Cut stumps of Prosopis juliflora treated with Triclon (René Eschen, CABI Switzerland)

Cut stump (Tanzania, United Republic of)

Kukata visiki

DESCRIPTION

The cut stump technology is probably the most effective means of killing mature Prosopis trees using the herbicide Triclon with active ingredients Triclopyr 480g/l . Stems are cut with a chainsaw as close to the ground as possible and the herbicide is applied to the stump within three minutes of cutting using a paintbrush. The young plants with less than 2 cm root collar diameter should be uprooted by hand. The treatment is repeated after three months on resprouting stumps.

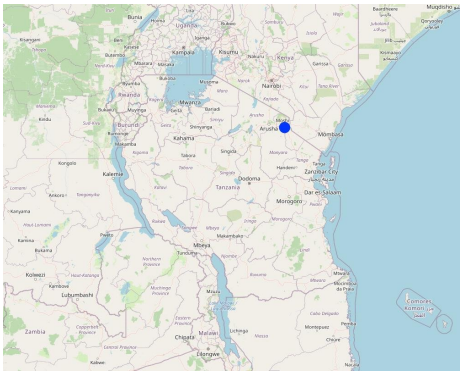
The technology is highly relevant and effective for controlling the invasion of Prosopis spp. in both agricultural and grassland areas where the species is considered problematic. It is particularly suitable for dry regions prone to Prosopis invasions, especially those experiencing drought periods of more than four months, which allow the herbicide to take significant effect. To avoid chemical contamination, the technology should only be applied in areas located more than 200 meters away from water sources.

This method requires simple tools to cut trees efficiently, with a chainsaw being recommended for the task. However, in areas where infestations cover less than 20 percent of the land, simpler tools such as machetes can be used. Trees should be cut as close to the ground as possible (no more than 15 cm stump height), and herbicide should be applied to the stump within three minutes of cutting. The treatment should be carried out during the dry season, ensuring no rainfall is expected within a month to allow for complete absorption of the herbicide.

A minimum of two people equipped with proper protective clothing is required for this operation: one to cut the trees and another to apply the herbicide and clear the cut branches. The herbicide, typically Triclopyr, is often mixed with diesel at a 1:50 ratio. A follow-up application is crucial to target any trees that were not completely killed during the initial treatment.

Herbicides can be ordered from Arysta Co. Ltd in Tanzania at a cost of TZS 1,000,000 (USD 430) per 20 liters. The advantages of using this technology include its effectiveness in killing the trees and the ability to utilize the cut branches as fuelwood or for making Prosopis charcoal. However, the major drawbacks include limited information leading to scepticism among land users regarding the health risks and potential long-term effects on soil quality, as well as the limited availability of the herbicide in local agro-stores.

LOCATION



Location: Kahe, Kilimanjaro, Tanzania, United Republic of

No. of Technology sites analysed: 2-10 sites

Geo-reference of selected sites
- 37.43857, -3.51626

Spread of the Technology: applied at specific points/ concentrated on a small area

In a permanently protected area?: Nee

Date of implementation: 2017; less than 10 years ago (recently)

Type of introduction
- ☐ through land users' innovation
- ☐ as part of a traditional system (> 50 years)
- ☑ during experiments/ research
- ☐ through projects/ external interventions

Stumps being treated with Triclopyr 480 g/l (René Eschen, CABI Switzerland)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- [x] improve production
- [x] reduce, prevent, restore land degradation
- [x] conserve ecosystem
- [ ] protect a watershed/ downstream areas – in combination with other Technologies
- [x] preserve/ improve biodiversity
- [ ] reduce risk of disasters
- [ ] adapt to climate change/ extremes and its impacts
- [ ] mitigate climate change and its impacts
- [ ] create beneficial economic impact
- [x] create beneficial social impact

Land use

Land use mixed within the same land unit: Ja - Agro-pastoralism (incl. integrated crop-livestock)

Cropland

- Annual cropping: cereals - maize, vegetables - other. Cropping system: Continuous vegetables

Is intercropping practiced? Ja
Is crop rotation practiced? Ja

Grazing land

- Transhumant pastoralism

Is integrated crop-livestock management practiced? Ja
Products and services: meat

Species	Count
cattle - non-dairy beef	10

Water supply

- [ ] rainfed
- [x] mixed rainfed-irrigated
- [ ] full irrigation

Purpose related to land degradation

- [ ] prevent land degradation
- [ ] reduce land degradation
- [x] restore/ rehabilitate severely degraded land
- [ ] adapt to land degradation
- [ ] not applicable

Degradation addressed

biological degradation - Bs: quality and species composition/ diversity decline

SLM group

- Weed control and management

SLM measures

management measures - M5: Control/ change of species composition

TECHNICAL DRAWING

Technical specifications

Stems of Prosopis should be cut very close to the ground (ca. 15 cm from the ground)

Author: Albrecht Ehrensperger (based on photos from different authors)

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology area (size and area unit: **0.01 Hectares**)
- Currency used for cost calculation: **Tanzanian Shilling**
- Exchange rate (to USD): 1 USD = 2400.0 Tanzanian Shilling
- Average wage cost of hired labour per day: 20,000

Most important factors affecting the costs

(i) Availability of labor during farming seasons (ii) Distance from and availability of agro-chemical stores (iii) Size of Prosopis trees (iv) Length of dry and wet seasons (long wet season makes many seed of Prosopis to germinate and long dry season makes it difficult to work out under the sun)

Establishment activities

1. Acquisition of Chemical (Triclon) (Timing/ frequency: anytime of the year)
2. Hiring a Chain Saw (Timing/ frequency: anytime of the year)
3. Cutting of stems (Timing/ frequency: During dry season (normally January - March))
4. Chemical application using paint brush (Timing/ frequency: Within five minutes after cutting the stems)
5. Separating intertwined branches (Timing/ frequency: Immediately after cutting the stems)
6. Cleaning the area from thorns and small branches (Timing/ frequency: Immediately after cutting the stems)
7. 2nd treatments of stumps (Timing/ frequency: Two months after chemical treatments and during dry season)
8. 3rd treatment of stumps (Timing/ frequency: After 6-8 months after 1st treatment and should be during dry season (normally September - October))
9. Removing regenerating Prosopis (Timing/ frequency: Every three months after 1st treatment for 15 months)

Establishment inputs and costs (per 0.01 Hectares)

Specify input	Unit	Quantity	Costs per Unit (Tanzanian Shilling)	Total costs per input (Tanzanian Shilling)	% of costs borne by land users
Labour					
Cutting of stems	Mandays	2.0	20000.0	40000.0	
Chemical application using paint brush	Mandays	1.0	20000.0	20000.0	
Separating intertwined branches	Mandays	2.0	20000.0	40000.0	
Removing small branches and debris	Mandays	1.0	20000.0	20000.0	
Equipment					
Hiring a Chain saw	Hours	8.0	4000.0	32000.0	
Fertilizers and biocides					
Triclon (480g/l Triclopyr)	Litres	1.2	50000.0	60000.0	
Total costs for establishment of the Technology				**212'000.0**	
Total costs for establishment of the Technology in USD				*88.33*	

Maintenance activities

1. Uprooting regenerating Prosopis (Timing/ frequency: after every three months)
2. Chemical application (Timing/ frequency: Every dry season up to 15 months)

Maintenance inputs and costs (per 0.01 Hectares)

Specify input	Unit	Quantity	Costs per Unit (Tanzanian Shilling)	Total costs per input (Tanzanian Shilling)	% of costs borne by land users
Labour					
uprooting regenerating Prosopis	Mandays	5.0	20000.0	100000.0	
Fertilizers and biocides					

Triclon (triclopyr 480g/L)	Litres	0.6	50000.0	30000.0	
Total costs for maintenance of the Technology				**130'000.0**	
Total costs for maintenance of the Technology in USD				*54.17*	

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [x] 251-500 mm
- [ ] 501-750 mm
- [ ] 751-1,000 mm
- [ ] 1,001-1,500 mm
- [ ] 1,501-2,000 mm
- [ ] 2,001-3,000 mm
- [ ] 3,001-4,000 mm
- [ ] > 4,000 mm

Agro-climatic zone
- [ ] humid
- [ ] sub-humid
- [x] semi-arid
- [ ] arid

Specifications on climate
Average annual rainfall in mm: 400.0
Extended dry seasons from September to mid-March. Bi-annual rainfall, with most rain falling from April to Mid and short rains from Mid November to December.
Name of the meteorological station: TPC Sugar Manufacturing Company
The area is very dry and agriculture is only possible through irrigation. Temperatures are very high during the day, at about 30 degrees Celcius. However, domestic animals such as cattle, goats, and sheep thrive fairly well in the area and there is very good hay during rainy seasons.

Slope
- [x] flat (0-2%)
- [ ] gentle (3-5%)
- [ ] moderate (6-10%)
- [ ] rolling (11-15%)
- [ ] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

Landforms
- [x] plateau/plains
- [ ] ridges
- [ ] mountain slopes
- [ ] hill slopes
- [ ] footslopes
- [ ] valley floors

Altitude
- [ ] 0-100 m a.s.l.
- [ ] 101-500 m a.s.l.
- [x] 501-1,000 m a.s.l.
- [ ] 1,001-1,500 m a.s.l.
- [ ] 1,501-2,000 m a.s.l.
- [ ] 2,001-2,500 m a.s.l.
- [ ] 2,501-3,000 m a.s.l.
- [ ] 3,001-4,000 m a.s.l.
- [ ] > 4,000 m a.s.l.

Technology is applied in
- [ ] convex situations
- [ ] concave situations
- [x] not relevant

Soil depth
- [ ] very shallow (0-20 cm)
- [ ] shallow (21-50 cm)
- [ ] moderately deep (51-80 cm)
- [x] deep (81-120 cm)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)
- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Topsoil organic matter content
- [x] high (>3%)
- [ ] medium (1-3%)
- [ ] low (<1%)

Groundwater table
- [ ] on surface
- [ ] < 5 m
- [x] 5-50 m
- [ ] > 50 m

Availability of surface water
- [ ] excess
- [ ] good
- [x] medium
- [ ] poor/ none

Water quality (untreated)
- [ ] good drinking water
- [ ] poor drinking water (treatment required)
- [x] for agricultural use only (irrigation)
- [ ] unusable

Water quality refers to: ground water

Is salinity a problem?
- [x] Ja
- [ ] Nee

Occurrence of flooding
- [x] Ja
- [ ] Nee

Species diversity
- [ ] high
- [ ] medium
- [x] low

Habitat diversity
- [ ] high
- [ ] medium
- [x] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [x] mixed (subsistence/ commercial)
- [ ] commercial/ market

Off-farm income
- [ ] less than 10% of all income
- [x] 10-50% of all income
- [ ] > 50% of all income

Relative level of wealth
- [ ] very poor
- [ ] poor
- [x] average
- [ ] rich
- [ ] very rich

Level of mechanization
- [x] manual work
- [ ] animal traction
- [ ] mechanized/ motorized

Sedentary or nomadic
- [ ] Sedentary
- [x] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [x] individual/ household
- [ ] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [x] women
- [ ] men

Age
- [ ] children
- [ ] youth
- [x] middle-aged
- [ ] elderly

Area used per household
- [ ] < 0.5 ha
- [x] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha

Scale
- [ ] small-scale
- [ ] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [ ] company
- [ ] communal/ village
- [ ] group
- [ ] individual, not titled
- [ ] individual, titled

Land use rights
- [ ] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [ ] individual

Water use rights
- [ ] open access (unorganized)
- [ ] communal (organized)

- 100-500 ha
- 500-1,000 ha
- 1,000-10,000 ha
- > 10,000 ha

- leased
- individual

Access to services and infrastructure

health	poor	good
education	poor	good
technical assistance	poor	good
employment (e.g. off-farm)	poor	good
markets	poor	good
energy	poor	good
roads and transport	poor	good
drinking water and sanitation	poor	good
financial services	poor	good

IMPACTS

Socio-economic impacts

Crop production

decreased — increased

Quantity before SLM: 1 t/ha of maize
Quantity after SLM: 1.5 t/ha of Maize
A significant increase was seen in maize production but also the production of tomatoes increased by about 25%.

fodder production

decreased — increased

Quantity before SLM: 4 loads@ 10kg
Quantity after SLM: 15 loads@ 10kg
A significant increase in fodder production due to reduced competition with Prosopis and increased production area.

wood production

decreased — increased

Quantity before SLM: 30 bags @ 20kg
Quantity after SLM: 0 bags
Absence of wood products was due to the removal of Prosopis. Wood from Prosopis was harvested after every 4 years, but with continuous application of the technology, no harvest is expected.

farm income

decreased — increased

Quantity before SLM: USD 260 per season
Quantity after SLM: USD 470 per season
Income from harvests per season (about 4 months)

diversity of income sources

decreased — increased

Quantity before SLM: 1
Quantity after SLM: 2
Only income from selling charcoal but after the application of the technology income is obtained from selling cereals and vegetables.

Socio-cultural impacts

health situation

worsened — improved

Quantity before SLM: more than 10 injuries
Quantity after SLM: 0 injuries
The technology has reduced incidences of injuries to both animals and humans from Prosopis thorns.

Ecological impacts

vegetation cover

decreased — increased

Quantity before SLM: lesser than 10%
Quantity after SLM: greater than 80%
Increased cover of preferred grass for pasture.

Off-site impacts

SLM/Land degradation knowledge

Decreased — Increased

Quantity before SLM: less than 5% of the village population
Quantity after SLM: about 10% of the village population
10% of the village population (about 450 households) is now aware of SLM technologies to manage invasive plant species.

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

Short-term returns	very negative	very positive
Long-term returns	very negative	very positive

Benefits compared with maintenance costs

Short-term returns	very negative	very positive
Long-term returns	very negative	very positive

It might be difficult to assess after 4 years of implementation of the technology but quick assessment of land users'perception indicate high initial costs that requires time to offset.

CLIMATE CHANGE

Climate-related extremes (disasters)
general (river) flood

not well at all ✓ very well

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- [x] single cases/ experimental
- [ ] 1-10%
- [ ] 11-50%
- [ ] > 50%

Of all those who have adopted the Technology, how many have done so without receiving material incentives?

- [x] 0-10%
- [ ] 11-50%
- [ ] 51-90%
- [ ] 91-100%

Number of households and/ or area covered
4 households farming a total of 5 hactares

Has the Technology been modified recently to adapt to changing conditions?

- [ ] Ja
- [x] Nee

To which changing conditions?

- [ ] climatic change/ extremes
- [ ] changing markets
- [ ] labour availability (e.g. due to migration)

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view

Strengths: compiler's or other key resource person's view

- Efficient and fast method with minimal impact as the chemical is applied directly on the cut stump.
- Allows to use the tree's biomass e.g. charcoal production

Weaknesses/ disadvantages/ risks: land user's viewhow to overcome

Weaknesses/ disadvantages/ risks: compiler's or other key resource person's viewhow to overcome

- Even though the method is relatively fast, very large invaded areas would still be difficult to clear with this method. For such large invasions the only feasible approach would be biological control.
- One must be very careful not to disperse seeds during the treatment, for example when transporting the cut biomass, as this could worsen the situation. Implement when trees have no fruits.

REFERENCES

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Resource persons
John Mbwambo - SLM specialist

Full description in the WOCAT database
https://qcat.wocat.net/af/wocat/technologies/view/technologies_6207/

Linked SLM data
n.a.

Documentation was faciliated by

Institution
- CABI Switzerland (CABI Switzerland) - Switzerland
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Project
- R4D Woody Weeds

Key references

- Experimental prosopis management practices and grassland restoration in three Eastern African countries, Eschen et al., 2023: https://doi.org/10.1186/s43170-023-00163-5

Links to relevant information which is available online

- Cut stump treatment to manage Prosopis juliflora: www.woodyweeds.org