Weed Control in Horticultural Crops

Sweet corn herbicide weed management trial at Waseca, MN - 2004. Becker, Roger L., Vincent A. Fritz, James B. Hebel, Douglas W. Miller, and Bradley D. Kinkaid. The objective of this experiment was to evaluate weed management systems with preemergence and postemergence herbicides in conventional sweet corn. This study was conducted on a Webster clay loam soil. The plot area was fertilized with 140 lb/A nitrogen. A randomized complete block design with three reps was utilized. Plots were 10 feet by 25 feet (4 rows). 'GH 2547' and 'GH 2298' sweet corn were seeded (two row subplots per plot) at 22,000 plants/A on May 28, 2004. Herbicide application data are provided below. Corn was harvested from a 20 foot row within each plot/subplot. Total ear yield, husked ear yield, and kernel yield were determined. In addition, total ears, 'usable' ears, average ear length, and average ear diameter were measured. Usable ears are defined as ears suitable for use as frozen corn-on-the-cob product. Weed control, injury, and yield data are provided in the tables below.

Application Data

Treatment	Preemergence	Postemergence
Date	6/03/04	6/21/04
Air Temp (°F)	74	72
Wind (mph)	NE 8	NW 12
Sky	partly sunny	partly cloudy
Grassy weeds		
Size	--	up to 3 inches
Broadleaf weeds		
Size	--	up to 4 inches
Rainfall before Application		
Week 1 (inch)	1.32	0.15
Rainfall after Application		
Week 1 (inch)	2.47	0.37
Week 2 (inch)	2.85	--

In general, weed control was excellent with little crop injury with herbicide use as labeled. There were specific cases known to pose challenges towards sweet corn tolerance that will be discussed. Weed populations in the test site were giant foxtail, common lambsquarter, and common cocklebur, in decreasing order of presence coupled with very sporadic populations of redroot pigweed, giant ragweed and velvetleaf. Redroot pigweed, giant ragweed and velvetleaf were rated but results are not shown as they did not provide meaningful comparisons. Even the common lambsquarter and common cocklebur pressures were at a low enough level that virtually every treatment gave adequate control including treatments that are known to need additional package mix or tank mix partners to provide complete broadleaf control if population densities of these broadleaf weeds were high. Giant foxtail control was good to excellent and population densities high enough that lack of giant foxtail control in the weedy checks caused severe yield reduction in both sweet corn varieties. Generally speaking the postemergence grass herbicide treatments with nicosulfuron or foramsulfuron provided equal to or slightly better giant foxtail control than did metolachlor applied preemergence.

Crop injury was compared on a known sulfonylurea susceptible hybrid, GH2298 and on a known sulfonylurea tolerant variety GH2547. The key treatment to ascertain sulfonylurea tolerance would be halosulfuron at 0.016 lbs ai/A in which case sulfonylurea injury including growth reduction, leaf curl, and leaf crinkling at the leaf-collar margin were expressed in GH2298, the sulfonylurea susceptible hybrid. Overall, the most notable crop injury occurred with treatments to determine if an aggressive surfactant loading could be used with foramsulfuron tank-mixed with growth regulator herbicides. The sulfonylurea susceptible GH2298 variety showed significant growth regulator injury when tank mixed with foramsulfuron + MSO and 28% N. This injury was expressed as growth reduction, leaf curl and buggy whip, and leaf crinkling at the leaf-collar margins. Leaf curling was severe with all growth regulator products applied with the aggressive

surfactant loading with foramsulfuron, with injury caused by 2,4-D equaling that of diflufenzopyr & dicamba, both being slightly more injurious than that which occurred with dicamba. The only notable injury in GH2547, the sulfonylurea tolerant line, was that of the expression of 2,4-D injury when tank mixed with foramsulfuron including the MSO + 28% N surfactants, though not nearly as severe in expression compared with what occurred with the same treatment on the GH2298 sulfonylurea susceptible variety, e.g. 15 vs. 38% leaf curl on the early July 8th ratings, respectively.

Foramsulfuron applied without growth regulator products did not cause injury that would be of concern in the marketplace other than very slight crinkling at the leaf collar area. Interestingly, the same growth regulator herbicides applied postemergence without MSO + 28% N to metolachlor applied preemergence did not result in this growth regulator injury. A caveat, slight, yet statistically significant leaf curling was present at the early evaluation on July 8th with diflufenzopyr & dicamba pkg. applied with a nonionic surfactant, though considerably less than the severe leaf curling/ buggy whip that occurred when applied with the foramsulfuron surfactant loading with MSO + 28% nitrogen. This low level of leaf curling with diflufenzopyr & dicamba pkg. + nonionic surfactant was no longer evident by the July 19th rating. Similar to last year, growth regulator herbicides did not appreciably injure sweet corn when applied postermergence to metolachlor underlays, while these same growth regulators caused serious sweet corn injury when applied postemergence with foramsulfuron + MSO + 28% N. It is apparent that the safening system in foramsulfuron will not adequately safen growth regulators for use on some key sweet corn varieties if the aggressive MSO + 28% nitrogen surfactant loading must be maintained.

Sulfonylurea injury with halosulfuron that was readily evident on the sulfonylurea susceptible GH2298 was barely visible with both the nicosulfuron or foramsulfuron treatments when applied without a growth regulator broadleaf herbicide. Only slight, economically acceptable leaf crinkling in the leaf collar area occurred with nicosulfuron and foramsulfuron applied alone. Carfentrazone caused the typical speckling necrosis on both varieties. A less obvious, but still distinct leaf necrosis occurred with the bentazon & atrazine pkg. mix treatments on both varieties.

The only clear distinction in reduced yield occurred due to giant foxtail competition in the weedy checks with both varieties on all parameters measured, except for ear diameter with GH2547 in which case there were no significant differences. Nuances could be discussed, however, in looking at the data in total, no clear indications of reduced yield could be attributed to any particular herbicide treatment. This included the growth regulator treatments when used with MSO + 28% N which resulted in severe visual injury. (Department of Agronomy and Plant Genetics, University of Minnesota, St. Paul).

Table 1. Sweet corn herbicide weed management trial at Waseca, MN - 2004. Weed control results. (Becker et al.).

Treatment[1]	Rate[1]	Weed Control SETFA 7/8	SETFA 7/19	ABUTH 7/8	ABUTH 7/19	CHEAL 7/8	CHEAL 7/19	XANST 7/8	XANST 7/19
	(lb ai/A)	(%)							
Postemergence									
Nicosulfuron + COC[2] + 28%N[3]	0.031 + 1.0% + 2.5%	98	98	99	99	94	83	91	93
Foramsulfuron + MSO[4] + 28%	0.0328 + 0.94% + 1.88%	99	98	99	94	99	97	88	91
Foramsulfuron + MSO + 28% + mesotrione	0.0328 + 0.94% + 1.88% + 0.063	98	98	99	99	99	99	99	99
Foramsulfuron + MSO + mesotrione	0.0328 + 0.94% + 0.063	98	97	99	99	99	99	99	99
Foramsulfuron + COC + mesotrione	0.0328 + 1.25% + 0.063	98	98	99	99	99	99	99	94
Foramsulfuron + MSO + 28% + atrazine	0.0328 + 0.94% + 1.88% + 1.0	99	98	99	99	99	99	98	99
Foramsulfuron + MSO + 28% + dicamba	0.0328 + 0.94% + 1.88% + 0.25	99	99	99	99	99	99	97	99
Foramsulfuron + MSO + 28% + 2,4-D amine	0.0328 + 0.94% + 1.88% + 0.5	99	99	99	99	99	99	99	99
Foramsulfuron + MSO + 28% + dicamba & diflufenzopyr[5]	0.0328 + 0.94% + 1.88% + 0.129 & 0.051	99	98	99	99	99	99	98	98
(Preemergence) and Postemergence									
(s-metolachlor & benoxacor) + halosulfuron + atrazine + NIS[6]	(1.9) + 0.016 + 0.5 + 0.25%	93	93	99	99	99	99	97	93
(s-metolachlor & benoxacor) + carfentrazone + atrazine + NIS	(1.9) + 0.008 + 0.5 + 0.25%	92	90	99	99	99	99	93	99
(s-metolachlor & benoxacor) + atrazine & bentazon[7] + COC + 28%N	(1.9) + 0.625 & 0.625 + 1.25% + 0.625%	97	95	99	99	99	99	97	99
(s-metolachlor & benoxacor) + dicamba & diflufenzopyr + NIS	(1.9) + 0 0.129 & 0.051 + 0.25%	95	95	99	99	99	99	97	98
(s-metolachlor & benoxacor) + dicamba & diflufenzopyr + NIS	(1.9) + 0 0.186 & 0.074 + 0.25%	95	92	99	99	99	99	98	96
(s-metolachlor & benoxacor) + 2,4-D amine	(1.9) + 0.5	94	93	99	96	99	99	93	99
(s-metolachlor & benoxacor) + dicamba	(1.9) + 0.25	92	85	99	99	99	91	98	92
(s-metolachlor & benoxacor) + mesotrione + atrazine + COC	(1.9) + 0.094 + 0.5 + 0.094 + 0.5 + 1.0%	94	92	99	99	99	98	99	97
Weedy check		--	--	--	--	--	--	--	--
Hand weeded check		100	100	100	100	100	100	100	100
LSD (0.05)		5	5	ns	ns	2	ns	ns	ns

[1] Treatments and rates in parenthesis represent a separate application.
[2] COC = Class Crop Oil Concentrate.
[3] 28%N = 28% UAN fertilizer solution.
[4] MSO = Methylated soy oil.
[5] Premix = Distinct 70WG
[6] NIS = Class Preference nonionic surfactant.
[7] Premix = Laddok S-12.

Table 2. Sweet corn herbicide weed management trial at Waseca, MN - 2004. GH 2547 sweet corn injury. (Becker et al.).

		GH 2547					
		G.R.[1]		Leaf Curl		Chlorosis/Necrosis	Leaf Crinkle
Treatment[2]	Rate[2]	7/8	7/19	7/8	7/19	7/8	7/8
	(lb ai/A)	---------- (%) ----------					
Postemergence							
Nicosulfuron + COC[3] + 28%N[4]	0.031 + 1.0% + 2.5%	0	0	0	0	0	0
Foramsulfuron + MSO[5] + 28%	0.0328 + 0.94% + 1.88%	0	0	0	0	0	0
Foramsulfuron + MSO + 28% + mesotrione	0.0328 + 0.94% + 1.88% + 0.063	0	2	0	0	2	1
Foramsulfuron + MSO + mesotrione	0.0328 + 0.94% + 0.063	0	2	0	0	1	1
Foramsulfuron + COC + mesotrione	0.0328 + 1.25% + 0.063	0	0	0	0	3	1
Foramsulfuron + MSO + 28% + atrazine	0.0328 + 0.94% + 1.88% + 1.0	0	0	0	0	0	0
Foramsulfuron + MSO + 28% + dicamba	0.0328 + 0.94% + 1.88% + 0.25	0	0	1	0	0	2
Foramsulfuron + MSO + 28% + 2,4-D amine	0.0328 + 0.94% + 1.88% + 0.5	1	7	15	4	0	7
Foramsulfuron + MSO + 28% + dicamba & diflufenzopyr[6]	0.0328 + 0.94% + 1.88% + 0.129 & 0.051	0	1	1	0	1	2
(Preemergence) and Postemergence							
(s-metolachlor & CGA-154281) + halosulfuron + atrazine + NIS[7]	(1.9) + 0.016 + 0.5 + 0.25%	0	0	0	0	0	0
(s-metolachlor & CGA-154281) + carfentrazone + atrazine + NIS	(1.9) + 0.008 + 0.5 + 0.25%	0	2	0	0	8	0
(s-metolachlor & CGA-154281) + atrazine & bentazon[8] + COC + 28%N	(1.9) + 0.625 & 0.625 + 1.25% + 0.625%	0	0	0	0	5	2
(s-metolachlor & CGA-154281) + dicamba & diflufenzopyr + NIS	(1.9) + 0 0.129 & 0.051 + 0.25%	0	0	0	0	1	1
(s-metolachlor & CGA-154281) + dicamba & diflufenzopyr + NIS	(1.9) + 0 0.186 & 0.074 + 0.25%	0	0	0	0	2	0
(s-metolachlor & CGA-154281) + 2,4-D amine	(1.9) + 0.5	0	1	0	0	0	0
(s-metolachlor & CGA-154281) + dicamba	(1.9) + 0.25	0	2	0	0	0	0
(s-metolachlor & CGA-154281) + mesotrione + atrazine + COC	(1.9) + 0.094 + 0.5 + 0.094 + 0.5 + 1.0%	0	0	0	0	0	0
Weedy check		0	0	0	0	0	0
Hand weeded check		0	0	0	0	0	0
LSD (0.05)		ns	ns	2	1	4	2

[1] G.R. = Growth reduction.
[2] Treatments and rates in parenthesis represent a separate application.
[3] COC = Class Crop Oil Concentrate.
[4] 28%N = 28% UAN fertilizer solution.
[5] MSO = Methylated soy oil.
[6] Premix = Distinct 70WG
[7] NIS = Class Preference nonionic surfactant.
[8] Premix = Laddok S-12.

Table 3. Sweet corn herbicide weed management trial at Waseca, MN - 2004. GH 2298 sweet corn injury. (Becker et al.).

		GH 2298					
		G.R.[1]		Leaf Curl		Chlorosis/Necrosis	Leaf Crinkle
Treatment[2]	Rate[2]	7/8	7/19	7/8	7/19	7/8	7/8
	(lb ai/A)	---------- (%) ----------					
Postemergence							
Nicosulfuron + COC[3] + 28%N[4]	0.031 + 1.0% + 2.5%	0	0	1	0	0	6
Foramsulfuron + MSO[5] + 28%	0.0328 + 0.94% + 1.88%	0	0	0	0	0	1
Foramsulfuron + MSO + 28% + mesotrione	0.0328 + 0.94% + 1.88% + 0.063	0	0	1	0	1	4
Foramsulfuron + MSO + mesotrione	0.0328 + 0.94% + 0.063	0	2	0	0	2	1
Foramsulfuron + COC + mesotrione	0.0328 + 1.25% + 0.063	0	0	0	0	1	1
Foramsulfuron + MSO + 28% + atrazine	0.0328 + 0.94% + 1.88% + 1.0	0	0	0	0	1	0
Foramsulfuron + MSO + 28% + dicamba	0.0328 + 0.94% + 1.88% + 0.25	2	8	29	5	0	13
Foramsulfuron + MSO + 28% + 2,4-D amine	0.0328 + 0.94% + 1.88% + 0.5	7	12	38	6	0	16
Foramsulfuron + MSO + 28% + dicamba & diflufenzopyr[6]	0.0328 + 0.94% + 1.88% + 0.129 & 0.051	0	3	35	7	2	17
(Preemergence) and Postemergence							
(s-metolachlor & CGA-154281) + halosulfuron + atrazine + NIS[7]	(1.9) + 0.016 + 0.5 + 0.25%	4	9	9	5	0	11
(s-metolachlor & CGA-154281) + carfentrazone + atrazine + NIS	(1.9) + 0.008 + 0.5 + 0.25%	0	2	0	0	11	0
(s-metolachlor & CGA-154281) + atrazine & bentazon[8] + COC + 28%N	(1.9) + 0.625 & 0.625 + 1.25% + 0.625%	0	0	0	0	7	1
(s-metolachlor & CGA-154281) + dicamba & diflufenzopyr + NIS	(1.9) + 0 0.129 & 0.051 + 0.25%	0	0	0	0	0	0
(s-metolachlor & CGA-154281) + dicamba & diflufenzopyr + NIS	(1.9) + 0 0.186 & 0.074 + 0.25%	0	0	4	2	2	3
(s-metolachlor & CGA-154281) + 2,4-D amine	(1.9) + 0.5	0	2	2	0	0	2
(s-metolachlor & CGA-154281) + dicamba	(1.9) + 0.25	0	3	0	0	0	2
(s-metolachlor & CGA-154281) + mesotrione + atrazine + COC	(1.9) + 0.094 + 0.5 + 0.094 + 0.5 + 1.0%	0	0	0	0	2	0
Weedy check		0	0	0	0	0	0
Hand weeded check		0	0	0	0	0	0
LSD (0.05)		2	5	4	3	3	4

[1] G.R. = Growth reduction.
[2] Treatments and rates in parenthesis represent a separate application.
[3] COC = Class Crop Oil Concentrate.
[4] 28%N = 28% UAN fertilizer solution.
[5] MSO = Methylated soy oil.
[6] Premix = Distinct 70WG
[7] NIS = Class Preference nonionic surfactant.
[8] Premix = Laddok S-12.

Table 4. Sweet corn herbicide weed management trial at Waseca, MN - 2004. GH 2547 sweet corn yield. (Becker et al.).

Treatment[1]	Rate[1]	GH 2547 Total Yield	Husked Yield	Kernel Yield	Total Ears	Usable Ears	Ear Length	Ear Diameter
	(lb ai/A)	--------- (ton/A) ----------			----- (#/A) -----		(inch)	(cm)
Postemergence								
Nicosulfuron + COC[2] + 28%N[3]	0.031 + 1.0% + 2.5%	6.9	4.7	3.1	3856	2137	7.7	4.6
Foramsulfuron + MSO[4] + 28%	0.0328 + 0.94% + 1.88%	6.3	4.3	3.0	3578	1905	7.6	4.6
Foramsulfuron + MSO + 28% + mesotrione	0.0328 + 0.94% + 1.88% + 0.063	8.3	5.8	4.0	4042	2927	8.0	4.7
Foramsulfuron + MSO + mesotrione	0.0328 + 0.94% + 0.063	6.1	4.2	2.7	3671	1998	7.7	4.6
Foramsulfuron + COC + mesotrione	0.0328 + 1.25% + 0.063	6.7	4.5	3.1	3671	2137	7.6	4.6
Foramsulfuron + MSO + 28% + atrazine	0.0328 + 0.94% + 1.88% + 1.0	6.5	4.4	3.0	3485	2370	7.8	4.6
Foramsulfuron + MSO + 28% + dicamba	0.0328 + 0.94% + 1.88% + 0.25	7.0	5.0	3.4	3996	2602	7.7	4.7
Foramsulfuron + MSO + 28% + 2,4-D amine	0.0328 + 0.94% + 1.88% + 0.5	6.3	4.6	3.2	4042	2044	7.1	4.7
Foramsulfuron + MSO + 28% + dicamba & diflufenzopyr[5]	0.0328 + 0.94% + 1.88% + 0.129 & 0.051	7.1	5.1	3.6	4089	2463	7.5	4.7
(Preemergence) and Postemergence								
(s-metolachlor & CGA-154281) + halosulfuron + atrazine + NIS[6]	(1.9) + 0.016 + 0.5 + 0.25%	5.7	3.8	2.5	3113	2091	7.6	4.6
(s-metolachlor & CGA-154281) + carfentrazone + atrazine + NIS	(1.9) + 0.008 + 0.5 + 0.25%	7.5	5.1	3.5	3949	2974	7.7	4.8
(s-metolachlor & CGA-154281) + atrazine & bentazon[7] + COC + 28%N	(1.9) + 0.625 & 0.625 + 1.25% + 0.625%	6.4	4.4	2.9	3810	1905	7.7	4.6
(s-metolachlor & CGA-154281) + dicamba & diflufenzopyr + NIS	(1.9) + 0 0.129 & 0.051 + 0.25%	6.5	4.6	3.3	3438	2602	7.7	4.7
(s-metolachlor & CGA-154281) + dicamba & diflufenzopyr + NIS	(1.9) + 0 0.186 & 0.074 + 0.25%	5.8	4.0	2.4	3531	1812	7.6	4.6
(s-metolachlor & CGA-154281) + 2,4-D amine	(1.9) + 0.5	6.6	4.6	3.2	3810	2370	7.7	4.7
(s-metolachlor & CGA-154281) + dicamba	(1.9) + 0.25	5.9	4.0	2.7	3392	1998	7.5	4.6
(s-metolachlor & CGA-154281) + mesotrione + atrazine + COC	(1.9) + 0.094 + 0.5 + 0.094 + 0.5 + 1.0%	7.5	5.1	3.5	3764	2927	7.9	4.7
Weedy check		2.9	1.7	1.0	2184	372	6.7	4.5
Hand weeded check		6.0	4.0	2.5	3531	1905	7.6	4.7
LSD (0.05)		1.9	1.3	1.0	ns	1032	0.4	ns

[1] Treatments and rates in parenthesis represent a separate application.
[2] COC = Class Crop Oil Concentrate.
[3] 28%N = 28% UAN fertilizer solution.
[4] MSO = Methylated soy oil.
[5] Premix = Distinct 70WG
[6] NIS = Class Preference nonionic surfactant.
[7] Premix = Laddok S-12.

Table 5. Sweet corn herbicide weed management trial at Waseca, MN - 2004. GH 2298 sweet corn yield. (Becker et al.).

Treatment[1]	Rate[1]	GH 2298 Total Yield	Husked Yield	Kernel Yield	Total Ears	Usable Ears	Ear Length	Ear Diameter
	(lb ai/A)	--------- (ton/A) ----------			----- (#/A) -----		(inch)	(cm)
Postemergence								
Nicosulfuron + COC[2] + 28%N[3]	0.031 + 1.0% + 2.5%	5.7	4.3	2.8	3717	2834	7.6	4.5
Foramsulfuron + MSO[4] + 28%	0.0328 + 0.94% + 1.88%	6.0	4.5	2.9	3949	2788	8.0	4.5
Foramsulfuron + MSO + 28% + mesotrione	0.0328 + 0.94% + 1.88% + 0.063	3.4	2.6	1.6	2416	1580	7.4	4.4
Foramsulfuron + MSO + mesotrione	0.0328 + 0.94% + 0.063	4.8	3.7	2.4	3299	2323	7.6	4.5
Foramsulfuron + COC + mesotrione	0.0328 + 1.25% + 0.063	4.7	3.5	2.2	3206	2044	7.6	4.5
Foramsulfuron + MSO + 28% + atrazine	0.0328 + 0.94% + 1.88% + 1.0	5.5	4.2	2.6	3624	2602	7.8	4.4
Foramsulfuron + MSO + 28% + dicamba	0.0328 + 0.94% + 1.88% + 0.25	4.9	3.7	2.4	3578	2509	7.6	4.4
Foramsulfuron + MSO + 28% + 2,4-D amine	0.0328 + 0.94% + 1.88% + 0.5	4.5	3.4	2.1	3717	1859	7.3	4.4
Foramsulfuron + MSO + 28% + dicamba & diflufenzopyr[5]	0.0328 + 0.94% + 1.88% + 0.129 & 0.051	5.0	3.7	2.4	3949	1905	7.3	4.4
(Preemergence) and Postemergence								
(s-metolachlor & CGA-154281) + halosulfuron + atrazine + NIS[6]	(1.9) + 0.016 + 0.5 + 0.25%	5.3	3.9	2.6	3438	2509	7.9	4.4
(s-metolachlor & CGA-154281) + carfentrazone + atrazine + NIS	(1.9) + 0.008 + 0.5 + 0.25%	5.5	4.2	2.7	3531	2555	7.8	4.5
(s-metolachlor & CGA-154281) + atrazine & bentazon[7] + COC + 28%N	(1.9) + 0.625 & 0.625 + 1.25% + 5.9 0.625%	5.9	4.4	2.8	3949	2881	7.8	4.5
(s-metolachlor & CGA-154281) + dicamba & diflufenzopyr + NIS	(1.9) + 0 0.129 & 0.051 + 0.25%	5.5	4.3	2.8	3671	2695	7.7	4.5
(s-metolachlor & CGA-154281) + dicamba & diflufenzopyr + NIS	(1.9) + 0 0.186 & 0.074 + 0.25%	5.3	4.1	2.8	3531	2602	7.6	4.5
(s-metolachlor & CGA-154281) + 2,4-D amine	(1.9) + 0.5	4.4	3.5	2.2	3160	2416	7.6	4.4
(s-metolachlor & CGA-154281) + dicamba	(1.9) + 0.25	4.3	3.3	2.0	3252	1998	7.4	4.3
(s-metolachlor & CGA-154281) + mesotrione + atrazine + COC	(1.9) + 0.094 + 0.5 + 0.094 + 0.5 + 1.0%	4.0	3.0	1.9	2834	1859	7.5	4.5
Weedy check		1.4	1.0	0.6	1347	232	6.1	4.1
Hand weeded check		4.0	3.1	2.0	3020	1812	7.5	4.5
LSD (0.05)		1.6	1.2	0.9	763	903	0.5	0.15

[1] Treatments and rates in parenthesis represent a separate application.
[2] COC = Class Crop Oil Concentrate.
[3] 28%N = 28% UAN fertilizer solution.
[4] MSO = Methylated soy oil.
[5] Premix = Distinct 70WG
[6] NIS = Class Preference nonionic surfactant.
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