



environmental affairs

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DEPARTMENT OF ENVIRONMENTAL AFFAIRS: ENVIRONMENTAL PROGRAMMES

REVISED AND UPDATED POLICY ON THE USE OF HERBICIDES AND MYCOHERBICIDES FOR THE CONTROL OF ALIEN VEGETATION

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WORKING FOR WATER HERBICIDE POLICY

1. OBJECTIVE FOR THE USE OF HERBICIDES AND MYCOHERBICIDES FOR ALIEN VEGETATION CONTROL

- 1.1 To implement a long-term strategy for the initial and long-term control of invasive alien plants.
- 1.2 To ensure the safety of operators involved in the control operations and public in the operational area.
- 1.3 To ensure that there is minimal environmental impact in the short-term and that there are no long-term adverse effects on the environment resulting from the application of herbicides, to humans and the environment.
- 1.4 To ensure that the application takes place in the most cost effective way within objectives 1.2 and 1.3.
- 1.5 To attain these objectives DEA: EP: Working for Water management shall be responsible for:
 - 1.5.1 Determining areas and species to be controlled and setting priorities.
 - 1.5.2 Deciding upon appropriate methods of chemical and mycoherbicide control.
 - 1.5.3 Drawing up short and long-term control programmes.
 - 1.5.4 Selection of suitable herbicides and/or mycoherbicides.
 - 1.5.5 Establishing training requirements for DEA: EP: Working for Water personnel and contractors and ensuring that the training takes place
 - 1.5.6 Costing control programmes.
 - 1.5.7 Sourcing suitable herbicide, mycoherbicide and equipment suppliers and obtaining product and equipment at the best prices. Ensuring compliance to government transversal contracts, such as RT 12.
 - 1.5.8 Ensuring that herbicide applications take place within all relevant legislation.

2. METHODS OF CONTROL

- 2.1 Selection of appropriate methods of control shall be based on the following criteria:
 - Species to be controlled
 - Size of target plants
 - Density of stand
 - Accessibility of terrain
 - Environmental safety
 - Disposal of dead vegetation
 - Cost of application.
- 2.1.1 Species to be controlled.
 - 2.1.1.1 Herbicides selected for control shall be registered for use on that species under the conditions specified under Act 36, the label and minor use registrations.
 - 2.1.1.2 Selection should be based on the WfW species and herbicide spreadsheet, AVCASA suggestions, minor use registrations, labels and information brochures issued by suppliers.

2.1.2 Size of plants.

The following methods of control are appropriate for age or size target plants:

2.1.2.1 Seedlings.

2.1.2.1.1 Hand pulling or hoeing. Hand pulling should be carried out in sparse stands under conditions where seedlings are easily removed from the soil. Operators should be supplied with suitable gloves or other hand protection. Hoeing is also most suited to sparse stands. Seedlings should be severed below the soil surface or removed from the soil. Soil disturbance should be minimized to reduce re-germination.

2.1.2.1.2 Foliar applications of herbicides/ mycoherbicides can be carried out in dense stands or open stands. For dense stands suitable fan nozzles for overall application should be fitted. Sprayers should be fitted with pressure or flow regulators. In stands where individual plants are treated solid cone nozzles should be fitted. This is the same for mycoherbicide applications, except the carrier is a medium grade mineral oil such as canola oil.

2.1.2.2 Saplings.

2.1.2.2.1 Hand pulling, hoeing or brashing. Where appropriate hand pulling or hoeing should be carried out as recommended for seedlings. Brashing is recommended for Eucalyptus species seedlings. Brashing is done using a hand saw or hatchet. The programme does not currently use this method.

2.1.2.2.2 Foliar sprays. Overall application or individual plant spraying can be carried out, depending on the density of the stand. Fan nozzles should be fitted for overall spraying and solid cone nozzles for individual plant treatment. Pressure or flow regulators should be fitted to sprayers for overall application. Spraying should be restricted to plants waist height or lower, but ensure there is sufficient foliage to carry the applied herbicide to the root system.

2.1.2.2.3 Basal stem treatments. Application of suitable herbicides in diesel can be carried out to the bottom 250 mm of the stem. Applications should be by means of a low pressure, coarse droplet spray from a narrow angle solid cone nozzle.

2.1.2.2.4 Cut stump treatments. Stems should be cut as low as practical as stipulated on the label. Herbicides are applied in diesel or water as recommended for the herbicide. Applications in diesel should be to the whole stump and exposed roots and in water to the cut area as recommended on the label. The gel applications need to be painted on the whole cut surface and should be 10mm in thickness. Mycoherbicides can be applied using the same method as for herbicides, but in canola oil as the carrier.

2.1.2.3 Mature trees. These should be regarded as trees above shoulder height or robust bushes 12-18 months or older.

2.1.2.3.1 Strip barking. Bark must be removed from approximately waist height to the bottom of the stem. All bark must be removed to below ground level for good results. Where clean de-barking is not possible due to crevices in the stem or where exposed roots are present, a combination of bark removal and basal stem treatments should be carried out. Handsaws (such as silky zubats) or hatchets (silky nata hatchets) should be used for de-barking.

2.1.2.3.2 Ring barking. A band of bark is removed around the stem, approximately 10cm wide and situated as close to the ground as possible. Ensure all bark, phloem and cambium tissue is removed within the

band.

- 2.1.2.3.3 Frilling or partial frilling. Cuts should be made through the bark into the sapwood by means of a bush knife or light axe and a suitable herbicide applied into the cuts. In a full frill the cuts join or overlap along the circumference of the stem. This is the standard method for most species to be frilled. A partial frill has cuts spaced along the stem circumference and is only used where a herbicide is very effective on a particular species.
- 2.1.2.3.4 Basal stem treatments. Suitable herbicides should be applied in diesel to the base of the stem and to any exposed roots. Stems with a diameter up to 50 mm should be treated to a height of 250 mm and stems above 50mm diameters to a height of 500 mm. This method is only suitable for stems up to 100 mm in diameter with smooth live bark. Application is by means of a low pressure coarse droplet spray from a narrow angle, solid cone nozzle.
- 2.1.2.3.5 Cut stump treatments. Stumps should be cut as low as practical as stipulated on the label. Herbicide is applied in diesel or water as recommended for the herbicide. A good mineral or vegetable oil is to be used for most of the pathogens/mycoherbicides. Applications in diesel should be to the whole stump and exposed roots and in water to the cut area as recommended on the label. The gel applications need to be painted on the whole cut surface and should be 10mm in thickness. Mycoherbicides should be sprayed onto the stem in the same way as a herbicide, although the carrier for the pathogens and fungi is a medium quality mineral oil like canola oil.
- 2.1.2.3.6 Stem injection. Herbicide solutions are applied directly into pre-made holes in the stem and cladodes of certain cactus species using a sheep dose applicator..
- 2.1.2.3.7 Soil application. Herbicide granules are applied directly to the soil under the trees in the dosage rates stipulated on the label. This method is mostly used for bush encroachers. Care must be taken when applying and the application must be timed with the rainfall.
- 2.1.3 Density of stands.
 - 2.1.3.1 Overall applications can be made to dense stands of seedlings or saplings. Where other desirable vegetation is present (e.g. grass cover), selective herbicides or mixes that will not damage the grass or other desirable vegetation cover should be applied. Fan nozzles and pressure regulators should be fitted to sprayers. The non-target species kill rate and acceptable non target criteria must be agreed upon prior to application. Aerial applications with mycoherbicides can also be used.
 - 2.1.3.2 Where dense stands of big trees, resulting in a large bio-mass, treatment of standing trees may be appropriate to obviate the problem of disposing of felled trees. Where there is a danger of dead trees falling into water courses they should be cut down and removed and the stumps treated with a suitable herbicide.
- 2.1.4 Accessibility of terrain.
 - 2.1.4.1 In inaccessible areas such as mountainous areas or where no access roads exist, methods of control where a minimum amount of transportation of equipment and chemical is involved should be given preference. Appropriate gel applied herbicides should be considered or nomix products
- 2.1.5 Environmental considerations.
 - 2.1.5.1 Protection of the environment is of prime importance. Riparian areas, where most alien vegetation infestations occur, require a particularly careful approach. Only herbicides that are approved for use

in riparian areas should be used. Only aquatic safe products that are tallow amine free can be used in riparian and aquatic systems. Consult the technical manager for these products. Washing of equipment or disposal of waste spray mixture or washings is prohibited in or near water courses where contamination of water can occur, including aquifer or ground water contamination.

2.1.6 Desirable vegetation.

2.1.6.1 Where desirable vegetation is present, e.g. grass cover in pastures or the margins of forests, methods of control must be selected that will cause minimum damage to the desirable vegetation. Alternative methods to foliar spraying should be adopted where there is a danger of damage to adjacent desirable plants occurring. The non target species kill rate must also be determined prior to the control.

2.1.7 Disposal of vegetation.

2.1.7.1 Where possible utilizable wood should be removed after felling from properly stacked and piled wood sources. Brush piles in certain environmental conditions is not ideal, and in these situations, the brush/cut biomass should be removed or spread out over the entire area to minimise the risks.

2.1.7.2 Brushwood is often burned on purpose or accidentally. If burning is planned, brushwood should be spread out rather than stacked to limit soil damage as intense fires result in stacked brushwood destroying soil structure and preventing grass establishment for many years.

2.1.7.3 If there is a danger of damaging fires, unusable trees should be left standing as this will result in a less intense fire. This can only be done for wood in landscape areas.

2.1.7.4 Felled trees or trees in danger of falling in water courses should be removed so that they do not cause blockages with resulting problems of flooding and damage to infrastructure such as roads and fences. The felled trees should not be stacked within 20m of the riverbank/shore.

3. LONG TERM CONTROL PROGRAMMES

- 3.1 In areas where after initial control of alien vegetation has taken place and regrowth of the species and/or other undesirable vegetation will occur, the programme should be so structured that a minimum of regrowth will occur and a follow-up programme will be actioned. The following must be taken into consideration:
 - 3.1.1 Species coppicing. Many species coppice from cut stumps and/or roots. Cut stumps must be thoroughly treated within 15 minutes of cutting according to label recommendations to minimise regrowth. Root coppice from species such as grey poplar (*Populus canescens*) and silver wattle (*Acacia dealbata*) occurs rapidly and control measures must be undertaken before plants become too large to be controlled with foliar sprays. Coppicing stumps should be treated before coppice reaches head height. Mycoherbicides should also be considered
 - 3.1.2 Seedling control. Germination of Acacia species takes place rapidly after a fire and control measures must be put in place as soon as possible to minimise the quantity of herbicide used and the cost of application. Selective herbicides should be used where there is a danger of damage to grass present. Mycoherbicides should also be considered.
 - 3.1.3 Burning. Burning should be considered part of the control programme to get rid of unwanted brushwood or to stimulate even growth of seedlings so that follow-up control measures are easier.
 - 3.1.4 Rehabilitation. Where the danger of erosion exists or where the re-establishment of pastures is desired after clearing, rehabilitation of the area with grasses or other suitable plants should be carried out. The advice of pasture / rehabilitation / ecology experts should be sought in planning this operation. Other erosion control measures such as the building of weirs should be undertaken where necessary.

4. SELECTION OF HERBICIDES

- 4.1 Herbicides are selected in accordance with the " Master species and herbicide spreadsheet" by the Technical unit. The selection of herbicides should be based on the following criteria and any deviation from this point must be approved by the management committee (MANCO). Consult the Working for Water Technical Advisor.
 - 4.1.1 State Tender. Most of the herbicides are found on The State Tender Contract – RT 12. These herbicides must be purchased in accordance with the correct procurement procedures as laid down by the department. The status of the State Tender Contract changes from time to time and it is therefore imperative that the latest version is used. For the latest version please contact your Regional DEA: EP Office.
- 4.2 Efficacy. Where alternative products are available for the same purpose, advice should be sought on the efficacy of these products under the prevailing application conditions. Mycoherbicides should be the priority as the environmental impacts are limited.
- 4.3 Cost. Where different methods of application exist the cost of application and retreatment, in addition to the cost of the product shall be taken into consideration in deciding on which herbicide to apply. The non target effects and toxicity to human health and the environment should also be taken into account when deciding on a product. Mycoherbicides should be considered.

4.4 Operator safety.

4.4.1 All measures must be taken to ensure the safety of the operators and where choices exist preference should be given to the safest product. Check the label colour band.

4.4.2 The following table gives the toxicity rating according to the label colour band:

BLUE	SLIGHTLY HAZARDOUS - CAUTION
YELLOW	MODERATELY HAZARDOUS - HARMFUL
RED	TOXIC TO VERY TOXIC

4.4.3 Label recommendations regarding safety must be strictly observed.

4.5 Environmental safety.

4.5.1 Herbicides that have the least impact on the environment shall be used where not effective mycoherbicide is available.

4.5.2 Every precaution shall be taken to ensure that these products are safely stored, handled and applied.

4.6 Availability. Products should be readily available from suppliers in the areas of use to limit quantities stored.

5. TRAINING

All contractors (or one of their employees) who apply herbicide for gain in the Working for Water Programme must attend and pass the approved WfW Limited Pest Control Certified Herbicide Course or it's equivalent. All Project Managers, in order to effectively manage the herbicide operations in their projects, must attend and pass the approved WfW Limited Pest Control Certified Herbicide Course or it's equivalent.

Operating teams shall be trained in the following aspects of herbicide use. Teams must receive training before commencing operations. Training shall be appropriate for the situations where teams will operate and specialized training or teams operating under specialized conditions, e.g. indigenous forests or soil applied herbicides, may be necessary.

5.1 Supervisors. Team supervisors shall receive training in the following:

5.1.1 Herbicide awareness. Basic training on the mode of action of herbicides.

5.1.2 Operator safety. Handling of concentrates and spray mixtures, personal hygiene and protective clothing.

5.1.3 Safe storage of product at depots and operational sites and spray mixtures at operational sites.

5.1.4 Mixing. Handling of concentrates and mixing techniques.

5.1.5 Safety procedures to be observed during transportation of product, spray mixtures, equipment and personnel.

5.1.6 Care and maintenance of application equipment, saws etc.

5.1.7 Record keeping in respect of quantities of product/spray mixtures used, area treated, person hours per area/operation, stock control.

5.1.8 Planning. Advanced planning for follow-up operations, transportation, equipment and spares requirements, product procurement and availability. Team management.

- 5.1.9 First aid. Actions to be taken in case of accidental contamination, suspected and actual poisoning, chronic poisoning, eye contamination and other physical injuries.
- 5.1.10 Health of operators. Persons unsuitable for use as application operators, e.g. chronically ill, disabled, pregnant women .Allergic reactions. Wearing of protective apparel. Hygiene.
- 5.1.11 Disposal of waste and spillage.
- 5.1.12 Managing major and minor spills, accident sites.
- 5.1.13 Calibrating application equipment.
- 5.1.14 Environmental safety.
- 5.1.15 Application techniques. Correct application to obtain most cost effective results.
- 5.1.16 Suitable and unsuitable application conditions.
- 5.2 Operators. Operators should receive training in the following:
 - 5.2.1 Basic herbicide awareness - the purpose and functioning of herbicides and the need for correct application.
 - 5.2.2 Safe handling of concentrates and spray mixtures, toxicity of herbicides, protective clothing, safe application, personal hygiene and disposal of waste.
 - 5.2.3 Application techniques. Correct, thorough application. Preventing waste.
 - 5.2.4 Care of equipment. Cleaning and disposal of washings.

6. COSTING OPERATIONS OR PROGRAMMES

- 6.1 Prior to the commencement of any control operations or programmes an assessment shall be made on the cost, based on the following:
 - 6.1.1 Cost of herbicides and wetter's.
 - 6.1.2 Quantity, to be based on:
 - 6.1.2.1 Method of application
 - 6.1.2.2 Size and density of target plants.
 - 6.1.2.3 Dilution rates
 - 6.1.3 Adjuvant/surfactants required.
 - 6.1.4 Personnel costs. Number of person hours per area/operation.
 - 6.1.5 Cost of equipment, spares and maintenance.
 - 6.1.6 Cost of transportation, storage and other incidental costs.
- 6.2 Follow-up treatments such as seedling and/or coppice control must be similarly costed and built into the total cost of the control operation.

7. PROVISION OF EQUIPMENT

- 7.1 Application equipment shall be standardised and obtained from approved suppliers.
- 7.2 Use of the following brand of knapsacks has been approved. CP 3, CP 15, Matabi, Solo, AgrimexA18,

Osatu. (On placing an order for knapsacks, ensure the quote includes the approved nozzles and pressure regulator or constant flow valves, and a replacement set.)

- 7.2.1 Where appropriate sprayers must be fitted with pressure regulators or flow regulators.
- 7.2.2 Spares must be readily available and spares such as nozzles, plumbers tape, nuts, screws, hose and washers must be carried with teams. Suppliers must be consulted on spares requirements.
- 7.2.3 The following nozzles or their equivalents shall be used as standard: TG-1, FL-5VS and TF-VS2 or their equivalents.
- 7.3 The teams should have the necessary tools, e.g. spanners, screwdrivers, pliers, to carry out necessary maintenance and repairs in the field.
- 7.4 Malfunctioning nozzles should be replaced in the field and no attempt should be made to clean them. Cleaning should be done at the workshop/store using preferably compressed air and water.
- 7.5 Small hand held sprayers should be standardised on to Polispray or equivalent and Hack-pack applicators.
- 7.6 Suitable plastic measuring cylinders, beakers and mixing containers must be available and only used for herbicide mixing.
- 7.7 Containers must always be provided for clean water for personal use.

8. STORAGE, HANDLING AND TRANSPORTATION

8.1 Storage.

All storage facilities shall comply with the requirements of AVCASA. These can be summarised as follows:

8.1.1 Isolation.

Where possible, a store should preferably be a separate building and should not be sited near a dwelling house, livestock buildings or where fodder, fuel or other flammable materials are stored. A minimum of five meters between the store and the other buildings is recommended. If part of a complex, the store must be totally sealed off from the rest of the complex, i.e. no free movement of air between the storage area and the rest of the complex.

- 8.1.1.1 The location of the store must take into account the possible pollution risk from spilt chemicals. The store should be away from rivers, dams, boreholes and areas likely to be flooded.

- 8.1.1.2 The store should be situated where it can be supervised.

8.1.2 Accessibility.

When planning a store bear in mind the ease of access for delivery or dispatch. Also consider the possibility of a fire and the need to be able to approach the building from all sides.

8.1.3 Construction.

8.1.3.1 Floor.

Earth, timber, bitumen, PVC or linoleum, coarse unscreened or disintegrating concrete is not acceptable. Smooth screeded concrete is ideal, however sealed, steel container floors are acceptable. The doorway should be bunded to a minimum height of 200 mm and this, as well as all wall to floor joints, should be made watertight. The purpose of the bund is to contain spills or fire water which could cause damage to the environment and prevent water (e.g. flood run-off) entering the store.

8.1.3.2 Walls.

Walls should preferably be brick or concrete block with airbricks or vents 200 mm from the floor and near or at roof level. Containers are acceptable if there is adequate ventilation 200 mm from floor level and near roof level. The container should where possible be placed in a shaded area. If this is not possible ensure good permanent ventilation.

8.1.3.3 Roof.

The roof should be leak-free and have some form of insulation to maintain temperatures at a reasonable level. Vent in the roof will allow for the escape of hot air during the summer months.

8.1.3.4 Doors.

Steel doors with an effective locking system are preferred. A wooden door should have a security gate to reduce the risk of forced entry. Containers with fitted security gates can be left open to cool the contents during the heat of the day. Only authorized personnel should have access to keys and be allowed in the store.

8.1.3.5 Windows.

Windows should be adequate to allow enough light into the store to be able to read product labels. All windows should be weather proof, burglar barred and preferably be at/or above head height for security reasons.

8.1.3.6 Lighting.

There should be sufficient lighting to allow for reading of product labels. If electric lighting is required it must be secure in order to reduce fire risk. The mains control should be outside the store itself.

8.1.3.7 Sanitation.

Staff should have immediate access to washing facilities with running water, soap and towels. They should be encouraged to use it frequently. An eye wash bottle or similar object must be available at all times for the flushing of contamination from the eyes should it occur. A shower facility is recommended.

8.1.4 Equipment.

8.1.4.1 Equip the room with a table of suitable strength and height to facilitate reading of labels, decanting and measuring out of herbicides.

8.1.4.2 Measuring jugs, funnels, pumps and buckets must be kept on hand and kept specifically for the purpose of measuring out herbicides. Do not use household items for this purpose.

8.1.4.3 For the sake of good housekeeping, have on hand a broom, spade and a supply of dry fine soil as absorbent material to contain and absorb spills (spill kit). This is available in "kit form" from a number of suppliers.

8.2 Handling.

The handling of herbicide concentrates requires strict precautions and personnel handling product concentrates must be fully aware of precautions to be observed.

8.2.1 Suitable protective clothing must be available and use thereof is compulsory.

8.2.1.1 Chemical resistant plastic aprons, gloves and eye protection must be worn when handling concentrates.

8.2.2 Adequate hygiene aids such as plentiful water, soap, towels and eye wash must be readily available.

8.2.3 Suitable absorbent material such as fine dry soil and cleaning equipment must be available to handle accidental spillage.

8.2.4 In the case of spillage, the spill must be contained immediately and cleaned up with absorbent material such as fine dry soil. The contaminated material should then be disposed of by burying in a safe place.

8.2.5 Concentrates should if possible be decanted in a safe, suitable place and not in the field. Such a handling and mixing area should have a hard impermeable floor, be bunded and have an adequate sump to accommodate run-off from washing, flooding or fire containment. A 1m³sump /10m²floor space is recommended.

8.2.6 Concentrates and mixtures should never be decanted into or be mixed in drinking bottles or other food containers.

8.2.7 All containers into which herbicides or wetter are decanted must be clearly marked and a copy of the original label secured to the container.

8.2.8 Suitable equipment must be available to prepare spray mixtures. These include plastic measuring cylinders and beakers, mixing containers (buckets) and funnels.

8.3 In the field the following must be observed:

8.3.1 If concentrates must be handled in the field, observe the precautions listed under 8.2.1, 8.2.2, 8.2.3, 8.2.4, 8.2.6, 8.2.7, and 8.2.8.

8.3.2 Spray mixtures must be kept in leak-proof, non-spill containers. The containers should be kept away from personal belongings, foodstuff, drinking water and eating and living areas.

8.3.3 Containers should stand on suitable absorbent material, EG a large piece of thick hessian sack, which will absorb minor drips, out of direct sunlight in a cool place.

8.3.4 Containers must be kept at least 20m away from water bodies.

8.3.5 Filling sites should be selected to prevent damage to desirable vegetation and to enable spillage to be cleaned up and disposed of.

8.3.6 Spray mixture containers must be clearly labelled and only reused for the specific herbicide.

8.3.7 Application equipment and containers should not be cleaned on site but at a suitable designated area at the store.

8.3.8 Suitable protective clothing, overalls, rubber boots, gloves and if necessary eye protection must be worn by operators when handling and applying herbicides.

8.4 Transportation.

- 8.4.1 Herbicides and application equipment must be carried on a separate vehicle or in a part of the vehicle isolated from people, food and clothing.
- 8.4.2 Vehicles should carry absorbent material to absorb any spillage.
- 8.4.3 Herbicides and equipment must be secured to prevent spillage and damage.
- 8.4.4 Product, spray mixtures and equipment must not be left unattended where there is a danger of theft or abuse.
- 8.4.5 Product should not be left uncovered in the sun.

8.5 Disposal.

- 8.5.1 A designated officer should be responsible to ensure that herbicide containers are correctly and safely disposed of, according to AVCASA guidelines.
- 8.5.2 Empty containers must be destroyed after use and not be used for any other purpose. Under no circumstances may containers be taken home for personal use.
- 8.5.3 Empty containers should be returned to the store for safe keeping and disposal.
- 8.5.4 Where arrangements have been made containers should be returned to the supplier.
- 8.5.5 Containers that have to be destroyed should be triple rinsed, punctured, flattened and, if suitable, burned. See attached pamphlet for details of triple rinsing.
- 8.5.6 Only sufficient spray mixture that can be used in a day should be prepared. Left- over material should be returned to the depot for safe storage and re-use. Spray mixture should only be disposed of in a suitable site.
- 8.5.7 Certain spray mixtures should not be left standing overnight and should be safely disposed of. Consult the product label. If mixtures can be left overnight with no adverse effects, they should be kept to reduce costs and pollution from herbicide and wash water.

9. PUBLIC SAFETY

- 9.1 Due regard must be paid at all times to the health and safety of the public.
- 9.2 Public should be kept out of operational areas where any hazard's exist. Warning notices should be displayed to this effect where necessary.
- 9.3 Herbicides must only be applied strictly according to label recommendations.
- 9.4 Product and spray mixtures should be stored so that they are inaccessible to the public.
- 9.5 Treatment of areas within 50 m of habitations and public areas (e.g. parks) should be avoided or only carried out in consultation with the parties effected.
- 9.6 Public should be informed of control operations in their area by means of verbal communication, notices, pamphlets, the press etc.

10. ENVIRONMENTAL SAFETY

Most alien vegetation control operations are carried out in riparian situations which are regarded as environmentally sensitive. In order to minimize the impact of the operation on the natural environment the following must be observed.

- 10.1 Area contamination must be minimised by careful accurate application with a minimum amount of herbicide to achieve good control.
- 10.2 All care must be taken to prevent contamination of any water bodies. This includes due care in storage, application, cleaning equipment and disposal of containers, product and spray mixtures.
- 10.3 Equipment should be washed where there is no danger of contaminating water sources and washings carefully disposed of in a suitable site.
- 10.4 To avoid damage to indigenous or other desirable vegetation product should be selected that will have the least effect on non-target vegetation.
- 10.4.1 Coarse droplet nozzles should be fitted to avoid drift onto neighbouring vegetation, e.g. TG-1 or equivalent.
- 10.5 Only tallow amine free, or aquatic safe herbicide formulations should be used in the riparian and aquatic environments so as to limit the impact on aquatic invertebrates

11. APPLICATION

11.1 Equipment.

Only application equipment and accessories specified (see 7. PROVISION OF EQUIPMENT).shall be used by operating teams.

- 11.1.1 Equipment shall be inspected regularly between and during applications and necessary repairs carried out.
- 11.1.2 Leaking sprayers or sprayer not applying correctly should be withdrawn until repairs have been carried out. Spare applicators and parts should always be available so as not to impede operations.
- 11.1.3 Ensure that correct nozzles are fitted and pressure settings are checked regularly.
- 11.1.4 Where possible use low water volumes to keep turn around (refilling) time down to a minimum. Caution must be observed to limit drift when using minimum output nozzles.
- 11.1.5 Always ensure that knapsacks are filled to the maximum. In aquatic programmes, never fill the knapsacks more than 50% to increase buoyancy of the sprayer in aquatic environments.
- 11.1.6 Equipment must be emptied and cleaned thoroughly after spraying ceases. Spray mixture must not be left in the apparatus overnight.
- 11.1.7 Apparatus should be stored under lock and key when not in use.

11.2 Rates of Application.

- 11.2.1 Products shall be mixed and applied at rates recommended on the label. This shall not be deviated from without consultation with Working for Water Technical Advisor and suppliers.
- 11.2.2 Applications should be checked regularly to ensure that they comply with recommendations.

11.3 Precautions.

- 11.3.1 Appropriate protective clothing must be changed and washed regularly and should be removed

immediately if grossly contaminated.

11.3.2 Spillage must be attended to immediately and appropriately disposed of.

11.3.3 Application teams must be trained to avoid damage to non-target species.

11.3.4 Contamination of all water bodies must be strictly avoided.

11.3.5 Hygiene aids - clean water, soap, towels and eye wash must always be available to spray operators.

11.4 Wetter.

11.4.1 Where recommended wetting and spreading agents should be added to spray mixtures. Wetters should always be mixed in accordance with label recommendations.

11.4.2 Dye must be added to all applications where the product has no built in dye to ensure that no target species are missed and plants are correctly treated.

11.4.3 In areas where alkaline water is used for spraying the use of a buffering agent may be necessary. Consult the product label. Buffers should always be added to the water before the herbicide.

11.4.4 In sensitive areas where drift must be controlled, the use of drift control agents may be necessary. Seek expert advice on the use of these agents.

11.5 Water Sources.

11.5.1 Only clean water may be used for spray mixtures.

11.5.2 Where particulate matter occurs in water, e.g. water drawn from rivers, the water must be filtered to avoid nozzle blockages.

11.5.2.1 Funnels with filters should be used for filling or filters should be fitted in the application equipment.

11.5.3 Where large volumes of water are transported, tankers or tanks should be fitted with buffer plates particularly where operating in rough terrain.

11.5.4 The product label should be consulted regarding the quality of water suitable for the specific herbicide.

12. WEATHER CONDITIONS

12.1 Applications should not be carried out under unfavourable weather conditions that could affect the control obtained or endanger nearby desirable vegetation, water bodies or personnel.

12.2 Label recommendations regarding suitable application conditions must be followed.

12.3 The following conditions must be taken into consideration, depending on the method of application.

12.3.1 Application to wet plants.

12.3.2 Threatening rain.

12.3.3 Wind conditions <15km/h

12.3.4 Hot, dry conditions and volatility of active ingredients under high temperatures

12.4 Conditions of target plants.

12.4.1 Poor results may result if target plants are not in a suitable condition for treatment. The following conditions may result in poor control.

12.4.1.1 Water stressed plants.

12.4.1.2 Water logged plants.

12.4.1.3 Dormant plants.

13. MIXING HERBICIDES

13.1 Mixing must take place according to label instructions.

13.2 Suitable protective clothing must be worn when handling concentrates.

13.3 Liquid concentrates should be added to the half full tank which is then topped up.

13.4 Wetters should be added to the tank as per the label instruction prior to the addition of the herbicide when buffering and afterwards for wetters and dyes.

13.5 Do not mix concentrates together before adding them to the tank. Consult product labels.

13.6 Proper mixing in knapsacks and hand held applicators is difficult and spray mixtures should be mixed in bulk containers or if necessary (e.g. wettable powders) buckets before pouring into the knapsacks or hand held applicators.

13.7 Spray mixtures should be agitated continuously if recommended. This is essential after they have been standing for a while.

14. CALIBRATION

14.1 Application equipment must be correctly calibrated to obtain optimum results and prevent wastage through over-application.

14.2 Calibration should be carried out in the area to be treated.

14.3 Calibration should be checked frequently during application. The following should be checked:

14.3.1 Correct spray pressure.

14.3.2 Correct nozzle size and spray pattern.

14.3.3 Correct nozzle output.

14.3.4 Volume of application over a specific area.

15. ESTIMATED VOLUMES OF PRODUCT PER HECTARE

THIS IS FOR PLANNING PURPOSES AND TO BE USED, AS A GUIDE TO CALCULATE THE REQUIRED HERBICIDE NEEDED TO TREAT THE INTENDED AREA. (THIS IS NOT FOR CALIBRATION PURPOSES.)

AS THERE IS NO OR LITTLE DIFFERENCE IN HERBICIDE USE FOR A CLOSED OR DENSE STAND, THE VOLUMES PER HECTARE ARE GIVEN FOR A DENSE / CLOSED STAND OF THE SPECIFIC SPECIES. FOR LOWER INFESTATIONS, VOLUMES SHOULD BE REDUCED ACCORDINGLY.

THE % FIGURE OF THE DENSE/CLOSED APPLICATION RATE FOR THE LOWER INFESTATION GROUPS IS CALCULATED AT THE MID POINT OF THE DENSITY RANGE. IE MEDIUM, 25% TO 50% THE MID POINT IS 37.5% THEREFORE IF THE RECOMMENDED RATE IS 6 LITRES OF A SPECIFIC PRODUCT PER HECTARE, THE RATE FOR A MEDIUM DENSITY WILL BE 37.5% OF THE 6 LITRES. THIS WILL BE EQUAL TO 2.25 LITRES PER HECTARE.

DENSE = 75 % OF CLOSED

MEDIUM	=	40 % OF CLOSED
SCATTERED	=	15 % OF CLOSED
VERY SCATTERED	=	3 % OF CLOSED
OCCASIONAL	=	1 % OF CLOSED
RARE	=	1 % OF CLOSED

- **FOR WATER BASED APPLICATIONS, A SUITABLE ADJUVANT (WETTER) SHOULD BE ADDED WHERE RECOMMENDED ON THE LABEL. THE WETTER QUANTITIES CAN BE CALCULATED AS A RATIO (%) OF THE HERBICIDE QUANTITY, AS THE LABEL PRESCRIBES. E.G. IF HERBICIDE IS 1% MIX AND WETTER IS 0.1%, HALF THE HERBICIDE QUANTITY IS THE WETTER QUANTITY. OR IT CAN BE CALCULATED AS % WETTER REQUIRED X TOTAL MIXTURE TO BE APPLIED / HA = Lt (0.1% X 300Lt =1.5Lt)**

RATE PER HECTARE FOR DENSE / CLOSED STAND – 1.75 l / ha

- **FOR DIESEL BASED APPLICATIONS, A SUITABLE OIL BASED DYE SHOULD BE ADDED. (QUANTITIES- APPROXIMATELY 0.1% PER LITRE SPRAYED. RATE PER HECTARE FOR DENSE / CLOSED STAND 300 ml / ha.**

16. HERBICIDE DOSAGE AND LITRES PER HECTARE SUMMARY

The list of herbicides, biocontrol and mycoherbicides are available in the master species and herbicide spreadsheet obtainable from the Technical Manager. Please ensure that you have the latest version. The following page contains a table of active ingredients and a list of some brand names that can be used. For more examples please consult the “Master species and herbicides spreadsheet” issued by the Technical Unit . This guide is updated from time to time, as new herbicides are being developed and registered as an ongoing process.

However before choosing other products please consult the National Office Technical Advisor. The Minor use registrations are available from the technical Unit. *The * indicates the mycoherbicides available.*

Active ingredients	Trade names	Restrictions	Comments
<i>Cylindrobasidium leave</i> *	Stumpout	None	Only registered for <i>A. Cyclops</i> , <i>A. mearnsii</i> , <i>A. dealbata</i> , <i>A. decurrans</i> . <i>A. melanoxydon</i> , <i>A. pycnantha</i>
<i>Colletotrichum acutatum</i> *	Hakea gummosis	Grahamstown hakea resistant to pathogen	Only used on Hakea sericea, H. drupacea and H. sericifolia Effective on all growth stages
<i>Puccinia eupatori</i> *	Leaf pathogen		Only for <i>C. macrocephalum</i>
<i>Uromycladium tepperianum</i> *	Rust fungus		Only for <i>A. saligna</i>
<i>Cercospora rodmannii</i> *			Only for <i>E. crassipes</i>
<i>Mycovellociella lantanae</i> *	Leaf pathogen		Only for <i>L. camara</i>
<i>Pasalora agaritinae</i> *	Leaf pathogen		Only for <i>A. adenophora</i>
<i>Entyloma ageratinae</i> *	Leaf pathogen		Only for <i>A. riparia</i>
<i>Puccinia abrupt</i> *	Leaf pathogen		Only for <i>P. hysterothorus</i>
<i>Puccinia xanthii</i> *	Leaf pathogen		Only for <i>P. hysterothorus</i>
<i>Prospodium transformans</i> *	Leaf pathogen		Only for <i>T. sans</i>
Triclopyr 270 g/L + Clopyralid 90g/L	Confront Astra	Eye irritant, skin irritant Don't use in aquatic environments	
Fluroxypyr 200g/L	Starane Tomahawk Voloxypr	Exclusion period	Limited species on Starane and Voloxypr Flammable
Picloram 80g/L + Fluroxypyr 80g/L	Plenum	Don't use in aquatic environments Eye and skin irritant	Toxic to aquatic invertebrates
Picloram (as potassium salt) 54g/L + Triclopyr (as triethylamine salt) 46g/L	Kaput gel	Limited species registered currently	No mixing necessary
2-4D (as dimethyl amine salt) 480g/L	2,4D 2,4D Amine	Limited registrations, herbaceous species	Weedy species such as <i>D. ferox</i>
Glyphosate (as isopropylamine salt) 180g/L	Glyphosate 180	Not to be used in riparian or aquatic environments	Tallow amines
Glyphosate (as isopropylamine salt) 360g/L	Ciplasate Glyphosate 360 Mamba Roundup Springbok	Not to be used in riparian or aquatic environments, unless tallow amine free adjuvants incorporated	Ensure tallow amine free as some of the products are toxic to aquatic environments

	Enviro-glyphosate		
Glyphosate (as phosphonic acid) 480g/L	Mamba DMA	Not in aquatic environments	Limited registrations
Glyphosate (as potassium salt) 480g/L	Roundup turbo	Spot spray only Use wipe type applicator	Exclusion period Skin, eye irritant Ammonium sulphate only
Glyphosate (as isopropylamine salt) 480g/L	Mamba max Seismic	Only seismic tallow amine free and recommended for aquatic weed control	Mamba max, limited species registered
Glyphosate (as potassium salt) 500g/L	Touchdown forte hitech	Aerial registrations, Prosopis Ammonium sulphate as adjuvant only	Flammable Possible weed resistance
Glyphosate (as sodium salt) 500g/L	Muscle up Kilo Glyphosate 500	Kilo registered for aquatic weeds, tallow amine free. 3km exclusion zone for aerial applications	Poisonous if swallowed, eye irritant
Glyphosate (as ammonium salt) 680g/L	Roundup max	Spot spray regrowth Use wipe type applicator	Skin and eye irritant
Glyphosate (as sodium salt) 700g/L	Kilo max	Registered for aquatic weeds Tallow amine free Aerial spray exclusion zones	Eye irritant
Imazapyr 100 g/L	Chopper Hatchet	Hatchet, limited registrations	Poisonous if swallowed
Imazapyr 250g/L	Format	Consult the technical unit for minor use registrations	
Chlorimuron ethyl 500g/L	Extreme Nicanor	Bush encroachment only	Consult technical unit for assistance
Metsulfuron methyl 600g/L	Brushoff Climax	28 days withholding period	Eyes, nose skin irritant
Picloram (as potassium salt) 240g/L	Access Browser		
Tebuthiuron 200g/kg	Molopo	Bush encroachment only Consult the technical unit PRIOR to application	
Tebuthiuron 500g/L	Molopo	Bush encroachment only Consult the technical unit PRIOR to application	
Tebuthiuron 800g/kg	Molopo Limpopo	Bush encroachment only Consult the technical unit PRIOR to application	
Triclopyr (as butoxy ethyl	Ranger	Eye irritant	

ester) 240g/L		Volatile over 35 degrees	
Triclopyr (as butoxy ethyl ester) 480g/L	Garlon Triclon Viroaxe	Volatile under certain conditions Do not use in riparian and aquatic environments Diesel mix not to be added to wet stumps	Toxic to fish and animals Skin and eye irritant Poisonous if swallowed
Triclopyr (as pyridyloxy compound) 360 g/L	Lumberjack Timbrel	BP crop oil only	Skin, eye irritant, burns Flammable Possible weed resistant
Triclopyr (as butoxy ethyl ester) 240g/L + Aminopyralid 30g/L	Garlon max		
Triclopyr (as thiethyl ammonium) 120g/L + Aminopyralid (as triisopropanol) 12g/L	Confront super		Limited registrations
Bromacil 250g/L + Tebuthiuron 250g/L	Bundu	Bush encroachers only	
Wetter/Adjuvant	H&R crop oil BP crop oil Actipron super	Ensure the adjuvant used is the approved adjuvant as per the relevant herbicide label	Please see the master species and herbicide list for which formulations require adjuvants
Blue/red/white dye	Ecoblue Ecowhite	Only marker dyes or pigments to be used, not food colouring	
Blue Dye = Approximately 0.5% per litre water		Medium = 37.5% of Closed/Dense	
Medium = 37.5% of Closed/Dense		Medium = 37.5% of Closed/Dense	Medium = 37.5% of Closed/Dense
Red Dye (diesel) = Approximately 0.5% per litre diesel.		Very Scattered = 3% of Closed/Dense	
		Occasional = 0.5% of Closed/Dense	
		Rare = 0.5% of Closed/Dense	

