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University of Pisa Tests Heat to Kill Vineyard Weeds

Researchers are weighing flame, foam and electric methods as growers seek alternatives to herbicides in vineyard rows

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Pisa, Italy — Researchers at the University of Pisa are examining thermal weed-control methods in vineyards as growers look for alternatives to chemical herbicides in the under-row area, where vegetation must be managed without harming vines, roots, irrigation lines or support structures.

The work, discussed in Il Corriere Vinicolo and highlighted by Unione Italiana Vini on May 27, focuses on three techniques: flame weeding with LPG, hot foam and electric weeding. Each aims to suppress weeds through heat rather than chemicals, but each also brings practical and financial limits that still make adoption uneven.

The under-row strip is one of the most difficult parts of a vineyard to manage. Weeds there compete with vines for water and nutrients, but conventional mechanical tools can damage trunks and shallow roots. Chemical herbicides have long been used in many vineyards, but pressure to reduce their use has pushed researchers and growers to test other options that fit more closely with sustainability goals.

According to the University of Pisa team, flame weeding is currently the most established thermal method. It works best on young weeds and avoids some of the soil disturbance linked to mechanical cultivation. But it requires repeated passes and depends on fuel costs. Hot foam uses heated water mixed with plant fibers to create an insulating layer that keeps heat on the plant tissue longer, though it demands substantial water and energy inputs. Electric weeding uses high-voltage current to damage weed tissue without open flames or tanks of water or gas, but the equipment remains expensive.

The researchers said the effectiveness of any control strategy also depends on the weed species present, their growth stage and their ability to regrow after treatment. That makes timing critical, especially in vineyards where the under-row zone must be treated carefully throughout the season.

The study places thermal control within a broader shift toward integrated vineyard management, where growers combine agronomic practices, mechanical tools and precision technologies to reduce inputs while keeping production stable. The authors said automation and precision agriculture could make these systems more targeted over time, lowering labor needs and improving efficiency in the field.

For now, however, cost remains a central obstacle. Fuel use, energy demand and equipment prices all shape whether these methods can move from research plots into routine vineyard practice.