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Study Shows Flame-weeding Works in Veggies



Killing weeds with a propane flamer, a practice that works in organic row crops, can help in certain vegetables, too. In a study of cabbages and tomatoes, Ohio State University scientists report that flaming takes far less work than hand-weeding, results in about the same crop yields and quality, and even leads to less blossom end rot, a costly tomato disorder.

The study determined two keys to success: flaming in the morning, not the afternoon, and reaching, for a split second, temperatures between 140-160 F. [Doug Doohan](#), one of the study's authors and an associate professor in the Department of Horticulture and Crop Science, said flaming gives farmers an added way to fight weeds without using chemicals.

"For certified organic growers, this is a useful tool they can have in their tool kit," said Doohan, who holds joint appointments with OSU Extension and the Ohio Agricultural Research and Development Center (OARDC) and is a member of [Ohio State's Organic Food and Farming Education and Research \(OFFER\)](#) program.



Flaming already is commonly used in organic corn and soybeans. The practice uses propane gas, lit and blown from a nozzle - picture a blowtorch - to kill weed seedlings by wilting them. The weeds don't burn but burst their cells. A typical propane flame weeder has multiple nozzles side by side and rides on the back of a tractor, mounted on a three-point hitch. The flames angle in on the sides of a row, shoot down near the base of the crop, and zap, ideally, just weeds - tiny ones, less than a half-inch high.

The two-year study used an eight-nozzle flamer on plots of cabbage and tomato plants. Comparisons were made between flat ground and raised beds and also between morning and afternoon treatments. Crop injury, soil surface temperatures, total and marketable yields, and weed control and communities were measured.



"This was exploratory research to see how flaming would work in veggies," Doohan said. "And I think the answer would be that it can work quite well." Other, previous studies have shown that organic farmers rate weed control as their number-one production challenge. Common organic weed-control methods include cultivating, hand-pulling and mulching, either with plastic sheeting or with plant materials such as

straw.

Flaming, though, doesn't disturb the soil, a feature that cuts the risk of erosion, fits under no-tillage systems and keeps from exposing more weed seeds to sprout. Unlike plastic mulch, flaming doesn't leave behind a pile of old plastic to dispose of. And flaming gives growers an option when a field is too wet to cultivate. "It might just be a day or so sooner," Doohan said. "But that day or so might be critical. A flamer can give you the control you need now."

Also of note, the study saw flaming slash the incidence of blossom end rot, a physiological disorder caused by too little calcium in the tomato fruit. "We found that very interesting," Doohan said. "It seems like the flaming is changing the plant's physiology ever so slightly. It would suggest that the tomato plant is experiencing that heat and is somehow altering its physiology because of it." Flaming has drawbacks, too, however. It won't work with mulch. The flames can melt or ignite it.

Year-in, year-out weed control is less consistent than that of chemical herbicides. Environmental conditions - rainy weather, wet or dry soil, and so on - affect how well and how long flaming works. For example, the study found flaming in the morning worked much better than in the afternoon. Reason: More moisture on the soil and the weeds. Moisture helps transfer the heat from the flames. On the other hand, too much moisture all season long, as happened in the study's second year, can spur more weeds, faster growth and species that tolerate flaming. Additional flaming and additional methods - cultivation and hand-weeding, among them - may then be required to get good control.

The results "indicate a need for the availability of multiple weed control methods, with flaming among them," Doohan and colleagues said in the study. "The need for alternative methods ... will vary from year to year but should be anticipated." And then there's the risk of roasting more than just the targeted weeds. The study found tomato plants stood largely unfazed by the heat, while cabbage plants saw their growth set back about two weeks then recovered. (Worst hit were cabbages in raised beds.) Both crops ended up giving good yields. Flaming, it seems, takes a balancing act.

"We need lethal temperatures at ground level - 60-70 degrees Celsius (about 140-160 degrees F) - but for just a very short period of time," Doohan explained. "Three to five miles per hour is where we are able to achieve that. Farmers using flame weeding for the first time will need to try several short test runs to determine the correct tractor speed to kill weeds but not damage the crop," he said. "Try starting with relatively fast tractor speeds, say, 6-7 miles per hour, then go to progressively slower speeds."

Then test for weed kill by squeezing - not too hard - a weed leaf between the thumb and index finger. A distinct, dark-colored thumbprint means you've reached the right speed. "Because conditions change rapidly in spring and early summer in response to plant growth and weather conditions, it may be necessary to repeat this test every time you flame in order to achieve 'just-right' temperatures at ground level," Doohan said.

He also suggests that the first flaming wait until about three weeks after planting. The time helps the crop plants develop their roots. Sometimes weeding can't wait, though, he said.

Co-researchers on the study were **Annette Wszelaki**, formerly of Ohio State and OFFER, now of the University of Tennessee, and **Athanasios Alexandrou**, formerly of Ohio State's Agricultural Technical Institute, now of Fresno State University. The study appeared in a recent issue of the journal Crop Protection. Funding came in part from a grant from the U.S. Department of Agriculture (USDA) Initiative for Future Agriculture and Food Systems. Organic and conventionally grown cabbage and tomatoes have a combined production value in Ohio of nearly \$20 million, according to the Ohio Department of Agriculture.

OARDC and OSU Extension are the research and outreach arms, respectively, of Ohio State's College of Food, Agricultural, and Environmental Sciences.

Story by Kurt Knebusch. Photos courtesy Doug Doohan. Web publishing by [Victor van Buchem](#).
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