

ALTERNATIVE METHODS OF WEED CONTROL WHAT'S THE DIFFERENCE?



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“In our first season using the Weedingtech Foamstream M1200 we have experienced similar kill rates and cycle times as glyphosate and other non-selective herbicide treatments.”

**Ian Boyd, General Supervisor,
City of Toronto**

Alternative methods of weed control: What's the difference?

Today, the use of chemical herbicides as a method of weed control is constantly being questioned in the public eye. There is a growing interest from organisations around the world, whether due to changes in legislation or public pressure, in finding eco-friendly and sustainable products, like Foamstream, to manage unwanted weeds and plants.

When deciding which method will be best for your organisation or local area, it can be hard to know which option to choose. There's a wide range of herbicide-free methods of weed control available and understanding how each method works can be a tricky task. There are key variables which organisations should look to consider when evaluating alternatives. These are efficacy, cost of operation and speed of regrowth. These vary tremendously across the alternatives sector and can be deceptive. Cost can often be misrepresented with regard to initial capital cost versus total cost of operation, so it is important that the variables are considered correctly. The biggest factors to effect the total cost of operation are the speed of regrowth and speed of treatment. These have the greatest impact as they directly effect time which impacts the cost of labour.

To help you make an informed decision, we've outlined the pros and cons of the most commonly used alternative methods. Alternatives can generally, be divided up in to the following categories; thermal, mechanical and biological and manual methods. Below will explain the methods available in each in more detail.

Thermal methods

Thermal methods of weed control, kill weeds using heat. There are thermal methods which involve wet heat such as steam, hot water and Foamstream and thermal methods which involve dry heat, such as flame weeding and electricity. They are designed to heat up the vegetative parts of the plant rapidly, mainly destroying the surface parts of the weed – however, some penetrate through to the root, killing the plant completely. Thermal methods involving wet heat principally kill weeds in the same way.

The key when assessing thermal methods is to find a solution that holds the plant in the zone known as the 'kill-zone' (57°C / 135°F and above) for an extended period of time. The heat delivered must stay within this temperature zone in order to damage the plant's structure and allow effective and efficient thermal heat transfer from leaf to root. Research conducted by Dr Sarah Cook from ADAS shows that stable delivery of heat at 80°C /176°F and above for the first five seconds is crucial to ensuring the most effective plant kill. Outside of the kill-zone (below 57°C /135°F) there is little, to no effect, on killing or substantially damaging the plant.

Steam

Steam systems kill weeds using saturated steam which has been heated to over 100°C / 212°F. It treats weeds due to its high heat level which causes the plants leaf cells to explode, killing the leaves. Being only steam, it is safe to use around people and animals safely.

The downfall to using steam is that its heat is rapidly lost to the atmosphere, immediately reducing its effectiveness as the plant is not kept in the 'kill zone' for long enough to have damaging effect on sufficient effect on the plant. As a result, steam systems need multiple applications across the season due to having little to no effect on the plants root structure. This makes it costly from a time and labour perspective as highlighted in the following table.

NB: this graph uses USD (\$) as the currency

Parameters	Unit	Steam	Foamstream
Hourly labor rate	\$	25	25
Number of hours worked in a day	Hours	5	5
Daily labor cost	\$	125	125
Consumable cost (Foamstream, diesel, petrol and anti-lime)*	\$	52.5	174.5
OPEX per day (5 hours of actual work)	\$	177.5	299.5
100% treatment area in an hour	sq. ft./hour	750	5250
Treatment area covered in 5 hours	sq. ft.	3750	26250
Cost per sq. ft.	\$	0.0473	0.0114
Comparative cost of single treatment area of 10,000 sq. ft.	\$	473	114
Treatment cycles per year	Treatments	10	3
Comparative cost of annual treatment of area of 100,000 sq. ft.	\$	4,733.33	342.29

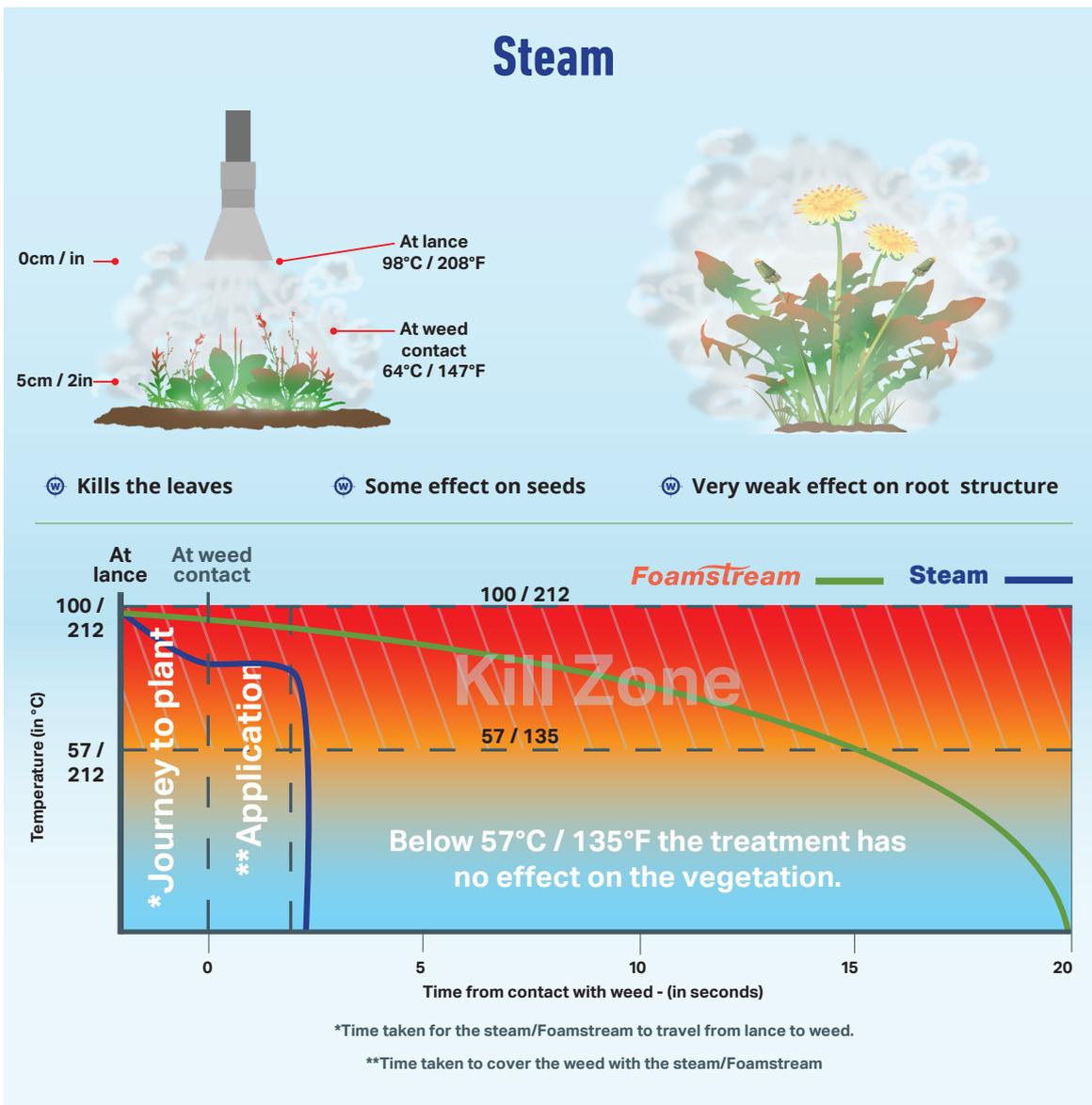
***Assumptions: (L = litre)**

Steam system consumes: 9 L diesel, 0.3 L of anti-lime, 1 L of gasoline per hour: \$7.20 + \$2.50 + \$0.80 = \$10.50

Foamstream consumes: 8 L of diesel and 3 L of foam = \$6.40 + \$28.50 = \$34.90

Price of gasoline: \$0.75 per L (0.21 gal) **Price of diesel:** \$0.80 per L (0.21 gal) **Price of Foamstream:** \$28.50 per hour

The infographic below shows how steam works when applied to vegetation.



“Put in the simplest terms, hot water insulated by foam (Foamstream) works better and costs less. Scientific study after scientific study, from the Clean Region Project, to independent research by experts such as Dr Arndver Schwele at JKI and Palle Kristoffersen from the University of Copenhagen, has conclusively proven that Foamstream delivers greatly improved weed and vegetation control compared to hot water on its own.”

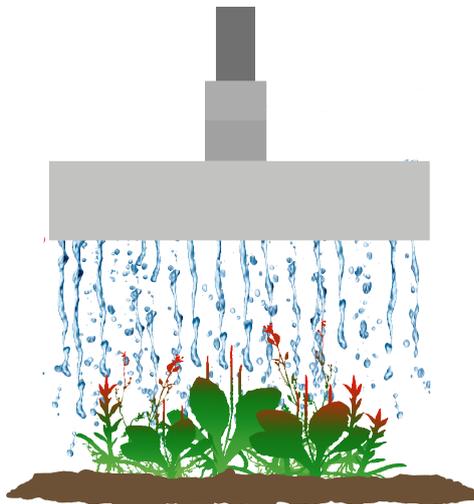
Dr Mike May - in-house
world-leading weed expert.

Steam is also limited by the type of weather it can be used in due to losing its heat so rapidly to the atmosphere. It also loses effectivity when treating soft surfaces due to poor ground penetration. This leads to substantially slower operational speeds and poor control of perennial weeds when treating soft surfaces.

Steam systems are susceptible to calcification therefore need to have an additive in order to keep systems scale free.



Hot water



Hot water works on weeds in a similar way to steam. The weeds are killed as a result of heat exposure. The heat generated from the hot water melts the protective coating of the leaf and severely damages the weed plants' cellular structure. The weeds are then unable to retain moisture and dehydrate within anywhere from a few hours to a number of days. It's considered a safe, economical and simple method of weed control with a relatively low cost of a single treatment in comparison to other alternatives.

The downfall of this method of weed control is that when the hot water is applied to the plant, the atmosphere impacts the temperature of the hot water, causing rapid heat loss. This is evident by the visible steam which occurs when treating with hot water. The loss of heat means that the plant isn't

kept in the kill zone for an extended period of time. This means a less effective plant kill due to the inefficient transfer of heat in to the plant roots which is critical to kill the vegetation. As a result regrowth occurs sooner, contributing to a higher treatment rate over the course of the season. It's estimated that hot water only kills around 50-60% of targeted weeds, In comparison to Foamstream, hot water requires two times more treatments over the course of a season. Hot water has little effect on seeds and spores therefore doesn't help reduce future regrowth in an area.

Similar to steam, due to the atmosphere having such a substantial effect on the temperature of the water, it limits the weather conditions in which it can be used to treat vegetation. This has the potential to cause costly downtime as a result of unallocated labour.

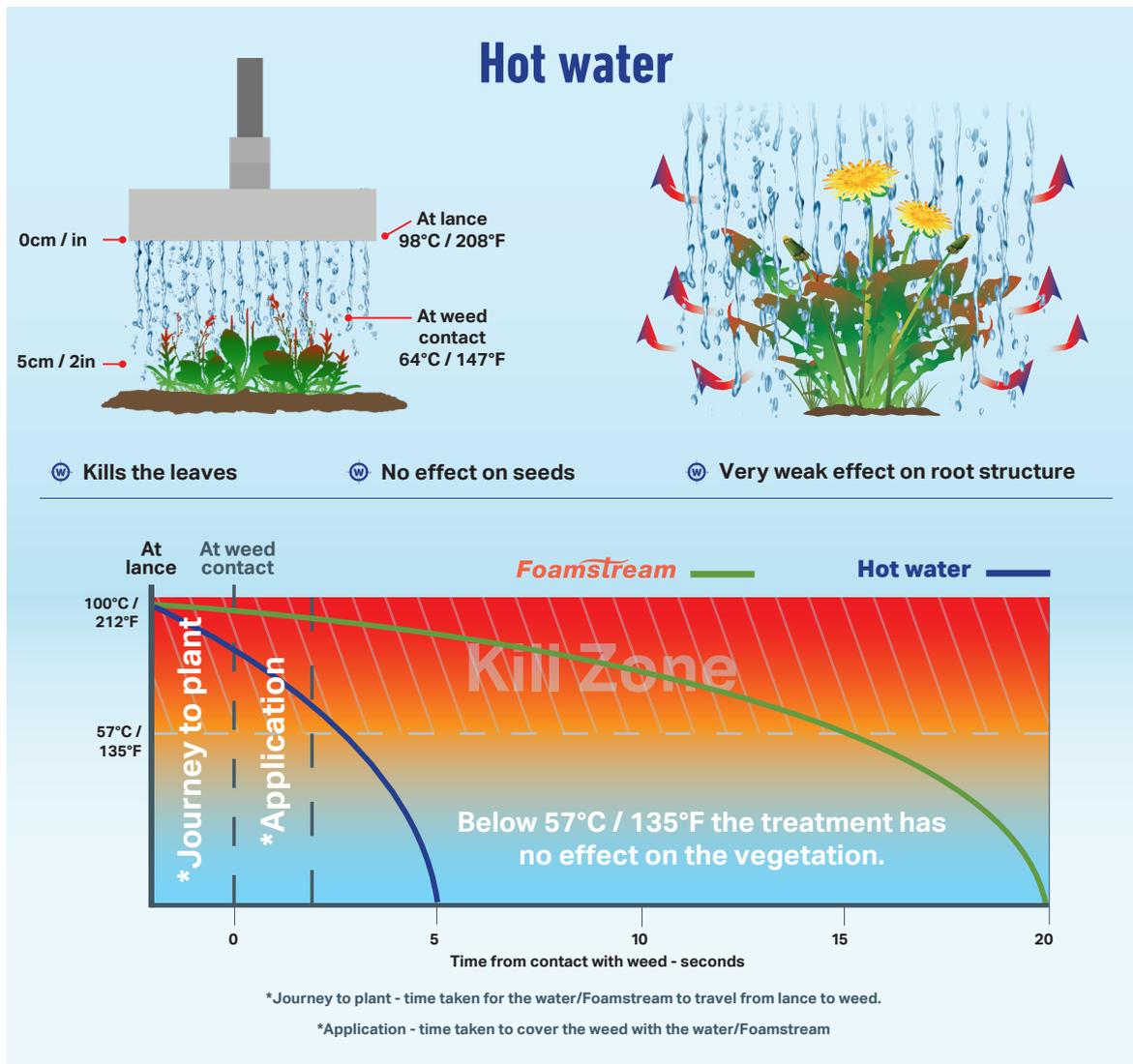


A person wearing a cap and dark clothing is using a long-handled device to treat a traffic island. The device appears to be a hot water or steam applicator. The background shows a residential area with a house and trees.

“Hot water insulated by a biodegradable foam (Foamstream) has been considered as the most efficient thermal weed control option as compared with hot air, open flame, or steam.”

Determining treatment frequency for controlling weeds on traffic islands using chemical and non-chemical weed control - Rask et al., 2013

The following diagram highlights the impact of hot water on a plant and the effect it has on the vegetation.



Like steam, hot water systems also require a de-calcification additive which adds additional cost.

Foamstream

Foamstream is the leading herbicide-free solution for controlling unwanted vegetation used by cities, boroughs and councils across the UK and overseas. Its patented process combines heat with a biodegradable foam which acts as a thermal blanket. The thermal blanket is key to retaining the heat on the plant and keeping it in the kill zone long enough to effectively penetrate the weeds waxy outer leaf layer, travel down the stem and in to the root, sufficiently killing the plant. Due to having such a high efficacy, Foamstream requires less treatment cycles compared with any other alternative method on the market. Foamstream also sterilises seeds and spores, reducing future regrowth of an area.

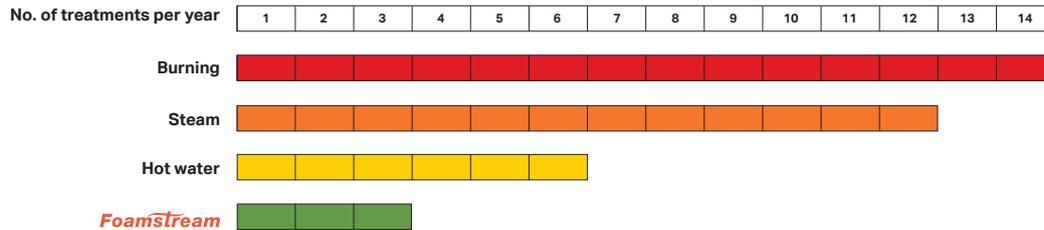


“We purchased a Foamstream M1200 in the spring of 2018. We used it through the season and found that the weed kill results we got were better than when using green, class 11 pesticides and its use doesn’t require advanced sign posting like a pesticide. From field observations, the Foamstream treated weeds did not regrow as quickly as the pesticide treated ones and new seeds did not tend to germinate after application. This unit is easy to use and has increased our efficiency in weed management.”

Rob Gagen, Parks Operations,
City of Pickering

Foamstream offers customers the lowest cost of ownership over any alternative solution, as it combines the lowest number of treatment cycles, reduces future re-growth and can be used all year round on any surface and in any weather. This limits time and cost attribute to downtime often associated with other alternative methods. See how Foamstream treatment cycles compare to alternative methods below.

HERBICIDE-FREE TREATMENT CYCLES - FOAMSTREAM VS THE ALTERNATIVES



As a multi-functional solution, it means it can also be used to control moss and algae, remove gum and graffiti, and clean and sterilise areas in urban environments. This allows organisations to help spread capital costs across multiple departments within their business, keeping costs low and manageable. Like other water based thermal methods, it is suitable for use in all environments including around people, animals and waterways. An additional benefit of Foamstream over steam and hot water, is that it doesn't need an additional de-calcification additive.



Flame weeding

Flame weeding or flaming, involves briefly passing an open flame over the weed. The aim is not to set the weed on fire; a common misconception. Instead, due to the intense high heat, the cells are ruptured in the leaf, which then causes the leaves to die. This is an old method of weed maintenance that has traditionally been used in the agricultural industry and is still used in the industry today.



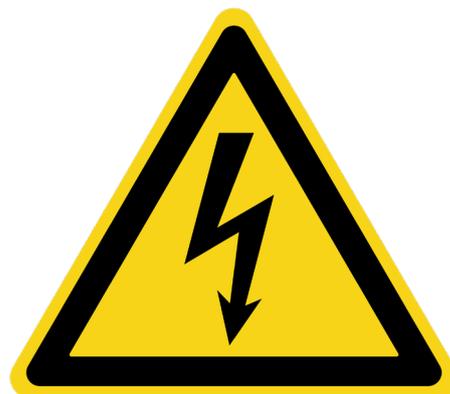
The use of flame weeding has a relatively cheap initial capital expenditure, and provides visible results not long after the initial treatment has been given. However, the heat simply burns the surface vegetation having little effect on root structure below. This means vegetation is quick to grow back, meaning treatments have to be carried out on a regular basis to keep regrowth at bay, approximately 14 times a season.

The main concern surrounding the use of flame weeding is health and safety. Due to the naked flame, there is a high fire risk. Plants with oily and waxy surfaces can be prone to catching fire and then spreading causing damage to the surrounding areas. Likewise if an area of weeds are particularly dry and/or brown, they will be prone to lighting quickly and spreading fire. In the worst case scenario, it can cause harm to the user or animals in the area.

The Shropshire Fire Service released a fire safety warning in 2016 following an event involving flame weeding whereby flames had spread from the device to a wooden fence and decking in the user's garden. For this reason, it has been banned in the domestic sector and deemed unviable in the UK. Flame weeding is also limited by weather – and cannot be used in the heat of Summer or on a windy day. In addition, costs can be added due to required safety equipment for the operator.

Electricity

There are two main types of electrical treatment, both of which use electrical currents to destroy the vital activity of the weed. These are referred to as spark discharges and continuous contact. The former administers short-duration electrical shocks to the plant, whereas the latter enforces a flow of electricity throughout the duration of contact. Electricity provides an effective kill by boiling the weed at the root – so is useful for spot weeding. As it provides an effective kill, it requires lower levels of treatment cycles.



Current electric systems in the municipal market tend to be designed for spot weeding, which can be time intensive. Viability and cost implications of treating large areas in public settings with spot weeders is something to consider when looking at electrical options. Unlike other methods such as Foamstream which is suitable for treating seed beds, weeds must be visible on the surface in order for them to be treated with an electric probe. Electric systems also require regular manual adjustment of the voltage (3000-15000 volts) to cater for the size of the weed.

“Foamstream is great for weeds, small woody growth like ragwort and for killing moss in places like tennis courts and play areas – and is excellent value. We fully support Weedingtech’s global mission to help organisations and cities across the world provide safer, cleaner and greener environments for their residents.”

Simon Cashmore, CEO,
TCL Group

Much like with flame weeding, there's a high health and safety risk when using electricity. If not used correctly, electrical currents have the potential to initiate fire or cause death or serious injury as stated on the product warning. A 2014 report commissioned by the Chemicals Regulation Directorate (a Division of the Health & Safety Executive (HSE)),¹ found that health and safety was highlighted as a concern of this method of weed control. Current electric weed machines recommend cordoning off public access to humans and pets where treatment is taking place to mitigate any potential risk of harm and being mindful of potential aquatic life when assessing areas to treat near water.

A higher level of compulsory training is required to be able to use the equipment properly and safely to ensure prevention of damage and harm to both the operator and those around them. There are also costs associated with protective clothing that needs to be worn when using the equipment such as dielectric boots.

Given that water conducts electricity, this method should not be used in wet, humid, condensing or foggy conditions. It is advised that extra caution and risk assessments are undertaken when treating around conductive items such as fences, signposts, gates or where there may be hidden cables underground (such as gas, water, electricity mains or sewerage). The weather and location restrictions reduce the ability to treat weeds in any weather, on all sites, all year round. This has the potential to lead to costly downtime of labour and unsightly untreated weeds.

Biological methods

Acetic acid

Acetic acid, the active ingredient found in vinegar, will kill most vegetation by burning through the wax coating of leaves and drawing the moisture out. The product is used in urban areas on hard surfaces - such as footpaths and pavements - and in industrial locations, but cannot be used near waterways.



Herbicidal vinegar is much stronger than household vinegar at around 10-20% acetic acid in comparison to 5% respectively. It can be damaging to the internal organs if ingested and can cause severe irritation to the operator if used incorrectly, and therefore must be handled with extreme care. The acid is also known for its strong and unpleasant smell, from which research has suggested has been the cause of irritation to the airway and headaches for the user.

Despite being an acidic substance, you don't need a licence to use acetic acid. You are, however, restricted as to when you can use it. The substance can only be used in dry weather conditions, meaning that your treatment cycles will be weather dependant. It's unlikely you'll be able to target the weeds during the cold and wet months. If used and then adverse weather conditions follow, it can render the treatment invalid, adding additional costs associated with retreating the area. It's not applicable on soft surfaces - such as soil or sand - so you are restricted to using the product solely on concrete. Due to the low efficacy of vinegar due to having no effect on the root structure of the plant, the number of treatments required a year are high, making it a costly alternative solution due to the labour required and the consumable needed. Acetic acid also has no effect on surrounding seeds and spores meaning it does nothing to reduce regrowth over time.

Mechanical methods

Mechanical brushing

Mechanical brushers can either be self-propelled pedestrian or tractor mounted systems. The brushes rotate quickly and are designed to scrape the unwanted vegetation from its bed. The idea of the brushers is that they remove offending weeds and moss, but also remove the organic detritus that harbours the moisture that is causing of the weed growth. Despite the low initial capital cost of mechanical brushers and the relatively fast forward speed of treatment, there are many limitations to mechanical brushers as a weed control solution.



Firstly, they can only be used on hard surfaces such as footpaths, pavements, block paving and concrete. This means alternative solutions would need to be used in order to control weeds on soft surfaces within your organisation. The rotating brushes are prone to cause flying debris create a health and safety risk to both the operator or passers-by. Despite destroying the head of the weed, the brushes often don't fully remove the plant structure below ground which leads to fast regrowth. A high number of repeat treatments are therefore required across the course of the season to keep weeds at bay.

In order to keep moss at bay, it is required to regularly sweep. However, the brushing leads to spreading of seeds and spores causing additional weed growth in an area. When using brushers, debris is simply moved from one place to another, so an additional method is required to clear up the mess created from the sweeper.

Strimming

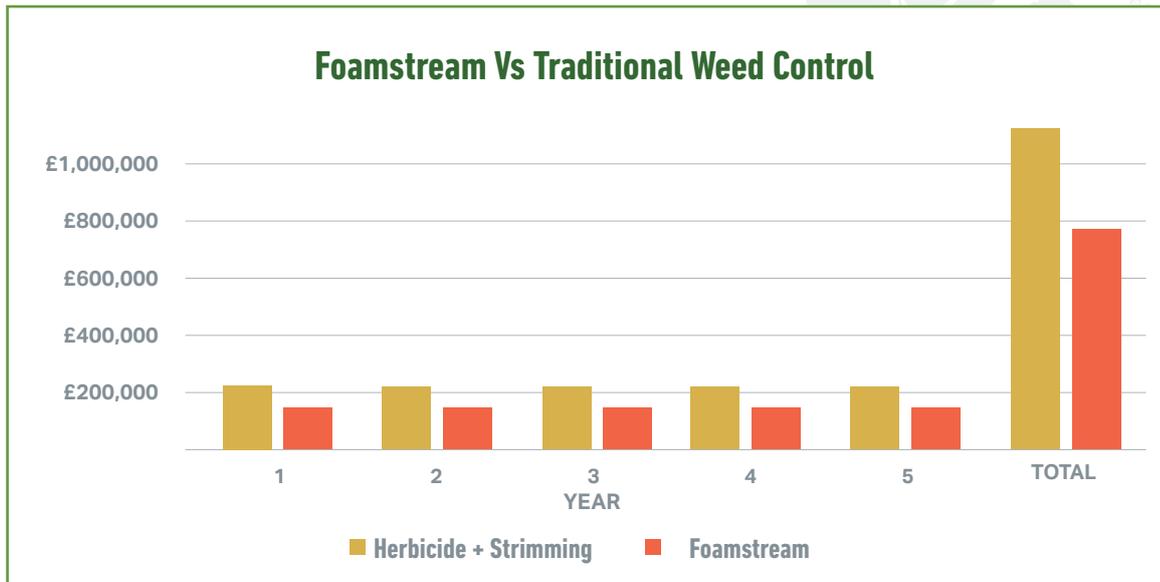


Strimming is often used as part of an integrated approach to weed control. They are often used to treat around difficult terrain such as trees or up against a wall or edging where traditional mowers would be unsuitable. They are also effective at clearing large patches of overgrown vegetation. With an initial low capital cost – it can seem an appealing solution to organisations looking to move away from herbicide use, however, as a solution to weed control, strimming has many drawbacks.

When strimming an area, much like when using weed brushers, there are health and safety risks.

Operators need to wear specialist clothing to protect them from flying debris and stones and the rotating blades or cord of the strimmer itself. There is a low-safety risk outside of flying debris however the vibrations from the strimmers can lead to white finger risk for operators. Due to having no effect on the root structure, and only removing the head of the weed, strimming does very little to help reduce regrowth – meaning many repeat treatments across the course of the season are necessary to keep weeds under control. This is both costly and time consuming. It is limited to certain weather conditions as blades (or cord) can struggle to effectively cut the unwanted vegetation in wet conditions.

Strimming is ineffective as a long term solution as it disturbs the seed bed and spreads seeds and spores increasing total weed coverage and causing rapid regrowth over a wider area. Below shows the cost of using strimming as part of an integrated approach to weed control over the course of a season over a period of five years. Something that initially may have seemed cost-effective – soon becomes the opposite.



Manual weeding

The most widespread non-chemical control method against weeds, manual weeding is the use of the hands or handheld tools to maintain weeds. It is commonly practiced in cities, parks, gardens, nurseries, horticulture and organic farming, and can be a very effective method of weed maintenance if done well. It is often done as part of an integrated approach to weed control.

With just the cost of labour and perhaps some small handheld tools like hoes, the initial set up costs and capital expenditure of manual weeding is low. It also gives a very targeted approach to controlling weeds with instantly visible results. However, it is incredibly time consuming and requires a large amount of labour which can be costly. See the cost table below which outlines the cost of Foamstream vs manual weeding over the course of a season.

The table below shows the costings of Foamstream vs Manual weeding as conducted by Glastonbury Council Council when evaluating the costs of moving away from manual weeding towards another alternative solution of herbicide-free weed control in 2015.

	Cost per treatment	No. of treatments per season	Total per season
Foamstream costing based on actual works undertaken	£425.89	3	£1,277.67
Handweeding – based on WAGS estimates	£2,160.50	9	£19,444.50
Handweeding – based on Curo Contract – Liner cost Housing paved area	£3,443.98	9	£30,995.78

Due to disturbing the seed bed and spreading of seeds and spores when pulling out weeds, speed of regrowth is high and weed coverage increases year on year, increasing time and cost of treating the same area. Unless the full root is removed, the weeds will reshoot in to new plants, causing additional growth in an area. As a result of the frequent regrowth, high numbers of treatment cycles are required to keep weeds at bay over the course of a season which is costly. Operators can also suffer from repetitive stress injuries as a result of constantly bending over to weed areas.

What about doing nothing?

It can be tempting to disregard the idea of weeding altogether, but doing so can be detrimental to other plants and wildlife in the area. Weeds are greedy by nature, and can rob the soil of vital nutrients and water that could otherwise be used by plants in the same area. This can weaken the surrounding plants, and make them prone to attacks from diseases and pests. To avoid this happening, you need to take action and administer a safe and environmentally friendly method of weed control.

There are two major impacts of taking a 'do nothing' approach to control vegetation.

1. Negative impact on public perception.

Organisations have a broader responsibility to control unwanted vegetation in order to maintain the aesthetics of an area, preserve infrastructure and avoid health and safety risks for the public.

2. Spread of seed bed.

The cost of doing nothing leads to a dramatic increase in the seed bank and the overall weed population in an area. This dramatically increases the cost and time of getting the unwanted vegetation under control in the future should a method, either herbicide or herbicide-free, be adopted.

Below illustrates the weed growth over the course of a three month trial comparing Foamstream against chemical herbicides and doing nothing. From the pictures it is clear how the weeds which had no treatment took over the area they were growing in.

FOAMSTREAM



16TH MARCH



30TH APRIL



15TH MAY

CHEMICAL HERBICIDE



16TH MARCH



30TH APRIL



15TH MAY

DOING NOTHING



16TH MARCH



30TH APRIL



15TH MAY

What next?

The environmental and business case for using herbicide-free methods of weed control has never been stronger. There has been a definite rise in interest towards the herbicide-free movement, which has led to positive change within various organisations and public entities. Decision makers across the world are banning chemicals within their districts to create a more sustainable and environmentally friendly way of living.

If you want more information about how you can implement an environmentally friendly method of weed control into your business or local area, contact Weedingtech today on +44 203 909 0050 or email info@weedingtech.com