



New and Potential Herbicides for Blueberries

GARY K. ENGLAND^{1*}, WILLIAM M. STALL², ANDREW MACRAE³, AND KEN MUZYK⁴

¹University of Florida, IFAS, Sumter County Extension, 7620 SR 471, Suite 2, Bushnell, FL 33513

²University of Florida, IFAS, UF Horticultural Sciences Department, PO Box 110690, Gainesville, FL 32611

³University of Florida, IFAS, UF Gulf Coast Research and Education Center, 14625 CR 672, Wimauma, FL 33598

⁴Gowan Company, LLC, 408 Larrie Ellen Way, Brandon, FL 33511

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There has been an increased interest in the establishment of commercial blueberry farms in the west-central Florida region over the last 10 years. Weed management has been one of the most important considerations that growers undertake in their normal production operations. Since the majority of the blueberry farms in the region utilize pine bark culture as their production system, it is important to evaluate the efficacy and crop tolerance of registered and potential herbicides in this system. Growers have been reporting phytotoxicity to blueberries treated with herbicides containing the active ingredient glyphosate. In 2007 a trial was established to evaluate glufosinate (Rely 1E) as an alternative to glyphosate containing products. Rely at 6 qt/acre provided control of Brazilian pusley [*Richardia brasiliensis* (RCHBR)] comparable to glyphosate (Roundup Weathermax), while only glyphosate resulted in acceptable yellow nutsedge [*Cyperus esculentus* (CYPES)] control. No significant crop phytotoxicity was observed. Results of this trial were utilized as support for the registration of Rely in Florida commercial blueberry farms. In 2008, two new herbicides registered for blueberries, flumioxazin (Chateau) and mesotrione (Callisto), plus one product with potential to be efficacious in blueberries grown in pine bark culture halosulfuron (Sanda) were evaluated. Sanda provided excellent yellow nutsedge control for 28 days. A tank mix of Rely 1E + Chateau herbicide provided acceptable Brazilian pusley control through 43 days. In 2009, an additional trial with Chateau and Callisto alone and tank mixed with Rely 200 was established. Initial results indicate acceptable weed control from both products.

There has been increased demand for fresh blueberries in the late March to early May market window over the last 10 years, leading to a significant increase in the establishment of commercial southern highbush blueberry farms in west-central Florida. One of the reasons the area has become popular for blueberry production is the fact that many of the farms receive chilling units equal to production areas to the north, while being able to initiate berry harvest somewhat earlier. The majority of these new blueberry farms utilize the pine bark culture production system, where young plants are set out spaced 2½ to 3 ft apart in 12- to 18-inch-high windrows of pine bark that are 8 to 10 ft apart. Pine bark culture is popular in the area because of the favorable pH, porosity, and drainage characteristics of the bark vs. many of the soils in the area.

With the increased acreage in the region, there has also been an increase in pests such as weeds, diseases, and insects associated with commercial blueberry production. There are various tools available for managing these pests but it is necessary to evaluate new management options for the ever changing pest situation.

Herbicide Evaluations

RELY LABEL SUPPORT. Herbicides containing the active ingredient glyphosate have been extensively used in the region for weed management purposes. These herbicides have been effective in managing most weed species encountered by blueberry growers. Occasionally, reports of phytotoxicity to blueberry plants were

linked to use of glyphosate and growers became interested in the evaluation of alternative non-selective herbicides that may control important weed species but have lower potential crop phytotoxicity. One of the candidates to meet this need was Rely herbicide with the active ingredient glufosinate-ammonium. Rely had received registration in blueberries grown in Georgia, and University of Florida researchers approached the manufacturer on the possibility of the same for Florida blueberry producers.

A trial was established in June 2007 at a blueberry farm utilizing pine bark culture in Hernando County. Two rates of Rely 1E herbicide were compared to an untreated control and Roundup Weathermax herbicide (Table 1) in a 1½-year-old commercial planting of 'Emerald' blueberry. The plots were 25 ft of blueberry row. The experimental design was a randomized complete block with four replications. Applications were made with a CO₂ backpack sprayer with two 11004 flat fan nozzles spraying a 40-inch band on each side of the row from the base of the plants to the base of the pine bark bed calibrated to 30 gal per treated acre at 30 lb per square inch. Visual ratings of 0 to 100, where 0 = no weed control or crop phytotoxicity and 100 = complete weed

Table 1. Treatments evaluated.

Treatment no.	Treatment	Rate per treated acre
1	Untreated	N/A
2	Rely	4 qt/acre
3	Rely	6 qt/acre
4	Roundup Weathermax	2 qt/acre

*Corresponding author; gke@ufl.edu

Table 2. Weed control ratings.

Treatment	Weed control evaluations							
	5 DAT ^z		14 DAT		21 DAT		38 DAT	
	CYPES	RCHBR	CYPES	RCHBR	CYPES	RCHBR	CYPES	RCHBR
Untreated	0.0 b	0.0 d ^y	0.0 d	0.0 c	0.0 c	0.0 c	0.0 b	0.0 c
Rely 1E 4 qt/acre	20.0 a	67.3 b	22.5 c	60.3 b	23.7 b	51.9 b	18.7 b	42.0 b
Rely 1E 6 qt/acre	25.0 a	79.2 a	48.7 b	90.6 a	31.2 b	87.2 a	18.7 b	75.6 a
Roundup 2 qt/acre	30.0 a	46.1 c	62.5 a	67.5 b	71.2 a	77.5 a	68.7 a	75.9 a

^zDays after treatment.^yP = 0.05, Duncan's New MRT.

control or crop phytotoxicity, were made 5, 14, 21, and 38 days after treatment (DAT).

Two weed species, yellow nutsedge [*Cyperus esculentus* (CYPES)] and Brazilian pusley [*Richardia brasiliensis* (RCHBR)] were evaluated in this trial. In the 5 and 14 DAT evaluations, only the 6 qt/acre rate of Rely was providing acceptable Brazilian pusley control (Table 2). Roundup Weathermax was providing the best yellow nutsedge control but not within an acceptable level over 70%. At the 21 and 38 DAT evaluation Rely 6 qt/acre and Roundup Weathermax provided acceptable Brazilian pusley control. Roundup Weathermax resulted in acceptable yellow nutsedge control at 21 DAT but control began to break by the 38 DAT evaluation.

Crop phytotoxicity ratings were made concurrent to weed control evaluations. At all rating dates, no treatment resulted in a crop phytotoxicity rating significantly different than the untreated control.

The results from this trial indicate that the 6 qt/acre rate of Rely 1E and Roundup Weathermax will provide acceptable Brazilian pusley control up to 38 DAT with no significant crop phytotoxicity. Roundup Weathermax provided acceptable yellow nutsedge control through 21 DAT but additional applications will be needed to extend control.

NEW AND POTENTIAL HERBICIDES 2008. Evaluation of two new herbicides for blueberries and one potential product took place in the 2008 season. Chateau herbicide (flumioxazin) has both preemergence and postemergence activity on several weed species commonly found on blueberry farms in west-central Florida and can be applied anytime other than between budbreak and final harvest. Callisto herbicide (mesotrione) is recommended as a post-directed spray to be applied prebloom either as one or split applications at least 14 d apart. University of Florida researchers were interested in expansion of this label to allow applications at other times in the season such as summer. Sandea herbicide (halosulfuron) has been used primarily for nutsedge control in various crops in Florida for a number of years. It has been under evaluation in Florida for two seasons as a potential tool to manage yellow nutsedge, a common weed found in blueberry farms.

A trial was established in May 2008 at a blueberry farm utilizing pine bark culture in Hernando County. Two rates of Rely 1E herbicide, Rely + Chateau, Callisto herbicide, three rates of Sandea herbicide + Rely were compared to an untreated control and Roundup Weathermax Herbicide (Table 4) in a 2½-year-old commercial planting of 'Emerald' and 'Jewell' blueberry. The plots were 25 ft of blueberry row. The experimental design was a randomized complete block with four replications. Applications were made with a CO₂ backpack sprayer with two 11004 flat fan nozzles spraying a 40-inch band on each side of the row from the base of the plants to the base of the pine bark bed calibrated to 30 gal per treated acre at 30 lb per square inch. Visual ratings of 0 to 100, where 0 = no weed control and 100 = complete weed control

15, 28, 43, and 54 DAT, while phytotoxicity ratings utilizing the same scale were made 15, 28, 43, 54, and 79 DAT.

Two weed species, yellow nutsedge and Brazilian pusley, were evaluated in this trial. All rates of Sandea provided excellent yellow nutsedge control through the 28 DAT evaluation (Table 5). Acceptable yellow nutsedge control resulted from the 2 oz/acre rate of Sandea through the 54 DAT evaluation and Roundup Weathermax through the 43 DAT rating. Rely plus Chateau herbicide provided excellent Brazilian pusley control through the 28 DAT evaluation with reduced control at 43 DAT and less than acceptable control at 54 DAT. Roundup Weathermax provided good Brazilian pusley control throughout the trial while Rely was effective through the 28 DAT rating.

Crop phytotoxicity ratings were made concurrent to weed control evaluations. Minimal phytotoxicity ratings were observed for both Rely rates, Rely plus Chateau, Callisto and all but the 15 DAT evaluation for Roundup Weathermax (Table 6). Significant phytotoxicity mainly in the 'Jewell' variety observed with the 2 oz/acre rate of Sandea was thought to be related to crop stress from a severe pruning that took place just prior to the establishment of the trial. Phytotoxicity ratings for the 0.5 oz/acre rate were minimal and became minimal in the 1.0 oz/acre rate by the final evaluation.

The proposed usage rate for Sandea herbicide is 0.5 to 0.75 oz/acre. At the 0.5 oz/acre rate of Sandea as well as with Roundup

Table 3. Crop phytotoxicity.

Treatment	Crop phytotoxicity			
	5 DAT ^z	14 DAT	21 DAT	38 DAT
	Crop	Crop	Crop	Crop
Untreated	0.0 d ^y	0.0 c	0.0 c	0.0 c
Rely 1E 4 qt/acre	8.7 a	12.5 a	5.0 a	7.5 a
Rely 1E 6 qt/acre	16.2 a	17.5 a	5.0 a	5.0 a
Roundup 2 qt/acre	11.2 a	12.5 a	8.7 a	6.2 a

^zDays after treatment.^yP = 0.05, Duncan's New MRT.

Table 4. Treatments evaluated.

Treatment no.	Treatment	Rate per treated acre
1	Untreated	N/A
2	Rely 1E	4 qt/acre
3	Rely 1E	6 qt/acre
4	Rely 1E+Chateau 51WDG	4 qt+8 oz/acre
5	Callisto 4SC+Crop Oil	6 oz+1.0% (by volume)/acre
6	Sandea 75DF+Rely 1E ^z	0.5 oz+4 qt/acre
7	Sandea 75DF+Rely 1E ^z	1.0 oz+4 qt/acre
8	Sandea 75DF+Rely 1E ^z	2.0 oz+4 qt/acre
9	Roundup Weathermax	2 qt/acre

^zA non-ionic surfactant @ 0.25 by volume was added.

Table 5. Weed control ratings.

Treatment	Weed control evaluations							
	15 DAT ^z		28 DAT		43 DAT		54 DAT	
	RCHBR	CYPES	RCHBR	CYPES	RCHBR	CYPES	RCHBR	CYPES
Untreated	0.0 c	0.0 b	0.0 b	0.0 d	0.0 c	0.0 e	0.0 c	0.0 c
Rely 1E 4 qt/acre	63.7 b	72.5 a	75.0 a	70.0 a-c	42.5 ab	67.5 a-c	48.7 ab	47.5 a
Rely 1E 6 qt/acre	75.0 ab	50.0 a	82.5 a	42.5 b-d	63.7 ab	67.5 a-c	60.0 ab	56.3 a
Rely 1E + Chateau 51WDG 4 qt + 8 oz	96.2 a	66.2 a	95.0 a	45.0 b-d	73.7 a	35.0 cd	68.7 a	57.5 a
Callisto 4SC + Crop Oil 6 oz + 0.25%	52.5 b	50.0 a	62.5 a	25.0 cd	57.5 ab	22.5 de	50.0 ab	15.0 b
Sandea 75DF + Rely 1E 0.5 oz + 4 qt	66.2 ab	66.2 a	70.0 a	97.5 a	55.0 ab	50.0 b-d	50.0 ab	62.5 a
Sandea 75DF + Rely 1E 1 oz + 4 qt	68.7 ab	75.0 a	80.0 a	97.5 a	68.7 ab	55.0 a-d	43.7 ab	66.3 a
Sandea 75DF + Rely 1E 2 oz + 4 qt	55.0 a	50.0 a	67.5 a	100 a	32.5 bc	85.0 a	26.2 bc	87.5 a
Roundup 2 qt	82.5 ab	61.2 a	90.0 a	85.0 ab	77.5 a	77.5 ab	76.2 a	61.3 a

^zDays after treatment.^y*P* = 0.05, Duncan's New MRT.

Table 6. Crop phytotoxicity.

Treatment	Crop phytotoxicity				
	15 DAT ^z	28 DAT	43 DAT	54 DAT	79 DAT
	Crop	Crop	Crop	Crop	Crop
Untreated	0.0 d ^y	0.0 d	0.0 d	0.0 d	0.0 c
Rely 1E 4 qt/acre	10.0 b-d	2.5d	20.0 bc	6.2 cd	2.5 c
Rely 1E 6 qt/acre	12.5 bc	0.0d	17.5 bc	5.0 cd	7.5 bc
Rely 1E + Chateau 4 qt + 8 oz/acre	7.5 cd	0.0 d	16.2 c	8.7 cd	7.5 bc
Callisto + Crop Oil 6 oz + 0.25%/acre	12.5 bc	0.0 d	17.5 bc	10.0 cd	2.5 c
Sandea + Rely 0.5 oz + 4 qt/acre	18.7 ab	12.5 c	16.2 c	12.5 bc	6.2 bc
Sandea + Rely 1 oz + 4 qt/acre	23.7 a	20.0 b	31.2 b	20.0 b	12.5 b
Sandea + Rely 2 oz + 4 qt/acre	25.0 a	45.0 a	52.5 a	31.2 a	21.2 a
Roundup 2 qt/acre	16.2 a	0.0 d	15.0 c	8.7 cd	1.2 c

^zDays after treatment.^y*P* = 0.05, Duncan's New MRT.

Weathermax, one could expect good yellow nutsedge control and little potential crop phytotoxicity for 28 to 43 DAT. Good Brazilian pusley control can be expected with Rely plus Chateau and Roundup Weathermax.

NEW HERBICIDES 2009. Two new herbicides for blueberry, Chateau and Callisto, were compared with an industry standard preemergence product containing the active ingredient simazine in the Spring 2009 season. Herbicide products containing simazine are not known to have postemergence activity. This trial was designed to evaluate Chateau and Callisto with and without a contact burn down product (Rely) to determine if either herbicide had postemergence and preemergence activity on the winter weeds evaluated in the trial.

A trial was established in Jan. 2009 at a blueberry farm utilizing pine bark culture in Hernando County. Two rates of Chateau and one + Rely 200, two rates of Callisto with and without Rely plus two rates of a generic simazine herbicide + Rely were compared to an untreated control (Table 7) in a 4-year-old commercial planting of 'Jewell' blueberry. The plots were 25 ft of blueberry row. The experimental design was a randomized complete block with four replications. Applications were made with a CO₂ backpack sprayer with two 11004 flat fan nozzles spraying a 40-inch band on each side of the row from the base of the plants to the base of the pine bark bed calibrated to 30 gal per treated acre at 30 lb per square inch. Visual ratings of 0 to 100, where 0 = no weed control and 100 = complete weed control were made at 15, 28, 43, and 54 DAT. To facilitate harvest, the grower mowed the plot area off and two ratings were made at 70 and 84 DAT to evaluate crop phytotoxicity and residual weed control for the treatments.

Blueberry phytotoxicity (B. Ber.) and the control of four weed species, Carolina geranium [*Geranium carolinianum* (GERCA)], narrowleaf cudweed [*Gnaphalium falcatum* (GNACA)], spiny sowthistle [*Sonchus asper* (SONAS)], and common fumitory [*Fumaria officinalis* (FUMOF)], were evaluated at the 15, 28, 43, and 54 DAT ratings. Blueberry phytotoxicity and residual control of Brazilian pusley were evaluated at the 70- and 84-d ratings.

All treatments except both rates of Callisto alone were providing excellent control of Carolina geranium, narrowleaf cudweed, and spiny sowthistle at the 15 DAT evaluation, while all herbicide treatments resulted in excellent common fumitory control (Table 8). Crop phytotoxicity was acceptable for all treatments. By the 31 DAT evaluation, all herbicide treatments except the two rates

Table 7. Treatments evaluated.

Treatment no.	Treatment ^z	Rate per treated acre
1	Untreated	N/A
2	Simazine + Rely	2 qt + 3 qt/acre
3	Simazine + Rely	4 qt + 3 qt/acre
4	Chateau + Rely	8 oz + 3 qt/acre
5	Chateau + Rely	12 oz + 3 qt/acre
6	Chateau	12 oz/acre
7	Callisto	3 oz/acre
8	Callisto + Rely	3 oz + 3 qt/acre
9	Callisto	6 oz/acre
10	Callisto + Rely	6 oz + 3 qt/acre

^zAll herbicide treatments made with crop oil concentrate at 1% by volume.

Table 8. Crop phytotoxicity and weed control ratings.

Treatment ^y	Weed control evaluations									
	15 DAT ^z					31 DAT				
	B. Ber.	GERCA	GNACA	SONAS	FUMOF	B. Ber.	GERCA	GNACA	SONAS	FUMOF
Untreated	0 a	0 c	0 c	0 d	0 c	0 a	0 d	0 d	0 c	0 b
Sim+Rel 2 qt + 3 qt	0 a	100 a	100 a	97 a	99 a	0 a	96 a	89 ab	75 a	97 a
Sim+Rel 4 qt + 3 qt	0 a	97 a	100 a	97 a	100 a	0 a	100 a	96 a	86 a	100 a
Chat+Rel 8 oz + 3 qt	0 a	100 a	100 a	98 a	100 a	0 a	95 a	84 bc	92 a	91 a
Chat+Rel 12 oz + 3 qt	0 a	100 a	100 a	100 a	100 a	0 a	100 a	91 ab	86 a	100 a
Chat 12 oz	5 a	92 a	96 a	95 a	100 a	5 a	90 a	92 ab	88 a	96 a
Cal 3 oz	0 a	76 a	80 b	75 b	100 a	0 a	64 b	76 c	27 b	77 a
Cal+Rel 3 oz+3 qt	2 a	100 a	100 a	96 a	100 a	2 a	99 a	98 a	95 a	97 a
Cal 6 oz	2 a	37 b	78 b	56 c	95 b	2 a	35 c	92 ab	35 b	98 a
Cal+Rel 6 oz+3 qt	0 a	100 a	100 a	94 a	100 a	0 a	92 a	88 ab	95 a	85 a

^zDays after treatment.^yCrop oil concentrate 1% by volume, $P = 0.05\%$, Duncan's New MRT.

Table 9. Crop phytotoxicity and weed control ratings.

Treatment ^y	Weed control evaluations									
	43 DAT ^z					56 DAT				
	B. Ber.	GERCA	GNACA	SONAS	FUMOF	B. Ber.	GERCA	GNACA	SONAS	FUMOF
Untreated	0 a	0 c	0 d	0 c	0 b	0 a	0 c	0 c	0 b	0 a
Sim + Rel 2 qt + 3 qt	4 a	96 a	81 b	90 a	94 a	2 a	92 a	81 a	85 a	84 a
Sim + Rel 4 qt + 3 qt	2 a	92 a	96 a	100 a	100 a	0 a	96 a	94 a	95 a	89 a
Chat + Rel 8 oz + 3 qt	4 a	95 a	81 b	100 a	79 a	0 a	87 a	72 ab	74 a	100 a
Chat + Rel 12 oz + 3 qt	4 a	100 a	96 a	95 a	100 a	0 a	99 a	85 a	96 a	91 a
Chat 12 oz	5 a	86 a	95 a	92 a	96 a	0 a	84 ab	90 a	91 a	92 a
Cal 3 oz	6 a	56 b	65 c	37 b	79 a	2 a	60 b	59 b	65 a	40 b
Cal + Rel 3 oz + 3 qt	6 a	99 a	96 a	97 a	92 a	0 a	91 a	79 ab	77 a	87 a
Cal 6 oz	5 a	42 b	85 ab	50 b	100 a	0 a	15 c	85 a	100 a	52 b
Cal + Rel 6 oz + 3 qt	5 a	94 a	80 b	94 a	81 a	2 a	94 a	75 ab	71 a	86 a

^zDays after treatment.^yCrop oil concentrate 1% by volume, $P = 0.05\%$, Duncan's New MRT.

of Callisto alone were resulting in excellent Carolina geranium and good spiny sowthistle control (Table 8). All herbicide treatments except the 3-oz rate of Callisto alone resulted in good cudweed control, while there were no differences in the level of control of common fumitory. No significant crop phytotoxicity was observed. The results of the 43 DAT evaluation revealed that all herbicide treatments except both rates of Callisto alone provided excellent Carolina geranium and spiny sowthistle control, while all herbicide treatments except the 3-oz rate of Callisto alone resulted in excellent narrowleaf cudweed control (Table 9). There was no statistical difference between herbicide treatments for common fumitory control and no significant crop phytotoxicity was observed in any treatment. At the 56 DAT evaluation, simazine, both rates of Chateau plus Rely and both rates of Callisto plus Rely were still providing excellent Carolina geranium control, while simazine, the 12-oz rate of Chateau with or without Rely and the 6-oz rate of Callisto were among the best treatments for cudweed control. There was no difference between herbicide treatments for spiny sowthistle control, while all herbicide treatments except both rates of Callisto alone were still resulting in good common fumitory control. There was no significant crop phytotoxicity.

After the 56 DAT evaluation, the grower mowed all plots to facilitate harvest. The next two evaluations rated crop phytotoxicity and the only weed species that established in the plots, Brazilian pusley. At the 70 and 84 DAT evaluations, no crop phytotoxicity was observed (Table 10). It was difficult to statistically separate

the herbicide treatments at these evaluations but the trend indicated that treatments containing Chateau seemed to provide the best control of Brazilian pusley.

In summary of this trial, no herbicide treatments resulted in significant crop phytotoxicity. Herbicide treatments containing Chateau and Callisto plus Rely generally provided control of a mix of winter weeds that was comparable to the industry standard, simazine. Trends indicated that Chateau tended to provide somewhat better residual control of Brazilian pusley.

Table 10. Crop phytotoxicity and weed control ratings.

Treatment ^y	Weed control evaluations			
	70 DAT ^z		84 DAT	
	B. Ber.	RCHBR	B. Ber.	RCHBR
Untreated	0 a	0 c	0 a	0 b
Sim + Rel 2 qt + 3 qt	0 a	77 ab	0 a	79 a
Sim + Rel 4 qt + 3 qt	0 a	84 ab	0 a	59 a
Chat + Rel 8 oz + 3 qt	0 a	97 a	0 a	86 a
Chat + Rel 12 oz + 3 qt	0 a	95 ab	0 a	91 a
Chat 12 oz	0 a	90 ab	0 a	87 a
Cal 3 oz	0 a	72 ab	0 a	67 a
Cal + Rel 3 oz + 3 qt	0 a	84 ab	0 a	75 a
Cal 6 oz	0 a	67 b	0 a	57 a
Cal + Rel 6 oz + 3 qt	0 a	77 ab	0 a	72 a

^zDays after treatment.^yCrop oil concentrate 1% by volume, $P = 0.05\%$, Duncan's New MRT.