

# CONTROL METHODS

- 1. Mechanical control methods** are the direct removal of species by hand, or with appropriate tools, instruments and machines.
- 2. Chemical control** is the optimal use of herbicides to control target species.
- 3. Biological control** involves the intentional use of populations of natural enemies of the target invasive alien species or other methods that adversely affect the biological integrity of the target species.
- 4. Habitat management** uses measures such as prescribed burning, grazing and other activities. (Methods 4 and 5 are possible options for those with large areas of veld).
- 5. Integrated pest management (IPM)** involves a combination of the methods above based on ecological research, regular monitoring and careful co-ordination.

## GOLDEN RULES

Break the seed (reproductive) cycle  
Follow-up timeously on previously  
cleared areas.

Don't clear more than you can  
handle!



*Mechanical control method- slashing*

## Mechanical methods

Some form of force is used to control the target weeds:



### 1. Uprooting



### 2. Hand-pulling



### 3. Slashing

mowing or felling, use of loppers.



### 4. Ring barking

removing every trace of bark and cambium in a 30 cm band around the stem at a height of about 50 cm.



### 5. Strip-barking

stripping off all the bark from about waist height to below the surface of the soil.



### 6. Lassoing

the plant is uprooted using a winch, car tow-bar, tractor or Tree Popper.

## Advantages include:

- little training or supervision needed;
- simple tools required and only target species treated;
- with care the environment is unharmed; (e.g. close holes, press down loose soil and spread grass/leaf litter over the exposed area). This method is ideal for gardens.

### Disadvantages include:

- physically demanding;
- slow and costly for large areas or dense infestations where it is seldom completely successful and requires repeated follow-up operations;
- any soil disturbance can promote germination of undesirable weed seeds and can lead to soil erosion on slopes;
- in dense infestations indigenous/desirable species are often mistakenly destroyed.

## Chemical Control

In the battle against IAPs the layman has an “arsenal” of herbicides to choose from and is often unaware of the possible damage to the environment and the potential consequences of the indiscriminate and unskilled use of these chemicals. Here are some simple but important facts and essential information on how to select and use a herbicide. Remember that new, up-to-date registrations are constantly being introduced onto the market.

### FACTS ABOUT HERBICIDES

All herbicides have to be registered before being sold in South Africa and their use is controlled by law. It is vitally important to read the instructions on the label of the herbicide container before use. Herbicides do not fall under the “poison category” but because of the “toxicity” hazard to people and the environment, safety precautions must be observed and protective clothing worn.

### SELECTION OF HERBICIDES

The correct choice of a herbicide is essential so do not be tempted to buy just because there is a “special” on offer! When selecting, take into account the important points as detailed below. Also see the summary in table 2 on page 14,



*Chemical control - wear protective clothing*

that illustrates these points, using a few of the more common branded herbicides.

### a. The active ingredient

- The key for selecting a herbicide is the chemical compound called the active ingredient (a.i.) Different herbicides can have the same active ingredient (e.g. glyphosate) but are sold (branded) under different trade names and at different prices. The concentration of the active ingredient can also be different (eg glyphosate 360g ae/l or 450, 480, 500 g ae/l). More/less is then needed to achieve the same result. Any product containing the same active ingredient in the same concentration is usually suitable.
- Always store your herbicide in the original labelled container and out of reach of children and pets.
- Some herbicides contain a dye. Dyes can also be bought and are useful to show where the herbicide has been applied.
- Some herbicides require the use of a “wetter” to be effective.
- Water or diesel is used as a “carrier”. Diesel is expensive and can affect the environment. Whenever appropriate, use water. Diesel is never used for foliar spraying.

## b. Selective vs non-selective herbicides

### Selective

These are herbicides that selectively affect the target plant, e.g. a selective, broadleaf herbicide will kill broad leaf plants but not grasses. Note: Most selective herbicides will lose their selectivity at a high enough dose.

### Non-Selective

Those herbicides that affect any plant they contact, often creating bare ground that only encourages further weed invasion.

## c. Systemic vs Contact herbicides

### Systemic

Systemic herbicides move within the plant from the point of contact towards the growing points that will then be destroyed. They are well adapted to controlling perennial species that have strong root systems. They usually require time to penetrate and migrate within the plant so tend to be slow acting (Many of the invader plants are perennials).

### Contact

Contact herbicides are translocated throughout the plant from the area initially treated. Thorough coverage and wetting of the plant is necessary for effective control. They work well on annual species and are adapted to remove the vegetation prior to planting especially in tropical environments. They are usually fast acting and rain-fast. Many plants become tolerant of such chemicals as they mature but seedlings are typically very sensitive to these herbicides. Roots usually remain intact thus allowing good erosion prevention. Remember that perennial plants can resprout and re-grow from the remaining root system and are often able to recover.

### d. Residual effect or non-residual effect

As some herbicides can remain active in the soil for a considerable amount of time, the residual effect needs to be seriously considered before rehabilitation of a treated area is attempted. Select carefully! Read the label! (See a few examples in table 2).

<b>Commercial Names</b>	<b>Target Plants</b>	<b>Active Ingredient</b>	<b>Effect on Plants</b>	<b>How it Works</b>	<b>Residual Effects</b>	<b>Carrier</b>
<i>Access Browser</i>	<i>Broadleaf</i>	<i>Picloram 240g/l SL</i>	<i>Selective</i>	<i>Systemic</i>	<i>Moderate</i>	<i>Water</i>
<i>Brush-Off Climax</i>	<i>Broadleaf</i>	<i>Metsulfuron-methyl 600g/kg WG</i>	<i>Selective</i>	<i>Systemic</i>	<i>Slight</i>	<i>Water</i>
<i>Chopper Hatchet</i>	<i>All</i>	<i>Imazapyr 100g/l SL</i>	<i>Non-selective</i>	<i>Systemic</i>	<i>Moderate</i>	<i>Water</i>
<i>Garlon Triclon</i>	<i>Broadleaf</i>	<i>Triclopyr 480g/l EC</i>	<i>Selective</i>	<i>Systemic</i>	<i>Nil</i>	<i>Water/ Diesel</i>
<i>Midstream</i>	<i>Water weeds</i>	<i>Diquat 200g/l (dibromide)</i>	<i>Non-selective</i>	<i>Contact</i>	<i>Nil</i>	<i>Water</i>
<i>MSMA SL</i>	<i>Succulents/ grasses</i>	<i>MSMA 720 SL</i>	<i>Selective</i>	<i>Contact/ Systemic</i>	<i>Nil</i>	<i>Water</i>
<i>Round Up Mamba Springbok Senator Xtra</i>	<i>All</i>	<i>Glyphosate 360g.a.e./l SL</i>	<i>Non-selective</i>	<i>Systemic</i>	<i>Nil</i>	<i>Water</i>

**Table 2. Examples of herbicide selection**

There are many plants with no registered herbicides. In this case, look at table 2 and try to choose a selective herbicide registered for a similar growth form. Try an appropriate dose on a few of the plants.

Non-selective herbicides containing glyphosate will control most annual and perennial weeds in non-crop areas and can also be tried on the softer woody plants mentioned in this booklet. For further information see the section on registered herbicides, page 124.

For explanation of abbreviations, see glossary on page 123.

that further application of herbicide then becomes a waste of time, money and effort. Too high a dose can also cause die-back of the treated part without killing the plant.

To assist you table 3 can be used to calculate the amount of herbicide that needs to be used for a recommended concentration in a given container. Spray bottles that are suitable for herbicide application are commercially available from most supermarkets or garden centres.

### PRECAUTIONS AND TIPS

- Take precautions to avoid getting herbicides on your skin.
- Avoid breathing the vapour.
- Wear overalls, rubber gloves and a face mask.
- If spraying, stay upwind of the target plants.
- Do not spray in windy weather or if it looks like rain.
- Apply herbicide when plant is actively growing.
- If leaf colour has started to 'turn' for winter, it is too late.
- Do not use herbicides on drought-stressed or diseased plants or in extremely hot or cold conditions. (The wilting temperature is 27 degrees Celsius.)
- Spray before seed is produced i.e. between flowering and fruit set.

### HERBICIDE CONCENTRATIONS

Herbicide prescriptions must be followed. Too weak a dose is costly in time, money and resources and is a waste of effort. Conversely, too strong a dose than is recommended may not only be an unnecessary waste of expensive herbicides but may lead to herbicide resistance in the target species i.e. a given population of the plant becomes tolerant to the herbicide so

Container Capacity (ml)	Concentration of Herbicide Recommended						
	0.5%	1.0%	1.50%	2.0%	3.0%	5.0%	10%
50	0.25 ml	0.5 ml	0.75 ml	1.0 ml	1.5 ml	2.5 ml	5 ml
100	0.5 ml	1.0 ml	1.50 ml	2.0 ml	3.0 ml	5.0 ml	10 ml
200	1.0 ml	2.0 ml	3.00 ml	4.0 ml	6.0 ml	10.0 ml	20 ml
400	2.0 ml	4.0 ml	6.00 ml	8.0 ml	12.0 ml	20.0 ml	40 ml
500	2.5 ml	5.0 ml	7.50 ml	10.0 ml	15.0 ml	25.0 ml	50 ml
1 000 (1L)	5.0 ml	10.0 ml	15.00 ml	20.0 ml	30.0 ml	50.0 ml	100 ml
2 000 (2L)	10.0 ml	20.0 ml	30.00 ml	40.0 ml	60.0 ml	100.0 ml	200 ml
5 000 (5L)	25.0 ml	50.0 ml	75.00 ml	100.0 ml	150.0 ml	250.0 ml	500 ml
7 500 (7.5L)	37.0 ml	75.0 ml	112.0 ml	150.0 ml	225.0 ml	375.0 ml	750 ml
10 000 (10L)	50.0 ml	100.0 ml	150.0 ml	200.0 ml	300.0 ml	500.0 ml	1 000 ml

Table 3. Amounts of herbicide to be used in different sized containers

- Be aware that there are restrictions on using herbicides near wetlands and waterways.
- Stage weed removal. Large areas of exposed soil are an open invitation to weed invasion and to erosion.



## 5. Soil application

herbicide is applied to the soil around the plant so the herbicide is absorbed through the roots.

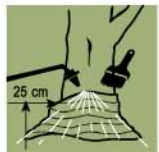
## WAYS OF APPLYING HERBICIDES

(Please use common sense and follow instructions on the labels!)

There are 5 ways of applying herbicide:



- 1. Foliar application**  
to the leaves and stems.



- 2. Stem applications**
  - a. Basal stem application**  
an exterior application to the stems of standing trees.



- b. Total frill**  
a ring of linked downward cuts made in the stem.



- c. Stem injection**  
holes made in the stem.



- 3. Stump applications**
  - a. Cut stump**  
apply to the outer ring of the freshly cut surface just inside the bark.



- b. Total stump**  
to the cut surface, the sides of the stump and any exposed roots.



- 4. Scrape & paint**  
for large vines and woody-stemmed plants.

## 1. Foliar Application

Use a foliar application with great care, especially in windy conditions, because of the potential damage to the surrounding environment. This method should be considered for large areas of invasive growth where risk to non-target species is minimal.

The correctly mixed herbicide is sprayed onto the rapidly growing leaves and stems (foliage) of the target plant, usually to the “point of runoff” i.e. when the herbicide mix is about to run off the leaves. Some herbicides require the use of a “sticking agent” or “wetter” to ensure efficient results. Ideally, enough foliage must be present so that the plant “catches” sufficient herbicide to kill it. When spraying plants previously cut down, the re-growth or coppice should generally have reached a height of between 50 and 100 cm for effective control, but labels may specify requirements. A dye can be added to indicate sprayed areas.

**NB. Don't use river water as it has a high soil content and blocks sprays etc. Uptake of herbicides is hampered by poor water quality**



Foliar spray

e.g. water with a high PH or containing dissolved solids. Be careful with borehole water.

**Advantages of foliar application include:**

- an easy and versatile technique;
- can be used on small or large areas, where conditions are rough or where there are small obstacles;
- ideal for follow-up work e.g. use "spot-spraying".

**Disadvantages include:**

- plants often require preparation making it a two-part operation;
- application rates are unlikely to be accurate as they are influenced by terrain, plant density, the weather (e.g. drift) and the operator (e.g. fatigue);
- environmental conditions (e.g. rain) and the state of the plant (e.g. stressed due to heat or drought, dusty, eaten by insects etc) affect herbicide efficacy;
- large amounts of clean water must be transported to the site;
- frequent refilling of apparatus slows rate of work (about 2 man-days per hectare)
- non-target plants can be 'caught in the spray'.



*Spot spraying works well on young Bugweed plants*

**Spot Spraying**  
Anecdotal reports suggest that spot spraying with 0.5% triclopyr EC with 0.5% wetter in water is an effective spot spraying mixture for Ageratum, Balloon vine, Blackjack, Khaki weed and young specimens of Bugweed, Castor oil, Madeira vine and Triffid weed.

**2. Stem Applications**

**a. Basal Stem**

For plants with thin bark or stems up to 25 cm in diameter.

Most IAP's are perennials and have the ability to regrow after being damaged or cut down, so apply mixture of herbicide and water or diesel to all bark with a paint brush or sprayer from ground level to at least 0.25 m. Spraying uses 3 x more mixture but is less tiring and faster than painting. All bark pieces left in crevices after strip-barking should be killed by thorough spraying/painting. In multi-stemmed plants, each stem must be treated separately. Avoid sand on stump or bark when painting on herbicides.

**b. Total Frill**

Frilling is used for treating shrubs or trees greater than 10 cm in diameter at the base or when you want them to die in place. Often used instead of ring barking as takes less time. A ring of linked downward cuts are made in the bark of the tree, as low as possible and deep enough to include the cambium, using a blunt hand-axe (cuts are too deep if axe is very sharp). Herbicide, mixed as per label, is applied to the frill with a suitable applicator, e.g. syringe or hand-held sprayer. Large cuts (5 cm long) hold about 1 ml initially if cut is level. Care is needed with cutting and application, so work is slow.

**c. Stem Injection**

Recommended mainly for succulents and woody weeds where you want them to die in place. There are purpose-built stem injection devices but a hammer and chisel or a cordless drill can be used. Make an angled cut or hole down into the sapwood just below the bark and apply

herbicide into the cut immediately. Don't drill too deeply or you get into the heart wood which does not take up the herbicide. About 2 ml of water-soluble herbicide solution is put in each hole. (Approximately 4 holes for a plant smaller than 2 m and a maximum of 12 holes for large plants). Note: Frilling is an easier method.

#### **Advantages of stem applications include:**

- a simple, target specific method which requires little preparation or training;
- ideal for tall trees that can remain standing (e.g. in a conservation area - remember that a dried-out tree is far more difficult to fell than a living one, so ensure correct initial planning decisions are made);
- not usually dependent on weather conditions. If diesel is the carrier, it is water repellent and work can continue in light rain although possibly less effective. Work can be continued when plant is stressed e.g. in winter.

#### **Disadvantages include:**

- if diesel is used as the carrier, it is expensive and usually more toxic to humans than the herbicide (wear rubber gloves);
- open containers used in paintbrush methods often fall over causing wastage;
- frill and stem injection are slow techniques.

### **3. Stump Applications**

#### **a. Cut stump**

Cut the plant as close to ground level as possible with a horizontal cut. Use a tool that will give a clean cut e.g. loppers for diameters up to 50 mm and a saw for diameters greater than 50 mm. The ideal stump is short, with a level cut-surface, none of the bark is torn away from the wood and there are no exposed roots. Remember sharp, angled cuts make the stumps hazardous. For cut stump, mix herbicide according to label and apply as soon as possible to the outer ring of the freshly-cut surface just inside the bark. If you are too slow, air is sucked into the sap vessels, preventing take-up of the herbicide. For multiple, small stumps with diameters less than 50 mm,



*Cut stump herbicide application*

treat all cut surfaces.

#### **b. Total stump**

Mix herbicide according to the label and apply to cut surface, the sides of the stump (all exposed bark) and any exposed roots. Seldom used here in SA as cut stump or frill are usually adequate and the costs unwarranted. However, in certain cases, total stump has been advised.

#### **Advantages of stump applications:**

- the most effective method which should be considered whenever practical;
- good in sensitive areas, because the herbicide is placed "into" the target plant;
- only a small amount of herbicide is used per plant;
- a one-pass operation, there is usually no need to return to the same plants.

#### **Disadvantages include:**

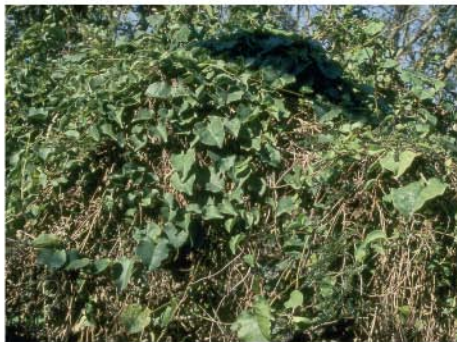
- cutting down is tiring work;
- progress is slow because falling branches need to be avoided and cleared to one side;
- removal and disposal of large amounts of wood may be difficult;
- if diesel is used as a carrier for the herbicide, it makes it expensive;
- removal of the canopy will stimulate many

seeds to germinate;

- some herbicides are long-acting (or have residual action) and may be absorbed by non-target species planted later (see table 2 on page 14).

#### 4 . Scrape & Paint

Suitable for large vines and scrambling plants with a woody stem. Using a knife and starting from the base scrape 20 to 100 cm of the stem to expose the sapwood just below the bark. Try to scrape all the main stems. Within 20 seconds apply herbicide to the scraped section. Do not scrape right around the stem, do only 1/3rd of the diameter. Stems over 1 cm in diameter can be scraped on 2 sides. Leave the vines to die in place to prevent damaging the plants they are growing over.



Scrape and paint can be used for large vines

#### 5. Soil Applied Herbicides (NOT recommended for general use)

A very specialised method, restricted to use on sandy soils. This treatment is unlikely to be suitable for use in urban open spaces. Leave this method to the expert!

## Biological Control



Biological control uses nature's natural enemies to reduce the vigour or reproductive potential of an invasive alien plant.

Because IAPs do not have natural enemies in their introduced habitat/range, they gain a competitive advantage over the indigenous vegetation.

Most frequently used agents are insects, mites and pathogens (disease causing organisms such as fungi or bacteria) and these are used to attack specific organs of the plant, like the vegetative parts or the flower buds.

Some agents are chosen for their ability to reduce existing infestations. The following examples attack the leaves and stems of the weed:

- the leaf defoliating moth, *Pareuchaetes insulata* for *Chromolaena odorata*;
- the herring bone leaf mining fly, *Ophiomyia camarae* for *Lantana camara*.

Others do not kill plants or reduce the infestation, but prevent further spread by attacking the reproductive sections of the plant like the flower buds, flowers and seeds e.g.:

- the seed feeding weevil, *Rhysomatus marginatus*;
- and the flower feeding weevil, *Trichapion lativentre* - both agents for *Sesbania punicea*.



*Trichapion lativentre*