ACTIVITY REPORT

Controlling Tree Weeds with Ultra-High-Pressure Herbicide Injection.

G. Butler. R&D Manager, SA No-Till Farmers Association. May 2023

Aim:

This activity investigates whether the stem injection of herbicide under Ultra-High-Pressure (UHP) can be used to control invasive tree weeds without damaging native plants in close proximity.

Supporting early-stage adoption of ultra-high-pressure water-jet technology is a project delivered by the SA No-Till Farmers Association with funding support from the Australian Government's National Landcare Program.

Problem Weeds

Weeds have major economic, environmental and social impacts in Australia, causing damage to natural landscapes, agricultural land, waterways and coastal areas.

Australian Weeds Strategy, 2017 – 2027.

Selectively terminating tree weeds that are invading habitats of significant value is very difificult.

Ripping or cultivating large weeds that have metre deep root systems is economically intensive and inflicts all sorts of other damage on the landscape.

When we think about applying herbicides to small weeds, the aim is to maximise the leaf area covered with a fine spray. However, achieving even spray coverage over the leaf area of much larger plants is more difficult. Moreover, the herbicide droplets can drift onto nearby plants and inflict unacceptable off-target damage.
For these reasons, spraying foliar herbicides is not a realistic means of terminating tree weeds in sensitive areas.

To use herbicide with less off-target damage, a method known as '*Drill & Fill*' was developed, whereby a hole is drilled into the tree stem, which is then immediately filled with a herbicide solution dispensed from a syringe. Nonetheless, Drill & Fill is labour intensive and exhibits variable efficacy if not applied with a great attention to detail.

A new method to quickly and reliably terminate tree weeds without inflicting off-target damage would be of great benefit to land managers across Australia.

SANTFA

Supporting early-stage adoption of ultra-high-pressure water-jet technology is a project delivered by the SA No-Till Farmers Association with funding support from the Australian Government's National Landcare Program.

Australian Government | National Landcare Program

A new tool for a similar problem.

Historically, cotton ratoon has been very difficult to control.

The field trials evaluating the injection of herbicide under ultra high pressure (UHP) (3450 Bar / 50,0000 psi) directly into the translocating tissue of cotton ratoon in recent years has demonstrated effective control.

Figure 1: Injecting herbicide under ultra-high-pressure into the stem of cotton ratoon has demonstrated effective control.

- *Left: After picking, the cotton plants require active termination.*
  Image Courtsey PSS Ag, NSW.

- *Centre: The aim is to inject herbicide into the cotton stem whilst not slicing it all the way through.*
  Slicing all the way through significantly reduces translocation of the active ingredient.
  Image Courtsey PSS Ag, NSW.

- *Right: The effectiveness of the injection applied down the middle row of cotton ratoon is shown alongside the untreated ratoon regrowth on either side.*
  Image Courtsey SANTFA.

Supporting early-stage adoption of ultra-high-pressure water-jet technology is a project delivered by the SA No-Till Farmers Association with funding support from the Australian Government's National Landcare Program.

Applying to Tree Weeds.

There are many tree weeds across Australia including Prickly Acacia, Mesquite, Athel Pine, Mediterranean Olive and many more.

On Kangaroo Island, Blue Gum is a significant invasive problem and the trial site was selected due to high interest from the property owner and the KI Landscapes Board.

A UHP system was developed to test the potential to inject herbicide directly into the trunks of the blue gum weeds.

The system included a 50,000psi Flow Hyplex UHP pump powered by a tractor driven PTO shaft. (Figure 2).

The pump was fed from a liquid tank containing the water and herbicide solution. (Glyphosate 540 g/l at 5% in water).
The herbicide solution was pumped through a 10m UHP flex hose, with an improvised lance including a discharge nozzle that was shielded with sponge to minimise herbicide drift.

Fig 2: Setting up the PTO powered UHP herbicide injection system on a tractor at Kiland. Insert: Herbicide Label.

Supporting early-stage adoption of ultra-high-pressure water-jet technology is a project delivered by the SA No-Till Farmers Association with funding support from the Australian Government's National Landcare Program.

The data for the cotton ratoon research trials shows good control when there is penetration into the stem however, cutting all the way through a stem significantly reduces efficacy.

The current information suggests that the efficacy of herbicide applied via UHP stem injection is highest when the target plant is still able to translocate around the injection site.

The UHP herbicide injection was targeted at the lower trunk of the tree weed. The nozzle was slowly moved back and forth on one side of the trunk, while ensuring the nozzle remained flush with the surface of the trunk. (Figure 3).

Fig 3: The nozzle was kept flush with the base of the trunk.

In this demonstration, the nozzle pressure was controlled from the pump by a second operator.

In the future, a commercial unit should consider incorporating a trigger on the operator's lance, and in doing so, control the pump pressure remotely.
A triggered lance would enable much greater operator control, reduce drift risk and lower operating costs. (Figure 4).

Supporting early-stage adoption of ultra-high-pressure water-jet technology is a project delivered by the SA No-Till Farmers Association with funding support from the Australian Government's National Landcare Program.

Figure 4: A triggered UHP lance.

Triggered UHP lances do exist in the surface preparation industry, so technically, building a weed control system with a triggered lance is achievable.

The UHP triggered lances do require a PLC controller and hydraulic valve system to be added to the pump.

Results

The symptoms of the UHP herbicide injected directly into the trunk of the tree were evident 21 days after treatment.

Necrosis started at the growing tips, well away from the point of application; reinforcing the notion that the herbicide was being translocated through the tree. (Figure 5).

Figure 5: Necrosis of the growing tips 21 days after treatment suggested translocation of the herbicide.

Supporting early-stage adoption of ultra-high-pressure water-jet technology is a project delivered by the SA No-Till Farmers Association with funding support from the Australian Government's National Landcare Program.

Figure 6:

2m – 5m tree weeds targeted with the ultra-high-pressure injection were fully controlled 60 days after treatment.

Off target damage to local biodiversity was monitored and does not appear to present a significant limitation for the future adoption of UHP stem injection.

Supporting early-stage adoption of ultra-high-pressure water-jet technology is a project delivered by the SA No-Till Farmers Association with funding support from the Australian Government's National Landcare Program.

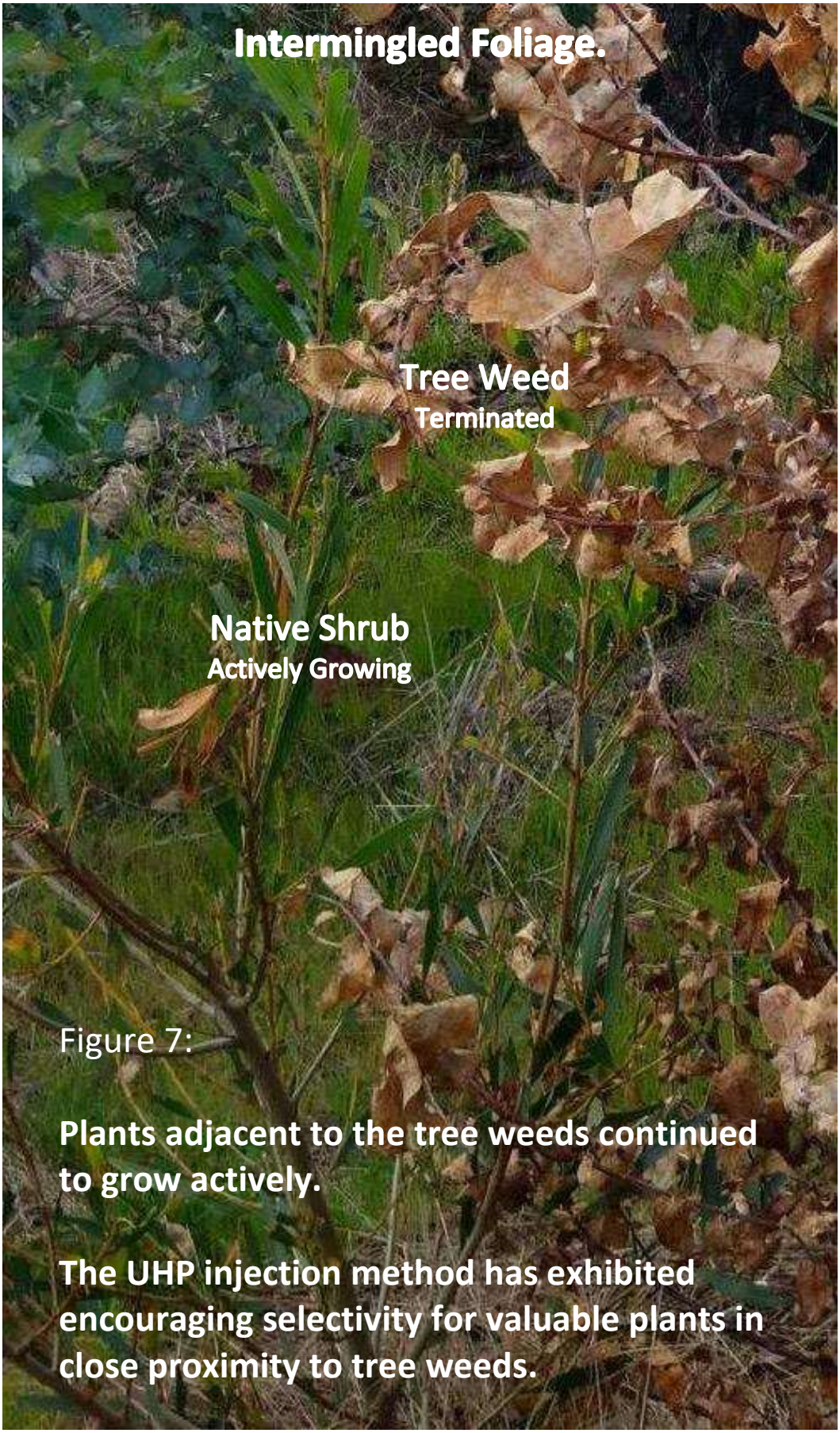

Figure 7:

Plants adjacent to the tree weeds continued to grow actively.

The UHP injection method has exhibited encouraging selectivity for valuable plants in close proximity to tree weeds.

Supporting early-stage adoption of ultra-high-pressure water-jet technology is a project delivered by the SA No-Till Farmers Association with funding support from the Australian Government's National Landcare Program.

Larger trees in the 10m – 30m range were also treated with the UHP stem injection.
For the larger tree weeds, a single band of herbicide was injected into approximately 40% of the trunk circumference.

At ultra high pressure, the herbicide was observed to move in real time through pores in the trunk, resulting in foaming and misting from other locations on the trunk. (Figures 8 & 9).

Fig 8: UHP injection at the base of tree resulted in foaming well above the injection site.

Fig 9:
a) A small amount of foam was being produced at the injection site.
b & c) After a relatively short exposure time, a mist began to form more than one metre above the injection point.

Supporting early-stage adoption of ultra-high-pressure water-jet technology is a project delivered by the SA No-Till Farmers Association with funding support from the Australian Government's National Landcare Program.

The large tree weeds did not show any significant symptoms for 30 to 60 days after treatment. However, symptoms were evident 90 days after treatment and the trees were highly impacted or fully controlled by 150 - 200 days after treatment. (Figure 11).

Fig 11: Large tree weeds were controlled however the process does take time.

Supporting early-stage adoption of ultra-high-pressure water-jet technology is a project delivered by the SA No-Till Farmers Association with funding support from the Australian Government's National Landcare Program.

Recommendations

This activity has demonstrated that tree weeds can be controlled with minimal off-target damage using ultra-high-pressure herbicide injection.

To be commercialised, the method requires further application specific development including:

- UHP flex-hose and reel management.
- Integration of the *Trigger* into the *Lance*.
- Increase durability of the *Lance Shroud*.
- Herbicide dosing, water carrying and power plant.
- Testing herbicide rates (how low can we go).
- Testing other herbicides with known efficacy for specific types of weeds.

Special Thanks

Kiland Pty Ltd
PSSAg.com

Supporting early-stage adoption of ultra-high-pressure water-jet technology is a project delivered by the SA No-Till Farmers Association with funding support from the Australian Government's National Landcare Program.