.34
II	Basin	7	ImA V6	4	-	0.4	-	0	6.1	10.4	27600	0.34
II	Basin	8	LDA v2	4	2.8	0	18	5	6.1	9.4	24700	0.34
	FPLSD (0.05)				*0.7*	*0.4*	*8*	*18*	*ns*	*ns*	*5200*	*0.02*
II	Coho	1	Untreated	4	0	0	3	0	6.0	14.1	36400	0.35
II	Coho	2	ImDA v2	4	4.0	0	18	10	5.8	13.7	36700	0.34
II	Coho	3	ImDA v6	4	-	3.3	-	38	6.1	13.9	37200	0.34
II	Coho	4	ImDA v2 + water	4	3.3	0	10	13	5.9	14.5	39000	0.34
II	Coho	5	ImDA v6 + water	4	-	3.0	-	33	6.0	15.2	39600	0.35
II	Coho	6	ImA v2	4	0	0	0	0	6.0	16.0	38200	0.39
II	Coho	7	ImA V6	4	-	0.5	-	25	6.2	15.8	39600	0.36
II	Coho	8	LDA v2	4	3.5	0	13	15	6.1	15.3	39300	0.35
	FPLSD (0.05)				*0.7*	*0.3*	*13*	*ns*	*ns*	*ns*	*ns*	*ns*
III	Basin	1	Untreated	4	0	0.9	0	1	6.5	8.1	21000	0.16
III	Basin	2	ImDA v2	4	3.0	0.3	35	15	6.7	6.9	20200	0.14
III	Basin	3	ImDA v6	4	-	3.0	-	4	6.5	6.5	19100	0.14
III	Basin	4	ImDA v2 + water	4	3.3	1.3	53	13	6.3	6.3	17500	0.15
III	Basin	5	ImDA v6 + water	4	-	1.8	-	5	6.2	6.3	17000	0.15
III	Basin	6	ImA v2	4	1.5	0.3	4	8	6.3	7.0	20500	0.14
III	Basin	7	ImA V6	4	-	0.4	-	4	6.5	6.4	17000	0.16
III	Basin	8	LDA v2	4	4.5	1.0	45	21	6.4	6.4	18300	0.14
III	Basin	9	DAv2	4	3.0	0	35	0	.	7.4	19100	0.16
III	Basin	10	DAv6	3	-	0.5	-	0	.	6.9	18400	0.16
	FPLSD (0.05)				*0.4*	*1.0*	*11*	*7*	*0.3*	*ns*	*ns*	*ns*
III	Coho	1	Untreated	4	0	0.9	0	0	6.6	14.2	34000	0.17
III	Coho	2	ImDA v2	4	3.3	0.3	35	11	6.5	12.7	30300	0.17
III	Coho	3	ImDA v6	4	-	3.0	-	19	6.4	13.1	32100	0.17
III	Coho	4	ImDA v2 + water	4	3.3	1.0	43	13	6.4	11.8	28200	0.17
III	Coho	5	ImDA v6 + water	4	-	2.3	-	13	6.5	12.1	30000	0.17
III	Coho	6	ImA v2	4	1.1	0.1	6	0	6.4	13.8	34300	0.17
III	Coho	7	ImA V6	4	-	0.4	-	0	6.4	14.0	33700	0.17
III	Coho	8	LDA v2	4	4.0	0.9	33	21	6.3	12.3	32100	0.16
III	Coho	9	DAv2	4	3.0	0	8	0	.	13.7	34800	0.16
III	Coho	10	DAv6	3	-	0.5	-	0	.	13.4	33600	0.16
	FPLSD (0.05)				*0.4*	*1.0*	*15*	*7*	*ns*	*1.7*	*4300*	*0.01*

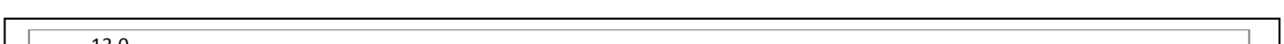

Table 3. Herbicide application data.

Exp.	Exp I		Exp II		Exp III	
Planting date	May 26		June 7		June 26	
Herbicide application date	5-Jun-10	25-Jun-10	25-Jun-10	9-Jul-10	9-Jul-10	22-Jul-10
Crop stage	Coty+1-2 collars, max ht 3 inches,	5-6 collars	2 collars, max ht 4 inches	Coty + 4-5 collars, max ht range 14-16, but highly variable, some as short as 6 in	Coty+ 1 collar, max ht 4 in, occasional 2 collars	5-6 collars
Herbicide/treatment	V2	V6	V2	V6	V2	V6
Start/end time	4-4:30 PM	4:30-5:30 pm	4:30-5:30 pm	7-8am	7-8am	12-12:45
Air temp/soil temp (2")/surface	73/76/78	78/87/91	78/87/91	76/74/77	76/74/77	77/80/90
Rel humidity	48%	45%	45%	56%	56%	48%
Wind direction/velocity	S 1-3	W 0-4	W 0-4	NE 0-0.3	NE 0-0.3	E 0-1.5
Cloud cover (%)	100 hazy	0	0	0	0	0
Soil moisture	Dry	Very dry	Very dry	Good moisture, irrigated 2 days ago,	Good moisture, irrigated 2 days ago,	Irrigated
Plant moisture	Dry except treatments that were watered	Dry except treatments that were watered	Dry except treatments that were watered	Dew, no whorls full except where water was applied	Dew, no whorls full except where water was applied	Dry except treatments that were watered
Sprayer/PSI	BP CO2 30 PSI	BP CO2 25PSI	BP CO2 25PSI	BP CO2 30 PSI	BP CO2 30 PSI	BP CO2 30 PSI
Mix size	2100	2100	2100	2100	2100	2100
Gallons H20/acre	20	20	20	20	20	20
Nozzle type	3-XR8003	3-XR8003 2	3-XR8003	3-XR8003	3-XR8003	3-XR8003
Nozzle spacing and height	20/20-24	20/20-24	20/20-24	20/20-24	20/20-24	20/20-24
Notes	Rain began 8 hours following application, misted through the night and into the morning					