2011 Research Report to the
Agricultural Research Foundation
and the
Oregon Processed Vegetable Commission

Title: *Weed control in sweet corn: tolerance to HHPD herbicides; control of nutsedge; and flame weeding in high-residue systems.*

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

Cooperator
George Clough, Hermiston Ag Exp Station, (541) 567-6337, george.clough@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. Research over the last 3 years indicates that there is a real potential of economic injury to sweet corn when these herbicides are applied as a tankmix with Dual Magnum. Tankmixes of Laudis or Impact with soil active herbicides are very attractive because they control nearly all weedy vegetation with a single application and setback even difficult to control weeds such as nutsedge.

There are several alternatives that should be considered to reduce the potential injury caused by HPPD and soil active herbicides. Data from 2008 to 2010 indicates that plant or possibly soil moisture may be implicated in a nearly 20% reduction in yield. However, the exact environmental conditions that caused the injury are unclear. Secondly, there is concern that adjuvant overloading may be enhancing the uptake of HPPD herbicides, and that the chloroacetamides Dual Magnum and Outlook may be aggravating injury by HPPD herbicides. The adjuvants MSO and UAN are typically applied with HPPD herbicides, and substantially improve weed control, as was demonstrated in research in 2007. Herbicides such as Dual Magnum and Outlook also act as adjuvants in some cases. The potential injury to corn may be mitigated by simply reducing the rate of soil active herbicide that is tankmixed with HPPD herbicides, by reducing the amount of adjuvant, or by reducing both. The effect these changes will have on sweet corn tolerance to these herbicides, and potential loss of weed control has not been studied, but will be the focus of this work.

Another crop safety issue arises when the HPPD herbicides are tankmixed with herbicides that can be used to control nutsedge. Again, the issue is whether the herbicides needed can be applied without injuring the corn. Data from 2010 indicated very little injury to sweet corn var. HM 2390, even when both Basagran and Sandea were added with Callisto. Additional data is needed to ensure that these combinations will not injure sweet corn. HM 2390 is generally considered to be a more tolerant to HPPD herbicides such as Callisto than many other varieties, as we determined in research distributed across the US in 2006-07. More work is needed to document crop safety under these conditions and whether the anticipated control of nutsedge justifies the additional risk.

Research Objectives

1. Determine sweet corn tolerance to HPPD herbicides combined with chloroacetamide herbicides such as Dual Magnum.
2. Determine the potential of controlling nutsedge in sweet corn with HPPD herbicides in combination with other products.
3. Evaluate strategies to improve flame weeding efficacy in high-residue systems.

Objective 1. Sweet corn tolerance to HPPD herbicides (Corvallis).

Coho and Merit sweet corn varieties were planted in 10 by 30 plots at the Vegetable Research Farm near OSU on June 10. Fertilizer (487 lb/A 12-29-10) was banded next to the row at planting and Lorsban insecticide applied over the row at planting in a T-band in front of the press wheels. All treatments listed were applied to the Coho plot; a subset of treatments was applied to the plot with the Var. Merit. The experimental design was a randomized complete block with four replications. Spacing between rows was 30” and between plants was 8 in. Atrazine was applied over the entire experimental area at 1 pt/A to reduce broadleaf weed emergence and competition with the crop. Experimental treatments were applied on June 27 and 29 (V2), and July 11 and 14 (v4) with a 5 nozzle boom with nozzles spaced 20” apart delivering 20 GPA spray (Table 1). Weeds were removed by hoeing as wet weather prevented cultivation. Corn was harvested from 20 ft of one of the middle rows in each plot and ears graded

Results

- Coho sweet corn tolerated herbicides better in this trial than 2 previous years (Table 2).
- In general, corn was more sensitive to tankmix treatments at V2 than at V6 (Fig. 1).
- Treatments 10 and 12 had Dual Magnum at 16 and 12 oz/A, respectively and still caused significant leaf burn and possible yield loss, particularly when applied at V2 (Table 2).
- Removing the MSO and UAN appeared to significantly reduce crop injury and yield loss caused when Dual Magnum and Impact or Laudis were applied together. The adjuvant Renegade caused the same effect as the MSO and UAN tankmix.
- Var. Merit followed similar trends with the exception that Laudis nearly killed the corn (Figure 5)

Table 1. Treatment application data for Objective 1.

Date	June 27, 2011	June 29, 2011	July 11, 2011	July 14, 2011
Crop stage	V2	Coho V2, Merit slightly ahead, near V3	V5.5, 11-17"	V6, 12-20"
Application timing	V2	V2+	V6	V6
Start/end time	6-7AM	7:30-10:30 A	9-9:30 A	5:45-8:15 AM
Air temperature	50	65	62	62
Rel humidity	73%	68% (9AM)	64% (9:30AM)	71%
Wind direction/velocity	SW 0-1	1-5 (9AM)	SW 0.7-3.4	SW 0.2 (start) to 3.2 (end)
Cloud cover	50%	80%	100%	100%
Sprayer/PSI	30	30	30	30
Mix size	2100	2100	2100	2100
Gallons H_20/acre	20	20	20	20
Nozzle no. and type	4-XR8003	4-XR8003	4-XR8003	4-XR8003
Nozzle spacing and height	20/20	20/20	20/20	20/20
Soil moisture	dry	wet	Very dry, not irrigated for 14 days	rain tues + 1 hr irrigation + showers last 2 days
Plant moisture	some dew present, water applied to treatment 20	very light dew present, mostly empty leaf wells	dry from morning wind	heavy dew
Notes	mist started in evening, rain fell mostly 4-7 AM next day	planned to spray on Tuesday but rained in morning	Irrigated 0.5 next morning	fertilized N and irrigated in PM
	irrigated 1 hr on 6-28		very slow growing conditions	
			dry the last 14 days but also cool the last 5	cool and wet last 3 days

Table 2. Effect of time, chloroacetamide herbicide, and adjuvant on sweet corn var. Coho tolerance to HPPD herbicides (Corvallis).

	Treatment	Crop injury (July 17)		Harvest								
		Phyto (leaf burn)	Stunting	Corn ht. (midseason)	Ear yield	Ear yield	Avg. ear wt	Avg. husked ear wt	Ear length	Tip fill	Ear width	Ear volume
		0-10	*%*	*ft.*	*no/A*	*t/A*	*lbs*	*lbs*	*in*	*%*	*in*	*in cu*
1	Check	0	0	7.1	35500	15.9	0.91	0.64	7.13	92	2.02	21.0
2	AF-Im D A v2	1	19	6.6	32500	14.5	0.90	0.63	7.03	96	2.03	21.8
3	AF-Im D A v6	3	14	7.0	34800	15.4	0.89	0.66	7.33	95	2.04	22.7
4	AF-Im D A v2 + water	1	15	6.8	36200	15.2	0.84	0.64	7.20	95	1.99	21.3
5	AF-Im D A v6 + water	3	13	6.8	36400	15.5	0.86	0.64	7.08	95	2.02	21.4
6	AF-Im A v2	0	14	6.7	38800	**17.4**	0.90	0.59	6.93	94	1.96	19.6
7	AF-Im A V6	0	10	6.8	35500	15.6	0.89	0.58	6.88	92	1.96	19.0
8	AF-D A v2	1	19	6.7	30900	14.2	0.92	0.63	7.15	95	2.00	21.1
9	AF-D A v6	3	11	6.7	35900	16.1	0.90	0.61	7.08	93	1.99	20.6
10	AF-Im D16 A v2	1	14	6.4	29200	13.5	0.92	0.67	7.30	96	2.05	23.0
11	AF-Im D12 A v2	1	20	6.9	32000	14.3	0.89	0.64	7.15	96	2.01	21.7
12	AF-Im D A 1/2A v2	1	24	6.5	29200	13.5	0.94	0.67	7.18	97	2.07	23.3
13	AF-Im D A NA v2	0	10	6.8	37700	15.7	0.84	0.63	7.05	96	2.00	21.2
14	AF-Im D16 A v6	2	6	6.9	38600	16.5	0.86	0.60	7.05	93	2.00	20.5
15	AF-Im D12 A v6	2	16	7.0	37900	16.6	0.88	0.63	7.18	94	1.97	20.6
16	AF-Im D A 1/2A v6	1	8	6.8	37200	15.8	0.85	0.66	7.18	94	2.05	22.3
17	AF-Im D A NA v6	0	4	6.8	36600	16.1	0.89	0.62	7.03	95	2.04	21.6
18	BI-Im D A v2	0	14	6.8	33300	15.2	0.91	0.59	6.93	92	1.96	19.1
19	BI-Im D A v6	2	18	6.6	35900	15.6	0.87	0.61	7.00	94	2.00	20.5
20	BI-Im D A v2 + water	0	13	6.8	31800	14.8	0.93	0.60	6.93	92	1.96	19.2
21	BI-Im D A v6 + water	2	8	7.0	37000	15.6	0.84	0.61	7.18	93	2.00	21.0
22	BI-Im A v2	0	4	7.0	35100	15.5	0.89	0.62	7.05	95	2.02	21.2
23	BI-Im A V6	0	5	6.6	34800	15.4	0.88	0.58	7.03	92	1.97	19.7
24	BI-D A v2	0	15	6.4	31100	14.0	0.90	0.63	6.93	98	2.05	22.3
25	BI-D A v6	2	10	6.9	36600	16.5	0.90	0.61	6.93	96	1.99	20.5
26	AF-L D A v2	1	23	6.5	34200	14.6	0.87	0.62	7.08	94	2.00	20.7
27	AF-L D A v6	3	15	6.9	37700	16.2	0.86	0.61	7.23	93	1.95	20.1
28	AF-L A v2	0	6	6.7	34800	15.6	0.90	0.65	7.15	96	2.04	22.4
29	AF-L A V6	0	0	7.0	36400	16.1	0.88	0.64	7.08	95	2.02	21.5
30	Check	0	0	6.7	38100	16.1	0.85	0.59	6.90	94	1.99	20.1
31	AF-L A R v2	0	6	6.8	34800	15.7	0.90	0.65	7.18	95	2.04	22.2
32	AF-I A R v2	0	10	7.0	32000	14.2	0.89	0.65	7.15	95	2.02	21.5
33	AF-L A 1178 v2	0	10	7.0	35500	16.1	0.91	0.66	7.25	97	2.07	23.5
34	AF-I A 1178 v2	0	9	6.8	37200	16.5	0.89	0.63	7.15	96	2.01	21.5
35	AF-L D A R v6	0	0	6.7	34000	14.2	0.84	0.63	7.07	95	1.99	21.0
36	AF-I D A R v6	1	11	6.5	35500	15.4	0.87	0.63	7.13	94	2.03	21.6
FPLSD				*0.4*	*ns*	*2.1*	*ns*	*ns*	*0.27*	*4*	*0.09*	*0.05*

Treatment key. AF, treatments applied after irrigation; BF, treatments applied before irrigation; Im, Impact herbicide; D, Dual Magnum herbicide at 24 oz/A; D16, Dual Magnum at 16 oz/A; D12, dual Magnum at 12 oz/A; L, Laudis; A, atrazine; R, adjuvant; 1178, WE1178 adjuvant; v2 and v6, leaf stage of corn; ½ NA, half rate of adjuvant; NA, no adjuvant; R, renegade adjuvant; Water, water dribbled over corn plants before treatments applied.

Table 3. Effect of time, chloroacetamide herbicide, and adjuvant on sweet corn var. Merit tolerance to HPPD herbicides (Corvallis).

	Treatments	Obs	Phyto	Stunting	Corn ht.	Ear yield	Yield	Avg. ear wt.	husked ear wt 10 ears	Ear length	Ear fill	Ear width	Volume
					ft	*no/A*	*t/A*	*lbs*	*lbs*	*in*	*%*	*in*	*cu in*
1	Check	15	0.0	0	6.9	27600	12.9	0.94	0.71	9.0	90	2.18	33.5
2	AF-ImDA v2	3	1.7	20	6.4	25800	12.2	0.95	0.69	9.1	90	2.15	32.8
4	AF-ImDA v2 + water	4	1.0	21	6.5	25000	12.0	0.96	0.68	9.0	90	2.09	31.1
6	AF-ImA v2	4	0.8	15	6.7	27000	12.4	0.92	0.71	9.0	79	2.18	33.3
8	AF-DAv2	3	1.0	8	6.6	26400	12.2	0.92	0.71	9.0	90	2.17	33.2
10	AF-ImD16A v2	4	1.3	15	6.3	27900	12.8	0.92	0.70	9.0	90	2.14	32.3
11	AF-ImD12A v2	4	1.0	11	6.5	27000	13.0	0.97	0.73	9.3	90	2.16	34.1
12	AF-ImDA v2 1/2A	3	1.0	17	6.3	29000	13.1	0.90	0.63	8.7	88	2.09	29.9
13	AF-ImDA v2 NA	2	1.0	5	6.7	25300	12.3	0.97	0.72	9.2	89	2.18	34.1
26	AF-LDA v2	2	4.5	80	4.4	21300	7.8	0.73	0.39	8.5	83	1.84	22.5
	FPLSD		*1.4*	*8*	*0.7*	*3300*	*1.3*	*0.08*	*0.43*	*0.52*	*10*	*0.10*	*4.1*

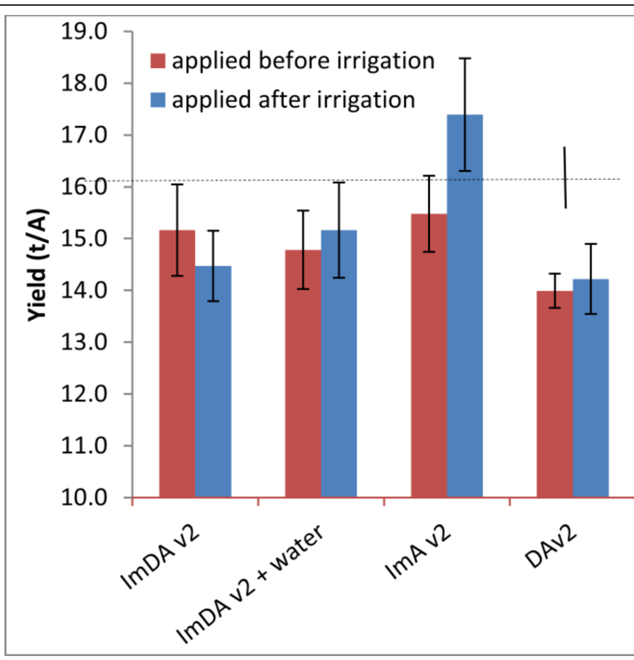

Figure 1. Coho tolerance to HPPD herbicides (dotted line is yield of check plot).

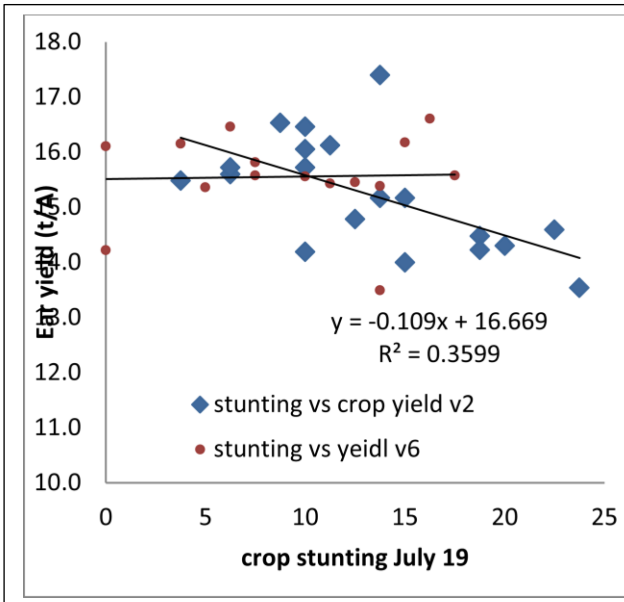

Figure 2. Stunting vs crop injury on V2 and V6 applications (excluding Impact only treatments).

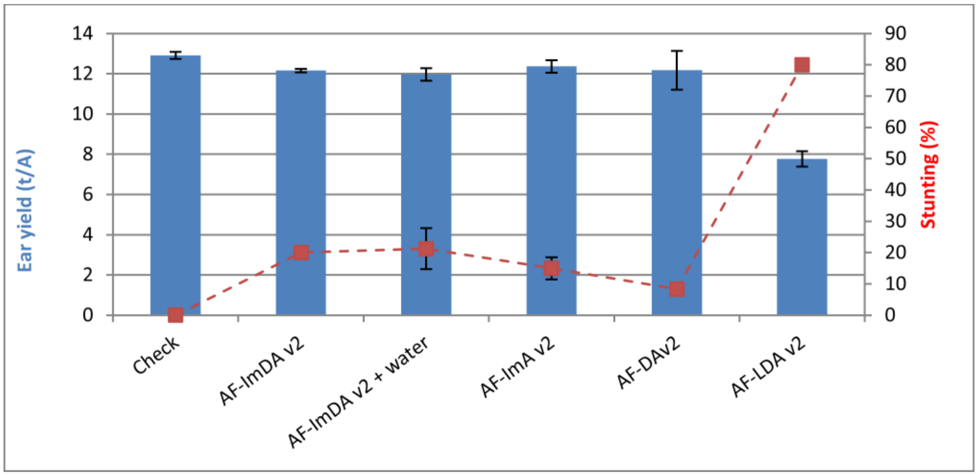

Figure 3 . Effect of Impact (I), Laudis (L), and Dual Magnum (D) herbicides (all applied with MSO and UAN and shortly after (AF) irrigation) on crop injury and yield of Merit sweet corn.

<u>Objective 2A. Determine the potential of controlling nutsedge in sweet corn with HPPD herbicides in combination with other products.</u>

The site selected near Jefferson had very heavy density of yellow nutsedge that had escaped a PPI application of Dual Magnum. Sweet corn (v Rogers 7189) was planted on May 15 on 30 in rows. Strips of nutsedge emerged through the field indicating that either the PPI herbicide was applied poorly, incorporated erratically, or that tubers were non-uniformly distributed throughout the field before planting. Plots 10 ft by 30 ft were set in 4 blocks and POST herbicides applied to plots on June 23 and the follow up herbicide Basagran applied to designated plots on July 5 (Table 4 for treatment description). Corn injury was evaluated visually and measured with a SPAD meter, nutsedge control was evaluated twice shortly after the applications and again at harvest. Corn was harvested from 20 ft of row on Sept 1.

Results

- The non-uniform distribution of nutsedge made evaluation very difficult.
- SPAD meter readings indicated that this corn variety was more tolerant to Impact than Callisto herbicide (Table 6).
- Nutsedge control was typically better with Callisto than Laudis (Fig. 4).
- Treatments with Dual Magnum consistently controlled nutsedge best, particularly when Sandea or Basagran were added to the tankmix. However, crop injury increased as well.
- Simply adding Dual Magnum to either the Callisto or Laudis application gave reasonable control of nutsedge with minimal risk of injury to the crop.

Table 4. Treatment descriptions for nutsedge trial. Data are presented in Table 6.

	Code	HPPD @ v2	Atr 0.5 lb ai/A	Surfactant	Dual Magnum 1.43 lb ai/A	Sandea 0.047 lb ai/A	Basagran 1 lb ai/A	Outlook 0.94 lb ai/A
1	LA	Laudis	v2,0.5	MSO/UAN				
2	LAD	Laudis	v2,0.5	MSO/UAN	v2, 1.43			
3	LAS	Laudis	v2,0.5	MSO/UAN		v2		
4	LAB	Laudis	v2,0.5	MSO/UAN			v2; 1 lb	
5	LASB	Laudis	v2,0.5	MSO/UAN		v2	v2; 1 lb	
6	LABB	Laudis	v2,0.5	MSO/UAN			v2 1lb and v6 1 lb	
7	LADS	Laudis	v2,0.5	MSO/UAN	v2, 1.43	v2		
8	LADB	Laudis	v2,0.5	MSO/UAN	v2, 1.43		v2; 1 lb	
9	LADSB	Laudis	v2,0.5	MSO/UAN	v2, 1.43	v2	v2; 1 lb	
10	LADBB	Laudis	v2,0.5	MSO/UAN	v2, 1.43		v2 1lb and v6 1 lb	
11	LAO	Laudis	v2,0.5	MSO/UAN				v2
12	LASO	Laudis	v2,0.5	MSO/UAN		v2		v2
13	LABO	Laudis	v2,0.5	MSO/UAN			v2; 1 lb	v2
14	CA	Callisto	v2,0.5	COC				
15	CAD	Callisto	v2,0.5	COC	v2, 1.43			
16	CAS	Callisto	v2,0.5	COC		v2		
17	CAB	Callisto	v2,0.5	COC			v2; 1 lb	
18	CASB	Callisto	v2,0.5	COC		v2	v2; 1 lb	
19	CABB	Callisto	v2,0.5	COC			v2 1lb and v6 1 lb	
20	CADS	Callisto	v2,0.5	COC	v2, 1.43	v2		
21	CADB	Callisto	v2,0.5	COC	v2, 1.43		v2; 1 lb	
22	CADSB	Callisto	v2,0.5	COC	v2, 1.43	v2	v2; 1 lb	
23	CADBB	Callisto	v2,0.5	COC	v2, 1.43		v2 1lb and v6 1 lb	
24	IA	Impact	v2,0.5	MSO/UAN				
25	Check		none					
26	Weeded check		none					

Table 5. Herbicide application data for the Jefferson site (Obj. 2A).

Date	Thursday, June 23, 2011	Tuesday, July 05, 2011
Corn stage	v2-4, 6 to 12, very irregular	v5-6; 10-17 in
Weeds and growth stage		
Nutsedge	Emerging to 8 ", up to 6 leaves, highly variable	≤10 in, 11 leaves untreated plots
Herbicide/treatment	All	2nd Basagran treatment
Application timing	Post	Post
Start/end time	11:30-2:30 pm	1:30-2 pm
Air temperature	66F	79F
Rel. humidity	43%	41%
Wind direction/velocity	0-2 all over	N 3-5
Cloud cover	90% with sun breaks	0
Soil moisture	Very dry	Very dry surface, good moisture at 1 in.
Plant moisture	Very dry	Dry
Sprayer/PSI	BackPack CO2	BackPack CO2
Mix size	2100	11,000 mls
Gallons $H_2$0/acre	20	20
Nozzle no. and type	5-XR8003	5-XR8003
Nozzle spacing and height	20/20	20/20

Table 6. Corn and weed tolerance to Laudis and Callisto tankmixes. Treatments yielding ≥ 9.0 t/acre and 90% nutsedge control are in bold type.

	Treatment	Obs	June 30 (7 DAT)					July 20 (27 DAT)			At harvest (Sept 1, 2011)								
			Spad meter reading	Phytotoxicity rating	HPPD symptoms	Crop stunting	Nutsedge control	Phytotoxicity rating	Crop stunting	Nutsedge control	Nutsedge control	Composite control rating	Ear yield	Average ear wt.	Fresh wt yield	Avg husked ear wt	Ear length (in)	tip fill %	ear diameter
				0-10	*0-10*	*%*	*%*	*0-10*	*%*	*%*	*%*	*%*	*no/A*	*lb/ear*	*t/A*	*lb/ear*	*in*	*%*	*in*
1	LA	4	33.0	0.0	0.0	5.0	47.5	0.0	0.0	3	25	30	24829	0.89	10.9	0.47	8.8	89	1.82
2	**LAD**	**4**	**31.1**	**2.5**	**0.0**	**2.5**	**42.5**	**0.0**	**6.3**	**88**	**86**	**86**	**22070**	**0.85**	**9.4**	**0.54**	**9.2**	**94**	**1.93**
3	LAS	4	32.6	0.3	0.0	2.5	57.5	0.0	15.0	87	64	65	22361	0.83	9.1	0.46	9.5	87	1.80
4	LAB	4	28.5	3.0	0.5	17.5	67.5	0.0	7.5	10	13	28	17860	0.80	7.2	0.43	8.9	94	1.71
5	LASB	4	30.5	2.8	0.0	13.8	70.0	0.0	17.5	94	80	80	18296	0.78	7.3	0.53	9.0	88	1.86
6	LABB	4	30.0	2.8	0.8	15.0	67.5	0.5	17.5	69	38	45	16553	0.98	8.0	0.53	9.1	90	1.86
7	LADS	4	33.2	3.0	0.0	22.5	45.0	0.0	40.0	95	91	85	19166	0.85	8.0	0.55	9.3	92	1.90
8	LADB	4	27.6	3.8	1.8	20.3	75.0	0.3	22.5	92	92	92	20909	0.81	8.5	0.53	9.1	86	1.86
9	LADSB	4	33.6	3.5	0.0	20.0	75.0	0.0	25.0	96	70	60	18949	0.93	8.7	0.59	9.2	92	1.93
10	**LADBB**	**4**	**28.8**	**4.3**	**0.0**	**35.0**	**76.3**	**0.3**	**37.5**	**94**	**93**	**93**	**24394**	**0.76**	**9.3**	**0.59**	**9.3**	**88**	**1.94**
11	LAO	4	31.7	1.1	0.0	2.5	32.5	0.0	6.7	80	86	86	17860	0.95	8.3	0.55	9.2	89	1.87
12	**LAOS**	**4**	**33.3**	**0.3**	**0.3**	**15.0**	**32.5**	**0.0**	**43.3**	**79**	**93**	**86**	**22651**	**0.87**	**9.8**	**0.57**	**8.9**	**88**	**1.92**
13	LAOB	4	26.9	3.5	2.3	27.5	65.0	1.0	23.3	93	86	86	19457	0.83	8.2	0.54	8.8	89	1.89
14	CA	4	31.0	0.0	0.3	2.5	60.0	0.0	0.0	48	48	53	22361	0.86	9.6	0.50	8.9	86	1.82
15	**CAD**	**4**	**23.5**	**1.0**	**2.3**	**5.0**	**57.5**	**0.0**	**7.5**	**91**	**90**	**92**	**21345**	**0.85**	**9.1**	**0.59**	**9.5**	**89**	**1.93**
16	CAS	4	26.9	0.0	1.0	15.0	50.0	0.0	21.3	92	75	74	20909	0.83	8.6	0.56	9.2	88	1.90
17	CAB	4	19.2	0.5	2.8	12.5	67.5	0.3	17.5	74	60	71	21127	0.82	8.6	0.56	9.4	86	1.87
18	CASB	4	24.3	0.3	1.8	10.0	62.5	0.0	22.5	93	83	79	17134	0.85	7.3	0.55	9.1	87	1.93
19	CABB	3	15.0	0.3	2.7	23.3	80.0	0.0	16.7	87	70	73	24394	0.83	10.2	0.53	8.8	93	1.87
20	**CADS**	**4**	**23.8**	**2.5**	**0.8**	**7.5**	**67.5**	**0.0**	**22.5**	**97**	**90**	**88**	**24103**	**0.85**	**10.1**	**0.59**	**9.2**	**90**	**1.95**
21	**CADB**	**4**	**24.0**	**1.8**	**1.5**	**12.5**	**72.5**	**0.0**	**30.0**	**91**	**93**	**91**	**21127**	**0.85**	**9.0**	**0.53**	**8.9**	**89**	**1.88**
22	CADSB	4	24.7	2.3	2.3	20.0	70.0	0.5	36.5	97	88	89	17206	0.81	7.0	0.58	9.5	93	1.89
23	**CADBB**	**4**	**18.5**	**2.0**	**3.5**	**22.5**	**77.5**	**0.0**	**27.5**	**94**	**94**	**93**	**20473**	**0.96**	**9.9**	**0.60**	**10.0**	**88**	**1.90**
24	IA	4	31.4	0.5	0.3	7.5	57.5	0.0	10.0	37	33	41	20909	0.81	6.5	0.57	9.6	90	19.1
25	Check	11	31.5	0.2	0.0	2.7	0.0	0.0	10.6	0	0	2	19275	0.83	8.0	0.58	9.40	92	19.1
26	Weeded check	4	32.4	0.0	0.0	4.0	0.0	0.0	7.5	0	89	90	23523	0.80	9.4	0.56	9.22	88	19.1
	FPLSD		*6.5*	*0.94*	*1.1*	*17*	*24*	*0.63*	*20*	*19*	*18*	*22*	*ns*	*ns*	*ns*	*0.086*	*0.039*	*5*	*ns*

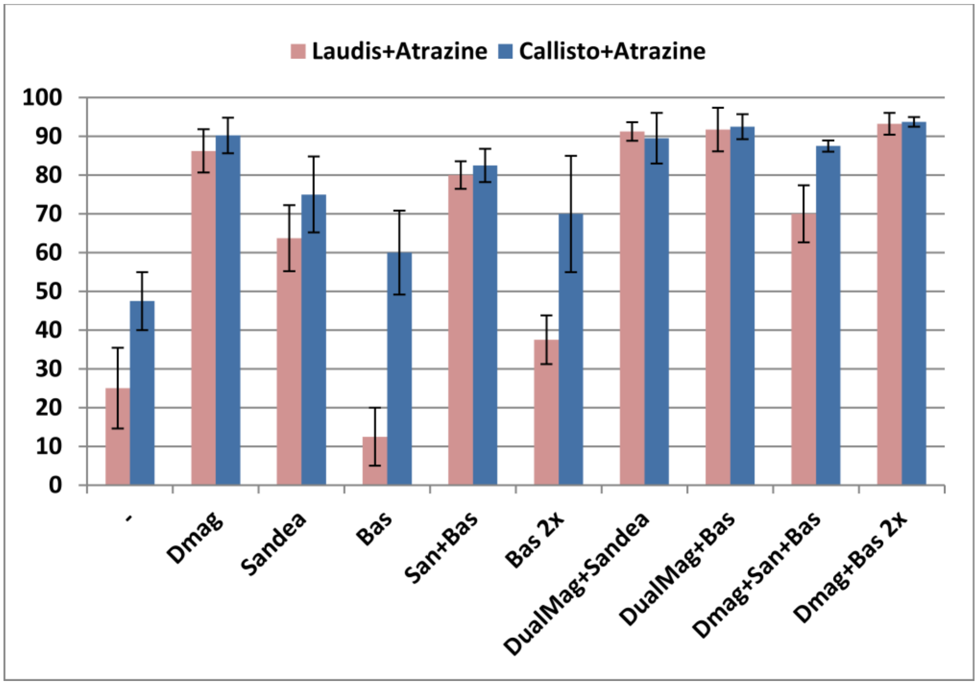

Figure 4. Nutsedge control with HPPD herbicides and tankmixes to improve efficacy.

Objective 2B. Determine crop safety of HPPD and other herbicides to control nutsedge in Sweet corn.

Field plots were established under center-pivot irrigation on the Hermiston Agricultural Research and Extension Center (HAREC) on an Adkins fine sandy loam (coarse-loamy, mixed mesic Xerollic Camborthid), pH 7.0, O.M. 1.0%. Fertilizer (75N-50P2O5-75K2O-20S-4Cu-3Zn-1.5B) was broadcast and incorporated on May 16. 'Basin' and 'GSS1477' sweet corn were planted on May 19, 4-30'rows/plot, 30" between rows, 9" between plants. Treatments were applied on Jun 6 and Jun 8, and Jun 27 (Table 7). An additional 30 lb/a N was applied in 0.20" irrigation on Jun 28, and 40 lb/a N was applied on Jul 5 and again on Jul 12. Insecticide applications for earworm control are listed in Table 8. Normal commercial production practices were followed. On Aug 22 (Basin) and Aug 24 (GSS1477), 20' of the interior 2 rows/plot were harvested. Ears were counted and weighed, 10 ears/plot were husked, and fresh weight, length, and diameter were measured. The experimental design was a randomized complete block, with 4 replications. Data were analyzed using the SAS GLM procedure with significant treatment effects separated by Duncan's multiple range test.

Results

- Crop height was reduced for both varieties when Sandea+ Basagran or Basagran (2 times) were tankmixed with Callisto (Table 10).
- Few if any effects were noted on yield of either variety (Table 11), but yields tended to be lowest (even though statistically insignificant) when Basagran was tankmixed with Sandea or Basagran applied twice (LADSB, CADSB, and CADBB).
- Several ear quality characteristics were influenced by treatment, but did not differ from the check plot, indicating that weed competition was more important than direct effects of the herbicides on ear quality (Table 9).
- An exception was the number of rows on ears of Basin with CABB; row number was significantly lower for this treatment than the check.
- Similarly ear diameter of GSS1477 was lower than the check when CADSB and LADSB were applied.

Table 7. Conditions at treatment application, HAREC, 2011.

V2 - broadcast: 80015VS spray nozzles, 30 psi, 2.5 mph (20 gpa water)
  Trtmnts 1-13: Jun 6
    Wind: 0-5
    Sunlight: overcast
    Air Temp: 70°F
    RH: 55%
    Crop: 2-3 leaf 2-4" tall
  Trtmnts 14-23: Jun 8
    Wind: 0
    Sunlight: overcast
    Air Temp: 64°F
    RH: 58%
    Crop: 2-3 leaf 2-4" tall
V6 - broadcast: 80015VS spray nozzles, 30 psi, 2.5 mph (20 gpa water)
  Trtmnts 6, 9, 19, 23: Jun 27
    Wind: calm
    Sunlight: overcast
    Air Temp: 68°F
    RH: 48%
    Crop: 6-8 leaf, 10" tall

Table 8. Insecticides applied for earworm control, HAREC, 2011.

Application date	Product	Rate
Aug 2	Asana (esfenvalerate)	7.7 oz/a
Aug 5	Mustang Max (zetamethrin)	4 oz/a
Aug 9	Lannate (methomyl)	1.2 pt/acre
Aug 12	Baythroid (B-cyfluthrin)	2.8 oz-prod/acre
Aug 15	Warrior (lambda cyhalothrin)	2.2 oz-prod/acre

Table 9. Basin ear quality characteristics as affected by HPPD herbicides and combinations, HAREC, 2011.

Tr.	Herbicide[1]	Ear quality characteristics							
		Basin				GSS1477			
		Weight (lbs)	Length (in)	Diameter (in)	Rows (no)	Weight (oz)	Length (in)	Diameter (in)	Rows (no)
1	LA	0.69defg	8.9cd	1.91cd	16.7abc	0.77abcd	7.96abcd	2.05ab	18.2ab
2	LAD	0.74abcd	9.06abcd	1.96abc	16.9abc	0.79ab	8.14ab	2.05abc	18.6a
3	LAS	0.70bcdefg	9.01abcd	1.93abcd	16.9abc	0.80a	7.89abcd	2.07a	18.5a
4	LAB	0.69cdefg	9.14abc	1.94abc	16.5abcd	0.77abcd	7.99abcd	2.03abcd	17.9abc
5	LASB	0.69cdefg	9.11abc	1.93abcd	16.9abc	0.75bcdef	8.05abc	2.02abcde	17.1bc
6	LABB	0.68efg	9.00abcd	1.90cd	16.7abc	0.75bcdef	7.88abcd	2.03abcd	17.9abc
7	LADS	0.76a	9.21ab	2.00a	17.0ab	0.78abc	8.02abcd	2.04abc	17.9abc
8	LADB	0.71abcdef	9.05abcd	1.96abc	17.2ab	0.77abcd	7.94abcd	2.01abcdef	17.6abc
9	LADSB	0.70bcdefg	9.00abcd	1.92bcd	16.5abcd	0.74cdef	7.96abcd	1.96ef	17.7abc
10	LADBB	0.71bcdefg	9.12abc	1.94abc	17.2ab	0.75bcdef	7.80bcd	2.02abcdef	17.7abc
11	LAO	0.75ab	9.23a	1.99ab	17.0ab	0.77abcd	7.78bcd	2.02abcde	17.8abc
12	LASO	0.74abc	9.06abcd	1.99ab	17.0ab	0.78abc	7.93abcd	2.05ab	17.0ab
13	LABO	0.70bcdefg	9.13abc	1.91cd	16.8abc	0.73def	7.77bcd	1.99bcdef	17.4abc
14	CA	0.72abcde	8.80d	1.93bcd	17.4a	0.75bcdef	7.79bcd	2.01abcdef	17.2bc
15	CAD	0.72abcde	9.09abc	1.94abc	16.7abc	0.79ab	7.83abcd	2.07a	16.8c
16	CAS	0.68efg	8.98abcd	1.93abcd	16.7abc	0.76abcde	7.88abcd	2.02abcdef	18.6a
17	CAB	0.71abcdef	9.09abc	1.95abc	16.6abcd	0.75bcdef	7.83abcd	1.99bcdef	17.6abc
18	CASB	0.66g	8.95bcd	1.91cd	16.2bcd	0.75bcdef	7.73cd	2.02abcdef	18.1ab
19	CABB	0.66fg	8.91cd	1.86d	15.7d	0.74cdef	7.80bcd	1.98cdef	17.2bc
20	CADS	0.73abcde	9.14abc	1.96abc	16.8abc	0.75bcdef	7.94abcd	2.03abcd	17.5abc
21	CADB	0.70bcdefg	8.91cd	1.95abc	17.0ab	0.76abcdef	7.84abcd	2.00bcdef	18.5a
22	CADSB	0.68efg	8.98abcd	1.91cd	16.4abcd	0.72ef	8.19a	1.95f	17.1bc
23	CADBB	0.69defg	9.08abc	1.92bcd	16.0cd	0.71f	7.67d	1.97def	16.9c
24	Check	0.69cdefg	9.01abcd	1.93bcd	16.7abc	0.75bcdef	7.95abcd	2.03abcd	16.7abc
	P>F	0.0001	0.0001	0.0001	0.0001	0.0001	0.01	0.0001	0.0001

[1] Herbicides (all at V2 growth stage except BB at both V2 and V6 growth stage):

L=Laudis at 3 oz/a + 1% v/v MSO + 1.5 qt/a UAN32
C=Callisto at 3 oz/a + 1% v/v COC
A=Atrazine at 0.5 lb ai/a
D=Dual Magnum at 1.43 lb ai/A
S=Sandea at 0.047 lb ai/A
O=Outlook at 0.94 lb ai/A
B=Basagran at 1 lb ai/A
BB= Basagran at 1 lb ai/A at V and V6 growth stages

Means followed by different letters significantly different at P≥0.01 (Duncan's MRT)

.

Table 10. Sweet corn plant height and yield as affected by cultivar and HPPD herbicides and combinations, HAREC, 2011.

Treatment	Plant height	Number ears/plot	Ear weight	Husked weight
Herbicide[1]	*in*		*lbs*	
LA	37.4abc	22.9	21.6	15.2
LAD	39.5a	28.4	27.6	20.3
LAS	37.1abc	23.8	22.8	16.9
LAB	36.4abc	24.1	23.9	16.9
LASB	33.4cde	26.6	24.4	19.0
LABB	36.9abc	28.3	26.0	18.8
LADS	35.4abc	24.1	23.8	17.6
LADB	34.6bcd	23.4	23.4	16.3
LADSB	30.6de	31.4	28.5	19.8
LADBB	35.2abc	28.3	27.4	19.8
LAO	36.3abc	31.8	30.2	20.9
LASO	35.0bc	33.6	30.7	23.0
LABO	35.5abc	26.1	24.4	18.3
CA	38.4ab	31.6	29.0	21.8
CAD	36.1abc	25.4	24.7	17.3
CAS	34.8bcd	27.6	26.0	20.1
CAB	34.3bcde	31.0	28.5	20.5
CASB	33.7cde	25.9	24.4	17.4
CABB	34.4bcde	26.6	24.6	18.2
CADS	35.5abc	29.0	28.1	21.4
CADB	34.6bcd	26.4	25.0	17.9
CADSB	30.2e	31.0	27.7	19.5
CADBB	30.5de	26.5	22.9	17.2
Check	36.7abc	31.3	30.5	22.0
P>F	0.0001	0.5599	0.4046	0.4507
Cultivar				
Basin	35.4	28.8	26.9	18.8
GSS1477	34.8	26.6	25.3	19.2
P>F	0.2702	0.0876	0.1310	0.4507
Cultivar X Herbicide	0.9036	0.0852	0.0175	0.0620

[1] Herbicides (all at V2 growth stage except BB at both V2 and V6 growth stage):

L=Laudis at 3 oz/a + 1% v/v MSO + 1.5 qt/a UAN32
C=Callisto at 3 oz/a + 1% v/v COC
A=Atrazine at 0.5 lb ai/a
D=Dual Magnum at 1.43 lb ai/A
S=Sandea at 0.047 lb ai/A
O=Outlook at 0.94 lb ai/A
B=Basagran at 1 lb ai/A
BB= Basagran at 1 lb ai/A at V2 and V6 growth stages.

Means followed by different letters significantly different at P≥0.01 (Duncans MRT)

Table 11. Sweet corn unhusked ear weight as affected by cultivar and HPPD herbicide combination interactions, HAREC, 2011.

Herbicide	Cultivar	
	Basin	GSS1477
	Weight (lbs)	
LA	21.6	15.2
LAD	27.6	20.3
LAS	22.8	16.9
LAB	23.9	16.9
LASB	24.4	19.0
LABB	26.0	18.8
LADS	23.8	17.6
LADB	23.4	16.3
LADSB	28.5	19.8
LADBB	27.4	19.8
LAO	30.2	20.9
LASO	30.7	23.0
LABO	24.4	18.3
CA	29.0	21.8
CAD	24.7	17.3
CAS	26.0	20.1
CAB	28.5	20.5
CASB	24.4	17.4
CABB	24.6	18.2
CADS	28.1	21.4
CADB	25.0	17.9
CADSB	27.7	19.5
CADBB	22.9	17.2
Check	30.5	22.0
P>F	0.1205	0.1374

[1] Herbicides (all at V2 growth stage except BB at both V2 and V6 growth stage):

L=Laudis at 3 oz/a + 1% v/v MSO + 1.5 qt/a UAN32
C=Callisto at 3 oz/a + 1% v/v COC
A=Atrazine at 0.5 lb ai/a
D=Dual Magnum at 1.43 lb ai/A
S=Sandea at 0.047 lb ai/A
O=Outlook at 0.94 lb ai/A
B=Basagran at 1 lb ai/A
BB= Basagran at 1 lb ai/A at V2 and V6 growth stages.

Means followed by different letters significantly different at P≥0.01 (Duncans MRT)

Objective 3. Evaluate strategies to improve flame weeding efficacy in high-residue systems.

Sweet corn was planted at 4 sites at the OSU Veg research farm. Flame weeding was applied VE, V1 or at both times to 10 by 50 foot plots replicated 4 times. Treatments included application of flame weeding with water applied with spray nozzles mounted in front of the flamer. Weeds between the rows were controlled with cultivation in a 12 inch band. Weed density was recorded in the row after the last flaming at V6, and corn harvested to determine the impact of flame weeding on corn yield.

Results. Flame weeding reduced weed density by about half. A doubling of propane delivery improved efficacy in EXP II but seemed to have little if any effect on weed density in EXP I. the addition of a film of water applied in front of the flamer appeared to have little if any effect on flame efficacy in some trials, but no effect in others. However, water applied in front of the flame in a very dry strip-till setting significantly reduced the number of ignition points.

Table 12. Effect of flame rate, timing and water film on efficacy.

Experiment	Treat code	Propone rate	Spray of water in front of flame @ 3 mph	Obs	Broadleaf weeds	Grass weeds
		PSI	*gpm*		*no/m sq*	
Exp I	Check	-	-	12	49.3	1.5
Exp I	PSI10+W	10	2	12	24.8	1.5
Exp I	PSI10-W	10	2	12	29.1	0.9
Exp I	PSI20+W	20	2	12	21.7	1.1
Exp I	PSI20-W	20	2	12	20.8	0.7
Exp II	Check	-	-	12	44.08	1.67
Exp II	P10/8001(+W)	10	1	12	24.50	0.58
Exp II	P10/8002(+W)	10	2	12	23.83	1.58
Exp II	P20/8001(+W)	20	1	12	11.33	1.42
Exp II	P20/8002(+W)	20	2	12	13.50	0.75

+W, water applied with spray nozzles in front of the flame weeder.

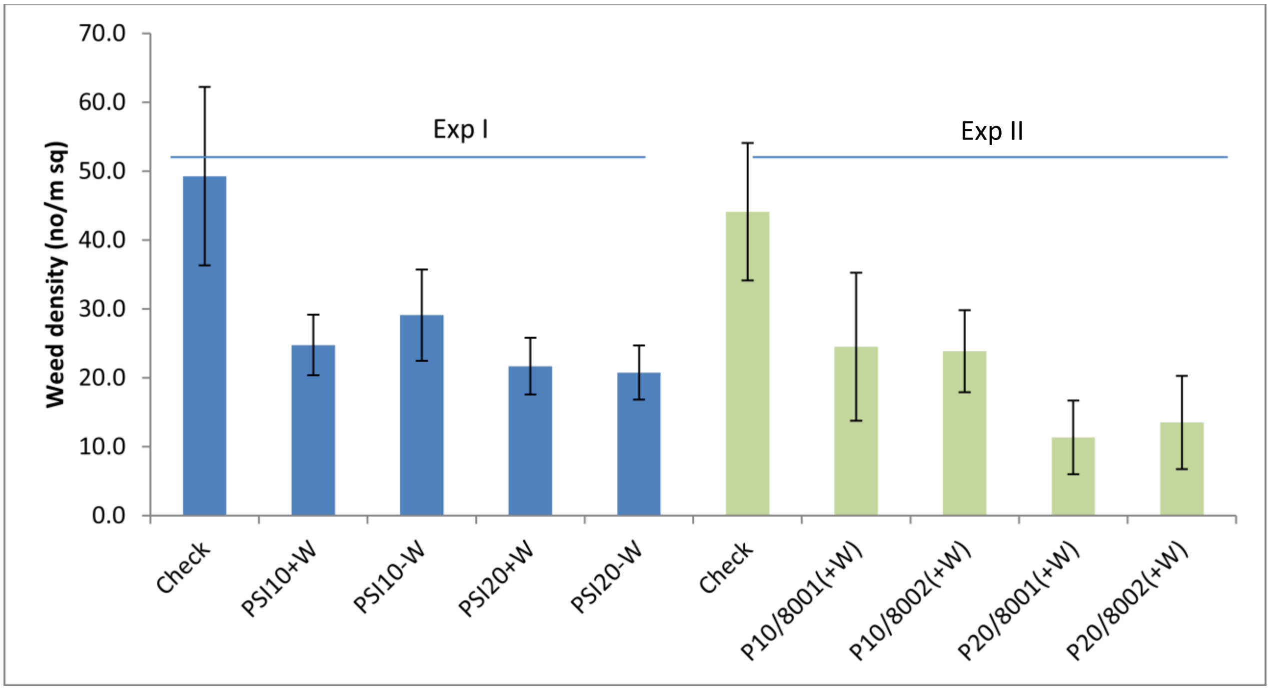

Figure 5. Flame delivery rate and water effects on weed survival in the corn row. See table above for treatment description.