OPTIMIZING POKEWEED AND BLACKBERRY MANAGEMENT STRATEGY IN ORGANIC PEAR ORCHARDS

(2023 Report)

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ABSTRACT

In Northern California, Pokeweed and blackberry have been around for a long time and is typically found in disturbed areas and fallow sites such as: under power lines, wooded areas, fences, pond edges, roadsides, etc. However, in recent years, organic orchard growers have reported that pokeweed has been invading and contaminating new areas that were not found before. A field trial was conducted during the 2023 growing seasons in an organic pear orchard with an existing stand of mixed pokeweed and blackberry to test the effectiveness of organic herbicides applied at two and three sequential applications with and without previous mechanical weeding of the weeds. The results showed that organic herbicides just burn back the top area where the herbicide gets in contact. However, pokeweed and blackberry are perennial weeds with the ability to recover quickly, and those herbicides suppress pokeweed and blackberry for only one or two weeks. Future Research will be designed to access long-lasting control of pokeweed in organic orchards using different organic management strategies, including other mechanical weeding approaches and the use of non-systemic herbicides at the early pokeweed growth stage. Also, strategies such as non-chemical weed control based on physical methods (e.g., tillage or mowing) or thermal methods such as propane flaming, steam, foamstream (steam plus foamer), or electric weed control should be tested as alternatives to suppress pokeweed or blackberry weed in organic pear orchards floor.

INTRODUCTION

Pokeweed (*Phytolacca americana*) and blackberry (*Rubus* spp.) are invading cultivated areas, making the harvest process difficult, as those species grow over 6 feet in height among the branches of the trees.

Organic herbicides are available to control weeds in conventional and organic production systems. However, there is limited data on their effectiveness in orchard systems regarding weed growing stage, number of sequential applications, application interval, and selectively.

Postemergence organic herbicides directly affect leaf epidermal cells, resulting in loss of cellular integrity followed by plant tissue desiccation (Lanini, 2010). However, control of established perennial weeds such as pokeweed and blackberry are difficult due to the extensive root system. Orchard growers have reported that these weeds begin recovery approximately two weeks after treatment application; thus, organic herbicides may require late sequential application due to the non-systemic characteristics of these products (Carroll et al., 2020).

The primary objective of this research was to provide California pear growers and agricultural pest control advisors (PCAs) with an organic herbicide application program for long-lasting control of perennial weeds.

OBJECTIVES

We tested two organic herbicides (AXXE Broad Spectrum Herbicide and Suppress) applied at two and three sequential applications under two different weed management programs (with and without previous mechanical weeding of the weeds).

- Compare single and sequential applications of organic herbicide programs with and without mechanical weeding for long-lasting control of pokeweed and blackberry.
- Determine the effects of potential phytotoxicity on pear trees.
- Evaluate the advantages and disadvantages of each management program and the most cost-effective program.

PROCEDURES

A field trial was conducted during the 2023 growing seasons as randomized complete block designs with four replications in an organic pear orchard with an existing stand of mixed pokeweed and blackberry. Treatments included an untreated control, a mechanical weeding standard, and 2 organic herbicide treatments applied at two and three sequential applications with and without previous mechanical weeding of the weeds, totaling 10 treatments (***Table 1***). Weed control and crop injury were assessed at 3, 7, 14, 21, 28, 35, 42, and 63 days using visual weed control estimations.

An economic analysis of all treatments was conducted based on estimated cost of herbicide products.

DATA ANALYSIS

Data was tested for normality and homogeneity of variance and subjected to ANOVA with the PROC GLM procedure of SAS 9.4 (SAS Institute Inc, Cary, NC). Appropriate nontransformed means of weed control and pear injury were separated by Fisher's Protected LSD at P = .05. Graphs were plotted with Sigma Plot 11.0 (Systat Software Inc.).

RESULTS

POKEWEED (*Phytolacca americana*). The first application of Axxe or Suppress for the plots with mechanical weeding resulted in pokeweed control over the 60% threshold for only 1 single week (***Fig. 1 a***). A second application increased pokeweed control back to 75% at 14 DAIT, but at 21 DAIT, pokeweed control decreased to less than 30%.

Both herbicides, Axxe and Suppress, showed similar performances in suppressing pokeweed. However, pokeweed is a perennial weed, and these herbicides just burn back the top area where the herbicide gets in contact, but due to the robust taproot system, pokeweed recovers quickly (***Fig. 2*** and ***3***).

At the plots without previous mechanical weeding of the weeds, two and three applications of Axxe or Suppress provided pokeweed control over the 60% threshold for more than 21 and 35 DAIT, respectively (***Fig. 1 b***). However, the pokeweed recovering over time (***Fig. 4***).

BLACKBERRY (*Rubus* spp.). The first application of Axxe or Suppress for the plots with mechanical weeding resulted in blackberry control greater than 78 % 3 DAIT (***Fig. 5 a***). However, 7 DAIT control decreased to less than 45%.

A second herbicide application at 7 DAIT did not provide control at the threshold of 60% and required three sequential applications to reach 85% control. However, the blackberry also recovered over time ((***Fig. 6***), and at about 45 DAIT control was under the threshold of 60%.

At the plots without previous mechanical weeding of the weeds, two and three applications of Axxe or Suppress also provided blackberry control over the 60% threshold for more than 21 and 35 DAIT, respectively (***Fig. 5 b***).

Although organic herbicides performed better in controlling blackberry weed in the plots without mechanical weeding, blackberries in the area will affect the harvesting process, making it difficult for workers to move around the pear orchard (***Fig. 7***).

Pear tree leaf injury was observed in the low canopy from 0 to 1.5 meters height at the plots without mechanical weeding (***Fig. 8***). During the growing season, pokeweed and blackberry overgrow between the branches of the orchard trees, reaching over 10 feet tall, making organic herbicide application difficult.

Injuries greater than 15% were observed for plots without mechanical weeding at 7 and 14 DAIT for all herbicide treatments, while for plots that received mechanical weeding before herbicide application, injuries did not exceed 1% (***Table 2***).

ORGANIC HERBICIDE COST. The cost of organic herbicide is still a limiting factor for growers. A single broadcast application can cost over 150 dollars per acre ***(Fig. 9***).

FINAL CONSIDERATIONS AND FUTURE RESEARCH

The results showed that organic herbicides just burn back the top area where the herbicide gets in contact. However, pokeweed and blackberry are perennial weeds with the ability to recover quickly, and those herbicides suppress pokeweed and blackberry for only one or two weeks.

Future Research will be designed to access long-lasting control of pokeweed in organic orchards using different organic management strategies, including other mechanical weeding approaches and the use of non-systemic herbicides at the early pokeweed growth stage. Also, strategies such as non-chemical weed control based on physical methods (e.g., tillage or mowing) or thermal methods such as propane flaming, steam, foamstream (steam plus foamer), or electric weed control should be tested as alternatives to suppress pokeweed or blackberry weed in organic pear orchards floor.

ACKNOWLEDGEMENTS

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REFERENCES

Carroll, D. E., Kaminski, J. E., & Borger, J. A. (2022). Efficacy of natural herbicides on dandelion (*Taraxacum officinale* GH Weber ex Wiggers) and white clover (*Trifolium repens* L.) populations. *International Turfgrass Society Research Journal*, 14, 759-769.

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Table 1. *Trade names, active ingredients, mechanical approach, and the number of applications suggested for this study.*

No.	**Treatment**	**Active ingredient**	**Rate (% v/v)**	**Mechanical Weeding***	**No. Applications***
1	Untreated	-		-	-
2	Mechanical Weeding	-		Yes	-
3	Suppress	Caprylic acid + Capric acid	9	Yes	Two
4	Suppress	Caprylic acid + Capric acid	9	Yes	Three
5	AXXE	Ammonium Nonanoate	13	Yes	Two
6	AXXE	Ammonium Nonanoate	13	Yes	Three
7	Suppress	Caprylic acid + Capric acid	9	No	Two
8	Suppress	Caprylic acid + Capric acid	9	No	Three
9	AXXE	Ammonium Nonanoate	13	No	Two
10	AXXE	Ammonium Nonanoate	13	No	Three

*A brushcutters/weedeater was used for mechanical weeding two weeks before initial organic herbicide application.
First application (16/May/2023); Second application (24/May/2023); Third application (6/Jun/2023).

Table 2. *Visual estimation of pear tree injury (%)* at the plots without mechanical weeding.

TREATMENT	**Pear Tree Injury (%)***											
	7 DAIT		**14 DAIT**		**21 DAIT**		**28 DAIT**		**42 DAIT**		**63 DAIT**	
Mower Only	0	b	0	b	0	c	0	c	0	b	0	b
Suppress	1	b	1	b	1	c	1	c	1	b	0	b
Suppress	1	b	1	b	1	c	1	c	1	b	0	b
Axxe	1	b	1	b	1	c	1	c	0	b	0	b
Axxe	0	b	0	b	1	c	0	c	4	b	3	b
Suppress	21	a	22	a	12	b	12	b	11	a	9	a
Suppress	18	a	19	a	18	ab	15	ab	15	a	11	a
Axxe	20	a	21	a	19	a	15	ab	14	a	11	a
Axxe	16	a	17	a	18	ab	19	a	16	a	12	a
Untreated Check	0	b	0	b	0	c	0	c	0	b	0	b
LSD (P=.05)	**4.1**		**3.8**		**4.8**		**4.3**		**5.4**		**3.8**	

*Visual estimation of pear tree injury (%) in the low canopy from 0 to 1.5 meters height.

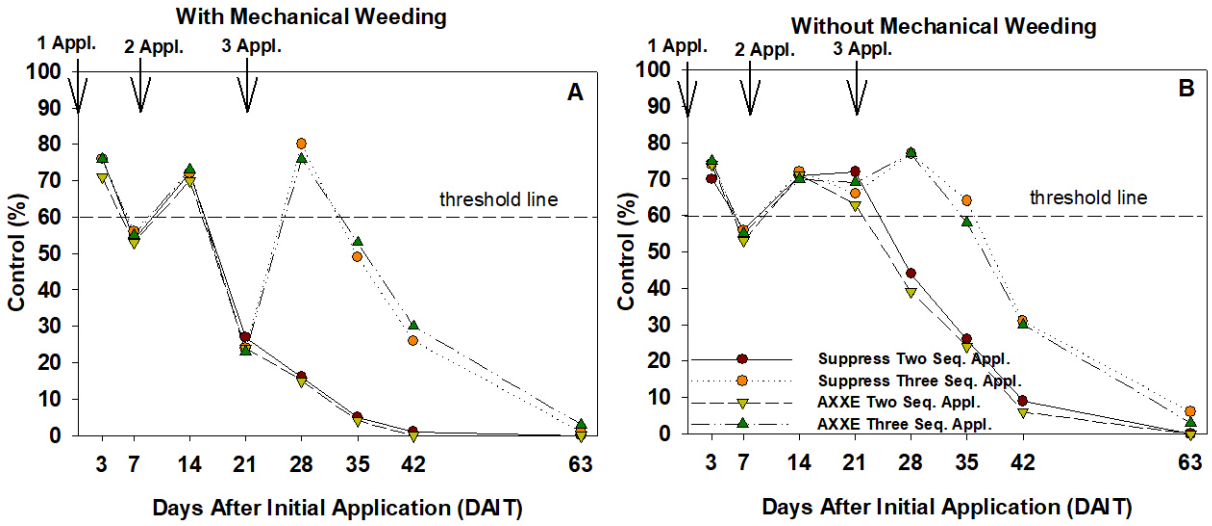

Fig. 1. *Pokeweed Control (%) with organic herbicides applied at two and three sequential applications with and without previous mechanical weeding of the weeds.*

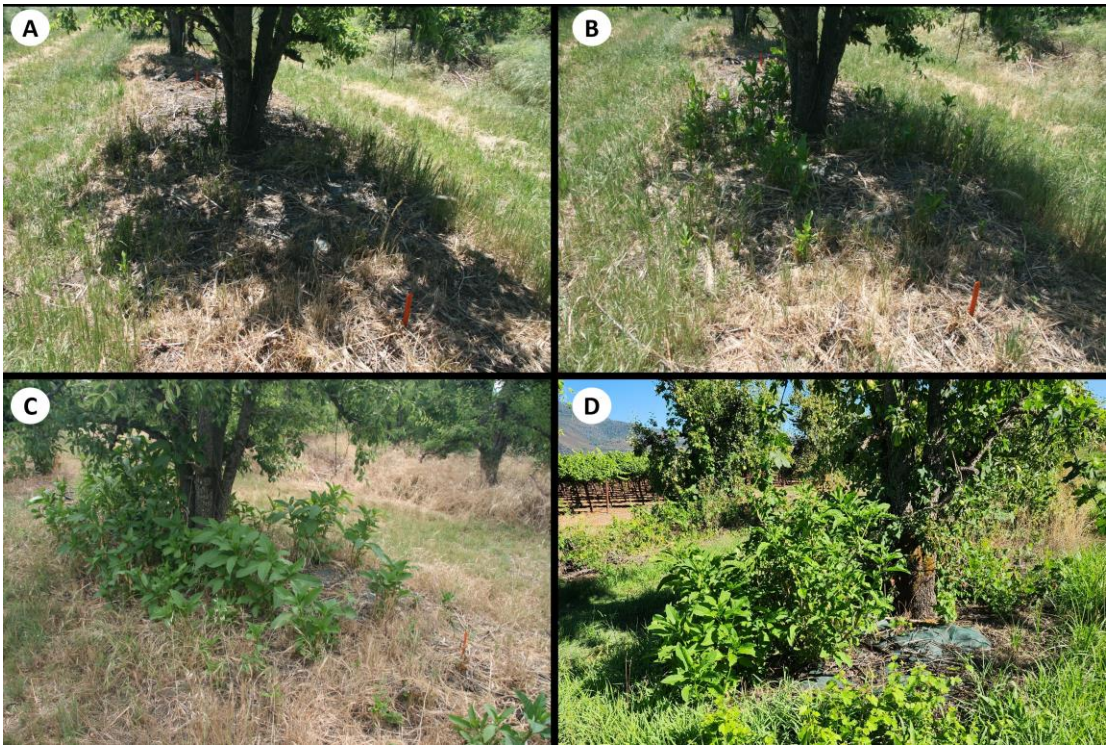

Fig. 2. *Pokeweed recovering from the application of the organic herbicide on the plots with mechanical weeding at 3 (A), 7(B), 28(C), and 63(D) DAIT (Plot with two applications of Suppress). Photo by Clebson Gonçalves.*

Fig. 3. *Pokeweed new growth emerges from the robust taproots system in the spring. Photo by Clebson Gonçalves.*

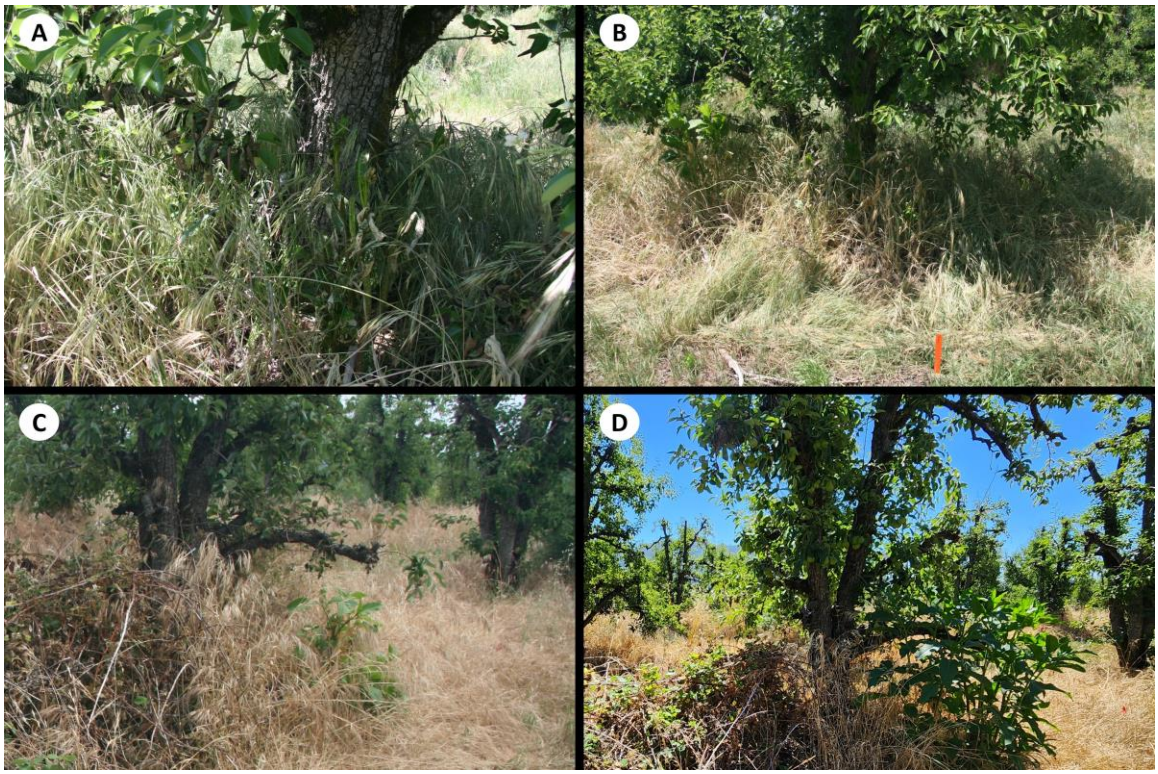

Fig. 4. *Pokeweed recovering from the application of the organic herbicide on the plots without mechanical weeding at 3 (A), 7(B), 28(C), and 63(D) DAIT (Plot with two applications of Suppress). Photo by Clebson Gonçalves.*

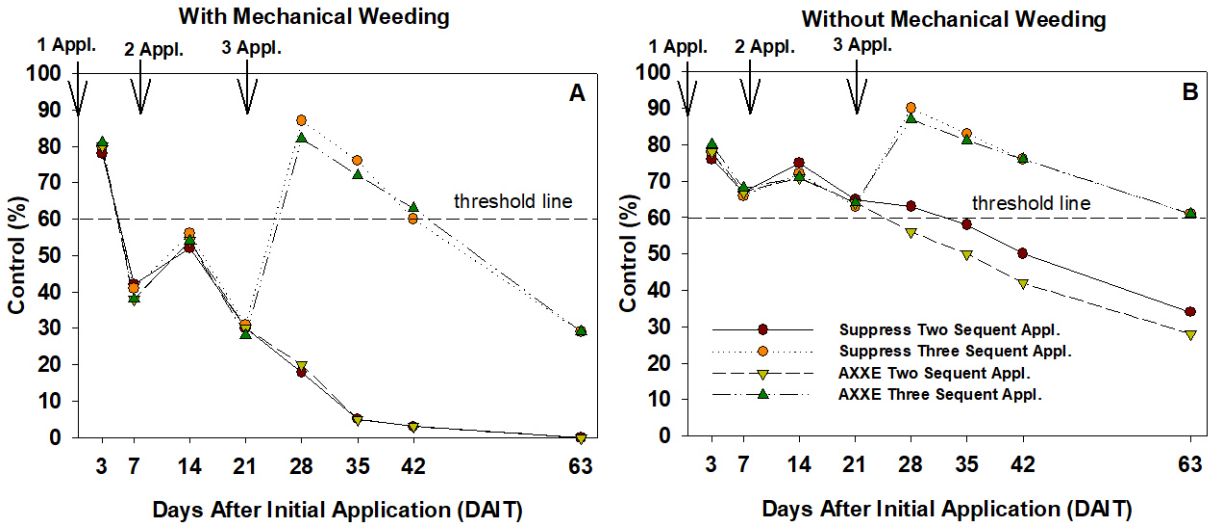

Fig. 5. *Blackberry Control (%) with organic herbicides applied at two and three sequential applications with and without previous mechanical weeding of the weeds.*

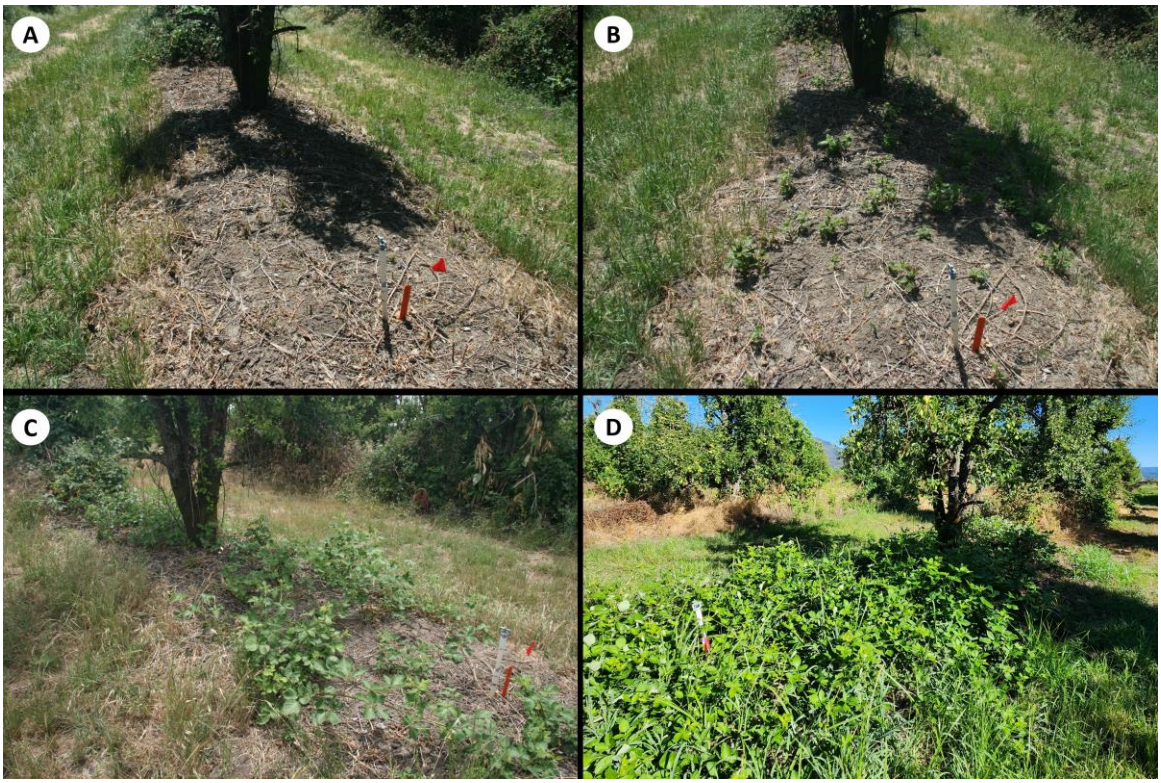

Fig. 6. *Blackberry recovering from the application of the organic herbicide on the plots with mechanical weeding at 3 (A), 7(B), 28(C), and 63(D) DAIT (Plot with two applications of Suppress). Photo by Clebson Gonçalves.*

Fig. 7. *Blackberry recovering from the application of the organic herbicide on the plots without mechanical weeding at 3 (A), 7(B), 28(C), and 63(D) DAIT (Plot with two applications of Suppress). Photo by Clebson Gonçalves.*

Fig. 8. *Pear tree injury from the application of the organic herbicide on the plots without mechanical weeding at 28 DAIT (Plot with two applications of Suppress). Photo by Clebson Gonçalves.*

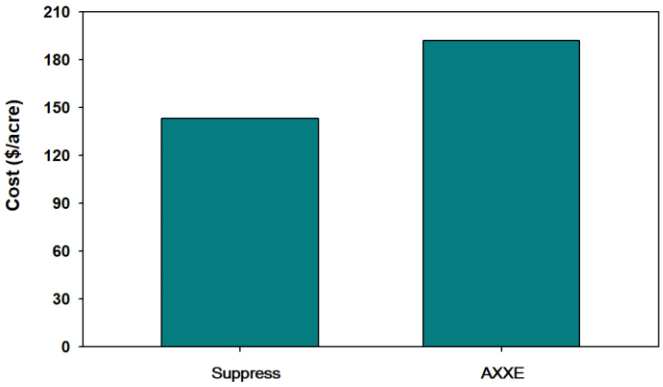

Fig. 9. *Cost per acre of organic herbicide products - broadcast single application.*