

Foamstream: an ecological weeding concept

AN INTERESTING INNOVATION FOR WEED CONTROL IN THE CAVAILLON

Could the Foamstream process, the application of hot foam to the ground, become a realistic soil maintenance practice in vineyards and a real alternative to chemical weed control? When compared to all other means of control, the principle of destroying weeds using this very innovative technology opens up new perspectives, the lack of limitations being unprecedented in the wine world. The implementation of a trial in Charente-Maritime has made it possible to test this innovative thermal weeding process within a wine estate. At the end of this first test campaign, the conclusions are very encouraging. The technological principle of the Foamstream process has demonstrated its ability to control various weed flora within the vines efficiently and effectively. Nevertheless, it is not yet a complete and functional solution as further adaptation to the viticulture market is required. The manufacturer seems keen to mobilize and offer a powerful application tool within one or two years.



The English company Weedingtech, who developed the process, patented the technology a little under ten years ago. The Foamstream process was developed in the 2010s to offer an ecological alternative to the use of chemical herbicides in public spaces (car parks, parks, airports, roadsides etc). It is also able to treat moss and algae and can be used for a variety of street cleaning tasks.

The concept of ecological weeding for public spaces appealed to the market, however the technology at times struggled with commercial viability due to a higher cost.

The product was possibly launched to market prematurely as the environmental considerations were not, at that time, a priority - since then however, the context has changed quickly! In municipalities, towns, agglomerations and public spaces, the use of herbicides is now virtually prohibited. This development has led

to a change in enforced practices. The English company, patenting Foamstream in the early 2010s, has re-launched this concept of ecological weeding and, currently, have one hundred machines operating in France alone. The machinery is also manufactured in a factory in Vendée.



Applying foam with the lance

The Ouvrard Charentes group immediately saw the potential for use in viticulture.

Foamstream, as a weed control solution, had never been tested in the wine world as Weedingtech were not focused on vineyards and agriculture. The area of focus was, until now, communities and public spaces. The equipment currently marketed is not designed for use in vineyards. It is a combination of circumstances that has led to its trial use in vineyards. Weedingtech has signed a distribution agreement in France for its equipment with Promodis, and one of its distributors for the whole of western France is the Ouvrard group. The regional team Ouvrard Charentes, at the time of the being shown the equipment, were impressed by the technology but questioned whether its efficiency was what Weedingtech claimed it was.



Serge Hamon, Laetitia Caillaud, Laurent Lablanche and Fabrice Pineau applying Foamstream among the vines in the Chez Audouin site.

Testing the efficiency of the Foamstream technology before selling it was important to Serge Hamon, the group manager.

He wanted to know more about the performance of the equipment before selling it: "As soon as we received the equipment in Gemozac, over the

summer of 2017, we trialled it outside our workshops on a small, grassy area. The results immediately following the application and in the subsequent weeks surprised us. We immediately thought that this technology could be suitable for use in viticulture as an alternative means to chemical weed control. However, before talking to our winemaking customers, we wanted to know if the process really worked. So when the Chamber of Agriculture of Charente-Maritime and the magazine Le Paysan offered to set up a trial, we immediately took to this initiative. It was an opportunity to acquire relevant data from our territory on the effectiveness of the Foamstream process."

Foamstream is presented by Weedingtech as an environmentally-friendly method of weed control. The vegetation is killed from the application of hot water and a biodegradable foam with great effect. The principle of applying hot foam rather than just hot water means the active ingredient, the heat, retains contact with the vegetation and soil for longer. The vegetation is destroyed at a temperature of 58 °C and above. The water used to produce the hot foam is mixed with the biodegradable foam concentrate, made from 100% natural plant oils and sugars. The foam then leaves the lance at a temperature of 97 °C and covers the vegetation for a sufficient amount of time to destroy the plant tissue and penetrate the soil 2 to 4 mm. The point of the foam is to extend the time the heat is in contact with the vegetation. This makes the process more effective on more woody plant tissues and produces longer lasting results. The company says that the retained heat will also sterilise any seeds and spores found in the first few millimeters below the soil surface.

The principle of the Foamstream process

- **A hot foam solution covering the vegetation.**
- The hot foam covers the vegetation and causes an almost instant burning effect.
- **The plant tissues are destroyed at a temperature of 58 °C and the foam solution leaves the equipment at a temperature of 97 °C.**
- The foam is made from natural, biodegradable products.
- **The foam also sterilises grass seeds and roots within 2 to 4 mm below the soil surface.**
- Sufficient foam contact time on plant tissues and soil is necessary to achieve good efficacy.
- **The application of treatments was carried out in 2018 with equipment designed for applications in public spaces.**



The Foamstream M1200 mounted on a flatbed truck

A Foamstream M1200's design and core components

- **Equipment consisting of three components:**
 - a **foam production cell**, a pump and water and foam concentrate tanks mounted on a carrying frame;
 - a **30 m hose reel** transfers the foam solution to the lance;
 - which is manually used by an operator.
- A water tank with a standard capacity of 780 L.
- **A 4.5 kW boiler running on a 20 hp diesel engine.**
- **Working width of the lance: 35 cm.** - The operator applies the foam taking the time to properly cover the unwanted vegetation.
- A simple touch screen control.
- The load-bearing chassis equipped with 'access windows' is easily positioned on a small truck or trailer.
- 8 hours run time with foam and fuel tanks.
- **A water consumption of about 720 L / h.**

The idea of exploring the interest of this principle of weed control among vines led to the establishment of a test in 2018 throughout the vegetative cycle. The Chamber of Agriculture of Charente-Maritime, the magazine Le Paysan and the company Ouvrard Charentes set up an experiment in the vineyard of Laurent Lablanche, in Chadenac. This winemaker, whose property is part of the Dephy Ecophyto reference farm network, played a leading role in driving this initiative. His knowledge of the soils and the behavior of the vineyard proved invaluable in implementing the test and then managing the renewal of applications during the season. The costs related to the implementation of this small experiment were fully supported by the Chamber of Agriculture of Charente-Maritime and the magazine Le Paysan. This trial was integrated into the studies of the Dephy Ecophyto network of reduction of inputs of 11 vineyards followed by the Chamber of Agriculture of Charente-Maritime.

Testing the Foamstream process took place during the active growth phase of the weeds

Lætitia Caillaud, the wine consultant (and Dephy Ecophyto network engineer) of the Charente-Maritime Chamber of Agriculture, discussed the performance evaluation of Foamstream with an approach consistent with the maintenance practices of the cavaillon of Charentais winemakers. The use of herbicides is currently widespread throughout the active growth phase of weeds, between March 15 and July 15. One of the major problems during this period is to implement a means of controlling weeds that is both effective and has sufficient effect on regrowth (persistence) along with economic viability. The trial was implemented with the objective of evaluating the effectiveness of the Foamstream technology for cavaillon maintenance throughout this period and in relation to the usual weeding program carried out on the property.

Two tests plots with very different flora.

The trial was voluntarily set up (implanted) in two plots with very different flora and which, from mid-March, had reached a level of weed growth that justified a first treatment. The first (the Chez Audouin plot), which can be described as traditional (classical) in its weed make-up, was dominated by annual grasses (especially bluegrass), veronica, sow thistles, thistles, geraniums, dandelions ... The second (the Sablon plot) was 90% ryegrass and had become resistant to glyphosate as a result of repeated treatments with this product.

In each plot, an area was left untreated to show the impact of weed growth when not controlled over the season. The abundant rainfall from mid-March to the beginning of July 2018 also represented very interesting and representative conditions experienced in our region some years ago.

A permanent monitoring of the speed of regrowth of the weeds took place over 6 months.

The parameters for the two trials included three methods of weed control: a chemical weed control solution, the Foamstream application and a method without any intervention. The decision to reapply the various treatments was based mainly on the opinion of the winemaker. A photo was taken each week after the treatment, always in the same place, to record the regrowth of the weeds in the area. This method showed a sequence of the speed of regrowth of the weeds on the soil after each treatment. Follow-up of the trial began on March 15 and ended in late September. The Foamstream system made it possible to evaluate the effectiveness of these two contrasting methods of maintenance of the cavaillon. Laurent Lablanche was associated with all the follow-up of the two tests, and his opinion as wine grower was decisive in driving and deciding on treatment times. He has provided a concrete and relevant vision in the assessment of the stage of development of the weeds and the level of nuisance that they could cause.

The Basics of the 2018 Trial Protocol at Laurent Lablanche"

- **Two test plots**, one with a typical spring flora and one with resistant ryegrass.
- Each test block consisted of 3 rows of 30m long vines
- **3 test types:** - Foamstream; - the 'do-nothing' approach; - chemical weeding.
- **The program of chemical weeding of the farm:**
 - Application No.1 on March 18th: glyphosate 1,5 l / ha + Katana + Elton;
 - Application No. 2 May 16: glyphosate 1 l / ha + Elton;
 - Application No. 3 at the end of June: glyphosate 1 l / ha + Elton.
- **The first foamstream foam application:**
 - 1st pass on March 14th;
 - manual applications all made by Fabrice Pineau;
 - a 35 cm surface was treated each side of the row.

The results on the test site - Chez Audouin



Good efficacy 2 days after treatment on 14th March

■ Weeds at the start

Lions, thistles, geraniums, bluegrasses, dandelions.

■ The Foamstream application calendar

Four applications between March 14th and September 6th:

No.1 14th March

No.2 18th May

No.3 20th June

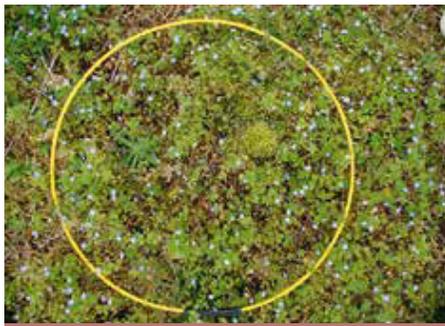
No.4 6th September

■ Time between treatments



Period	Time between treatments	Rain	Average temperature
14th March - 18th May	65 days	139 mm	12.0°C
18th May to 20th June	33 days	159 mm	18.2°C
20th June to 6th September	78 days	88 mm	21.9°C

Foamstream: 1st application - 14th March



Before treatment



While treating



+ 1 hour

Foamstream



16th March



30th April



15th May

Chemical weeding



16th March



30th April



15th May

Control group



16th March



30th April



15th May

Test results on the test site “le Sablon”



Good efficacy 2 days after treatment on 14th March



■ Weeds at the start

Well-established ryegrass that covered 80% of the soil surface.

■ The Foamstream application calendar

Four applications between March 14th and September 6th:

No.1 14th March

No.2 24th April

No.3 20th June

■ Time between treatments

Period	Time between treatments	Rain	Average temperature
14th March - 24th April	41 days	111 mm	12.0°C
24th April - 20th June	57 days	188 mm	18.2°C
20th June to 6th September	no treatment necessary	-	-

Foamstream: 1st application - 14th March



Before treatment



While treating



+ 1 hour

Foamstream



16th March



30th April



15th May

Chemical weed control



16th March



30th April



15th May

Doing nothing



16th March



30th April



15th May



The three thermometers measured the temperature of the foam.

Almost immediate effectiveness of the foam after 48 hours maximum

The results of both tests are ultimately quite encouraging given the rainy climate between March 15 and the end of June. Precipitation levels reached almost 300mm during this period and stimulated the growth of the weeds. Laetitia Caillaud and Laurent Lablanche admit that after the first treatment they were surprised by the almost immediate effect of the foam: "After the treatment on March 14th, we were surprised to see that all of the vegetation showed signs of break down after only 48 hours. The foam worked very fast and was effective on all the vegetation. Also, the frequency of rain during the spring of 2018, represented an ideal context for the conduct of the test. The rainy climate had stimulated weed growth for three months. "

Temperature measurements at the time of application

One of the questions concerning the application of foam was to know at what temperature the lance sprays it on to the vegetation. The heat generator is set to produce the foam at a temperature of 97 ° C, but then heat losses occur during the transfer into the 30 m flexible hose. A small manipulation was put in place to control the temperature levels of the foam at the exit of the lance and in the following minutes. The installation of three

thermometers, one on the surface of the herbs, the second in the heart of the plants and a third at the base of the roots, has shown interesting results on the actual temperatures during treatment and their evolution after a few minutes. Measurements were made at several locations in the Sablon plot on April 24th.

The temperatures of the foam is greater than 58°C for more than one minute

In view of the results, the temperature levels at the surface and the heart of the plants at the time of application of the foam were between 65 and 79 ° C, values well above the 58 ° C kill zone required to kill the plant. On the other hand, the temperatures at the root level (1 cm deep) are weaker. Then, the heat contained on the vegetation decreases rapidly over a period of 3 minutes 35 seconds, but remains above 58 ° C for almost 1 minute. These relatively long contact times surely help to explain the high efficacy on vegetation within 48 hours of application. The supply of heat at the roots and the first centimeter of soil is still quite limited. The heat from the foam had a limited effect on the roots.

The interest of the Foamstream technology principle is validated but not operational

The conclusions of the tests confirm that the principle of Foamstream thermal weeding is of real interest to the viticulture market and for the maintenance of the cavailon. The frequency of application

was at minimum 33 days and at maximum, 78 days. Both types of weeds were well controlled during a period of 7 months and in the presence of an extremely rainy spring (386 mm of rainfall between March 14 and September 6). L. Caillaud makes a rather optimistic analysis of the principle of this new solution of soil maintenance: "The test has demonstrated that, from an agronomic point of view, Foamstream can be effectively used to control dense and diverse weeds with interesting after-effect in the Spring. However the current equipment, as we know, has not been designed with viticulture in mind. The equipment used in the test uses large volumes of water that is not compatible with requirement or the current environmental climate".

The manufacturer plans to design a machine for viticulture in 2019.

The future success of this method to control weeds as an alternative to chemical weed control is based on the ability to develop machinery suitable for treating vines. Weedingtech has experienced a strong growth in recent years in the municipal and public space sector but expressed strong interest in the trials in Charentes, which support another initiative in Switzerland conducted by a Foamstream distributor in Swiss vineyards. A first approach to defining a specific application system for viticultural requirements was raised by the Swiss distributor.

Weedingtech understands the importance and the value of the technology in the wine sector. Apparently, they would look to start working on a project for the development of a vine-specific Foamstream product in the latter half of 2019. The design of the equipment would be based on a module attached at the back of a tractor, with an automated front boom spraying foam on two or four sides of the rows.

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The temperature levels observed at the outlet of the lance

Source : chambre d'agriculture 17 et Le Paysan Vigneron.

	T° max 24 Apr Le Sablon
On the surface of the weeds	75 at 78°C
At the heart of the weeds	65 at 79°C
At the base of the roots	40 at 58°C

Evolution of the temperature in the minutes following treatment

Source : chambre d'agriculture 17 et Le Paysan Vigneron.

	T° max	After 45 sec	After 1'30 sec	After 3'35 sec
On the surface of the weeds	78°C	56°C	48°C	40°C
At the heart of the weeds	65°C	62°C	58°C	50°C
At the base of the roots	58°C	50°C	46°C	40°C