

2022 - Ohio Vegetable & Small Fruit Research & Development Program

QuinStar & Alternatives to Gramoxone for Perennial Weed Control in Berries & Apples

Final Report

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Objectives: To determine:

1. The best QuinStar 4L (quinclorac) tank mixes to control perennial weeds in raspberries.
2. The best QuinStar 4L and Gramoxone (paraquat) tank mixes to control weeds in apple.
3. Crop safety and efficacy of QuinStar 4L applied on strawberry.

Trial 1. Quinstar for the Control of Honeyvine Milkweed in Raspberries

Methods:

An experiment was established at the Champaign Berry Farm in Urbana. The experimental design was a randomized complete block with four replications (Figure 1). Matrix (rimsulfuron), Princep (simazine) and Karmex (diuron) were tested by itself and in tank-mix with Quinstar 4L (quinclorac). All treatments included a crop oil concentrate (COC), and were sprayed as a broadcast over-the-top application. Treatments were applied using a backpack sprayer with CO₂ propellant and a 2-nozzle boom.

Treatments were sprayed on 8/11/22 when the honeyvine milkweed (HVM) was actively growing and covering most of the crop foliage (Figure 1). The plots were set up in 3 rows of raspberries that had not been used in the previous research done in HVM during 2020-2021. Visual assessments of HVM control and coverage, and crop injury were evaluated at approximately 2 and 4 weeks after treated (WAT).

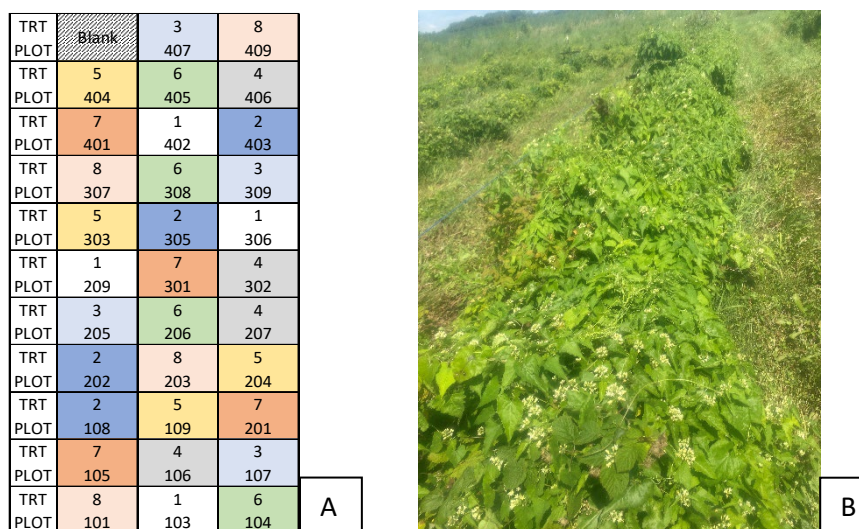


Figure 1. Experimental design (A) and Honeyvine milkweed coverage over the crop row at Champaign Berry Farm on spray day (8/11/22).

Results

Previous research funded by the OVSFRDP in 2020 and 2021 confirmed that Quinstar could be used safely on brambles and had herbicidal activity on honeyvine milkweed (HVM) when applied POST in autumn. However, control was incomplete and 2022 trials were established at the Champaign Berry Farm to evaluate the efficacy and safety of Quinstar when sprayed directly to the foliage, tank-mixed with other commonly used herbicides.

Results for 2022 research show that at 4 WAT the % coverage of HVM decreased which in time would help reduce HVM's population. Quinstar by itself did not provide good suppression. Karmex + Quinstar provided closed to 30% HVM control at 4 WAT but caused a significant injury to the crop. % control of HVM was increased when Quinstar was added to all the tank-mixes.

Overall, it was observed that Quinstar is safe to be sprayed over-the-top of the crop by itself or in tank-mix with Matrix or Princep. Crop establishment was not consistent amongst plots, and we were not able to collect crop injury data in all plots. The crop injury observed in some of the plots did not exceed the 10% when Quinstar was tank-mixed with Matrix or Princep.

Table 1. Honeyvine milkweed response to Quinstar by itself and in tank-mix with commonly used herbicides in brambles.

Treatment	Rate	2 WAT			4 WAT		
		% HVM control	% HVM coverage	% crop injury	% HVM control	% HVM coverage	% crop injury
Untreated	.	0.0 b	76.4 a	0.0 c	0.0 b	48.8 a	0.0 b
Quinstar 4L	12.6 fl oz/a	6.3 b	88.8 a	1.7 c	12.5 cd	71.3 a	6.3 b
COC	2 pt/a						
Matrix	4 oz wt/a	9.4 ab	74.4 a	5.0 c	18.8 bc	56.3 a	6.7 b
COC	2 pt/a						
Matrix	4 oz wt/a	15.0 a	86.3 a	16.7 b	22.5 b	53.8 a	10.0 b
Quinstar 4L	12.6 fl oz/a						
COC	2 pt/a						
Princep	2 qt/a	3.8 b	76.3 a	0.0 c	9.4 d	58.1 a	3.8 b
Princep	2 qt/a	7.5 b	61.3 a	6.3 bc	19.4 bc	36.3 a	6.3 b
Quinstar 4L	12.6 fl oz/a						
COC	2 pt/a						
Karmex	2 lb/a	10.0 ab	77.5 a	10.0 bc	16.3 bcd	66.3 a	30.0 a
Karmex	2 lb/a	9.4 ab	81.3 a	45.0 a	31.3 a	66.3 a	37.5 a
Quinstar 4L	12.6 fl oz/a						
COC	2 pt/a						

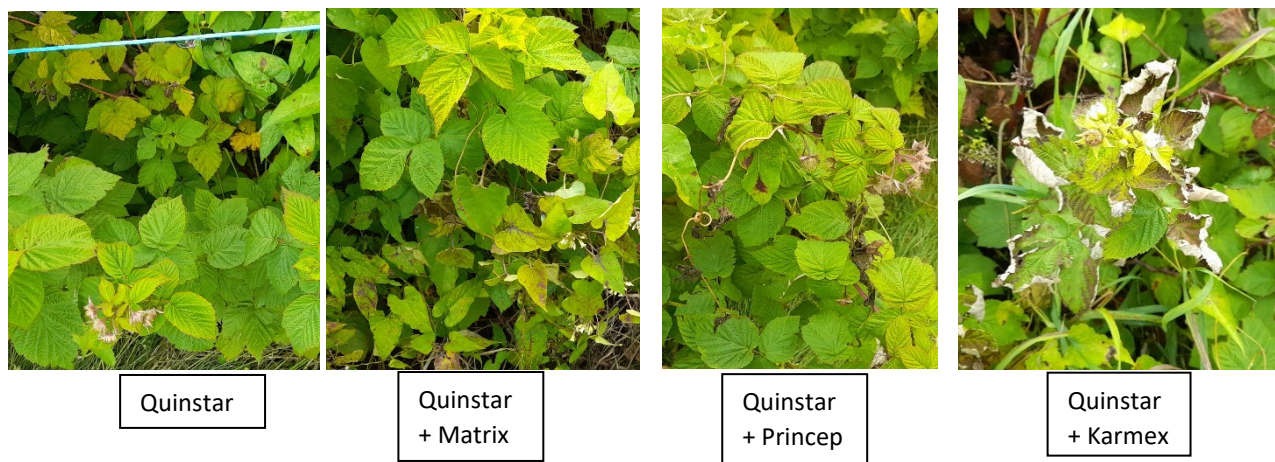


Figure 2. Crop injury at 2 WAT after Quinstar broadcast applications.

Trial 2 A. Quinstar tank-mixes for the control of perennial weeds in apples

Methods:

One experiment was established at the Rittman Orchards in Doylestown. The experimental design was a randomized complete block with four replications. Matrix (rimsulfuron), Karmex (diuron), Solicam (norflurazon) and Roundup (glyphosate) were tested in tank-mix with Quinstar 4L (quinclorac). All treatments included a crop oil concentrate (COC) and were sprayed as a soil broadcast application. Treatments were applied using a backpack sprayer with CO₂ propellant and a 2-nozzle boom. Each plot consisted of one tree/plot.

Treatments were sprayed on 5/23/22 and 6/27/22. Plots were heavily infested with Canada thistle and the thistles were ~1.5 ft tall when the first set of treatments were sprayed. Before spraying the 2nd application, plots needed to be mowed down since the treatments were not able to control the thistle that had already emerged. Visual assessments of Canada thistle control, chlorosis and necrosis were collected at 1 and 2 weeks after treated (WAT), after each application. 4 WAT data after the first application was not collected since plots were mowed down.

Results:

This year's research indicates that size of Canada thistle at application is crucial in order to achieve control of Canada thistle when using Quinstar. Quinstar by itself did not provide good control of C. thistle. All other treatments provided very good weed control after the second application. Treatments that included Quinstar in the tank-mix made the C. thistle in the plots grow very tall and chlorotic. Thistles reached heights of approximately 5 ft at 2 WAT.

When Quinstar was added to Karmex + Matrix + Roundup (Q+K+M+RU), the performance of this treatment increased compared to the tank-mix that did not include Quinstar. Canada thistle control at 1 WAT after the first application of Q+K+M+RU was 50%, which translated into better weed control after the second application when thistles were shorter.

Table 1. Canada thistle response to Quinstar by itself and in tank-mix with Karmex, Matrix and Solicam.

Treatment	Treatment Rate	% Control of Canada Thistle			
		1 WAT 1st Application	2 WAT	1 WAT 2nd Application	2 WAT
Untreated	.	0 c	0 a	0 b	0 d
Quinstar 4L	12.6 fl oz/a	18 b	10 a	77 a	76 c
COC	2 pt/a				
Karmex	1.16 lb/a	25 b	20 a	99 a	95 a
Matrix SG	4 oz wt/a				
Roundup	32 fl oz/a				
COC	2 pt/a				
Quinstar 4L	12.6 fl oz/a	13 bc	10 a	86 a	90 ab
Karmex	1.16 lb/a				
Matrix SG	4 oz wt/a				
COC	2 pt/a				
Quinstar 4L	12.6 fl oz/a	50 a	20 a	92 a	99 a
Karmex	1.16 lb/a				
Matrix SG	4 oz wt/a				
Roundup	32 fl oz/a				
COC	2 pt/a				
Quinstar 4L	12.6 fl oz/a	24 b	10 a	83 a	80 bc
Solicam	3.75 lb/a				
COC	2 pt/a				



Figure 1. Weed control at 2 weeks after second application of treatments.

Trial 2 B. Alternatives to Gramoxone for the control of perennial weeds

Methods:

Two experiments were set up at the OSU/CFAES Wooster Campus to evaluate burndown alternatives to Gramoxone (Paraquat) for the control of perennial weeds. Gramoxone, the standard burndown herbicide, has essentially been eliminated as an option due to changes in availability and registration. AIM, Venue and Sharpen were tested by itself and in tank-mix with Karmex and Matrix (table 1). Plots were not replicated as the trials were only set up to observe performance and compare to the commercial standard: Gramoxone.

Site 1: plots were set up using 0.5 m² quadrats at a site that was heavily infested with poison ivy and Virginia creeper.

Site 2: plots were set up using 1m² quadrats at a site that was heavily infested with Canada thistle.

Both sites were sprayed once using a backpack sprayer with a CO₂ propellant and a 2-nozzle boom. Site 1 was sprayed on 7/14/22 and Site 2 on 7/26/2022. Weed control visual assessments were made at 1, 2 and 4 weeks after treatments (WAT) were sprayed.

Table 1. Treatments tested at both sites for the control of poison ivy, Virginia creeper and Canada thistle.

Trt No.	Treatment	a.i.	Rate
1	Untreated	-	-
2	Gramoxone	Paraquat	2 pt/a
	NIS		0.25 %v/v
3	Aim	Carfentrazone	2 fl oz/a
	NIS		0.25 %v/v
4	Aim	Carfentrazone	2 fl oz/a
	Karmex	Diuron	1.16 lb/a
	Matrix	Rimsulfuron	4 oz wt/a
	NIS		0.25 %v/v
5	Venue	Pyraflufen	4 fl oz/a
	COC		1 gal/100gal
6	Venue	Pyraflufen	4 fl oz/a
	Karmex	Diuron	1.16 lb/a
	Matrix	Rimsulfuron	4 oz wt/a
	COC		1 gal/100gal
7	Sharpen	Saflufenacil	2.5 fl oz/a
	MSO		1 gal/100gal
	AMS		3 qt/100gal
8	Sharpen	Saflufenacil	2.5 fl oz/a
	Karmex	Diuron	1.16 lb/a
	Matrix	Rimsulfuron	4 oz wt/a
	MSO		1 gal/100gal
	AMS		3 qt/100gal

Results:

Site 1: None of the alternatives to Gramoxone included in this experiment were able to completely control poison ivy. The struggles with the control of poison ivy are likely due to the weed's waxes, deep roots and vining growth habits. Sharpen was the only treatment that provided approximately 60% control of poison ivy but it was not enough to stop growth. Virginia creeper was more sensitive to the treatments and Sharpen by itself and in tank-mix provided control similar to Gramoxone. Venue in tank-mix with Karmex + Matrix provided 80 % control at 4 WAT.

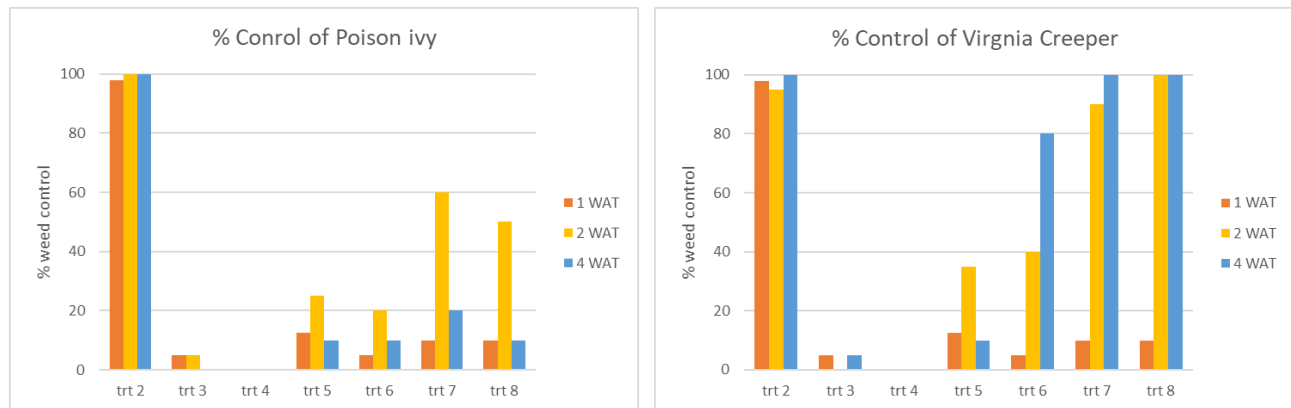


Figure 1. Response of poison ivy and Virginia creeper to burndown alternatives to Gramoxone.

Site 2: Aim, Venue and Sharpen in tank-mix with Karmex + Matrix provided very good control of Canada thistle compared to Gramoxone. It was observed that all treatments provided some residual control at 4 WAT, except for Gramoxone since it is a contact herbicide.

Aim weed control at 1 WAT reached 50% but by the 4 WAT all treatment effect was lost and regrowth started to occur. However, Venue's weed control increased over time achieving 50% control by the 4 WAT. Sharpen's performance by itself was very good, with % weed control of almost 100% at 1 WAT. All three herbicides tested performed really good when tank-mixed with Karmex + Matrix. Aim and Venue provided marginal control of Canada thistle by itself. None of the treatments tested provided control of grasses.

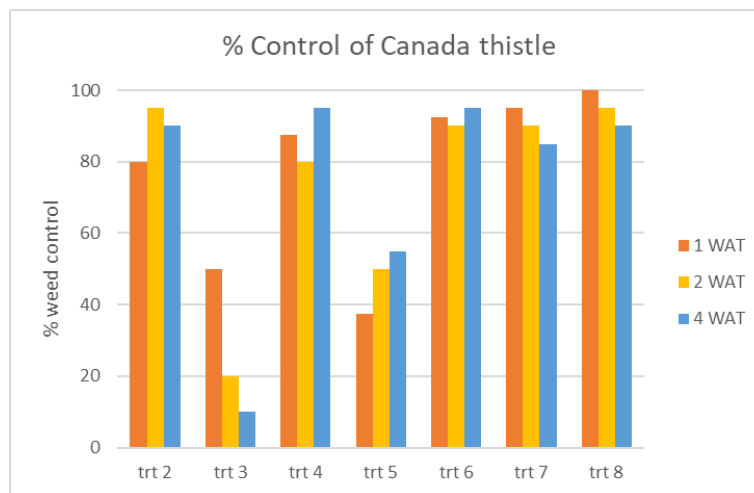


Figure 2. Response of Canada thistle to burndown alternatives to Gramoxone.

Trial 3. Crop Safety of Quinstar 4L on strawberry.

Methods:

An experiment was established at the Horticultural Unit 1 Farm in Wooster to determine crop safety of Quinstar 4L applied on the interrows of a newly established strawberry field. The experimental design was a randomized complete block with four replications. Three rates of Quinstar were evaluated: 12.6, 25.2 and 50.4 fl oz/A. All rates of Quinstar had a COC at 2 pt/A. Each plot consisted of two 25-foot long rows of strawberries spaced 5 ft apart.

Strawberry plants were transplanted on 5/10/22 and herbicides were applied as a shielded application to the interrows on 7/14/22 when runners were starting to get into the interrows. The application was made using a backpack sprayer with a CO₂ propellant and a one nozzle boom + shield with VS 11003 XR nozzle. The boom was calibrated to deliver 25 GPA. Visual assessment was made to evaluate any possible crop injury using a linear scale of 0-100 at 1, 2 and 4 weeks after treated (WAT). The field where this trial was established did not have vining weeds or Canada thistle to evaluate. Weed control data was not collected since plots were kept weed free until the treatment's application.

Results:

Quinstar applied as a shielded banded application was safe to the strawberry plants and strawberry runners that had gone into the interrows when application took place. No injury was observed. See table.

The use of Quinstar on strawberry was moved forward in the IR-4 2022 Food Use Workshop and classified as a high priority. Residue or performance trials funded by the IR-4 Project are expected in 2023.

Treatment	Rate	1 WAT	2 WAT	4 WAT
Untreated		0 a	0 a	0 a
Quinstar 4L	12.6 fl oz/a	0 a	0 a	0 a
COC	2 pt/a			
Quinstar 4L	25.2 fl oz/a	0 a	0 a	0 a
COC	2 pt/a			
Quinstar 4L	50.4 fl oz/a	0 a	0 a	0 a
COC	2 pt/a			



Untreated

Quinstar 4L 12.6 fl oz/A

Quinstar 4L 25.2 fl oz/A

Quinstar 4L 50.4 fl oz/A

Figure 1. Crop safety observed on strawberry plants when using Quinstar as a banded application at 4 WAT.

Trial 4. Stinger and Quinstar for the control of vining weeds in apples

Methods:

One experiment was established at the Rittman Orchards in Doylestown along the Quinstar/Canada thistle plots. Observational plots were set up and were not replicated as the objective of the trial was only to observe performance. Stinger (clopyralid) at 0.67 pt/A, Matrix (rimsulfuron) at 4 oz/A, Karmex (diuron) at 1.16 lb/A and Roundup (glyphosate) at 32 fl oz/A were tested in tank-mix with Quinstar 4L (quinclorac). All treatments were sprayed in early July as a soil broadcast application. Treatments were applied using a backpack sprayer with CO₂ propellant and a 2-nozzle boom. Each plot was established in three trees that were infested with field bindweed and some Canada thistle. Evaluations were made at 1 and 2 WAT. Data at 4 WAT was not collected since all plots received a maintenance spray as part the orchard's weed control management.

Results:

Stinger by itself provided good weed control of field bindweed at 1 WAT but marginal control of Canada thistle was observed at 1 and 2 WAT. The plot treated with Stinger + Karmex + Matrix + Quinstar + Roundup had 95% control of field bindweed by the 2 WAT evaluation. The latter treatment also provided good control of Canada thistle by 2 WAT. Overall the addition of Quinstar to the standard tank mix of Karmex + Matrix + Roundup increased the control of field bindweed and C. thistle.

Table 1. Canada thistle and field bindweed response to Stinger and Quinstar

Treatment	% weed control					
	Canada thistle		Bindweed		Overall	
	1 WAT	2 WAT	1 WAT	2 WAT	1 WAT	2 WAT
Untreated	0	0	0	0	0	0
Stinger	40	70	80	70	60	70
Stinger+K+M+RU	50	90	90	80	70	85
Stinger+K+M+Q+RU	80	90	80	95	80	90



Untreated



Stinger



Stinger + Karmex + Matrix + Roundup



Stinger + Karmex + Matrix + Roundup + Quinstar

Figure 1. Weed control observed at 2 WAT in plots treated with Stinger by itself and in tank mix.

Acknowledgements

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