



# Weed Control and Economic Considerations of Flame Cultivation in Pawpaw Orchards

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## Abstract

Pawpaw [*Asimina triloba* (L.) Dunal] is a new niche tree fruit crop for small farmers in the eastern United States. Flame cultivation offers an organic alternative to herbicide application for the control of grass and perennial weeds and uses a torch-directed flame to kill weeds by causing the plant cells to rupture. The objectives of this study were to determine if flame cultivation with a backpack flamer would control grass/weed coverage around pawpaw trees without damage to trunks, and if flame cultivation is economically viable. A completely randomized experimental design was implemented using 12 five-year-old seedling trees treated with either 1) control (weed eating), 2) flaming with avoidance of the trunk, and 3) flaming without avoiding flame contact with the trunk. There were four replicate trees in each treatment. On July 25 and August 2 and 18, 2006, a three foot area around treatment trees was either subjected to the flaming treatments or weed eating (to a height of 2 inches). On August 25, and September 8 and 15, 2006, re-growth in plots was rated from 1 to 10, with 1 having no grass/weed coverage and 10 having total grass/weed coverage. By August 25, all flame plots had significantly less grass/weed coverage (about 2.25 rating) than control plots (7.75). On September 15, flame treatment plots had increased grass/weed coverage (about 4.75), but less coverage than control plots (9.5). By September 15, trees in either flaming treatment did not display noticeable trunk damage or wilting. Trunk damage will be evaluated again in 2007.

## Introduction

- Pawpaw [*Asimina triloba* (L.) Dunal] has potential as a new niche tree fruit crop for small farmers in the eastern United States (Layne, 1996; Pomper and Layne, 2005).
- The pawpaw fruit has fresh market and processing potential with a tropical-like flavor and aroma resembling a mixture of banana, mango, and pineapple (Duffrin and Pomper, 2006).
- Weed management in orchards reduces competition for nutrients and water and enhances rodent management; irrigation and fertilization cannot overcome the severe weed competition.
- Poor pawpaw tree establishment has been an issue for growers; trees do not compete well with weeds during establishment.
- Flame cultivation uses a torch-directed flame to kill weeds, and the flame sears the weeds causing the plant cells to rupture (Seifert and Snipes 1998).
- Flame cultivation or weeding offers an organic alternative to herbicide use for control of grass and perennial weeds.
- There is little information concerning the effectiveness of flame cultivation and the potential for trunk injury for tree fruit crops.

## Objective

The objectives of this study were to determine if:

- 1) flame cultivation with a backpack flamer would control grass/weed coverage around pawpaw trees without damage to trunks
- 2) flame cultivation is economically viable.

## Materials and Methods

A completely randomized experimental design was implemented using 12 five-year-old seedling trees. These trees were treated with either: control (weed eating), flaming with avoidance of the trunk, and flaming without avoiding flame contact with the trunk.

There were four replicate trees in each treatment. On July 24 and August 2 and 18, 2006, a three foot area around treatment trees was either subjected to the flaming treatments or weed eating (to a height of 2 inches). On August 25, and September 7 and 15, 2006, re-growth in plots was rated from 1 to 10, with 1 having no grass/weed coverage and 10 having total grass/weed coverage. Weed species encountered in flaming plots prior to flaming were: Dandelion, Crabgrass, Fescue, Plantain, Johnson grass, Pigweed, and Clover.



Figure 1: A hand-held flamer. Fig. 2: Flame cultivation of pawpaw trees on 7/24. Fig. 3: Flame cultivation around the pawpaw trunk.

Table 1: Weed regrowth in pawpaw plots 1, 3, and 4 weeks after last flaming treatment

Flame cultivation and weed regrowth in pawpaw	date		
	8/25/2006	9/8/2006	9/15/2006
Control	7.75 a	8.50 a	9.50 a
Normal flaming	2.25 b	3.75 b	4.75 b
Heavy flaming	2.50 b	3.00 b	4.50 b
Significance	***	***	***

Table 2: Weed control costs for three different methods over one

Weed control method	Cost per 100 trees
flame cultivation (repeat 6x/year)	\$157.50
straw mulch (applied 1x/year)	\$400.00
glyphosate (applied 4x/year)	\$9.97



Figure 4: Pawpaw plot before flame cultivation (7/24). Fig. 5: One week after last flaming treatment (8/25). Fig. 6: Three weeks after last flaming treatment (9/7). Fig. 7: Four weeks after last flaming treatment (9/15).



Figure 8: What you **don't** want your flame cultivation to look like.

## Results

- Flaming was slow, about 3.75 minutes per tree.
- By August 25, all flame plots had significantly less grass/weed coverage (about 2.25 rating) than control plots (7.75) (Table 1).
- On September 15, flame treatment plots had increased grass/weed coverage (about 4.75), but less coverage than control plots (9.5).
- By September 15, trees in either flaming treatment did not display noticeable trunk damage or wilting.
- Based on the time required and cost of materials, the cost of flame cultivation per 100 trees was examined and flame cultivation was found to be 2.5 times less expensive than straw mulch (organic) but 15 times more expensive than glyphosate (conventional; Table 2).

## Discussion

- Flame cultivation can be used to control grass/weed coverage around pawpaw trees.
- During this growing season, it did not appear that trunks were damaged by either flaming treatment. Trunk damage will be evaluated again in 2007. Plastic flame guards for trunks may be an option if trunk damage is apparent in 2007.
- Flame cultivation can control grass and weeds without herbicide use and deplete weed root reserves preventing regrowth of weeds. Several drawbacks of flame cultivation are that it uses fossil fuel for organic crop production and weed organic matter is lost for incorporation into the soil.

## Conclusions

- Flaming did control grass and weeds for several weeks after treatment.
- Pawpaw trunks did not initially appear to be damaged.
- Flame cultivation is economically viable for organic pawpaw production.

## References

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