



Is Flame Cultivation a Viable Method for Organic Weed Control in Pawpaw Orchards?

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Introduction:

What is Pawpaw?

- *Asimina triloba* (L.)
Dunal.
- Native tree fruit in the southeastern U.S.
- Fruit can weigh up to 2 lbs.
- Organic production possible.



The Pawpaw Fruit

- Tropical-like flavor and aroma resembles mixture of banana, mango, and pineapple.
- Custard-like fruits are berries.
- The fruit is very nutritious and high in antioxidant activity.
- Could be used in blended fruit drinks, ice creams, yogurt, etc.



Zimmerman

Why control weeds in orchards?

- Weed management in orchards:
 - Reduced competition
 - Nutrient management
 - Irrigation and water management
 - Rodent management
- Irrigation and fertilization cannot overcome the severe weed competition.
- During establishment, pawpaws do not compete well with weeds.



The U.S. Organic Market

- The value of the US organic market is expected to exceed \$30 billion in 2007.
- It the fastest-growing segment of U.S. agriculture (Yussefi and Willer 2004, Oberholtzer et al. 2005).

What does “Organic” mean?

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- In 2002, the U.S. Department of Agriculture put in place a set of national standards that food labeled “organic” must meet, whether it is grown in the United States or imported from other countries.
- Organic crops are produced without using most synthetic products, pesticides, bioengineering; or ionizing radiation.

■ § 205.206 Crop pest, weed, and disease management practice standard.

■ (a) The producer must use management practices to prevent crop pests, weeds, and diseases including but not limited to:

- (1) Crop rotation and soil and crop nutrient management practices, as provided for in §§ 205.203 and 205.205;
- (2) Sanitation measures to remove disease vectors, weed seeds, and habitat for pest organisms; and
- (3) Cultural practices that enhance crop health, including selection of plant species and varieties with regard to suitability to site-specific conditions and resistance to prevalent pests, weeds, and diseases.

■ (b) Pest problems may be controlled through mechanical or physical methods including but not limited to:

- (1) Augmentation or introduction of predators or parasites of the pest species;
- (2) Development of habitat for natural enemies of pests;
- (3) Nonsynthetic controls such as lures, traps, and repellents.

■ (c) Weed problems may be controlled through:

- (1) Mulching with fully biodegradable materials;
- (2) Mowing;
- (3) Livestock grazing;
- (4) Hand weeding and mechanical cultivation;
- (5) Flame, heat, or electrical means; or
- (6) Plastic or other synthetic mulches: Provided, That, they are removed from the field at the end of the growing or harvest season.

Flame Cultivation



- Flame cultivation uses a torch-directed flame to kill weeds, and the flame sears the weeds causing the plant cells to rupture.
- 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.

Flaming



- Tractor models
- Backpack flamer
 - Useful to small growers



Flame Cultivation

■ Pros

- Weed control without herbicide use.
- Depletion of weed root reserves.

■ Cons

- Using a fossil fuel for organic production.
- Release of C and N?

The objectives of this study were to determine if:

- flame cultivation with a backpack flamer would control grass/weed coverage around pawpaw trees.
- flaming would damage tree trunks.

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
 - flaming without avoiding flame contact with the trunk
- There were four replicate trees in each treatment.



Materials and methods

- 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).







Materials and methods

- 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
 - 10 having total grass/weed coverage.
- Weed species encountered in flaming plots:
 - Dandelion, Crabgrass, Fescue, Plantain, Johnson grass, Pigweed, and Clover





Last flaming on August 18, photo
taken on August 25, 2006



Last flaming on August 18, photo
taken on September 7, 2006



Last flaming on August 18, photo
taken on September 15, 2006



Number of dandelions on 8/25/06

<u>Treatment</u>	<u># of plants</u>
control	31a
normal flaming	10 b
heavy flaming	10 b
significance	***



Last flaming on
August 18, photo
taken on September
15, 2006



Heavy
flaming

Control

Flame cultivation and weed regrowth in pawpaw

<u>Treatment</u>	<u>date</u>		
	<u>8/25/2006</u>	<u>9/8/2006</u>	<u>9/15/2006</u>
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	***	***	***

Results and Discussion

- Flaming was slow, about 3.75 minutes per tree.
- One week after flaming, all flame plots had significantly less grass/weed coverage (about 2.25 rating) than control plots (7.75).
- Three weeks after flaming, flame treatment plots had increased grass/weed coverage (about 4.75), but less coverage than control plots (9.5).

Results and Discussion

- By three weeks after flaming, trees in either flaming treatment did not display noticeable trunk damage or wilting.
- During this growing season, it would appear that trunks were undamaged by either flaming treatment.
- Trunk damage will be evaluated again in 2007.
- Costs?

Conclusions

- Flaming did control grass and weeds for several weeks after treatment.
- Pawpaw trunks did not initially appear to be damaged.

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