

Batchen Stinger: Propane Steam Weed Control

Effective, safe, alternative thermal weed control

Farms use a variety of weed control methods to protect crops. Chemical spraying is common. However, chemicals can be expensive to use and difficult to apply in wet or windy weather, and some are hazardous to water and soil. Chemical spraying can also delay crop harvesting. A common alternative to chemical spraying is mechanical cultivation, which can damage crop roots and facilitate soil erosion and moisture loss.

Modern consumers and growers alike are increasingly concerned about groundwater protection and food quality. This awareness is accelerating the development of sustainable farming practices, which include chemical-free weed control methods such as flame, heat, and steam.

Propane steam weed control technology is creating a new choice for farmers looking to protect their crops without chemicals. This technology reduces chemical use and has been accepted by the U.S. Department of Agriculture National Organic Program as a recognized organic production practice.

D.J. Batchen Pty. Ltd. has patented a propane steam machine in Australia for weed control in vineyards, orchards, bramble crops, row crops, and horticulture. Successful demonstrations of this machine have drawn interest from growers in Australia and the United States.

Project Goals and Description

To support the transfer of patented propane steam weed control technology to the United States, the Propane Education & Research Council initiated a research effort, *Thermal Weed Control Technology (Docket 10644)*. The project's goal was to develop a touchable, viewable propane steam weed control machine to show U.S. farmers the technology's simplicity and use in vineyard applications. The transfer supports the expansion of propane use in U.S. agricultural markets.

D. J. Batchen Pty. Ltd. presented the Batchen Stinger, a propane-powered thermal weed control machine prototype, at the World Ag Expo in Tulare, CA, in February 2005. The Stinger is driven by steam-quenched combustion, which uses combusting propane fuel to superheat steam that efficiently kills weeds from the outside in (see sidebar).

Steam-Quenched Combustion Starves Weeds

Because weeds compete with crops for water and nutrients, farmers must quickly eradicate them.

Steam-quenched combustion applies intense steam heat directly to the weed to raise the temperature of moisture inside its cells.

Normally, these cells provide energy to the plant's stalk and leaves via photosynthesis. When steam is applied, the heat vaporizes the moisture in the cells, rupturing them and destroying their photosynthesis capabilities.

Without food, the weed withers away, dying from the outside of the plant back to the root system, within three days after steam treatment.



Steam-Quenched Combustion System

The Batchen Stinger is driven by steam-quenched combustion, which uses a generator to convert combusting propane fuel and water into a moist, high-velocity, 806°F (430°C) air flow. The steam enhances thermal transfer efficiency and reduces fire risk to kill weeds without damaging drip irrigation systems.

The Stinger is a towable trailer that utilizes a steam generator with a double outlet, a water tank, and a propane cylinder capable of operating the machine for approximately 7 hours without refueling. Incoming water is preheated in a coil wrapped around the outer body of the generators, then introduced into an open-ended steam heat exchanger that balances incoming water and steam outlet flow. A lightweight, adjustable, spring-loaded canopy retains heat to increase thermal transfer and reduce the cooling effect of wind.



Project Completion: Key Results

The machine was tested in several California and Washington vineyards after the World Ag Expo in February 2005. Field tests measured the Stinger's efficacy at a range of operating speeds, on various weed types, at different levels of maturity, and through various vineyard and environmental conditions (including 8-foot rows and 10-foot rows in both flat and hilly terrain).

Benefits

Steam-quenched combustion provides significant benefits over conventional weeding technologies:

- Increased thermal efficiency for better heat transfer and weed kill
- Immediate reentry into fields
- No harvest delays
- Fewer wind and weather delays
- Reduced fire risk
- Minimized use of water
- Reduced risk of damage to drip irrigation systems
- Reduced risk of damage to groundwater
- Reduced soil erosion
- Preservation of soil moisture
- Ease of use
- Increased treatment effectiveness (weeds cannot become resistant to heat)
- No burning or removal of biomass

The Stinger produced dramatic results in controlling all weed types at early growth stages, reducing average weed coverage from 85% to 2% after three days. Thirty days after treatment, average weed regrowth was 30%.

The recommended speed of use was 2 to 3 miles per hour, with a cost below that of other sustainable, low-risk treatment programs. Depending on key variables such as ground speed and row width, the machine covered 2 to 2.5 acres per hour and consumed 6-7 gallons of propane per hour. There were no measured environmental impacts of thermal weed control.

D.J. Batchen Pty. Ltd. of Australia has begun commercial production of Batchen Stinger units for the U.S. market.

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