Propane-Powered Flame Treatment

Effective, environmentally friendly weed control

Interest in organic farming continues to increase as consumers demand organic foods and more sustainable production methods. Organic farmers, who cannot use conventional herbicides, often rank weeds as their number one problem. Conventional (non-organic) growers may also face herbicide restrictions because of environmental regulations or sensitive crops.

Weed control alternatives are often time consuming and cost prohibitive for these farmers. Many face the prospect of weeding by hand or using expensive organic herbicides. Repeated machine cultivation can temporarily control weed growth, but it requires several runs in a season and promotes soil erosion, exacerbating other environmental problems. Frequent tillage also results in soil moisture loss, which is a critical issue to farmers who regularly have to deal with restrained water resources.

Propane-powered weed-crop flamers, which use a concentrated flame to damage or kill weeds, add an effective and economical weed control method to the organic farmer's toolbox. Propane flaming can control several different weeds on a variety of crops, and it offers a time-saving, soil-friendly alternative that reduces moisture loss and can be repeated as needed during the growing season. Current testing to determine the necessary doses of propane to kill common weed species will further enhance the technology's accuracy, making it a competitive weed-control method of choice for all farmers.

Propane weed control can create new propane consumers and significantly increase off-peak summertime demand. The U.S. has nearly 2 million acres of certified organic cropland, which is a large potential market for this technology.

Project Description

To optimize propane flaming as a weed control tool, the Propane Education & Research Council (PERC) is supporting the University of Nebraska in the research effort *Determining Biologically Effective Propane Dose for Weed-Crop Flaming* (**Docket 12202**). This project aims to:

- Test flames fueled by varying propane levels on several types of common crops and weeds.
- Collect baseline data to determine the propane dose needed to effectively damage or kill each type of weed.
- Identify which crops are most flame tolerant and the best potential candidates for use with propane flaming.
- Compile propane flaming data on the factors affecting weed control and crop tolerance, including propane dosage amount, growth stage of the affected plant, and crop/weed combinations for the most effective weed control.

Benefits of Weed Flaming

Using a propane-powered flamer to control weeds has several benefits:

- Flaming is faster than tilling and significantly less expensive than both hand weeding and organic herbicides
- Weeds cannot become resistant to flame as they can to some herbicides
- It does not damage the soil or cause erosion as other alternative weed control methods can
- It is environmentally friendly and a viable option for both organic farmers and conventional farmers who want to cut back herbicide use
- Farmers will use about 5-15 gallons of propane per acre, depending on the desired extent of weed control

Flamed rows of marestail (a hard to kill weed) during the testing process

Custom-Built Weed Flamer

Weed Flaming: How It Works

The propane-powered weed flamer uses different amounts of propane and pressure to vary the heat created by its concentrated flame.

The user sprays the flame near the weed leaves or stalks. The flame does not char the leaves, but instead quickly heats the water inside the plant cells. Because plant cells are filled mostly with water, the pressure from this quickly heating water causes the cells to burst.

Without a way to move water and nutrients from roots to leaves, the weed dries out and wilts. Its future re-growth will also be stunted, but permanent elimination of the weed depends on the degree of damage inflicted in the initial spray, as well as the depth of the weed's root system.

Project Implementation

While propane flaming is already considered a viable weed control option, the heat produced by the flame varies according to the pressure, amount of propane used, and speed of application. Research was needed to determine the most effective propane dose for each plant species.

During the summer 2007 growing season, researchers tested propane flaming using six different propane doses on ten types of common weeds and six row crops grown in the Midwest. The researchers used three custom-built flamers mounted on an all-terrain vehicle. Two broadcast flamers covered spans of 1.2 m and 3 m, and one intra-row flamer covered three to five crop rows planted 76 cm apart.

The burners sprayed concentrated flame 18 cm above the soil at a 30-degree angle at a constant speed of 4 mph. Flame pressure ranged from 10-90 PSI and the propane was applied in doses of 0, 2.5, 6.5, 10.5, 14.4, and 18.4 gallons per acre.

Researchers then rated the plant damage for both crops and weeds at intervals for 1 to 14 days after the treatment.

Preliminary Project Results

The first round of testing revealed:

- Broadleaf weeds were more susceptible to flaming than grassy species, which required higher doses of propane to control.
- Some crops, like soybean and sunflower, were more easily damaged by the flaming. More research is needed to determine flaming techniques that might minimize this damage.
- Field corn showed the most potential for successful propane flaming, followed by sorghum.
- Most broadleaf weed species were controlled at 90 percent by a propane dose of 50-70 kg/ha. Although 70-90 kg/ha provided 80 percent control of grasses, no propane test dose provided 90 percent control. A drastic dose increase to about 150-180 kg/ha is needed to achieve 90 percent grass control.
- Both plant species and growth stage could greatly affect recovery rates after flaming, indicating a need for users to have detailed knowledge of both the crop and weed before flaming in farm use.

Project Status: Continued Testing in 2008

A second round of similar testing will occur in the 2008 growing season to finalize these results and develop response curves for each crop and weed. A final report outlining the results and recommendations of this effort is expected to be completed by the end of 2009.

Flaming Weeds in the Research Plot

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