

CCBB21PRE Safety and Efficacy

Crop safety and weed control from directed vs. broadcast applications of preemergence herbicides in containers.

Objectives:

To test the efficacy and crop safety of spray-applied preemergence herbicides applied broadcast over the top vs. directed applications using a prototype mechanized sprayer (CCBB).

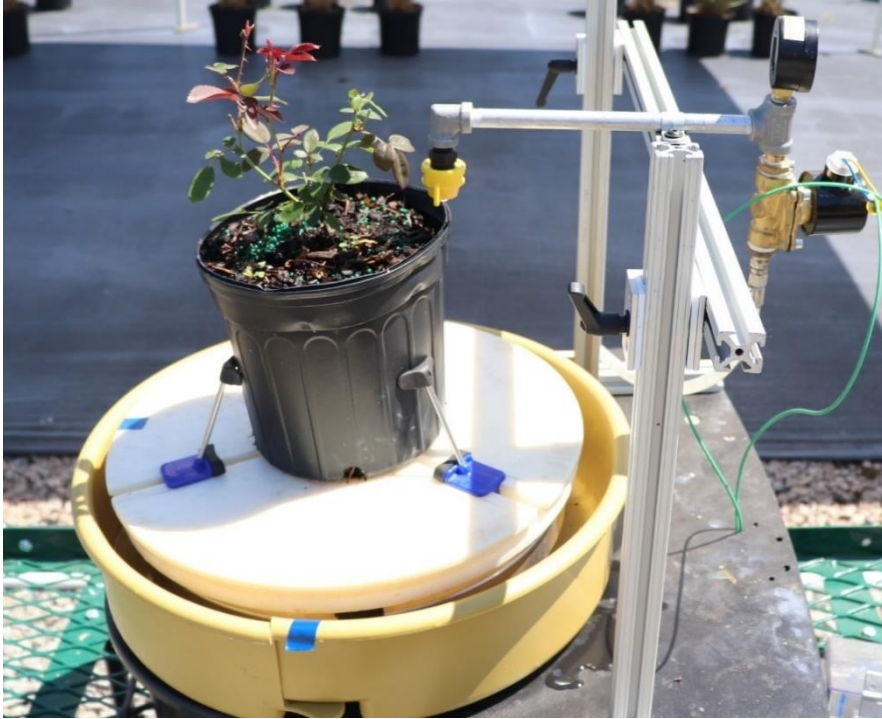
Summary

Rooted cuttings of *Hydrangea macrophylla* 'Bloomstruck', *Thuja* x 'Green Giant' (arborvitae), and *Rosa* x 'Knockout double red' were potted on August 12, 2021 into 4-L plastic pots using hammer milled pine bark substrate amended with lime. Pots hand watered to settle the substrate, then top dressed with 19 g of Harrells slow release nursery fertilizer. All plants were cut to uniform heights after potting. Additional pots were filled with substrate for weed control evaluations; 19 g fertilizer per pot was manually incorporated into the top inch of substrate then hand watered to settle the substrate. Thereafter pots were overhead irrigated daily with about 0.6 inches of water applied in 3 equal cycles, early morning, mid-day and late afternoon.

On September 3, herbicides were applied either with an over-the-top broadcast spray or as directed sprays using a prototype spray system (CCBB). The interval between potting and herbicide applications was intentional to simulate a delayed PRE application. Broadcast applications were made with a CO₂ sprayer equipped with TeeJet 8006 flat fan nozzles and calibrated to deliver 30 GPA. CCBB applications utilized a single TeeJet UB8501 off-center fan nozzle operating at 14.5 psi and positioned 2.5 cm above the substrate surface. See photos below. This configuration had previously been shown to provide a uniform application of spray to the surface of the substrate in a 4-L pot. The sprayer operating parameters were:

- Rotational speed: 60 rpm;
- Spray duration: 2 rotations (120 seconds)
- Pressure: 14.5 psi
- Calibration volume: 8.7 ml (average of 10 test runs of 2 rotations. @ 14.5 psi)
- Target spray volume: 350 GPA

Herbicide treatments included flumioxazin (Sureguard SC) at 0.375 lb ai/A; indaziflam (Marengo SC) at 0.06 lb ai/A, and isoxaben + prodiamine (Gallery + Barricade) at 1 + 0.75 lb ai/A. Each herbicide was applied as a broadcast spray or a directed application with CCBB system. Treated pots, including substrate-only containers for weed control evaluations, were arranged in a randomized complete block design with 6 replicates. Pots were irrigated about 2 hours after herbicide applications. Substrate-only pots were then surface seeded with either *Euphorbia maculata* (spotted spurge) or *Cardamine flexuosa* (flexuous bittercress), one pot of each species in each experimental unit.



The prototype sprayer. The base plate rotational speed and spray duration are controlled with an Arduino.



A single off-center flat fan nozzle was positioned 2.5 cm above the substrate and at the edge of the pot. The distal edge of the spray pattern reached the base of the stem in the center of the pot.



Preemergence herbicide safety and efficacy experiment; photo taken about 2 months after herbicide applications. Treatments were arranged in RCBD with 6 replicates, one pot of each crop and weed species per experimental unit.

Percent injury to crop plants was visually evaluated weekly using a subjective scale where 0 = no injury (visually indistinguishable from nontreated plants) and 10 = 100% necrosis. At the one-week evaluation, intermediate values were based on a percent of the existing foliage that was necrotic. Subsequently, the intermediate values were visual estimates of the percent reduction in living above-ground biomass compared to nontreated plants. Above ground fresh weights of hydrangeas, roses and weeds were recorded 54 days after herbicide applications. Arborvitae plant heights were measured on the same day. Data were subjected to analysis of variance and means separated using an LSD procedure with $\alpha = 0.05$. Paired comparisons for testing spray application method (broadcast vs. directed) were conducted using a general linear models procedure in SAS.

Results

When applied as a broadcast spray, all herbicides severely injured hydrangea and caused some damage to new growth on roses, but no injury was observed on arborvitae. Injury symptoms were visible within 2 days for flumioxazin and within one week for both isoxaben + proflam and for indaziflam. By 12 days after application, flumioxazin had caused about 70% foliar and tip necrosis on rose; indaziflam or isoxben + proflam caused 20 to 25% injury to the new growth (Table 1 and photos below). In contrast, no visible injury to crop plants was observed with directed applications of indaziflam or isoxaben + proflam using the CCBB applicator. Directed applications of flumioxazin damaged a few lower leaves contacted by the spray but otherwise plants appeared uninjured by CCBB applications.

Hydrangea plants did not recover from broadcast herbicide applications (Table 2 and photos that follow). By 54 days after application, rose plants did recover from a single broadcast application of indaziflam. However, rose plants treated with a broadcast application of isoxaben + proflam were marginally smaller than those receiving the same herbicides as a directed spray ($P < 0.077$). Rose did not recover from broadcast flumioxazin treatments, but were uninjured by directed application. Height of arborvitae plants was unaffected by herbicide treatments.

Although there were differences in weed control between herbicides, there were no differences between broadcast or directed sprays (Table 2).



Gallery + Barricade applied over the top (left) and as a directed spray using the CCBB sprayer. Photo taken 2 weeks after application.



Indaziflam applied over the top (left) and as a directed spray using the CCBB sprayer. Photo taken 2 weeks after application.



Flumioxazin applied over the top (left) and as a directed spray using the CCBB sprayer. Photo taken 2 weeks after application.



Rose treated with flumioxazin broadcast (left) or directed with the CCBB spray system (right).



Indaziflam applied over the top (left) injured the new growth on roses; but directed applications with the CCBB sprayer caused no visible injury. Photo: 2 weeks after application.

Table 1. Means and analysis of variance for paired comparisons of broadcast vs. directed applications – crop injury 12 days after application (DAA) and weed control 30 DAA

Herbicide	Application	% injury, 12 DAA		% Control 30 DAA	
		Hydrangea	Rose	Spurge	Bittercress
Indaziflam	Broadcast	73 b	25 b	97 a	91 bc
	Directed	3 d	2 c	94 a	87 c
Flumioxazin	Broadcast	92 a	73 a	100 a	99 a
	Directed	7 d	2 c	100 a	100 a
Isoxaben + prodiamine	Broadcast	38 c	20 b	97 a	93 b
	Directed	5 d	0 c	98 a	91 bc
Nontreated	--	0 d	0 c	0 b	0 d
Paired comparisons for broadcast vs. directed applications, by herbicide		----- P-value for f-test -----			
Indaziflam		<0.001	<0.001	NS	NS
Flumioxazin		<0.001	<0.001	NS	NS
Isoxaben + prodiamine		< 0.003	<0.002	NS	NS

Table 2. Means and analysis of variance for paired comparisons of broadcast vs. directed applications – crop and weed fresh weights 54 days after application.

Herbicide	Application	Fresh weights (g) 54 days after application			
		Hydrangea	Rose	Spurge	Bittercress
Indaziflam	Broadcast	4 c	95 a	3.0 b	15.5 bc
	Directed	43 a	92 ab	4.9 b	22.0 b
Flumioxazin	Broadcast	4 c	37 d	0.0 b	0.0 c
	Directed	42 a	87 abc	0.0 b	0.0 c
Isoxaben + prodiamine	Broadcast	29 b	75 c	2.5 b	4.8 c
	Directed	39 a	90 abc	2.3 b	15.5 bc
Nontreated	--	42 a	78 bc	31.0 a	47.0 a
Paired comparisons for broadcast vs. directed applications, by herbicide		----- P-value for f-test -----			
Indaziflam		<0.001	NS	NS	NS
Flumioxazin		<0.001	NS	NS	NS
Isoxaben + prodiamine		<0.03	0.077	NS	NS



Nontreated (left) vs indaziflam applied broadcast over the top (center) or a directed application with the CCBB prototype sprayer (right).



Nontreated (left) vs isoxaben + prodiamine (Gallery + Barricade) applied broadcast over the top (center) or a directed application with the CCBB prototype sprayer (right).



Nontreated (left) vs flumioxazin (Sureguard) applied broadcast over the top (center) or a directed application with the CCBB prototype sprayer (right).



Flumioxazin (Sureguard) applied over the top (Left) vs. directed using the CCBB prototype sprayer. Significant differences in visual quality and fresh weight were recorded 54 DAA.



Indaziflam applied over the top (left) vs. directed using the CCBB prototype sprayer. No significant differences in visual quality or fresh weight were recorded 54 DAA.



Nontreated, 4 weeks after seeding



Gallery + Barricade
CCBB application

Gallery + Barricade
broadcast spray
application

Experiment #: HFL21PreCCBBappl

Title:	Safety to Container-grown Ornamentals and Efficacy of Preemergence Herbicides Applied Over-the-top or Directed with Prototype Sprayer		
Location	Horticultural Field Laboratory, NCSU, Raleigh, NC		
Soil Type / Substrate:	Parker Bark 'old bark' + lime		
Application Equipment:	CO ₂ -pressurized bottle sprayer; and CCBB spray system		
# and type of nozzle	2 x 8006;	Speed:	3 mph; or
GPA:	1 x UB8501	PSI:	60 rpm, 2
Experimental Design:	30; / 350		rotations
# of Treatments:	RCB	Replicates:	6
Plot Size:	8	Plants / Species / Plot:	1
	3.33' x 7'; or	Planting Date:	8/12/2021
	1 pot sprayed at a time	Pot Size:	4-L
Application Information	Over-the-top CCBB		
Date:	9/3/2021		9/3/2021
Calibration (ml/15 Seconds):	287 @ 22 psi		~8.7 ml/2 rot. @ 14.5 psi
Treatments Applied:	all		
Soil Moisture:	moist		
Soil Condition:	potted ~3 wks prior		
Temperatures (°F):			
Air	76		
Soil Surface/2 Inches/6 Inches	75/76/73		
Sky (% cloud cover)	<5% cloud cover		
Wind Speed (MPH) & Direction:	2-6, W		
First Rain (R) or Irrigation (I):	9/3/2021, ~2 hrs after treatment application		
Amount (Inches) for R or I	~0.2", I		
Crop Status:			
<i>Hydrangea macrophylla</i> 'Bloomstruck'	cut back to 6" tall 3 wks prior; new buds; ~0.5-0.75" new growth		
Arborvitae (<i>Thuja</i> x) 'Green Giant'	cut to 10" tall 3 weeks prior; new buds ~ 1/4" long cut to 6" tall 3 wks prior; some deer damage; variable new growth; all plants w/new bud break to 4" new growth		
<i>Rosa</i> x 'Knockout double-red'	blocked by amount of new growth		
Weed Status:	Surface seeded after irrigation. 30 to 40 seeds per pot		
	Flexuous bittercress, <i>Cardamine flexuosa</i> (CARFL)		
	Spotted spurge, <i>Euphorbia maculata</i> (EPHMA)		

North Carolina State University

Safety to Container-grown Ornamentals and Efficacy of Preemergence Herbicides Applied Over-the-top or Directed with Prototype Sprayer

Trial ID: HFL21PreCCBBappl
Location: HFL

Protocol ID: HFL21PreCCBBappl
Study Director: Neal
Investigator: Joseph C. Neal, Ph.D.

Pest Type										
Crop Name	Hydrangea	Hydrangea	Hydrangea	Hydrangea	Hydrangea	Hydrangea				
Rating Date	9/6/2021	9/9/2021	9/15/2021	9/25/2021	10/3/2021	10/8/2021				
Rating Data Type	PHYGEN	PHYGEN	PHYGEN	PHYGEN	PHYGEN	PHYGEN				
Rating Unit	0-10	0-10	0-10	0-10	0-10	0-10				
Days After First/Last Applic.	3 3	6 6	12 12	22 22	30 30	35 35				
Trt-Eval Interval	3 DA-A	6 DA-A	12 DA-A	22 DA-A	30 DA-A	35 DA-A				
Trt No.	Treatment Name	Form Conc	Form Type	Rate	1	2	3	4	5	6
1	Nontreated				0.0 c	0.0 d	0.0 d	0.0 d	0.0 d	0.00 c
2	Specticle FLO	0.622	FL	0.04 lb ai/a	0.5 b	3.0 b	7.3 b	8.0 b	8.8 b	9.00 a
5	Specticle FLO - CCBB	0.622	FL	0.04 lb ai/a	0.2 bc	0.2 d	0.3 d	0.0 d	0.0 d	0.17 c
3	Sureguard SC	4	SC	0.375 lb ai/a	6.0 a	7.8 a	9.2 a	9.5 a	9.5 a	9.25 a
6	Sureguard SC - CCBB	4	SC	0.375 lb ai/a	0.0 c	0.5 d	0.7 d	0.0 d	0.3 d	0.17 c
4	Gallery SC	4.16	SC	1 lb ai/a	0.2 bc	1.8 c	3.8 c	4.2 c	5.3 c	5.17 b
	Barricade	4	L	0.75 lb ai/a						
7	Gallery SC -- CCBB	4.16	SC	1 lb ai/a	0.0 c	0.0 d	0.5 d	0.3 d	0.2 d	0.33 c
	Barricade	4	L	0.75 lb ai/a						
LSD (P=.05)					0.48	0.57	1.08	0.58	0.50	0.642
Standard Deviation					0.41	0.48	0.92	0.50	0.43	0.544
CV					42.02	25.27	28.8	15.78	12.32	15.82
Bartlett's X2					1.399	5.836	15.215	1.973	3.406	4.357
P(Bartlett's X2)					0.706	0.212	0.019*	0.578	0.492	0.499
Replicate F					0.142	4.356	2.684	1.858	2.658	2.237
Replicate Prob(F)					0.9811	0.0042	0.0404	0.1316	0.0419	0.0764
Treatment F					176.132	209.726	97.462	416.936	626.842	372.992
Treatment Prob(F)					0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

Pest Type										
Crop Name	Hydrangea	Hydrangea	Hydrangea	Arborvitae	Arborvitae	Arborvitae				
Rating Date	10/13/2021	10/27/2021	10/27/2021	9/6/2021	9/9/2021	9/15/2021				
Rating Data Type	PHYGEN	PHYGEN	WEIFRE	PHYGEN	PHYGEN	PHYGEN				
Rating Unit	0-10	0-10	G	0-10	0-10	0-10				
Days After First/Last Applic.	40 40	54 54	54 54	3 3	6 6	12 12				
Trt-Eval Interval	40 DA-A	54 DA-A	54 DA-A	3 DA-A	6 DA-A	12 DA-A				
Trt No.	Treatment Name	Form Conc	Form Type	Rate	7	8	9	10	11	12
1	Nontreated				0.00 c	0.00 c	42.2 a	0.0 a	0.0 a	0.0 a
2	Specticle FLO	0.622	FL	0.04 lb ai/a	8.67 a	9.00 a	4.2 c	0.0 a	0.0 a	0.0 a
5	Specticle FLO - CCBB	0.622	FL	0.04 lb ai/a	0.00 c	0.33 c	43.0 a	0.0 a	0.0 a	0.0 a
3	Sureguard SC	4	SC	0.375 lb ai/a	8.83 a	8.42 a	3.7 c	0.0 a	0.0 a	0.0 a
6	Sureguard SC - CCBB	4	SC	0.375 lb ai/a	0.00 c	0.00 c	42.0 a	0.0 a	0.0 a	0.0 a
4	Gallery SC	4.16	SC	1 lb ai/a	5.50 b	4.33 b	29.3 b	0.0 a	0.0 a	0.0 a
	Barricade	4	L	0.75 lb ai/a						
7	Gallery SC -- CCBB	4.16	SC	1 lb ai/a	0.00 c	0.33 c	39.0 a	0.0 a	0.0 a	0.0 a
	Barricade	4	L	0.75 lb ai/a						
LSD (P=.05)					0.499	0.914	7.44	0.00	0.00	0.00
Standard Deviation					0.424	0.775	6.31	0.00	0.00	0.00
CV					12.89	24.21	21.74	0.0	0.0	0.0
Bartlett's X2					2.209	6.103	15.735	0.0	0.0	0.0
P(Bartlett's X2)					0.331	0.192	0.015*	.	.	.
Replicate F					1.991	0.390	5.742	0.000	0.000	0.000
Replicate Prob(F)					0.1087	0.8516	0.0008	1.0000	1.0000	1.0000
Treatment F					601.106	164.762	47.588	0.000	0.000	0.000
Treatment Prob(F)					0.0001	0.0001	0.0001	1.0000	1.0000	1.0000

Means followed by same letter do not significantly differ (P=.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

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Pest Type					Arborvitae	Arborvitae	Arborvitae	Arborvitae	Arborvitae	Arborvitae
Crop Name										
Rating Date					9/25/2021	10/3/2021	10/8/2021	10/13/2021	10/27/2021	10/27/2021
Rating Data Type					PHYGEN	PHYGEN	PHYGEN	PHYGEN	PHYGEN	HEIGHT
Rating Unit					0-10	0-10	0-10	0-10	0-10	CM
Days After First/Last Applic.					22 22	30 30	35 35	40 40	54 54	54 54
Trt-Eval Interval					22 DA-A	30 DA-A	35 DA-A	40 DA-A	54 DA-A	54 DA-A
Trt No.	Treatment Name	Form Conc	Form Type	Rate Rate Unit	13	14	15	16	17	18
1	Nontreated				0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	27.7 abc
2	Specticle FLO	0.622	FL	0.04 lb ai/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	26.0 c
5	Specticle FLO - CCBB	0.622	FL	0.04 lb ai/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	26.5 bc
3	Sureguard SC	4	SC	0.375 lb ai/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	29.0 a
6	Sureguard SC - CCBB	4	SC	0.375 lb ai/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	28.3 ab
4	Gallery SC	4.16	SC	1 lb ai/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	26.7 bc
	Barricade	4	L	0.75 lb ai/a						
7	Gallery SC -- CCBB	4.16	SC	1 lb ai/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	26.0 c
	Barricade	4	L	0.75 lb ai/a						
LSD (P=.05)					0.00	0.00	0.00	0.00	0.00	2.17
Standard Deviation					0.00	0.00	0.00	0.00	0.00	1.84
CV					0.0	0.0	0.0	0.0	0.0	6.77
Bartlett's X2					0.0	0.0	0.0	0.0	0.0	5.382
P(Bartlett's X2)					0.496
Replicate F					0.000	0.000	0.000	0.000	0.000	2.493
Replicate Prob(F)					1.0000	1.0000	1.0000	1.0000	1.0000	0.0530
Treatment F					0.000	0.000	0.000	0.000	0.000	2.482
Treatment Prob(F)					1.0000	1.0000	1.0000	1.0000	1.0000	0.0454

Pest Type					Rose	Rose	Rose	Rose	Rose	Rose
Crop Name										
Rating Date					9/6/2021	9/9/2021	9/15/2021	9/25/2021	10/3/2021	10/8/2021
Rating Data Type					PHYGEN	PHYGEN	PHYGEN	PHYGEN	PHYGEN	PHYGEN
Rating Unit					0-10	0-10	0-10	0-10	0-10	0-10
Days After First/Last Applic.					3 3	6 6	12 12	22 22	30 30	35 35
Trt-Eval Interval					3 DA-A	6 DA-A	12 DA-A	22 DA-A	30 DA-A	35 DA-A
Trt No.	Treatment Name	Form Conc	Form Type	Rate Rate Unit	19	20	21	22	23	24
1	Nontreated				0.0 c	0.0 d	0.0 c	0.0 c	0.0 c	0.0 c
2	Specticle FLO	0.622	FL	0.04 lb ai/a	1.5 b	2.7 b	2.5 b	1.0 bc	0.5 c	0.8 bc
5	Specticle FLO - CCBB	0.622	FL	0.04 lb ai/a	0.0 c	0.0 d	0.2 c	0.0 c	0.0 c	0.0 c
3	Sureguard SC	4	SC	0.375 lb ai/a	5.0 a	6.2 a	7.3 a	5.5 a	5.2 a	5.2 a
6	Sureguard SC - CCBB	4	SC	0.375 lb ai/a	0.0 c	0.3 d	0.2 c	0.1 c	0.3 c	0.5 bc
4	Gallery SC	4.16	SC	1 lb ai/a	0.5 c	1.7 c	2.0 b	1.3 b	1.8 b	1.3 b
	Barricade	4	L	0.75 lb ai/a						
7	Gallery SC -- CCBB	4.16	SC	1 lb ai/a	0.0 c	0.2 d	0.0 c	0.0 c	0.0 c	0.2 c
	Barricade	4	L	0.75 lb ai/a						
LSD (P=.05)					0.59	0.65	0.58	1.03	0.88	1.15
Standard Deviation					0.50	0.55	0.49	0.87	0.74	0.97
CV					50.24	35.04	28.26	77.05	66.7	85.11
Bartlett's X2					1.225	5.394	7.6	6.811	2.861	8.856
P(Bartlett's X2)					0.542	0.249	0.107	0.078	0.414	0.065
Replicate F					1.132	1.696	2.704	1.509	1.618	1.298
Replicate Prob(F)					0.3650	0.1660	0.0393	0.2179	0.1868	0.2920
Treatment F					81.226	101.492	177.961	31.479	39.075	21.568
Treatment Prob(F)					0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

Means followed by same letter do not significantly differ (P=.05, LSD)
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

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Pest Type					Rose	Rose	Rose	
Crop Name					10/13/2021	10/27/2021	10/27/2021	
Rating Date					PHYGEN	PHYGEN	WEIFRE	
Rating Data Type					0-10	0-10	G	
Rating Unit					40 40	54 54	54 54	
Days After First/Last Applic.					40 DA-A	54 DA-A	54 DA-A	
Trt-Eval Interval								
Trt No.	Treatment Name	Form Conc	Form Type	Rate	Unit	25	26	27
1	Nontreated					0.0 c	0.0 b	77.8 bc
2	Specticle FLO	0.622	FL	0.04	lb ai/a	0.3 bc	0.5 b	95.0 a
5	Specticle FLO - CCBB	0.622	FL	0.04	lb ai/a	0.0 c	0.0 b	92.2 ab
3	Sureguard SC	4	SC	0.375	lb ai/a	6.0 a	4.5 a	37.2 d
6	Sureguard SC - CCBB	4	SC	0.375	lb ai/a	0.3 bc	0.0 b	86.9 abc
4	Gallery SC	4.16	SC	1	lb ai/a	1.0 b	0.5 b	74.7 c
	Barricade	4	L	0.75	lb ai/a			
7	Gallery SC -- CCBB	4.16	SC	1	lb ai/a	0.0 c	0.0 b	90.0 abc
	Barricade	4	L	0.75	lb ai/a			
LSD (P=.05)						0.92	1.20	15.96
Standard Deviation						0.78	1.02	13.52
CV						71.26	129.04	17.09
Bartlett's X2						2.793	10.467	4.718
P(Bartlett's X2)						0.425	0.015*	0.58
Replicate F						1.679	1.608	3.296
Replicate Prob(F)						0.1713	0.1893	0.0177
Treatment F						47.482	15.860	13.040
Treatment Prob(F)						0.0001	0.0001	0.0001

Means followed by same letter do not significantly differ (P=.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

North Carolina State University

Safety to Container-grown Ornamentals and Efficacy of Preemergence Herbicides Applied Over-the-top or Directed with Prototype Sprayer

Trial ID: HFL21PreCCBBappl
Location: HFL

Protocol ID: HFL21PreCCBBappl
Study Director: Neal
Investigator: Joseph C. Neal, Ph.D.

Pest Type					W Weed	W Weed	W Weed	W Weed	W Weed	
Pest Code					EPHMA	EPHMA	EPHMA	EPHMA	EPHMA	
Pest Name					Spotted spu>	Spotted spu>	Spotted spu>	Spotted spu>	Spotted spu>	
Rating Date					9/25/2021	10/3/2021	10/8/2021	10/13/2021	10/27/2021	
Rating Data Type					CONTROL	CONTROL	CONTROL	CONTROL	CONTROL	
Rating Unit					0-10	0-10	0-10	0-10	0-10	
Days After First/Last Applic.					22 22	30 30	35 35	40 40	54 54	
Trt-Eval Interval					22 DA-A	30 DA-A	35 DA-A	40 DA-A	54 DA-A	
Trt No.	Treatment Name	Form Conc	Form Type	Rate	Unit					
1	Nontreated					0.0 b	0.00 b	0.00 b	0.00 b	0.00 b
2	Specticle FLO	0.622	FL	0.04	lb ai/a	9.8 a	9.67 a	9.50 a	9.33 a	9.17 a
5	Specticle FLO - CCBB	0.622	FL	0.04	lb ai/a	9.8 a	9.42 a	9.08 a	9.17 a	8.83 a
3	Sureguard SC	4	SC	0.375	lb ai/a	10.0 a	10.00 a	10.00 a	10.00 a	10.00 a
6	Sureguard SC - CCBB	4	SC	0.375	lb ai/a	10.0 a	10.00 a	10.00 a	10.00 a	10.00 a
4	Gallery SC	4.16	SC	1	lb ai/a	9.8 a	9.67 a	9.65 a	9.57 a	9.67 a
	Barricade	4	L	0.75	lb ai/a					
7	Gallery SC -- CCBB	4.16	SC	1	lb ai/a	10.0 a	9.75 a	9.58 a	9.65 a	9.33 a
	Barricade	4	L	0.75	lb ai/a					
LSD (P=.05)					0.40	0.701	0.930	1.056	1.478	
Standard Deviation					0.30	0.595	0.789	0.896	1.253	
CV					3.59	7.12	9.55	10.87	15.39	
Bartlett's X2					0.0	11.075	13.286	13.274	14.984	
P(Bartlett's X2)					.	0.011*	0.004*	0.004*	0.002*	
Replicate F					0.462	0.646	0.813	0.872	0.791	
Replicate Prob(F)					0.7632	0.6662	0.5496	0.5115	0.5643	
Treatment F					754.462	231.162	128.897	99.552	49.960	
Treatment Prob(F)					0.0001	0.0001	0.0001	0.0001	0.0001	

Pest Type					W Weed	W Weed	W Weed	W Weed	W Weed	
Pest Code					EPHMA	CARFL	CARFL	CARFL	CARFL	
Pest Name					Spotted spu>	Flexuous bi>	Flexuous bi>	Flexuous bi>	Flexuous bi>	
Rating Date					10/27/2021	9/25/2021	10/3/2021	10/8/2021	10/13/2021	
Rating Data Type					WEIFRE	CONTROL	CONTROL	CONTROL	CONTROL	
Rating Unit					G	0-10	0-10	0-10	0-10	
Days After First/Last Applic.					54 54	22 22	30 30	35 35	40 40	
Trt-Eval Interval					54 DA-A	22 DA-A	30 DA-A	35 DA-A	40 DA-A	
Trt No.	Treatment Name	Form Conc	Form Type	Rate	Unit					
1	Nontreated					30.83 a	0.00 b	0.00 d	0.00 d	0.00 d
2	Specticle FLO	0.622	FL	0.04	lb ai/a	3.00 b	9.17 a	9.08 bc	8.80 bc	8.63 bc
5	Specticle FLO - CCBB	0.622	FL	0.04	lb ai/a	4.92 b	8.75 a	8.67 c	8.00 c	7.83 c
3	Sureguard SC	4	SC	0.375	lb ai/a	0.00 b	10.00 a	9.92 a	10.00 a	10.00 a
6	Sureguard SC - CCBB	4	SC	0.375	lb ai/a	0.00 b	8.33 a	10.00 a	10.00 a	10.00 a
4	Gallery SC	4.16	SC	1	lb ai/a	2.50 b	9.33 a	9.32 b	9.38 ab	9.37 ab
	Barricade	4	L	0.75	lb ai/a					
7	Gallery SC -- CCBB	4.16	SC	1	lb ai/a	2.33 b	9.08 a	9.08 bc	8.50 bc	8.23 bc
	Barricade	4	L	0.75	lb ai/a					
LSD (P=.05)					6.557	1.829	0.484	0.920	1.167	
Standard Deviation					5.561	1.551	0.410	0.780	0.990	
CV					89.32	19.86	5.12	9.99	12.82	
Bartlett's X2					10.436	44.497	7.119	5.047	9.608	
P(Bartlett's X2)					0.034*	0.001*	0.13	0.168	0.022*	
Replicate F					1.591	1.405	1.330	0.856	0.847	
Replicate Prob(F)					0.1929	0.2507	0.2783	0.5219	0.5275	
Treatment F					23.416	30.230	452.891	122.465	75.273	
Treatment Prob(F)					0.0001	0.0001	0.0001	0.0001	0.0001	

Means followed by same letter do not significantly differ (P=.05, LSD).

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Pest Type					W Weed	W Weed
Pest Code					CARFL	CARFL
Pest Name					Flexuous bi>	Flexuous bi>
Rating Date					10/27/2021	10/27/2021
Rating Data Type					CONTROL	WEIFRE
Rating Unit					0-10	G
Days After First/Last Applic.					54 54	54 54
Trt-Eval Interval					54 DA-A	54 DA-A
Trt No.	Treatment Name	Form Conc	Form Type	Rate	Unit	
1	Nontreated					38
2	Specticle FLO	0.622	FL	0.04	lb ai/a	39
5	Specticle FLO - CCBB	0.622	FL	0.04	lb ai/a	0.00 d
3	Sureguard SC	4	SC	0.375	lb ai/a	47.00 a
6	Sureguard SC - CCBB	4	SC	0.375	lb ai/a	15.50 bc
4	Gallery SC	4.16	SC	1	lb ai/a	5.92 c
	Barricade	4	L	0.75	lb ai/a	22.00 b
7	Gallery SC -- CCBB	4.16	SC	1	lb ai/a	10.00 a
	Barricade	4	L	0.75	lb ai/a	10.00 a
	LSD (P=.05)					6.75 bc
	Standard Deviation					15.50 bc
	CV					2.146
	Bartlett's X2					1.820
	P(Bartlett's X2)					26.73
	Replicate F					93.04
	Replicate Prob(F)					2.243
	Treatment F					6.507
	Treatment Prob(F)					0.164
						1.094
						0.3841
						0.2366
						21.381
						8.401
						0.0001
						0.0001

Means followed by same letter do not significantly differ (P=.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

**Safety to Container-grown Ornamentals and Efficacy of Preemergence Herbicides
Applied Over-the-top or Directed with Prototype Sprayer**

Trial ID: HFL21PreCCBBappl
Location: HFL

Protocol ID: HFL21PreCCBBappl
Study Director: Neal

Crop Name	Hydrangea	Hydrangea	Hydrangea	Hydrangea	Hydrangea						
Rating Date	9/6/2021	9/9/2021	9/15/2021	9/25/2021	10/3/2021						
Rating Data Type	PHYGEN	PHYGEN	PHYGEN	PHYGEN	PHYGEN						
Rating Unit	0-10	0-10	0-10	0-10	0-10						
Days After First/Last Applic.	3 3	6 6	12 12	22 22	30 30						
Trt-Eval Interval	3 DA-A	6 DA-A	12 DA-A	22 DA-A	30 DA-A						
Trt No.	Treatment Name	Form Conc	Form Type	Rate	Unit	Plot	1	2	3	4	5
1	Nontreated					104	0.0	0.0	0.0	0.0	0.0
						203	0.0	0.0	3.0	0.0	0.0
						301	0.0	0.0	0.0	0.0	0.0
						404	0.0	0.0	0.0	0.0	0.0
						506	0.0	0.0	0.0	0.0	0.0
						607	0.0	0.0	0.0	0.0	0.0
						Mean =	0.0	0.0	0.5	0.0	0.0
2	Specticle FLO	0.622	FL	0.04	lb ai/a	105	0.0	2.0	5.0	7.0	8.0
						204	1.0	3.0	8.0	7.0	9.0
						303	1.0	3.0	8.0	8.0	9.0
						405	1.0	3.0	8.0	9.0	9.0
						503	0.0	3.0	7.0	9.0	9.0
						604	0.0	4.0	8.0	8.0	9.0
						Mean =	0.5	3.0	7.3	8.0	8.8
5	Specticle FLO - CCBB	0.622	FL	0.04	lb ai/a	106	1.0	0.0	0.0	0.0	0.0
						202	0.0	0.0	0.0	0.0	0.0
						306	0.0	0.0	1.0	0.0	0.0
						407	0.0	0.0	0.0	0.0	0.0
						505	0.0	1.0	1.0	0.0	0.0
						601	0.0	0.0	0.0	0.0	0.0
						Mean =	0.2	0.2	0.3	0.0	0.0
3	Sureguard SC	4	SC	0.375	lb ai/a	107	6.0	7.0	9.0	10.0	10.0
						205	5.0	7.0	9.0	9.0	9.0
						307	6.0	7.0	9.0	9.0	9.0
						401	6.0	8.0	9.0	10.0	10.0
						504	6.0	9.0	9.0	9.0	9.0
						602	7.0	9.0	10.0	10.0	10.0
						Mean =	6.0	7.8	9.2	9.5	9.5
6	Sureguard SC - CCBB	4	SC	0.375	lb ai/a	101	0.0	0.0	0.0	0.0	0.0
						206	0.0	0.0	1.0	0.0	0.0
						305	0.0	0.0	1.0	0.0	1.0
						402	0.0	0.0	1.0	0.0	1.0
						507	0.0	2.0	0.0	0.0	0.0
						603	0.0	1.0	1.0	0.0	0.0
						Mean =	0.0	0.5	0.7	0.0	0.3
4	Gallery SC	4.16	SC	1	lb ai/a	103	0.0	1.0	2.0	4.0	5.0
	Barricade	4	L	0.75	lb ai/a	201	1.0	2.0	3.0	3.0	5.0
						302	0.0	2.0	5.0	4.0	6.0
						403	0.0	2.0	5.0	5.0	6.0
						501	0.0	2.0	2.0	4.0	4.0
						605	0.0	2.0	6.0	5.0	6.0
						Mean =	0.2	1.8	3.8	4.2	5.3
7	Gallery SC -- CCBB	4.16	SC	1	lb ai/a	102	0.0	0.0	0.0	0.0	0.0
	Barricade	4	L	0.75	lb ai/a	207	0.0	0.0	1.0	0.0	0.0
						304	0.0	0.0	2.0	1.0	0.0
						406	0.0	0.0	0.0	0.0	1.0
						502	0.0	0.0	0.0	1.0	0.0
						606	0.0	0.0	0.0	0.0	0.0
						Mean =	0.0	0.0	0.5	0.3	0.2

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Pest Type				Hydrangea		Hydrangea		Hydrangea		Hydrangea		Arborvitae	
Crop Name				10/8/2021		10/13/2021		10/27/2021		10/27/2021		9/6/2021	
Rating Date				PHYGEN		PHYGEN		PHYGEN		WEIFRE		PHYGEN	
Rating Data Type				0-10		0-10		0-10		G		0-10	
Rating Unit				35 35		40 40		54 54		54 54		3 3	
Days After First/Last Applic.				35 DA-A		40 DA-A		54 DA-A		54 DA-A		3 DA-A	
Trt-Eval Interval													
Trt No.	Treatment Name	Form Conc	Form Type	Rate	Rate Unit	Plot	6	7	8	9	10		
1	Nontreated					104	0.00	0.00	0.00	49.0	0.0		
						203	0.00	0.00	0.00	42.0	0.0		
						301	0.00	0.00	0.00	44.0	0.0		
						404	0.00	0.00	0.00	43.0	0.0		
						506	0.00	0.00	0.00	46.0	0.0		
						607	0.00	0.00	0.00	29.0	0.0		
						Mean =		0.00	0.00	0.00	42.2	0.0	
2	Specticle FLO	0.622	FL	0.04	lb ai/a	105	8.00	8.00	8.00	9.0	0.0		
						204	9.00	8.00	9.50	2.0	0.0		
						303	9.00	9.00	9.50	2.0	0.0		
						405	9.50	9.00	9.50	3.0	0.0		
						503	9.50	9.00	9.50	3.0	0.0		
						604	9.00	9.00	8.00	6.0	0.0		
						Mean =		9.00	8.67	9.00	4.2	0.0	
5	Specticle FLO - CCBB	0.622	FL	0.04	lb ai/a	106	0.00	0.00	0.00	65.0	0.0		
						202	0.00	0.00	0.00	38.0	0.0		
						306	0.00	0.00	1.00	49.0	0.0		
						407	1.00	0.00	0.00	31.0	0.0		
						505	0.00	0.00	0.00	41.0	0.0		
						601	0.00	0.00	1.00	34.0	0.0		
						Mean =		0.17	0.00	0.33	43.0	0.0	
3	Sureguard SC	4	SC	0.375	lb ai/a	107	10.00	9.50	9.50	2.0	0.0		
						205	8.00	8.00	7.00	8.0	0.0		
						307	9.00	8.00	7.00	7.0	0.0		
						401	9.50	9.50	9.00	1.0	0.0		
						504	9.00	8.00	8.00	4.0	0.0		
						602	10.00	10.00	10.00	0.0	0.0		
						Mean =		9.25	8.83	8.42	3.7	0.0	
6	Sureguard SC - CCBB	4	SC	0.375	lb ai/a	101	0.00	0.00	0.00	57.0	0.0		
						206	1.00	0.00	0.00	42.0	0.0		
						305	0.00	0.00	0.00	40.0	0.0		
						402	0.00	0.00	0.00	47.0	0.0		
						507	0.00	0.00	0.00	37.0	0.0		
						603	0.00	0.00	0.00	29.0	0.0		
						Mean =		0.17	0.00	0.00	42.0	0.0	
4	Gallery SC	4.16	SC	1	lb ai/a	103	5.00	6.00	5.00	29.0	0.0		
						201	4.00	5.00	5.00	37.0	0.0		
						302	5.00	5.00	3.00	31.0	0.0		
	Barricade	4	L	0.75	lb ai/a	403	6.00	6.00	5.00	26.0	0.0		
						501	5.00	5.00	3.00	32.0	0.0		
						605	6.00	6.00	5.00	21.0	0.0		
						Mean =		5.17	5.50	4.33	29.3	0.0	
7	Gallery SC -- CCBB	4.16	SC	1	lb ai/a	102	0.00	0.00	0.00	58.0	0.0		
						207	0.00	0.00	1.00	38.0	0.0		
						304	0.00	0.00	0.00	46.0	0.0		
	Barricade	4	L	0.75	lb ai/a	406	2.00	0.00	0.00	34.0	0.0		
						502	0.00	0.00	1.00	28.0	0.0		
						606	0.00	0.00	0.00	30.0	0.0		
						Mean =		0.33	0.00	0.33	39.0	0.0	

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Pest Type							Arborvitae	Arborvitae	Arborvitae	Arborvitae	Arborvitae				
Crop Name							9/9/2021	9/15/2021	9/25/2021	10/3/2021	10/8/2021				
Rating Date							PHYGEN	PHYGEN	PHYGEN	PHYGEN	PHYGEN				
Rating Data Type							0-10	0-10	0-10	0-10	0-10				
Rating Unit							6	12	22	30	35				
Days After First/Last Applic.							6	12	22	30	35				
Trt-Eval Interval							6 DA-A	12 DA-A	22 DA-A	30 DA-A	35 DA-A				
Trt No.	Treatment Name	Form Conc	Form Type	Rate	Unit	Plot	11	12	13	14	15				
1	Nontreated					104	0.0	0.0	0.0	0.0	0.0				
						203	0.0	0.0	0.0	0.0	0.0				
						301	0.0	0.0	0.0	0.0	0.0				
						404	0.0	0.0	0.0	0.0	0.0				
						506	0.0	0.0	0.0	0.0	0.0				
						607	0.0	0.0	0.0	0.0	0.0				
						Mean =	0.0	0.0	0.0	0.0	0.0				
2	Specticle FLO	0.622	FL	0.04	lb ai/a	105	0.0	0.0	0.0	0.0	0.0				
						204	0.0	0.0	0.0	0.0	0.0				
						303	0.0	0.0	0.0	0.0	0.0				
						405	0.0	0.0	0.0	0.0	0.0				
						503	0.0	0.0	0.0	0.0	0.0				
						604	0.0	0.0	0.0	0.0	0.0				
						Mean =	0.0	0.0	0.0	0.0	0.0				
5	Specticle FLO - CCBB	0.622	FL	0.04	lb ai/a	106	0.0	0.0	0.0	0.0	0.0				
						202	0.0	0.0	0.0	0.0	0.0				
						306	0.0	0.0	0.0	0.0	0.0				
						407	0.0	0.0	0.0	0.0	0.0				
						505	0.0	0.0	0.0	0.0	0.0				
						601	0.0	0.0	0.0	0.0	0.0				
						Mean =	0.0	0.0	0.0	0.0	0.0				
3	Sureguard SC	4	SC	0.375	lb ai/a	107	0.0	0.0	0.0	0.0	0.0				
						205	0.0	0.0	0.0	0.0	0.0				
						307	0.0	0.0	0.0	0.0	0.0				
						401	0.0	0.0	0.0	0.0	0.0				
						504	0.0	0.0	0.0	0.0	0.0				
						602	0.0	0.0	0.0	0.0	0.0				
						Mean =	0.0	0.0	0.0	0.0	0.0				
6	Sureguard SC - CCBB	4	SC	0.375	lb ai/a	101	0.0	0.0	0.0	0.0	0.0				
						206	0.0	0.0	0.0	0.0	0.0				
						305	0.0	0.0	0.0	0.0	0.0				
						402	0.0	0.0	0.0	0.0	0.0				
						507	0.0	0.0	0.0	0.0	0.0				
						603	0.0	0.0	0.0	0.0	0.0				
						Mean =	0.0	0.0	0.0	0.0	0.0				
4	Gallery SC Barricade	4.16	SC	1	lb ai/a	103	0.0	0.0	0.0	0.0	0.0				
						4	L	0.75	lb ai/a	201	0.0	0.0	0.0	0.0	0.0
										302	0.0	0.0	0.0	0.0	0.0
		403	0.0	0.0	0.0					0.0	0.0				
		501	0.0	0.0	0.0					0.0	0.0				
		605	0.0	0.0	0.0	0.0	0.0								
		Mean =	0.0	0.0	0.0	0.0	0.0								
7	Gallery SC -- CCBB Barricade	4.16	SC	1	lb ai/a	102	0.0	0.0	0.0	0.0	0.0				
						4	L	0.75	lb ai/a	207	0.0	0.0	0.0	0.0	0.0
										304	0.0	0.0	0.0	0.0	0.0
		406	0.0	0.0	0.0					0.0	0.0				
		502	0.0	0.0	0.0					0.0	0.0				
		606	0.0	0.0	0.0	0.0	0.0								
		Mean =	0.0	0.0	0.0	0.0	0.0								

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Pest Type							Arborvitae	Arborvitae	Arborvitae	Rose	Rose				
Crop Name							10/13/2021	10/27/2021	10/27/2021	9/6/2021	9/9/2021				
Rating Date							PHYGEN	PHYGEN	HEIGHT	PHYGEN	PHYGEN				
Rating Data Type							0-10	0-10	CM	0-10	0-10				
Rating Unit							40 40	54 54	54 54	3 3	6 6				
Days After First/Last Applic.							40 DA-A	54 DA-A	54 DA-A	3 DA-A	6 DA-A				
Trt-Eval Interval															
Trt No.	Treatment Name	Form Conc	Form Type	Rate	Rate Unit	Plot	16	17	18	19	20				
1	Nontreated					104	0.0	0.0	30.0	0.0	0.0				
						203	0.0	0.0	29.0	0.0	0.0				
						301	0.0	0.0	30.0	0.0	0.0				
						404	0.0	0.0	26.0	0.0	0.0				
						506	0.0	0.0	25.0	0.0	0.0				
						607	0.0	0.0	26.0	0.0	0.0				
						Mean =	0.0	0.0	27.7	0.0	0.0				
2	Specticle FLO	0.622	FL	0.04	lb ai/a	105	0.0	0.0	27.0	0.0	2.0				
						204	0.0	0.0	26.0	2.0	3.0				
						303	0.0	0.0	28.0	2.0	3.0				
						405	0.0	0.0	28.0	2.0	3.0				
						503	0.0	0.0	24.0	2.0	3.0				
						604	0.0	0.0	23.0	1.0	2.0				
						Mean =	0.0	0.0	26.0	1.5	2.7				
5	Specticle FLO - CCBB	0.622	FL	0.04	lb ai/a	106	0.0	0.0	31.0	0.0	0.0				
						202	0.0	0.0	27.0	0.0	0.0				
						306	0.0	0.0	24.0	0.0	0.0				
						407	0.0	0.0	25.0	0.0	0.0				
						505	0.0	0.0	26.0	0.0	0.0				
						601	0.0	0.0	26.0	0.0	0.0				
						Mean =	0.0	0.0	26.5	0.0	0.0				
3	Sureguard SC	4	SC	0.375	lb ai/a	107	0.0	0.0	29.0	4.0	5.0				
						205	0.0	0.0	29.0	4.0	6.0				
						307	0.0	0.0	31.0	6.0	6.0				
						401	0.0	0.0	29.0	5.0	7.0				
						504	0.0	0.0	27.0	5.0	6.0				
						602	0.0	0.0	29.0	6.0	7.0				
						Mean =	0.0	0.0	29.0	5.0	6.2				
6	Sureguard SC - CCBB	4	SC	0.375	lb ai/a	101	0.0	0.0	28.0	0.0	0.0				
						206	0.0	0.0	27.0	0.0	1.0				
						305	0.0	0.0	31.0	0.0	0.0				
						402	0.0	0.0	28.0	0.0	0.0				
						507	0.0	0.0	26.0	0.0	0.0				
						603	0.0	0.0	30.0	0.0	1.0				
						Mean =	0.0	0.0	28.3	0.0	0.3				
4	Gallery SC Barricade	4.16	SC	1	lb ai/a	103	0.0	0.0	24.0	1.0	2.0				
						4	L	0.75	lb ai/a	201	0.0	0.0	27.0	0.0	1.0
										302	0.0	0.0	28.0	1.0	2.0
		403	0.0	0.0	30.0					1.0	3.0				
		501	0.0	0.0	23.0					0.0	0.0				
		605	0.0	0.0	28.0	0.0	2.0								
		Mean =	0.0	0.0	26.7	0.5	1.7								
7	Gallery SC -- CCBB Barricade	4.16	SC	1	lb ai/a	102	0.0	0.0	27.0	0.0	0.0				
						4	L	0.75	lb ai/a	207	0.0	0.0	26.0	0.0	0.0
										304	0.0	0.0	26.0	0.0	0.0
		406	0.0	0.0	27.0					0.0	1.0				
		502	0.0	0.0	26.0					0.0	0.0				
		606	0.0	0.0	24.0	0.0	0.0								
		Mean =	0.0	0.0	26.0	0.0	0.2								

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Pest Type		Rose		Rose		Rose		Rose			
Crop Name		9/15/2021		9/25/2021		10/3/2021		10/8/2021			
Rating Date		PHYGEN		PHYGEN		PHYGEN		PHYGEN			
Rating Data Type		0-10		0-10		0-10		0-10			
Rating Unit		12 12		22 22		30 30		35 35			
Days After First/Last Applic.		12 DA-A		12 DA-A		30 DA-A		35 DA-A			
Trt-Eval Interval		12 DA-A		12 DA-A		30 DA-A		35 DA-A			
Trt No.	Treatment Name	Form Conc	Form Type	Rate	Rate Unit	Plot	21	22	23	24	25
1	Nontreated					104	0.0	0.0	0.0	0.0	0.0
						203	0.0	0.0	0.0	0.0	0.0
						301	0.0	0.0	0.0	0.0	0.0
						404	0.0	0.0	0.0	0.0	0.0
						506	0.0	0.0	0.0	0.0	0.0
						607	0.0	0.0	0.0	0.0	0.0
						Mean =	0.0	0.0	0.0	0.0	0.0
2	Specticle FLO	0.622	FL	0.04	lb ai/a	105	2.0	0.0	0.0	0.0	0.0
						204	3.0	0.0	0.0	0.0	0.0
						303	2.0	0.0	0.0	0.0	0.0
						405	3.0	4.0	2.0	4.0	2.0
						503	3.0	2.0	1.0	1.0	0.0
						604	2.0	0.0	0.0	0.0	0.0
						Mean =	2.5	1.0	0.5	0.8	0.3
5	Specticle FLO - CCBB	0.622	FL	0.04	lb ai/a	106	0.0	0.0	0.0	0.0	0.0
						202	0.0	0.0	0.0	0.0	0.0
						306	0.0	0.0	0.0	0.0	0.0
						407	0.0	0.0	0.0	0.0	0.0
						505	0.0	0.0	0.0	0.0	0.0
						601	1.0	0.0	0.0	0.0	0.0
						Mean =	0.2	0.0	0.0	0.0	0.0
3	Sureguard SC	4	SC	0.375	lb ai/a	107	7.0	5.0	5.0	5.0	5.0
						205	7.0	5.0	4.0	4.0	5.0
						307	7.0	5.0	5.0	5.0	6.0
						401	8.0	5.0	5.0	5.0	6.0
						504	7.0	6.0	6.0	6.0	7.0
						602	8.0	7.0	6.0	6.0	7.0
						Mean =	7.3	5.5	5.2	5.2	6.0
6	Sureguard SC - CCBB	4	SC	0.375	lb ai/a	101	0.0	0.0	0.0	0.0	0.0
						206	0.0	-0.4*	-0.1*	-0.1*	-0.1*
						305	0.0	0.0	0.0	0.0	0.0
						402	0.0	0.0	0.0	0.0	0.0
						507	0.0	1.0	2.0	3.0	2.0
						603	1.0	0.0	0.0	0.0	0.0
						Mean =	0.2	0.1	0.3	0.5	0.3
4	Gallery SC	4.16	SC	1	lb ai/a	103	2.0	1.0	0.0	1.0	0.0
	Barricade	4	L	0.75	lb ai/a	201	2.0	0.0	1.0	0.0	0.0
						302	0.0	1.0	2.0	1.0	0.0
						403	3.0	3.0	3.0	3.0	3.0
						501	2.0	0.0	1.0	0.0	0.0
						605	3.0	3.0	4.0	3.0	3.0
						Mean =	2.0	1.3	1.8	1.3	1.0
7	Gallery SC -- CCBB	4.16	SC	1	lb ai/a	102	0.0	0.0	0.0	1.0	0.0
	Barricade	4	L	0.75	lb ai/a	207	0.0	0.0	0.0	0.0	0.0
						304	0.0	0.0	0.0	0.0	0.0
						406	0.0	0.0	0.0	0.0	0.0
						502	0.0	0.0	0.0	0.0	0.0
						606	0.0	0.0	0.0	0.0	0.0
						Mean =	0.0	0.0	0.0	0.2	0.0

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Pest Type							Rose	Rose				
Crop Name							10/27/2021	10/27/2021				
Rating Date							PHYGEN	WEIFRE				
Rating Data Type							0-10	G				
Rating Unit							54	54				
Days After First/Last Applic.							54 DA-A	54 DA-A				
Trt-Eval Interval							54 DA-A	54 DA-A				
Trt No.	Treatment Name	Form Conc	Form Type	Rate	Unit	Plot	26	27				
1	Nontreated					104	0.0	58.0				
						203	0.0	76.0				
						301	0.0	78.0				
						404	0.0	98.0				
						506	0.0	96.0				
						607	0.0	61.0				
						Mean =						
2	Specticle FLO	0.622	FL	0.04	lb ai/a	105	0.0	115.0				
						204	0.0	96.0				
						303	0.0	98.0				
						405	3.0	75.0				
						503	0.0	104.0				
						604	0.0	82.0				
						Mean =						
5	Specticle FLO - CCBB	0.622	FL	0.04	lb ai/a	106	0.0	113.0				
						202	0.0	101.0				
						306	0.0	79.0				
						407	0.0	88.0				
						505	0.0	100.0				
						601	0.0	72.0				
						Mean =						
3	Sureguard SC	4	SC	0.375	lb ai/a	107	5.0	41.0				
						205	0.0	52.0				
						307	5.0	42.0				
						401	6.0	46.0				
						504	6.0	25.0				
						602	5.0	17.0				
						Mean =						
6	Sureguard SC - CCBB	4	SC	0.375	lb ai/a	101	0.0	103.0				
						206	-0.9*	91.6*				
						305	0.0	101.0				
						402	0.0	97.0				
						507	1.0	60.0				
						603	0.0	69.0				
						Mean =						
4	Gallery SC Barricade	4.16	SC	1	lb ai/a	103	0.0	98.0				
						4	L	0.75	lb ai/a	201	0.0	71.0
										302	1.0	81.0
		403	0.0	71.0								
		501	0.0	86.0								
		605	2.0	41.0								
		Mean =							0.5	74.7		
7	Gallery SC -- CCBB Barricade	4.16	SC	1	lb ai/a	102	0.0	86.0				
						4	L	0.75	lb ai/a	207	0.0	99.0
										304	0.0	85.0
		406	0.0	100.0								
		502	0.0	84.0								
		606	0.0	86.0								
		Mean =							0.0	90.0		

**Efficacy of Preemergence Herbicides
Applied Over-the-top or Directed with Prototype Sprayer**

Pest Type	W Weed	W Weed	W Weed	W Weed					
Pest Code	EPHMA	EPHMA	EPHMA	EPHMA					
Pest Name	Spotted spu>	Spotted spu>	Spotted spu>	Spotted spu>					
Rating Date	9/25/2021	10/3/2021	10/8/2021	10/13/2021					
Rating Data Type	CONTROL	CONTROL	CONTROL	CONTROL					
Rating Unit	0-10	0-10	0-10	0-10					
Days After First/Last Applic.	22 22	30 30	35 35	40 40					
Trt-Eval Interval	22 DA-A	30 DA-A	35 DA-A	40 DA-A					
Trt No.	Treatment Name	Form Conc	Form Type	Rate Unit	Plot	28	29	30	31
1	Nontreated				104	0.0	0.00	0.00	0.00
					203	0.0	0.00	0.00	0.00
					301	0.0	0.00	0.00	0.00
					404	0.0	0.00	0.00	0.00
					506	.	0.00	0.00	0.00
					607	0.0	0.00	0.00	0.00
					Mean =	0.0	0.00	0.00	0.00
2	Specticle FLO	0.622 FL		0.04 lb ai/a	105	10.0	10.00	10.00	10.00
					204	10.0	10.00	10.00	10.00
					303	9.0	8.00	7.00	6.00
					405	10.0	10.00	10.00	10.00
					503	.	10.00	10.00	10.00
					604	10.0	10.00	10.00	10.00
					Mean =	9.8	9.67	9.50	9.33
5	Specticle FLO - CCBB	0.622 FL		0.04 lb ai/a	106	10.0	10.00	9.50	9.50
					202	9.0	7.00	6.00	6.00
					306	10.0	10.00	10.00	10.00
					407	10.0	10.00	10.00	10.00
					505	.	10.00	10.00	10.00
					601	10.0	9.50	9.00	9.50
					Mean =	9.8	9.42	9.08	9.17
3	Sureguard SC	4 SC		0.375 lb ai/a	107	10.0	10.00	10.00	10.00
					205	10.0	10.00	10.00	10.00
					307	10.0	10.00	10.00	10.00
					401	10.0	10.00	10.00	10.00
					504	.	10.00	10.00	10.00
					602	10.0	10.00	10.00	10.00
					Mean =	10.0	10.00	10.00	10.00
6	Sureguard SC - CCBB	4 SC		0.375 lb ai/a	101	10.0	10.00	10.00	10.00
					206	10.0	10.00	10.00	10.00
					305	10.0	10.00	10.00	10.00
					402	10.0	10.00	10.00	10.00
					507	.	10.00	10.00	10.00
					603	10.0	10.00	10.00	10.00
					Mean =	10.0	10.00	10.00	10.00
4	Gallery SC	4.16 SC		1 lb ai/a	103	9.0	9.00	9.50	9.50
	Barricade	4 L		0.75 lb ai/a	201	10.0	9.50	9.00	9.00
					302	10.0	10.00	9.90	9.90
					403	10.0	9.50	9.50	9.00
					501	.	10.00	10.00	10.00
					605	10.0	10.00	10.00	10.00
					Mean =	9.8	9.67	9.65	9.57
7	Gallery SC -- CCBB	4.16 SC		1 lb ai/a	102	10.0	9.50	9.50	9.50
	Barricade	4 L		0.75 lb ai/a	207	10.0	10.00	10.00	10.00
					304	10.0	9.50	9.00	9.00
					406	10.0	10.00	9.50	9.50
					502	.	9.50	9.50	9.90
					606	10.0	10.00	10.00	10.00
					Mean =	10.0	9.75	9.58	9.65

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Pest Type		W Weed	W Weed	W Weed	W Weed					
Pest Code		EPHMA	EPHMA	CARFL	CARFL					
Pest Name		Spotted spu>	Spotted spu>	Flexuous bi>	Flexuous bi>					
Crop Name										
Rating Date		10/27/2021	10/27/2021	9/25/2021	10/3/2021					
Rating Data Type		CONTROL	WEIFRE	CONTROL	CONTROL					
Rating Unit		0-10	G	0-10	0-10					
Days After First/Last Applic.		54 54	54 54	22 22	30 30					
Trt-Eval Interval		54 DA-A	54 DA-A	22 DA-A	30 DA-A					
Trt No.	Treatment Name	Form Conc	Form Type	Rate	Rate Unit	Plot	32	33	34	35
1	Nontreated					104	0.00	27.00	0.00	0.00
						203	0.00	47.00	0.00	0.00
						301	0.00	29.00	0.00	0.00
						404	0.00	36.00	0.00	0.00
						506	0.00	18.00	0.00	0.00
						607	0.00	28.00	0.00	0.00
						Mean =	0.00	30.83	0.00	0.00
2	Specticle FLO	0.622 FL		0.04 lb ai/a		105	10.00	0.00	8.00	8.00
						204	10.00	0.00	9.50	10.00
						303	5.00	18.00	9.00	8.50
						405	10.00	0.00	9.50	9.50
						503	10.00	0.00	9.50	9.50
						604	10.00	0.00	9.50	9.00
						Mean =	9.17	3.00	9.17	9.08
5	Specticle FLO - CCBB	0.622 FL		0.04 lb ai/a		106	10.00	2.00	9.00	9.00
						202	4.00	21.00	9.00	9.00
						306	10.00	0.00	9.00	9.00
						407	10.00	0.00	9.50	9.00
						505	10.00	0.50	8.00	8.00
						601	9.00	6.00	8.00	8.00
						Mean =	8.83	4.92	8.75	8.67
3	Sureguard SC	4 SC		0.375 lb ai/a		107	10.00	0.00	10.00	10.00
						205	10.00	0.00	10.00	10.00
						307	10.00	0.00	10.00	10.00
						401	10.00	0.00	10.00	10.00
						504	10.00	0.00	10.00	9.50
						602	10.00	0.00	10.00	10.00
						Mean =	10.00	0.00	10.00	9.92
6	Sureguard SC - CCBB	4 SC		0.375 lb ai/a		101	10.00	0.00	0.00	10.00
						206	10.00	0.00	10.00	10.00
						305	10.00	0.00	10.00	10.00
						402	10.00	0.00	10.00	10.00
						507	10.00	0.00	10.00	10.00
						603	10.00	0.00	10.00	10.00
						Mean =	10.00	0.00	8.33	10.00
4	Gallery SC	4.16 SC		1 lb ai/a		103	9.50	2.00	9.00	8.50
	Barricade	4 L		0.75 lb ai/a		201	9.50	5.00	9.50	9.90
						302	10.00	0.00	9.50	9.50
						403	9.00	8.00	9.50	9.50
						501	10.00	0.00	9.00	9.50
						605	10.00	0.00	9.50	9.00
						Mean =	9.67	2.50	9.33	9.32
7	Gallery SC -- CCBB	4.16 SC		1 lb ai/a		102	9.50	2.00	9.00	9.50
	Barricade	4 L		0.75 lb ai/a		207	10.00	0.00	9.50	9.00
						304	8.00	7.00	9.50	9.50
						406	9.00	3.00	9.00	9.00
						502	9.50	2.00	8.00	8.50
						606	10.00	0.00	9.50	9.00
						Mean =	9.33	2.33	9.08	9.08

Pest Type	W Weed	W Weed	W Weed	W Weed						
Pest Code	CARFL	CARFL	CARFL	CARFL						
Pest Name	Flexuous bi>	Flexuous bi>	Flexuous bi>	Flexuous bi>						
Crop Name										
Rating Date	10/8/2021	10/13/2021	10/27/2021	10/27/2021						
Rating Data Type	CONTROL	CONTROL	CONTROL	WEIFRE						
Rating Unit	0-10	0-10	0-10	G						
Days After First/Last Applic.	35 35	40 40	54 54	54 54						
Trt-Eval Interval	35 DA-A	40 DA-A	54 DA-A	54 DA-A						
Trt No.	Treatment Name	Form Conc	Form Type	Rate	Plot	36	37	38	39	
1	Nontreated					104	0.00	0.00	0.00	75.00
						203	0.00	0.00	0.00	31.00
						301	0.00	0.00	0.00	27.00
						404	0.00	0.00	0.00	45.00
						506	0.00	0.00	0.00	50.00
						607	0.00	0.00	0.00	54.00
						Mean =	0.00	0.00	0.00	47.00
2	Specticle FLO	0.622 FL		0.04 lb ai/a		105	7.50	7.00	3.00	31.00
						204	9.90	9.90	9.00	1.00
						303	8.00	8.00	3.00	40.00
						405	9.00	9.00	8.50	1.00
						503	9.90	9.90	9.00	2.00
						604	8.50	8.00	6.00	18.00
						Mean =	8.80	8.63	6.42	15.50
5	Specticle FLO - CCBB	0.622 FL		0.04 lb ai/a		106	9.00	8.50	7.50	7.00
						202	9.00	8.50	9.00	1.00
						306	8.00	8.00	5.00	33.00
						407	8.00	8.00	5.00	23.00
						505	6.00	7.00	3.00	41.00
						601	8.00	7.00	6.00	27.00
						Mean =	8.00	7.83	5.92	22.00
3	Sureguard SC	4 SC		0.375 lb ai/a		107	10.00	10.00	10.00	0.00
						205	10.00	10.00	10.00	0.00
						307	10.00	10.00	10.00	0.00
						401	10.00	10.00	10.00	0.00
						504	10.00	10.00	10.00	0.00
						602	10.00	10.00	10.00	0.00
						Mean =	10.00	10.00	10.00	0.00
6	Sureguard SC - CCBB	4 SC		0.375 lb ai/a		101	10.00	10.00	10.00	0.00
						206	10.00	10.00	10.00	0.00
						305	10.00	10.00	10.00	0.00
						402	10.00	10.00	10.00	0.00
						507	10.00	10.00	10.00	0.00
						603	10.00	10.00	10.00	0.00
						Mean =	10.00	10.00	10.00	0.00
4	Gallery SC	4.16 SC		1 lb ai/a		103	9.00	8.50	6.00	17.00
	Barricade	4 L		0.75 lb ai/a		201	9.90	10.00	10.00	0.00
						302	9.00	9.00	8.00	7.00
						403	9.50	9.80	9.50	0.50
						501	9.90	9.90	10.00	0.00
						605	9.00	9.00	8.00	4.00
						Mean =	9.38	9.37	8.58	4.75
7	Gallery SC -- CCBB	4.16 SC		1 lb ai/a		102	9.00	9.00	7.00	11.00
	Barricade	4 L		0.75 lb ai/a		207	9.00	9.00	8.00	3.00
						304	9.50	9.90	9.00	3.00
						406	8.00	9.00	8.00	4.00
						502	6.00	4.00	1.00	64.00
						606	9.50	8.50	7.50	8.00
						Mean =	8.50	8.23	6.75	15.50