



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.

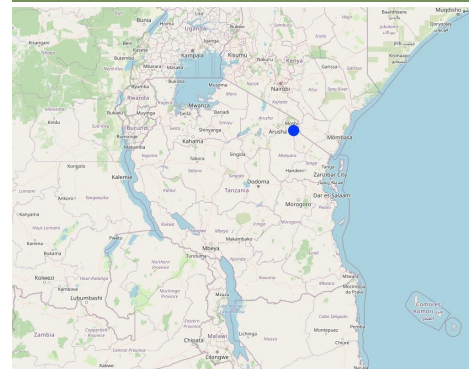
The technology is highly relevant and effective for controlling the invasion of *Prosopis* spp. in both agricultural and grassland areas where the species is considered problematic. It is particularly suitable for dry regions prone to *Prosopis* invasions, especially those experiencing drought periods 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?:** No

**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

- improve production
- reduce, prevent, restore land degradation
- conserve ecosystem
- protect a watershed/ downstream areas – in combination with other Technologies
- 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
- create beneficial social impact

### Land use

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



#### Cropland

- Annual cropping: cereals - maize, vegetables - other.
- Cropping system: Continuous vegetables
- Is intercropping practiced? Yes
- Is crop rotation practiced? Yes



#### Grazing land

- Transhumant pastoralism
- Is integrated crop-livestock management practiced? Yes
- Products and services: meat

Species	Count
cattle - non-dairy beef	10

### Water supply

- rainfed
- mixed rainfed-irrigated
- full irrigation

### Purpose related to land degradation

- prevent land degradation
- reduce land degradation
- 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)



**Step 1:** cut the tree with either a chain saw or a machete (max. 15 cm above ground)

**Step 2:** apply chemical on the cut stump with a paint brush within 3 minutes after cutting

**Step 3:** remove biomass and use as firewood or charcoal; make sure not to disperse pods in the process; return to site to verify if treatment was successful and to uproot regenerating Prosopis.

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

- Acquisition of Chemical (Triclon) (Timing/ frequency: anytime of the year)
- Hiring a Chain Saw (Timing/ frequency: anytime of the year)
- Cutting of stems (Timing/ frequency: During dry season (normally January - March))
- Chemical application using paint brush (Timing/ frequency: Within five minutes after cutting the stems)
- Separating intertwined branches (Timing/ frequency: Immediately after cutting the stems)
- Cleaning the area from thorns and small branches (Timing/ frequency: Immediately after cutting the stems)
- 2nd treatments of stumps (Timing/ frequency: Two months after chemical treatments and during dry season)
- 3rd treatment of stumps (Timing/ frequency: After 6-8 months after 1st treatment and should be during dry season (normally September - October))
- 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
<b>Labour</b>					
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	
<b>Equipment</b>					
Hiring a Chain saw	Hours	8.0	4000.0	32000.0	
<b>Fertilizers and biocides</b>					
Triclon (480g/l Triclopyr)	Litres	1.2	50000.0	60000.0	
<b>Total costs for establishment of the Technology</b>				<b>212'000.0</b>	
<i>Total costs for establishment of the Technology in USD</i>				<i>88.33</i>	

### Maintenance activities

- Uprooting regenerating Prosopis (Timing/ frequency: after every three months)
- 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
<b>Labour</b>					
uprooting regenerating Prosopis	Mandays	5.0	20000.0	100000.0	
<b>Fertilizers and biocides</b>					

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

## NATURAL ENVIRONMENT

### Average annual rainfall

- < 250 mm
- 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
- 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

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

### Landforms

- plateau/plains
- ridges
- mountain slopes
- hill slopes
- footslopes
- valley floors

### Altitude

- 0-100 m a.s.l.
- 101-500 m a.s.l.
- 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
- not relevant

### Soil depth

- very shallow (0-20 cm)
- shallow (21-50 cm)
- moderately deep (51-80 cm)
- deep (81-120 cm)
- very deep (> 120 cm)

### Soil texture (topsoil)

- coarse/ light (sandy)
- medium (loamy, silty)
- fine/ heavy (clay)

### Soil texture (> 20 cm below surface)

- coarse/ light (sandy)
- medium (loamy, silty)
- fine/ heavy (clay)

### Topsoil organic matter content

- high (>3%)
- medium (1-3%)
- low (<1%)

### Groundwater table

- on surface
- < 5 m
- 5-50 m
- > 50 m

### Availability of surface water

- excess
- good
- medium
- poor/ none

### Water quality (untreated)

- good drinking water
- poor drinking water (treatment required)
- for agricultural use only (irrigation)
- unusable

*Water quality refers to: ground water*

### Is salinity a problem?

- Yes
- No

### Occurrence of flooding

- Yes
- No

### Species diversity

- high
- medium
- low

### Habitat diversity

- high
- medium
- low

## CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

### Market orientation

- subsistence (self-supply)
- mixed (subsistence/ commercial)
- commercial/ market

### Off-farm income

- less than 10% of all income
- 10-50% of all income
- > 50% of all income

### Relative level of wealth

- very poor
- poor
- average
- rich
- very rich

### Level of mechanization

- manual work
- animal traction
- mechanized/ motorized

### Sedentary or nomadic

- Sedentary
- Semi-nomadic
- Nomadic

### Individuals or groups

- individual/ household
- groups/ community
- cooperative
- employee (company, government)

### Gender

- women
- men

### Age

- children
- youth
- middle-aged
- elderly

### Area used per household

- < 0.5 ha
- 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

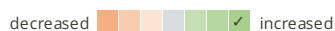
### Socio-economic impacts

#### Crop production



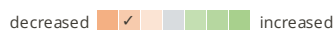
Quantity before SLM: 1 t/ha of maize  
 Quantity after SLM: 1.5 t/ha of Maize  
 A significant increase was seen in maize production but also the production of tomatoes increased by about 25%.

#### fodder production



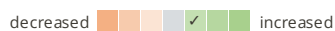
Quantity before SLM: 4 loads@ 10kg  
 Quantity after SLM: 15 loads@ 10kg  
 A significant increase in fodder production due to reduced competition with Prosopis and increased production area.

#### wood production



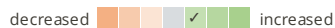
Quantity before SLM: 30 bags @ 20kg  
 Quantity after SLM: 0 bags  
 Absence of wood products was due to the removal of Prosopis. Wood from Prosopis was harvested after every 4 years, but with continuous application of the technology, no harvest is expected.

#### farm income



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

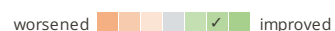
#### diversity of income sources



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

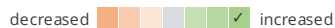
#### health situation



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

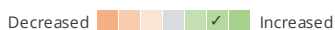
#### vegetation cover



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



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

- 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?

- 0-10%
- 11-50%
- 51-90%
- 91-100%

### Number of households and/ or area covered

4 households farming a total of 5 hectares

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

- Yes
- No

### 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 view how to overcome

### Weaknesses/ disadvantages/ risks: compiler's or other key resource person's view how 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

### Compiler

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### Resource persons

John Mbwambo - SLM specialist

### Full description in the WOCAT database

[https://qcat.wocat.net/en/wocat/technologies/view/technologies\\_6207/](https://qcat.wocat.net/en/wocat/technologies/view/technologies_6207/)

### Linked SLM data

n.a.

### Documentation was facilitated by

#### Institution

- CABI Switzerland (CABI Switzerland) - Switzerland
- CDE Centre for Development and Environment (CDE Centre for Development and Environment) - Switzerland
- Tanzania Forestry Research Institute (TAFORI) - Tanzania, United Republic of

#### 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](http://www.woodyweeds.org)

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