FORMER RUM JUNGLE MINE SITE

5 YEAR WEED MANAGEMENT PLAN

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1.0 INTRODUCTION

The management of weeds has special significance to the sustainability of industries, protection of the environment and to community welfare in the Northern Territory (NT Weed Management Strategy *2001*).

Weed management is a long-term process. In general the life cycle of weeds can be successfully interrupted in approximately 3 - 5 years. Sufficient changes in weed infestation should occur within that time frame to enable a revised management approach.

Development of the 5 Year Weed Management Plan for the former Rum Jungle Mine Site has drawn upon history and the present status of weed infestations at the Mine Site and the surrounding region. Understanding the growth cycle, dispersal and colonisation mechanisms of weeds and efficient methods of disrupting these are key elements of the Plan. The biological context these infestations occur in, such as native vegetation, landscape processes and land use specific to the former Rum Jungle Mine Site are also important.

It is vital to address the cause of weed infestations rather than simply adopting a 'bandaid' management approach. Recurrence of infestations will continue until the causes of dispersal are mitigated. A key strength of the Plan is that it represents a mechanism for integrated weed management. The long-term planning not only allows for effective weed treatment, but also consideration of other broad environmental issues such as erosion, fire and land management practices that often contribute to problem infestations.

The 5 Year Plan is split into two strategies. The Weed Treatment Strategy represents the eradication and control of individual weed infestations through chemical, physical and fire treatments. Prioritisation is the foundation of this strategy, which will ensure strategic and focussed allocation of available resources. The Weed Prevention Strategy is designed to reduce the amount of weed introductions onto the former Rum Jungle Mine Site and the spread of existing infestations through education and awareness programs.

Guideline implementation standards and methodologies have been developed for the 5 years. These incorporate the timing, type, application, and safety procedures of treatment as well as data collection standards and development of education programs. Specific evaluation and monitoring procedures have been detailed to ensure standardisation of data management and analysis.

This Plan will form the basis of each year's weed management implementation, which will entail the objectives and methodology specific to that year's weed management implementation. The short-term objectives for each year will collectively accomplish the long-term objectives of the 5 Year Weed Management Plan.

1.1 LOCATION AND SITE DESCRIPTION

The former Rum Jungle Mine Site is located 105km by road, south of Darwin, near Batchelor in the Northern Territory. The former Rum Jungle Site, Section 2968 Hundred of Goyder, comprises of an area of approximately 655 hectares. Uranium, copper, nickel and lead were mined at various times between 1954 and 1971. The mining operations led to significant environmental impact, primarily from the long-term generation of acid mine drainage. At the time when the former Rum Jungle mine was initiated, present environmental standards and legislation did not exist and the possible environmental consequences of mining operations received less attention than now.

On 7 October 2009 the Territory and Commonwealth Governments entered into a *National Partnership Agreement (NPA) on the management of the former Rum Jungle Mine Site*. Under the NPA, the Department of Resources (DoR) will project manage a range of site maintenance activities, environmental monitoring programs and commission investigative studies to develop an updated remediation strategy for the site by June 2013.

The site is extensively infested with exotic and weed species with at least 22 weed species currently known to occur on the site; as surveyed by Wildman Land Management (WLM) in November/December 2010 and April 2011.

1.2 PROBLEM DEFINITION

Weed management is an essential part of land management in northern Australia. Poorly managed weeds can have serious environmental consequences:

a. Changing hydrology/water quality;
b. Altering natural ecosystems;
c. Loss of biodiversity;
d. Changing fire regimes and creating increased fire hazards;
e. Displacing native vegetation;
f. Harbouring feral animals; and
g. Reducing accessibility to areas.

Two comprehensive weed surveys were conducted at former Rum Jungle Mine Site in November /December 2010 and April 2011.

A total of twenty-two weed species were observed and identified during the weed surveys (refer Table 1). The species of greatest concern at the site are Gamba Grass and Mimosa given their classification and high density. Other high priority species of major concern include Mission Grass, Olive Hymenachne, Coffee Bush, Hyptis and Grader Grass due to their invasive nature. Mimosa and Olive Hymenachne are both considered a Weed of National Significance (WONS). Gamba Grass is deemed as Class A, B and C, but due to the fact that the former Rum Jungle Mine Site is situated within the Northern Gamba Grass Management Zone, it is deemed as Class B and C.

Introduced pasture grasses are rated as the most insidious and uncontrolled threats to the native vegetation communities of northern Australia (Lonsdale 1994). These highly invasive and competitive grasses are tall vigorous species that displace native communities and greatly increase the impact of fire on open woodland communities.

Under the Northern Territory Weeds Management Act, weeds in the Northern Territory are divided into the following classes:

- **Class A: To be eradicated** (Reasonable effort must be made to eradicate the plant within the NT);
- **Class B: Growth and spread to be controlled** (Reasonable attempts must be made to contain the growth and prevent the movement of the plant); and
- **Class C: Not to be introduced into the NT (**All Class A and B are also classified as Class C).

The main weed threats at the former Rum Jungle Mine Site are the introduction of weeds from neighboring properties and spread along creeks and associated drainage lines.

Ground maintenance, including contaminated vehicles and the movement of contaminated soil, are also responsible for weed introduction and spread.

1.3 LEGISLATIVE FRAMEWORK

The former Rum Jungle Mine Site operates under a range of environmental legislation. The overriding document that details the operational framework under which Rum Jungle is managed is the *National Partnership Agreement (NPA) on the management of the former Rum Jungle Mine Site*. Under the NPA, the Department of Resources (DoR) will project manage a range of site maintenance activities.

Commonwealth legislation relevant to the Rum Jungle Weed Management Plan includes:

- *Environment Protection and Biodiversity Conservation Act* 1999;
- *National Environment Protection Council Act* 1994; and
- *Endangered Species Protection Act* 1992.

Northern Territory legislation relevant to the Rum Jungle Weed Management Plan includes:

- *NT Weed Management Act* 2001;
- *NT Weeds Management Strategy* (1996-2005);
- *NT Water Act;*
- *NT Soil Conservation and Land Utilisation Act;*
- *NT Aboriginal Sacred Sites Act* 2000;
- *NT Dangerous Goods Act* 1981;
- *NT Waste Management and Pollution Control Act* 1998;
- *NT Poisons and Dangerous Drugs Act*; and
- *NT Work Health Act* 2002.

The Rum Jungle Weed Management Plan is developed in accordance with the above statutory requirements and incorporates aspects of other legislation deemed to be appropriate. The weeds contractor is responsible for implementing weed management at Rum Jungle in accordance with all relevant legislation.

1.4 OBJECTIVES

The objectives of the 5 Year Weed Management Plan are to:

- Collate existing data (including recent survey data) and summarise the existing weed problems at the former Rum Jungle Mine Site for each Weed Management Area;
- Identify data deficient areas and provide recommendations for future research;
- Develop long-term weed management strategies (preventive and reactive) for 5 years that aims to:
    a) Ultimately eradicate or reduce the distribution and density of weed species at the former Rum Jungle Mine Site;
    b) Maintain the integrity of weed free areas; and
    c) Prevent further introduction of weed species.
- Develop implementation standards and methodologies that will form the foundation of each year's implementation that:
    a) Prioritise Weed Management Areas for weed control;
    b) Develop management objectives for each Weed Management Area including yearly treatment regimes to accomplish these;

c) Detail evaluation and monitoring methods; and
d) Provide a guideline schedule for each year's implementation.

2.0 PLANNING

2.1 DESKTOP ANALYSIS

To assess the past and present status of weed infestations at the former Rum Jungle Mine Site and to determine an appropriate management strategy the following documents were reviewed and analysed:

- WLM Rum Jungle weed survey data 2010/2011;
- Published weed literature, including books, journal papers and Agnotes; and
- Consultation with the former Rum Jungle Mine Site Project Coordinator.

An overview of the key findings from these documents is presented below.

2.1.1 Weed Survey Reports

The Rum Jungle Weed Survey Report 1 and 2 formulate the basis of the Rum Jungle 5 Year Weed Management Plan. The site has been divided into four management areas to assist in the implementation of weed treatment. Weeds are widespread throughout the site with Gamba Grass (*Andropogan gayanus*) being the most predominant species, accounting for almost fifty percent of all recorded weed sites. Mimosa (*Mimosa pigra*) infestations were observed in Management Areas 1 and 4 and Olive Hymenachne (*Hymenachne amplexicaulis cv Olive*) infestations were recorded in Management Areas 2 and 4.

Drainage lines and catchment areas are a major source of weeds being spread throughout the property. Catchment strategies recommended in the Plan relevant to weed management on Rum Jungle are as follows:

- Consolidate and expand remnant native bushland areas into areas that are degraded. Stabilise degraded areas and undertake spot removal of highly invasive grass species; and
- Implement a weed control program for gradual removal of weed species from remnant vegetation.

A major project component of high priority of the Plan is to implement a weed control program alongside regeneration and revegetation programs.

2.1.2 Published Weed Literature

Published weed literature, particularly Department of Resources, *Weed Management on Mine Sites* (2010); Department of Business, Industry and Resource Development (DBIRD) – Agnotes; NRETAS Weed Management Branch (2009); Department of Primary Industries Queensland - DPI notes; *Weeds of Natural Ecosystems* (Smith 2002); *A Weed Management Strategy for Kakadu National Park 1996-2001* (Storrs 1996) and *Weeds of the Wet / Dry Tropics of Australia, A Field Guide* (Smith, 2002), Florabase WA (1993), Tropical Forages (2005) and Herbiguide (2010) were the sources of the majority of weed treatment methods.

Legislation and the weed literature were used as the primary guides to prioritising weed species.

2.2 SURVEYS

As part of the RFQME – 0069 former Rum Jungle Mine Site Scope of Works (SoW), two intensive weed surveys were carried out in November / December 2010 and April 2011 to identify and record weed infestations present at different stages of growth due to change in the seasons.

Ground and aerial surveys were carried out across the former Rum Jungle Mine Site, excluding registered Sacred Sites and Monsoon Vine Thicket located along the western boundary. Each observer recorded the GPS location, weed species, density and diameter of identified weed infestations. Surveys were conducted along the road verges, tracks, fencelines, disturbed areas, woodlands, drainage and creeklines to ensure a complete coverage of the survey area. Transects spaced 100m apart were implemented systematically using quad bikes.

The data was overlaid onto a topographical map featuring observed weed species and GPS locations. The presentation of data in map form provides a visual representation of weed distribution across the former Rum Jungle Mine Site and will assist in the development of a specific Weed Management Plan.

It is possible that some weed infestations have been missed during the survey due the dense weed populations and some inaccessible areas.

Map 2 – Rum Jungle Mine Total Weed Sites (Page 41).

2.3 LIAISON AND CONSULTATION

To ascertain the context of weed management at the former Rum Jungle Mine Site, the weed problems of the region, and contemporary treatment methods, liaison and consultation with a variety of individuals and organisations was conducted.

2.3.1 External Consultation

Consultation with the DoR regarding weed legislation, local and regional weed management strategies and technical information on weed species and control methods was conducted.

As a source of technical information the Natural Resources, Environment, The Arts and Sports (NRETAS) Agnote series on weeds was particularly useful.

Liaison with the fire management contractor will be required to determine the feasible levels of fire and weed management integration. Determination of locations, timing and intensity of burns will be essential to successful burning regimes for weed control.

2.3.2 Internal Administration

Liaison and coordination with internal administration regarding the Weed Prevention Strategy was conducted (see Section 2.5). This included:

- DoR Contract Manager; and
- Ground maintenance staff.

2.4 WEED TREATMENT STRATEGY

Preventing the introduction of weeds onto the former Rum Jungle Mine Site and the spread of existing weeds into weed free areas are important preventive elements of weed management. With this in mind the Plan has been divided into two strategies. The Weed Treatment Strategy represents the chemical, physical and fire treatment of weed infestations and the Weed Prevention Strategy aims to prevent the introduction and spread of weeds.

The Weed Treatment Strategy not only aims to eradicate high priority weeds and restrict the distribution and abundance of low priority weeds, but also to maintain weed free areas. The strategy is systematic and focused upon early detection and efficient treatment. Treatment of infestations is of paramount importance due to the rapid escalation of infestation size and density if allowed to seed.

2.4.1 Weed Species to be Managed

The Rum Jungle Weed Surveys were conducted in November/December 2010 and April 2011 and categorised according to the NRETAS weed classification system. A total of 22 weed species have been identified at Rum Jungle.

Previous weed surveys were conducted by NRETAS in June 2009. The results of this survey were not available for review prior to writing this Weed Management Plan and were superseded by the recent survey works referred to throughout this document.

Table 1 is a list of all weeds identified at Rum Jungle during these surveys and there attributed classification as per NRETAS specifications. Different weed species present varying levels of environmental problems and maintenance issues.

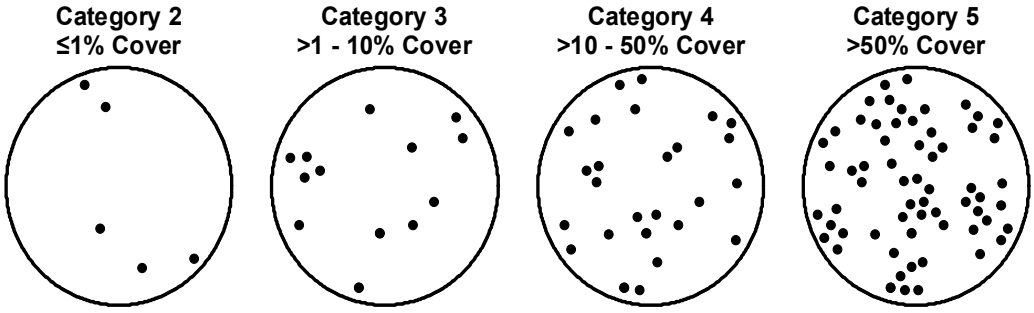
Table 1 – Rum Jungle Mine Site Weed Species Recorded 2010/11

Common Name	Scientific Name	Class
Calopo	*Calopogonium mucunoides*	Unclassified
Candle Bush	*Senna alata*	B, C
Centro	*Centrosema pubescens*	Unclassified
Coffee Bush	*Leucaena leucocephala*	Unclassified
Flannel Weed	*Sida cordifolia*	B, C
Gamba Grass	*Andropogon gayanus*	B, C
Grader Grass	*Themeda quadrivalvis*	B, C
Guinea Grass	*Urochloa maxima*	Unclassified
Hyptis	*Hyptis suaveolens*	B, C
Leaf Flower	*Phyllanthus* species	Unclassified
Mimosa	*Mimosa pigra*	A, B, C, WONS
Mission Grass	*Pennisetum polystachion*	B, C
Olive Hymenachne	*Hymenachne amplexicaulis cv Olive*	B, C, WONS
Paddy's Lucerne	*Sida rhombifolia*	B, C
Para Grass	*Brachiaria mutica*	Unclassified
Phalaris	*Phalaris aquatica*	Unclassified
Red Natal Grass	*Melinis repens*	Unclassified
Spiny Head Sida	*Sida acuta*	B, C
Snakeweed	*Stachytarpheta australis*	B, C
Stylo	*Stylosanthes hamata*	Unclassified
Tully Koronivia Grass	*Brachiaria humidicola* cv Tully	Unclassified
Wild Passion Fruit	*Passiflora foetida*	Unclassified

NT Weeds Management Act 2001 declarations:

Class A Noxious Weeds - To be eradicated.
Class B Noxious Weeds - Growth and spread to be controlled.
Class C Noxious Weeds - Not to be introduced into the NT.
All Class A and B weeds are also Class C weeds.
WONS – Weed of National Significance

Weed species identified have been classified using NRETAS classification system as demonstrated below.



Size of infestation was recorded base upon NRETAS classification, which is as follows:

- 5 metres in diameter;
- 20 metres in diameter;
- 50 metres in diameter; and
- 100 metres in diameter.

Coordinates were recorded in WGS84 – decimal degrees using GPS units.

2.4.2 Weed Species

Weed infestations have the potential to cause serious environmental degradation at the former Rum Jungle Mine Site. These are the focus of the Rum Jungle Weed Management Plan with the aim of ultimately eradicating species from the facility.

Weed species encountered at Rum Jungle declared under the *NT Weeds Management Act* 2001 and other recognised serious environmental weeds have been listed for control. The current and potential impact of these species has been considered.

A brief summary of the weeds species identified during the surveys is as follows:

Calopo (*Calopogonium mucunoides*)
Calopo is an annual leguminous vine with twining stems covered in yellowish hairs. Leaves have 3 densely hairy leaflets. Flowers (April - August) are small pea shaped, blue-purple and yellow-green towards the center. Pods (June - October) are pale brown, straight and densely hairy containing 5-7 pale brown or yellow seeds. Native to tropical America it was introduced as a pasture species and now inhabits tropical areas of NT and Queensland where populations are rapidly expanding. It is an extremely vigorous climber that smothers supporting vegetation. Its seed is dispersed by in mud adhering to vehicles and stock.

Candle Bush (*Senna alata*)
Candle Bush is an evergreen shrub up to 4m tall. It has short pithy stems and leaves with 8-11 pairs of large, oblong leaflets. The bright yellow flowers are followed by winged pods, which can be spread by animals and humans. Candle Bush is a weed in many tropical countries and was introduced to Darwin as an ornamental garden plant. It is now naturalised in the Northern Territory particularly in areas with a high water table. It is also naturalised in Queensland

and Western Australia. It has a tough rootstock and plants sucker when damaged. It is grown as a garden and indoor plant. Candle Bush is declared a Class B and Class C weed in accordance with the *NT Weeds Management Act*.

Centro (*Centrosema pubescens*)
Native to South America, Centro is a vigorous twining perennial herb now an established pasture plant. Centro forms a tangled mat about 50cm deep or grows up shrubs to 3m with leaflets about 2cm long and 1-1.5cm wide and covered with fine downy hairs, large mauve pea flowers grow in groups of one to several at the end of slender stalks from the leaf axils pods are long, 7.5-15cm, flat and brown when ripe, holding up to 20 brownish-red seeds with black streaks.

Coffee Bush (*Leucaena leucocephala*)
Coffee Bush is a small tree that grows to 6m. It spreads by seed of which it produces vast quantities. The thin, flat pod may be dispersed short distances by wind but many seeds fall close to the parent plant. A native of Central America, it is now found in most tropical and subtropical countries. It is a common weed in suburban Darwin and most coastal settlements.

Flannel Weed (*Sida cordifolia L.)*
Annual or short-lived perennial woody shrub that grows up to 1.5m. Leaves are bright green and flowers are pale yellow appearing from April to September. Common in disturbed and degraded areas, it will displace native vegetation. The plant possesses a well developed tap root. It is widely distributed across northern Australia and once established, it is very difficult to contain or control. Flannel Weed is declared a Class B and Class C weed in accordance with the *NT Weeds Management Act*.

Gamba Grass (*Andropogon gayanus*)
Gamba Grass is a tall perennial grass that forms large dense tussocks up to 4m in height and 70cm in diameter. It has the potential to reduce biodiversity in woodland in the Top End by competing with native vegetation and creating more intense fires. These fires impact on the tree canopy, sometimes killing the tree, even in species that are relatively fire resistant. Gamba Grass is declared a Class B and C weed in accordance with the *NT Weeds Management Act*. Rum Jungle Mine Site falls within the Northern Gamba Grass Management Zone.

Grader Grass (*Themeda quadrivalvis*)
Tufted annual or perennial grass that grows up to 2m tall, often growing in dense patches. Mature plants are golden in appearance. Large seeds are produced in prolific numbers and are distributed by attaching to clothing, fur, etc. Road graders have also been responsible for spreading seed along roadways. Machinery and vehicles also disperse seed through carrying mud containing seed. Can invade native pastures and grassland and seriously reduce diversity. Grader Grass is Class B and Class C Noxious Weed under the *NT Weeds Management Act*.

Guinea Grass (*Urochloa maximum*)
Guinea Grass is a tall perennial grass that forms dense tussocks. Its leaves are broad, flat and long; they taper to a fine point. The leaf blades and sheaths have soft hairs. Flowering stalks of taller varieties can reach 3 to 4m in height. Seeds are small, numbering 2.4 million/kg. Leaves are mainly basal, flat and mostly hairy. Seeds prolifically and germinates close to parent plant. Favours wetter areas, along roadsides and disturbed areas. Guinea Grass is a native of tropical

and sub-tropical Africa. It is suited to areas with an annual rainfall of over 1100mm, but grows better with higher rainfall. There is naturalised "Darwin" Guinea Grass in the wetter areas around Darwin, along creeks and in low-lying areas.

Hyptis (*Hyptis suaveolens*)
Hyptis is an annual or perennial upright branched plant with a characteristic aromatic minty smell, generally growing 1 to 1.5m high, but at times reaches 2m. Under favourable conditions it can act as a perennial plant. Stems are square with opposite leaves, which are broader at the base than at the tip, varying from 2.5 to 7cm long and 1 to 5cm wide, with serrated margins. Small lavender blue flowers occur in clusters in the leaf axils. Seeds are dark brown to black in colour, shield shaped, 3.5 to 4mm long and 2.5 to 3mm wide. Hyptis is a native of South America and was first recorded in the Northern Territory by the explorer Leichhardt in about 1845. It is now widespread in the Darwin, Katherine, Gulf and Victoria River Districts. This weed is continuing to invade through natural spread and is a contaminant in hay, on livestock, clothing, native animals and vehicles. Hyptis is Class B and C Noxious Weed under the *NT Weeds Management Act.*

Leaf Flower *(Phyllanthus)*
Phyllanthus is the largest genus in the family Phyllanthaceae. *Phyllanthus* has a remarkable diversity of growth forms including annual and perennial herbs, shrubs, climbers, floating aquatics, and pachycaulous succulents. Some have flattened leaf like stems called cladodes. It has a wide variety of floral morphologies and chromosome numbers and has one of the widest range of pollen types of any seed plant genus.

Despite their variety, almost all *Phyllanthus* species express a specific type of growth called "phyllanthoid branching" in which the vertical stems bear deciduous, floriferous (flower bearing), plagiotropic (horizontal or oblique) stems. The leaves on the main (vertical) axes are reduced to scales called cataphylls while leaves on the other axes develop normally. *Phyllanthus* is distributed in all tropical and subtropical regions on Earth. Leaf Flower is the common name for all *Phyllanthus* species.

Mimosa *(Mimosa pigra)*
Mimosa is a *Weed of National Significance*. It is regarded as one of the worst weeds in Australia because of its invasiveness, potential for spread, and economic and environmental impacts. Mimosa forms dense stands that replace all native vegetation on the ecologically and economically valuable wetlands of the Top End of northern Australia. Mimosa invasion threatens the production, cultural and conservation values of wetlands, and reduces the scope for exploitation of resources by land users. Pastoralists are affected because the inedible and thorny Mimosa smothers and replaces grasslands, blocks access to stock watering points and hinders mustering. Additionally, the harvesting of bush foods by indigenous people is hampered by Mimosa. Mimosa is declared a Class A, B and C weed in accordance with the *NT Weeds Management Act*.

Mission Grass (*Pennisetum polystachion*)
Mission Grass is a tall perennial grass that displaces native vegetation and will occupy a number of different types of landforms and soil types. Mission Grass remains green longer than native vegetation and provides fuel loads for much

hotter fires than would normally occur and also changes savanna fire regimes to the detriment of native vegetation. Mission Grass is declared a Class B and C Noxious Weed.

Olive Hymenachne *(Hymenachne amplexicaulis cv Olive)*
Olive Hymenachne is a *Weed of National Significance.* It is a grass introduced from South America and tested as a species for ponded pastures. Olive Hymenachne appears almost identical to native Hymenachne, except for shorter and broader leaves. The stems are thick, and can be over 4m long, containing 10 or more nodes. Leaves are 15-30cm long and 2-3cm wide. The plant generally has a dark green appearance. The seed head is a spike 8-10cm long. It is not recommended for sowing as a pasture in the Northern Territory. Native Hymenachne is found on the black cracking clay soils in permanent swamps, on the margins of permanent water-holes and on the coastal and sub-coastal riverine plains of the Top End of the NT where flooding occurs for 6-12 months of the year. This species is Class B and C under the *NT Weeds Management Act* 2001 and also declared a Weed of National Significance.

Paddy's Lucerne (*Sida rhombifolia L.)*
A perennial or sometimes annual plant in the Family Malvaceae. The stems are erect to sprawling and branched, growing 50 to 120 centimeters in height, with the lower sections being woody. The dark green, diamond-shaped leaves are arranged alternately along the stem, 4 to 8 centimeters long, with petioles that are less than a third of the length of the leaves. They are paler below, with short, grayish hairs. The apical half of the leaves have toothed or serrated margins while the remainder of the leaves are entire (untoothed). The petioles have small spiny stipules at their bases. This species is usually confined to waste ground, such as roadsides and rocky areas, stock camps or rabbit warrens, but can be competitive in pasture, as it is unpalatable to livestock. This species is Class B and C under the *NT Weeds Management Act* 2001.

Para Grass *(Brachiaria mutica)*
Para Grass is a coarse, vigorous, trailing perennial, which is useful for wet and flooded soils in the higher rainfall areas of the Top End of the Northern Territory. It has stout runners (stems, stolons) which branch and root readily at all nodes. The runners grow up to 5m long, but the sward grows only to a height of 1m. Leaves and leaf sheaths are generally hairy; leaves are 6-20cm long and 1-2cm wide. The seeds are small, numbering about 935 000/kg. Para Grass is a native of tropical Africa and South America. It was introduced into Australia in 1880, and into the NT between 1905 and 1910. It prefers annual rainfall of more than 1000 mm. Para Grass is tolerant of soil salinity. It will withstand flooding for a number of weeks provided some green material is above the water surface. Stands of Para Grass can thin out if flooded, grazed, cut very short or burnt.

Phalaris (*Phalaris aquatica*)
Phalaris is a perennial grass, better suited to moderate to high fertility soils. It is sensitive to acid soils and tolerates wet soils, flooding and moderately saline soils. A winter growing annual species in southern Australia that produces a bulk of useful pasture forage but is a major weed of winter cropping systems, particularly on heavy soils. Wild Phalaris emerges at around planting time and competes strongly with winter crops. It is able to set seed before most crops are ready for harvest. Found throughout the southern and central cropping areas of Australia.

Red Natal Grass *(Melinis repens*)
An attractive 1 to 2 foot tall perennial grass with reddish to purple flower spikes that grows in full sun and looks best with regular water, but also grows well on dry slopes and edges of roadways. It is a native of Africa that was introduced to Australia. It flowers throughout the year and has a distinctive red coloured flower head, which makes it attractive as an ornamental grass. It is short lived, but freely reseeds itself.

Spiny Head Sida (*Sida acuta*)
Annual or short-lived perennial woody shrub to 1.5m. Leaves are bright green and flowers are pale yellow appearing from April to September. Common in disturbed and degraded areas it will displace native vegetation. Well developed tap root. It is widely distributed across northern Australia and once established, it is very difficult to contain or control. This species is Class B and C under the *NT Weeds Management Act* 2001.

Snakeweed (*Stachytarpheta spp.*)
Snakeweed is a perennial shrub growing up to 2m with tough stems and woody roots. Leaves are fleshy, opposite and shallowly toothed. Flowers are mauve, blue, violet or purple. They flower and fruit all year round. They readily invade disturbed areas, such as roads, creeklines and monsoon vine forests where disturbed by feral animals. They can dominate and exclude the establishment of native species. Native to the tropical and subtropical Americas they occur in parts of tropical northern Australia. Seeds are dispersed by vehicles and other human activities related to gardening and fodder. Snakeweed is a Class B and C weed under the *NT Weeds Management Act* 2001.

Stylo (*Stylosanthes hamata*)
Caribbean Stylo is a native of the Caribbean Islands and Tropical Central and South America. It is an annual or a short-lived perennial herbaceous legume and well-adapted to a wide range of soil types in the Top End and has grown well on most, except on the heavier clay soils. In the Northern Territory, they behave either as a self-regenerating annual or a biennial plant. Up to 40 percent of plants survive from one wet season to the next. It is a multi-branched, semi-erect plant that grows to a height of 75cm. The stems have short white hairs down one side. The leaves are trifoliate; the leaflets are lanceolate in shape, generally 19 to 37mm long and 3 to 6mm wide.

Tully Koronivia Grass (*Brachiaria humidicola* cv Tully)
Tully is a strong creeping perennial, which roots vigorously from lower nodes and forms a dense matted sward. Leaf blades are 12-15cm long, expanded, rounded at the base, lanceolate and tapering to an acute point. They are 8-10mm wide. Flowering stems are erect, and up to 60cm high. There are 200,000 seeds per kilogram. Tully grass is a native of East and Southeast tropical Africa and has been widely used in Fiji. Koronivia is the Fijian name. It is suitable for areas receiving more than 1,000mm average annual rainfall.

Wild Passion Fruit (*Passiflora foetida*)
Wild Passion Fruit is an herbaceous vine covered in fine yellow hairs. Leaves are alternate and three lobed. Flowers are singular with purple to white petals and fruits are yellow-orange, fleshy and rounded 2-3cm across. Flowers/fruits all year round. It is widely distributed across northern Australia, is a widespread weed of

riparian areas of northern Australia. Its seed is spread by birds and water. This weed has the ability to choke out native vegetation.

Refer **Table 2** - Published Recommended Treatments for Weed Species Identified at Rum Jungle (Page 20).

2.4.3 Weed Management Structure

Weed Management Areas are parcels of land based on general landform or operational activities (ie infrastructure, roads etc) designed to assist in weed management planning, implementation and data analysis. The former Rum Jungle Mine Site has been divided into four Weed Management Areas (1 – 4) based predominantly on the existing access roads, creeklines and topography.

Delineation and prioritisation of the Weed Management Areas also took into account:

- Distribution and density of weeds;
- Priority status of weeds;
- Potential for weed introduction and establishment;
- Potential for control on a cost-effective basis;
- Potential boundaries to contain weeds and reduce spread from untreated areas;
- Sub-catchment boundaries to ensure upstream treatment before downstream; and
- Access to weed locations.

Prioritisation of Weed Management Area treatment is based primarily upon the priority status of the weed species located within. High and Low Priority weed species will be focused on throughout the 5-year plan.

2.5 WEED PREVENTION STRATEGY

Preventing the introduction of weeds onto Rum Jungle and the spread of existing weeds into weed free areas is an important form of weed management. Not only does it reduce the threat of new weed introductions, but also allows the Weed Treatment Strategy to focus on eradicating existing infestations.

To facilitate weed control beyond the Rum Jungle boundaries, liaison and coordination with adjacent landholders will be required by the Rum Jungle Environment Officer. The weeds contractor is to provide technical assistance to the Coordinator in developing effective strategies.

Infrastructure development and ground maintenance are the other major sources of weed introduction and spread through weed material (ie seeds) attached to machinery and vehicles used at other locations. The Weed Prevention Strategy consists of education and awareness programs aimed at enlisting the cooperation of internal staff and external contractors in preventing the introduction and spread of weeds.

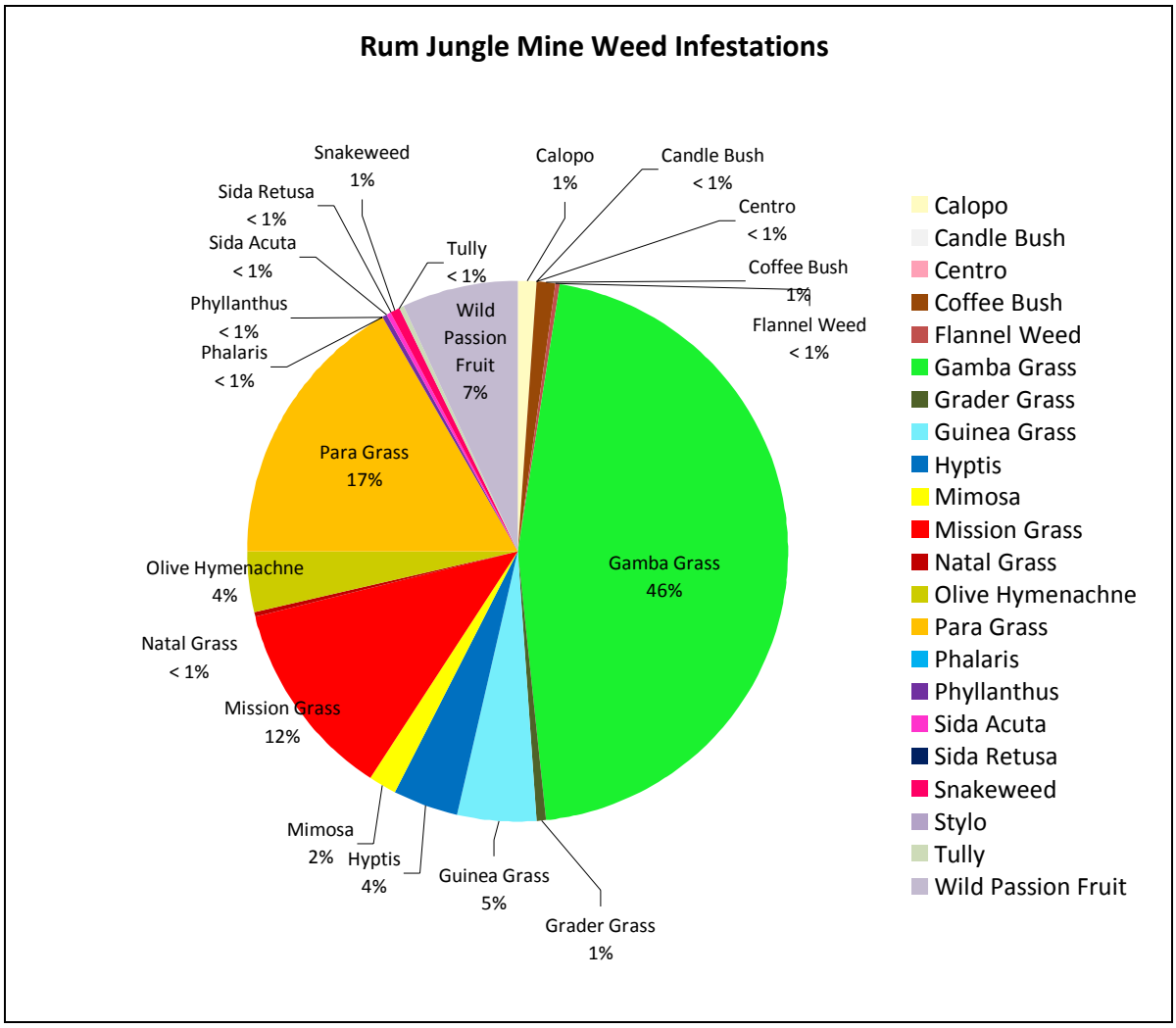
To facilitate education and awareness several information packages should be developed and integrated under the former Rum Jungle Mine Site Environment Management System. These should include training, guides and briefings to internal ground maintenance staff and external contractors likely to be working in weed infested areas.

Posters displayed at prominent staff viewing positions are also recommended to further educate and aid in weed identification and therefore more effective management.

2.6 WEED MANAGEMENT AREAS

This section provides an overview of each Weed Management Area including the dominant vegetation community, weed infestations and management objectives/priorities for the 5 Year Plan.

A total of 22 weed species were identified and a total of 1,097 weed infestations were observed and recorded. Graph 1 represents all observed and recorded weed species within Rum Jungle Mine Site survey area.



Graph 1. Comparative percentage of observed weed infestations within Rum Jungle Mine Site.

2.6.1 Management Area 1

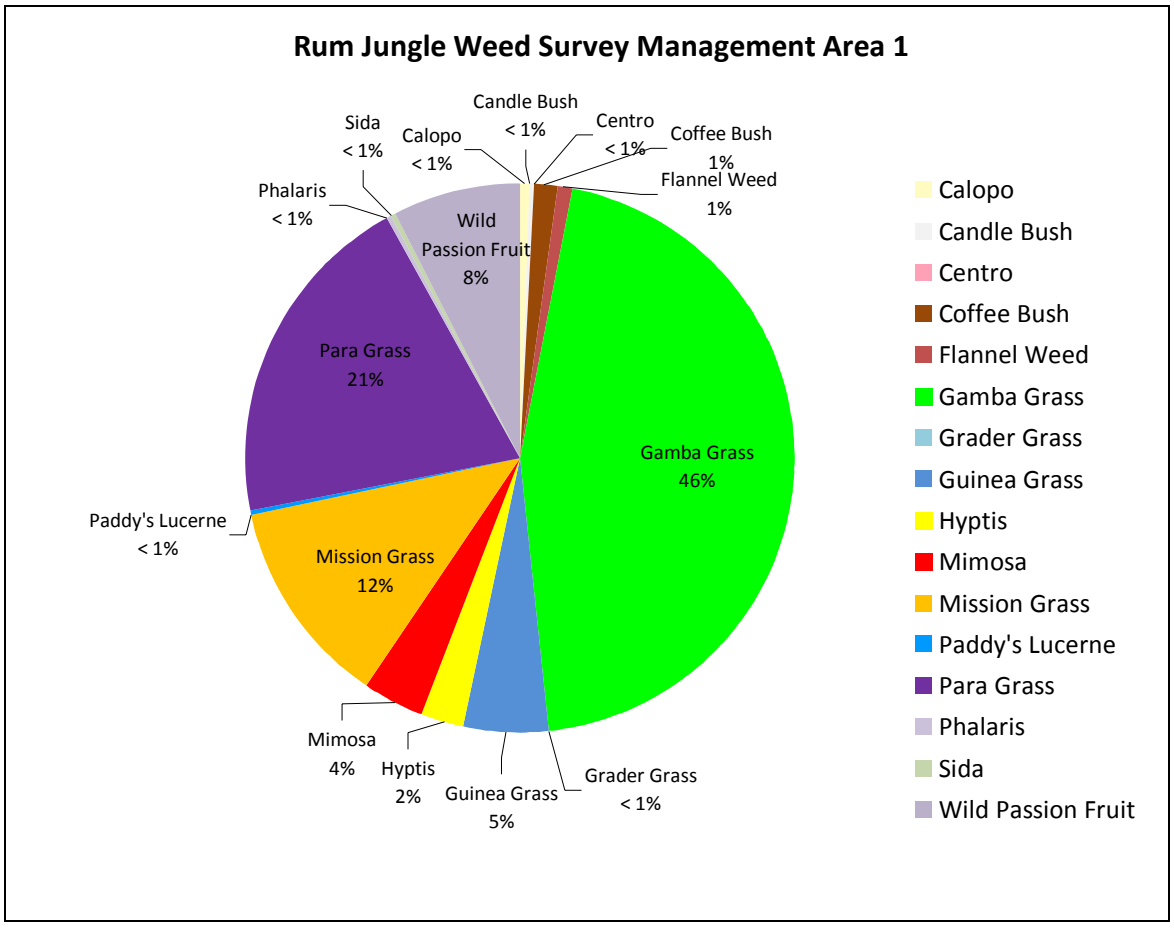
Management Area 1 contains high-density infestations of Gamba Grass, Mimosa, Para and Mission Grass. Mimosa infestations were found along the significant creeklines with almost fifty percent of recorded weed infestations being Gamba Grass, with 192 infestations observed and recorded. A total of 435 weed sites were recorded, comprising of sixteen different weed species within Management Area 1.

Phalaris (*Phalaris aquatica)*, also known as Toowoomba Canary Grass, was identified and recorded towards the centre of Management Area 1. Only one infestation was observed throughout the survey area. Phalaris has not been declared a noxious weed in the NT; however it is recognised as a weed in Victoria and New South Wales. Used as a cattle feed in southern Australia, Phalaris is a major problem in Victoria along roadsides where it can overwhelm native vegetation to the detriment of endangered native bird species (Robinson, 1997).

Management Objective:

Management Area 1 can only be described as containing high to extreme density weed infestations. Buffers will need to be established along external boundaries, roads and around infrastructure in the Year 1 to break up the management area and assist in future weed management schedules.

Gamba Grass and WONS classified weed species will be targeted in the first year of the weed management program and other weed species are scheduled for treatment in Year 3 of the 5 Year Weed Management Plan.



Graph 2. Comparative percentage of observed weed infestations in Management Area 1.

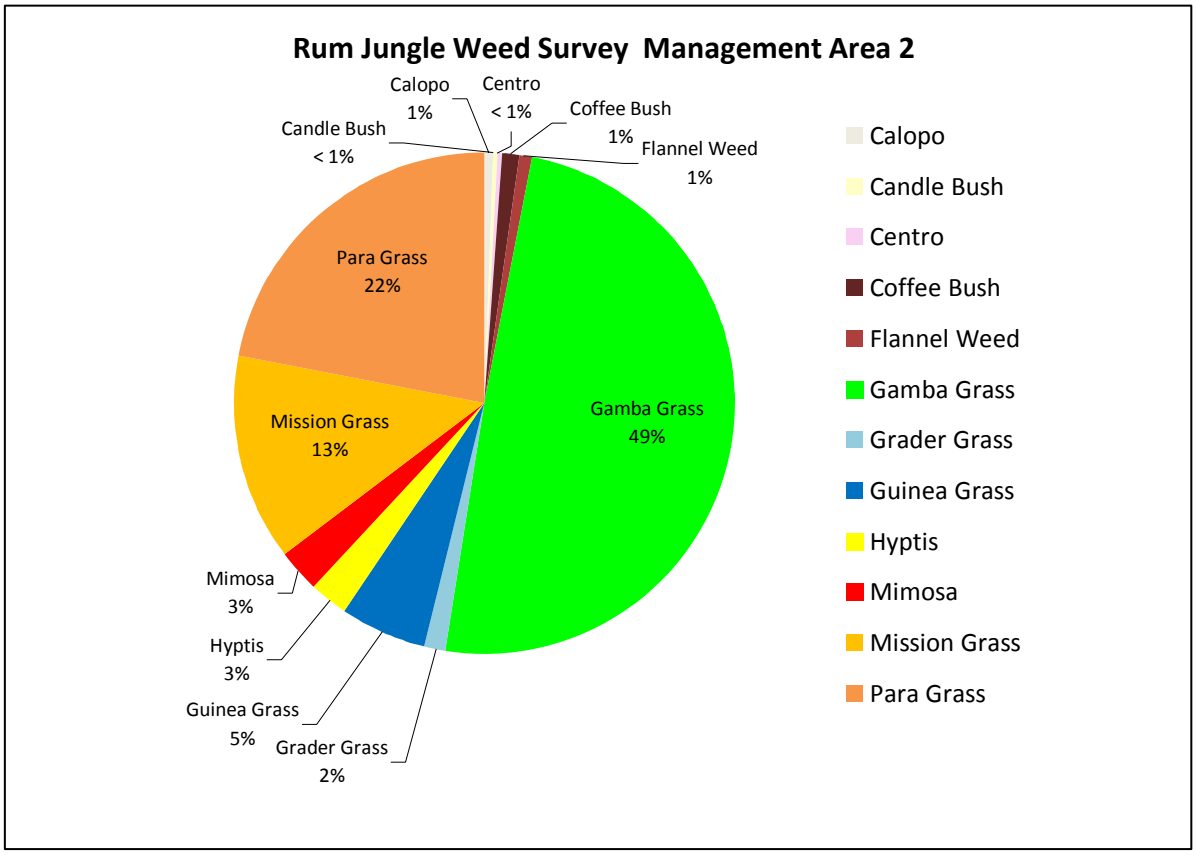
2.6.2 Management Area 2

Management Area 2 contains high-density infestations of Mimosa, Gamba, Para and Mission Grass. Fifty percent of recorded weed infestations are Gamba Grass, with 185 infestations observed and recorded. Twelve different weed species were identified within Management Area 2.

Management Objective:

Management Area 2 can only be described as containing high to extreme density weed infestations. Buffers will be established along external boundaries, roads and around infrastructure in the Year 1 to break up the country and assist in future weed management schedules.

Gamba Grass and WONS classified weed species should be targeted in the first year of the weed management program and weed species within this management area are scheduled for treatments in Year 4 of the 5 Year Weed Management Plan.



Graph 3. Comparative percentage of observed weed infestations in Management Area 2.

2.6.3 Management Area 3

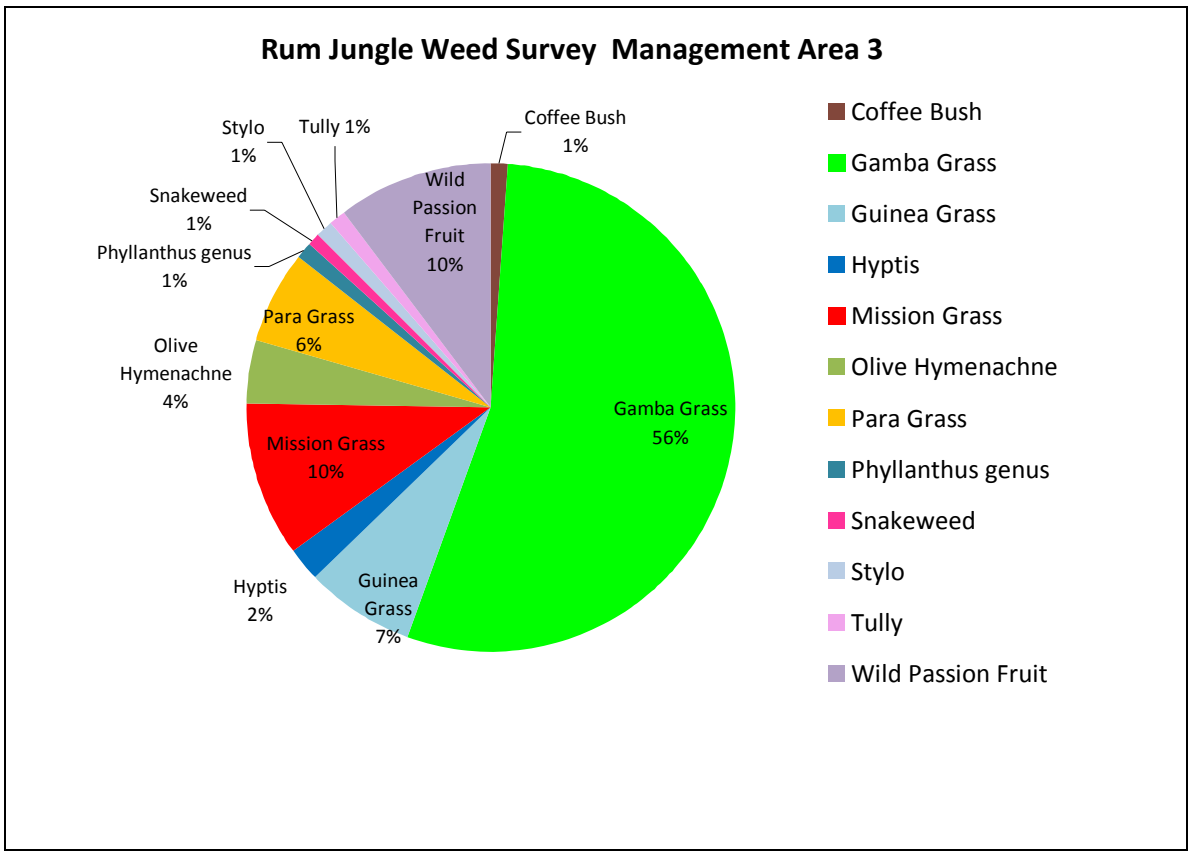
Management Area 3 contains high density infestations of Gamba Grass, Mission Grass and Wild Passion Fruit. Over fifty percent of recorded weed infestations are Gamba Grass, with 53 infestations observed and recorded. A total of 96 weed sites were recorded, comprising of twelve different weed species within Management Area 3.

A new weed species was observed within this management area and identified as belonging to the *Phyllanthus* genus. The plant was unable to be identified down to species as it was neither in flower nor seed, making species identification not possible.

Management Objective:

Management Area 3 can only be described as containing high density weed infestations. Buffers will be established along external boundaries, roads and around infrastructure in the Year 1 to break up the country and assist in future weed management schedules.

WONS classified weed species and Gamba Grass should be targeted in the first year of the weed management program. Other weed species within this management area are scheduled for treatment in Year 5 of the 5 Year Weed Management Plan.



Graph 4. Comparative percentage of observed weed infestations in Management Area 3.

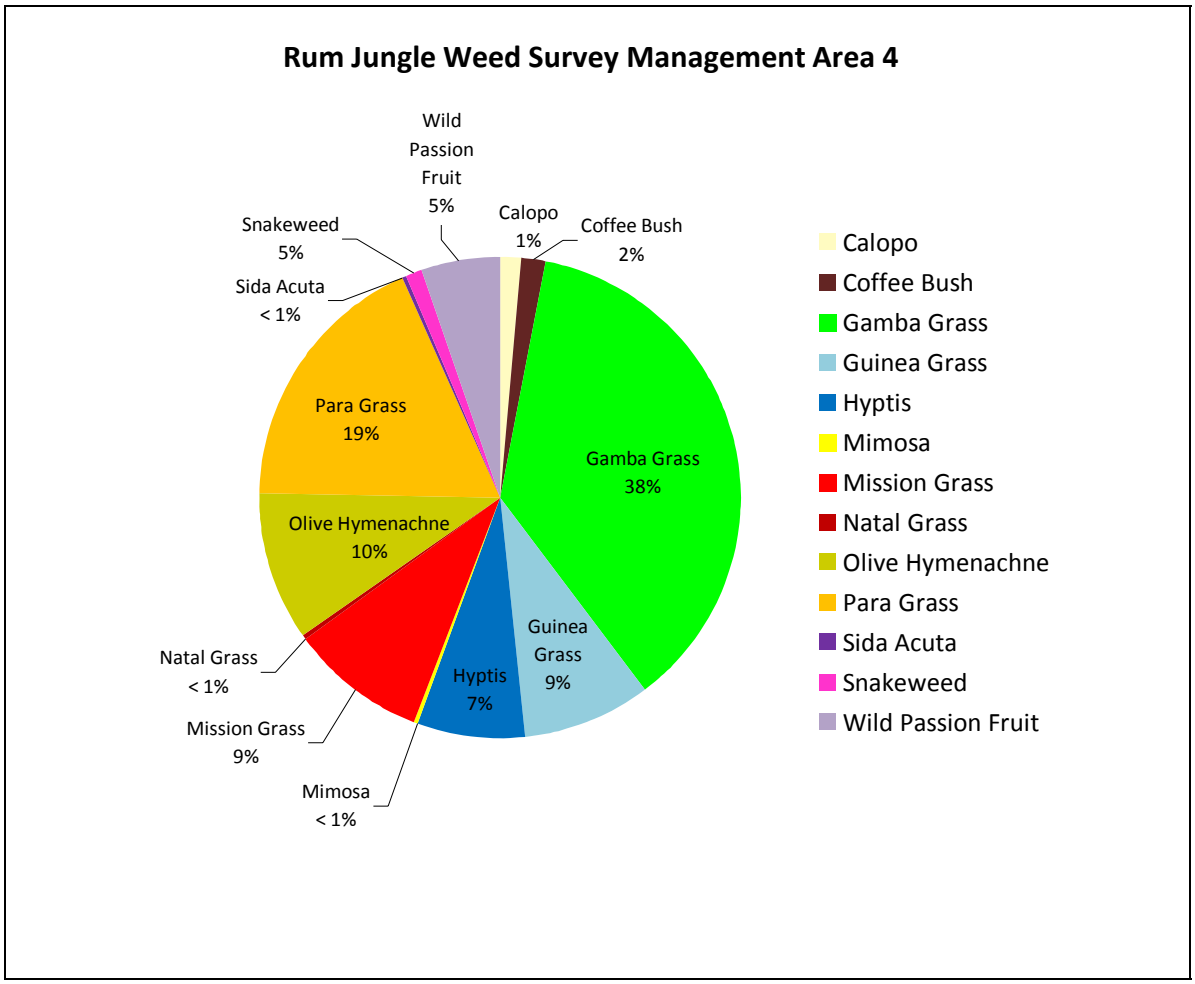
2.6.4 Management Area 4

Management Area 4 contains high density infestations of Mimosa, Gamba Grass, Para Grass, Olive Hymenachne and Mission Grass. Almost forty percent of recorded weed infestations are Gamba Grass, with 105 infestations observed and recorded. A total of 288 weed sites were recorded, comprising of thirteen different weed species within Management Area 4.

Management Objective:

Management Area 4 can only be described as containing high to extreme density weed infestations. Buffers should be established along external boundaries, roads and around infrastructure in the Year 1 to break up the country and assist in future weed management.

WONS classified weed species and Gamba Grass should be targeted in the first year of the weed management program. Other weed species within this management area are scheduled for treatment in Year 5.



Graph 5. Comparative percentage of observed weed infestations in Management Area 4.

Table 2 - Published Recommended Treatments for Weed Species Identified at Rum Jungle

WEED SPECIES	COMMON NAME	REFERENCES	PHYSICAL TREATMENT	CHEMICAL TREATMENT
Calopogonium mucunoides	Calopo	NRETAS Weed Management Branch (2009)	Hand pulling or grubbing and burn (NRETAS 2009).	Foliar spray (NRETAS Weed Management Branch 2009); Glyphosate 360 at 1:100 with water applied to actively growing plants (WLM).
Senna alata	Candle Bush	Smith (2002)	Hand pulling, slashing, cultivation (Smith 2002).	Foliar spray (Smith 2002); Glyphosate 360 at 1:100 with water applied to actively growing plants (WLM).
Centrosema pubescens	Centro	Smith (2002)	Hand pulling or grubbing (Smith 2002).	Foliar spray - Glyphosate 360 at 1:100 with water applied to actively growing plants (WLM).
Leucaena leucocephala	Coffee Bush	Smith (2002)	Hand pulling, slashing cultivation, hygiene, revegetation (Smith, 2002).	Foliar, basal bark, cut stump (Smith 2002); Banvel 200 (Dicamba) or Starane (Fluroxpyr) 1:50 with diesel as cut stump or basal bark application. Velpar on cut stumps (Storrs) Starane or Access (Pitt) Access in Diesel (Schultz).
Sida cordifolia	Flannel Weed	Smith (2002); Storrs (1996); Pitt Agnote 482; WLM	Hand pulling, grubbing slashing, cultivation (Smith, Agnote, Storrs, WLM).	Foliar, Biological (Smith, 2002); Amicide 500 (2,4-D) 1:200 plus Starane (Fluroxpyr) 1:200 with water, or Glyphosate (360) 1:100 with water. Spray while actively growing before flowering (Storrs); + Calligrapha pantherina bio control (Agnote) Starane (Pitt).
Andropogon gayanus	Gamba Grass	Smith (2002); Storrs (1996)	Grubbing, cultivation, slashing (Smith, 2002); Hand pulling OR grubbing of large plants (Storrs, 1996); Burning when controlled 'cooler' fires are achievable, during the wet season before seeding (NRETAS 2009).	Foliar spray (Smith, 2002). Glyphosate (360) 1.5:100 with water using high vol. spray equipment when plant is actively growing, not under stress ie mild wet season; spray during late dry season is **ineffective**. Spray until runoff. Add a wetting agent 1:1000 (Storrs).
Themeda quadrivalvis	Grader Grass	Smith (2002), NRETAS Weed Management Branch (2009)	Hand pulling and slashing (Smith, 2002) and burnt on site (NRETAS, 2009).	Foliar spray (Smith, 2002). Glyphosate (360) 1:100 with water when plant is actively growing (NRETAS 2009).

WEED SPECIES	COMMON NAME	REFERENCES	PHYSICAL TREATMENT	CHEMICAL TREATMENT
Urochloa maxima	Guinea Grass	Smith (2002).	Hand pulling and slashing.	Foliar spray, Glyphosate 360 at 1:100 with water applied to actively growing plants (WLM).
Hyptis suaveolens	Hyptis	Storrs (1996); Miller & Shultz (1997) Agnote 477; Smith (2002)	Hand pulling, chipping or mowing during wet season before seed sets (Storrs); Small infestations manual removal & burning plant material before seeding, slashing (Agnote); Reduced by fire (Schultz).	Amicide 500 (2,4-D) 1:100; or Amicide 500 (2,4-D) 1:200 plus Banvel 200 (Dicamba) 1:100 with water, or Glyphosate (360) 1.5:100 with water. Spray while actively growing (Storrs); foliar spray, ropewick (Smith); chemical (Agnote) Amicide or Banvel (Pitt), not Glyphosate as it kills grasses which compete with Hyptis; Banvel kills seeds also, but is very slow; Amicide at 0.5 L/ha (Schultz).
Mimosa pigra	Mimosa	Smith (2002), NRETAS Weed Management Branch (2009)	Hand pulling, grubbing and chaining (Smith, 2002).	Foliar spray, Fluroxypyr 1:300 with wetting agent Uptake 1:200; Basal barking, Fluroxypyr 1:60 mixed with Diesel; Cut stump, Glyphosate 1:40; Soil Application (NRETAS, 2009).
Pennisetum polystachion	Mission Grass	Smith (2002); Hills (1998)-Agnote 453; Storrs (1996); WLM	Grubbing, cultivation (Smith, 2002); Hand pulling OR grubbing of large plants (Storrs, 1996).	Foliar spray (Smith); herbicide (Agnote); Glyphosate (360) 1.5:100 with water plus DC Trate (surfactant) 1:100. Spray whilst actively growing until just after flowering (Storrs 1996). Roundup (WLM). Glyphosate 360 1:100 (WLM).
Hymenachne amplexicaulis cv Olive	Olive Hymenachne	Smith (2002)	Slashing or cultivation (Smith, 2002).	Foliar spray, Glyphosate 360 1:100 with water, apply when actively growing.
Sida rhombifolia	Paddy's Lucerne	Smith (2002)	Hand pulling, grubbing slashing, cultivation	Foliar, biological (Smith); Amicide 500 (2,4-D) 1:200 plus Starane (Fluroxpyr) 1:200 with water, or Glyphosate (360) 1:100 with water. Spray while actively growing before flowering (Storrs); + Calligrapha pantherina bio control (Agnote) Starane (Pitt).

WEED SPECIES	COMMON NAME	REFERENCES	PHYSICAL TREATMENT	CHEMICAL TREATMENT
Brachiaria mutica	Para Grass	Smith (2002)	N/A	Foliar spray (Smith, 2002), Glyphosate 360 1:100 with water, apply when actively growing (WLM).
Phalaris aquatica	Phalaris	Herbiguide (2010)	Slashing generally keeps it under control.	Foliar spray 800 mL/ha Glyphosate (450g/L) followed by 800 mL/ha 4 weeks later. Following fire is an optimum time to undertake control of populations.
Melinis repens	Red Natal Grass	Florabase (1993)	Hand pulling prior to seed set.	Foliar spray - Glyphosate at 1-2% solution + surfactant prior to flowering and seed set. Following fire is an optimum time to undertake control of populations.
Stachytarpheta australis	Snakeweed	Smith (2002), NRETAS Weed Management Branch (2009)	Hand pulling, grubbing, or slashing (Smith, 2002). Slash before seed set and re-establish pasture grass for competition.	Foliar spray, 2, 4 – D amide 625g/L, 1:300 (NRETAS, 2009)
Sida acuta	Spiny Head Sida	Smith (2002); Storrs (1996); Pitt Agnote 496; WLM	Hand pulling, grubbing slashing, cultivation (Smith, Agnote, Storrs, WLM).	Foliar, biological (Smith); Amicide 500 (2,4-D) 1:200 plus Starane (Fluroxpyr) 1:200 with water, or Glyphosate (360) 1:100 with water. Spray while actively growing before flowering (Storrs); + Calligrapha pantherina bio control (Agnote) Starane (Pitt).
Brachiaria humidicola cv Tully	Tully Koronivia Grass	Tropical Forages	N/A	Foliar spray, Glyphosate 360 1:100 with water, apply when actively growing (WLM).
Passiflora foetida	Wild Passion Fruit	Smith (2002); WLM; Storrs, 1996	Hand pulling for small areas (Storrs, 1996); Burning (WLM).	Foliar (Smith); Glyphosate (Pitt); Amicide 500 (2,4-D) with water (Storrs, 1996); Amicide 2, 4-D OR Glyphosate 360 (WLM).

3.0 IMPLEMENTATION

3.1 WEED TREATMENT SCHEDULE

A methodical approach to inspection and treatment is required to ensure a strategic coverage of the former Rum Jungle Mine Site. Each year the treatment period will generally be from November to May. The frequency of inspections and treatments will be dependent on the species managed and previous treatment. It will be the weed contractor's responsibility to determine the appropriate frequency of inspection.

The timetable will be dependent on the onset, duration and intensity of monsoonal activity. Whilst schedules need to be quite specific, flexibility is essential should inspections indicate changes are necessary, for example, when new species or infestations are identified. Appropriate adjustment throughout the duration of each yearly program will be required.

A weed treatment schedule for the existing weed species at the former Rum Jungle Mine Site has been developed as a guide to the timing and type of treatment throughout each year's implementation.

Weed infestations from the previous year's program must be scheduled for follow up inspections throughout each year's implementation to inspect for regrowth. Follow up inspections must be scheduled prior to flowering and/or seed set.

During inspection and treatment, vigilance will be important for undetected or new infestations.

Table 3 - Yearly Guide to Weed Treatment Schedule is attached at the end of this section (Page 28).

3.2 WEED CONTROL TREATMENTS

An integrated approach to weed treatment is necessary to ensure efficient control and eradication is implemented throughout the 5 Year Plan. As there are many weed species of differing biology and growth forms present at the former Rum Jungle Mine Site, a combination of physical and chemical control methods need to be applied.

3.2.1 Physical

Small, isolated weed infestations or individual plants are to be physically removed by hand pulling or grubbing. Hand pulling is suitable for shallow rooted herbaceous weeds, where as grubbing, the use of spades and mattocks is used for deep rooted woody weed species. All root material and plants must be removed and disposed of appropriately, such as by incineration. These methods are labour intensive but can be very effective if carried out systematically before seed set.

Seed head collection can be effective against some species, such as Mission Grass, when infestations have already produced mature viable seeds. Seed heads are collected, removed from the site and disposed of appropriately (ie incineration).

3.2.2 Chemical

Weed management at the former Rum Jungle Mine Site relies heavily on herbicide usage. These chemicals have been developed to be highly specific in application and are usually effective against a particular species or group of species.

Stubborn, well established, or large infestations will usually require chemical treatment.

There are three recommended herbicide categories for comprehensive weed eradication and control at the former Rum Jungle Mine Site as discussed further in Section 3.3.

3.2.3 Fire

Fire is useful to manage particular weed species in a number of ways. Wet season burns assist in providing access and efficient herbicide application to densely infested areas. It reduces densities of fire intolerant species, such as Hyptis, when burning is conducted prior to seed maturation. Seedlings of many weed species are also fire intolerant. Fire can be used as a follow up to chemical treatment to further weaken individuals of hardy species.

Generally, areas of Gamba Grass infestations at the former Rum Jungle Mine Site may be recommended to be burnt in the wet season. This will assist in providing access and enabling efficient herbicide application though some areas consisting of a monoculture of Gamba Grass.

Liaison with the fire management contractor at the beginning of each year's implementation is required to ensure successful integration of fire and weed management. Determination of locations, timing and intensity of burns will be essential to successful burning regimes for weed control.

3.3 HERBICIDES

3.3.1 Type

Grass and herbaceous weed species or young seedlings are to be treated with the foliar herbicide Nufarm Glyphosate 360 at a rate of 1:100. Glyphosate 360 is a non-selective, non-residual contact herbicide. The active ingredient is isopropylamine salt with ethoxylated surfactant.

Broadleaf weed species should be treated with the selective foliar herbicides Brush Off or Amicide. Brush Off is to be applied at a rate of 10g per 100 litres. The active ingredient of Brush Off is Metsulfuron methyl. Amicide needs to be applied at a rate of 1 litre per 300 litres. The active ingredient of Amicide is 2, 4-D dimethylamine salt.

Woody weed species, such as Coffee Bush, are to be basal barked with a 1:60 mixture of Access and Diesel. Access herbicide is a selective non-residual contact herbicide applied by basal bark or cut stump methods. The active ingredients are Triclopyr butoxyethyl ester 343g/L, picloram isooctyl ester 205g/L and aromatic solvent 390g/L.

3.3.2 Weeds in Drains

Weed species existing in drains should be treated with Roundup Biactive. Roundup Biactive herbicide is a formulation specifically developed for use in aquatic situations, made possible by the improved environmental characteristic of a unique surfactant system.

Roundup Biactive consists of 360g/L Glyphosate, and is a Group M herbicide. Roundup Biactive has substantially lower aquatic toxicity, can be safely applied in channels, drains, streams and rivers, and has an improved toxicological profile.

The improved environmental characteristics of Roundup Biactive means it is now registered for use in and around waterways in addition to approved uses of standard Roundup Herbicide.

Material Safety Data Sheets (MSDS) for Nufarm Glyphosate 360, Brush Off, Roundup Biactive, Amicide and Access are attached in **Appendix 1**.

3.3.3 Application

Special application techniques are to be used when conducting foliar and basal bark spraying to avoid spray drift onto non-target plant species:

- Direct spot spraying on individual plants;
- Not spraying during windy conditions; and
- Using spraying systems with adjustable nozzles to decrease potential spray drift.

Chemical usage is to be kept to a minimum to avoid undesirable environmental impacts.

3.3.4 Equipment

To implement the Weed Treatment Strategy the weed contractor will require the following equipment:

- 1 x 4WD vehicle with slip-on spray unit;
- 1 x quad bike and spray tank;
- 1 x trailer and spray tank (to fit quad) with boom spray; and
- Hand spray packs.

Vehicles and equipment are to be maintained in good working order.

3.3.5 Safety Procedures

Chemical use, storage and transport must be undertaken in accordance with the following:

- Chemicals must be stored and transported in accordance with the principles and recommendations of the *Australian Dangerous Goods Code*;
- Chemicals must be used in accordance with the *NT Work Health Act* 2001 and with safe working practices; and

- Operators must be licensed to operate equipment and use herbicides by the Northern Territory Department of Health.

The MSDS for herbicides must be issued to and understood by staff prior to conducting spraying operations.

Personal protective equipment including PVC gloves, face shield, breathing apparatus and full length clothing must be used in spraying operations. Information for the correct design of safety apparel is to be gathered from the following:

- MSDS;
- Label directions; and
- NT Department of Health– Poisons and Pharmacy Branch.

3.4 DATA COLLECTION

3.4.1 Inspection and Treatment Data

The following weed inspection and treatment data can be collected at each visit:

- Treatment Date;
- Management Area;
- Location;
- Species
- Density; and
- Treatment Method.

Data can be entered into weed data sheets and used to analyse treatment efficiencies and determine program results.

Table 4 - A Weed Mapping Data Collection Sheet Template is attached at the end of this section (Page 31).

3.4.2 Chemical Register

A chemical register for herbicide application should be maintained in the formatted data sheets and the following attributes recorded:

- Management area;
- Herbicide/adjuvant type;
- Month;
- Quantity applied; and
- Rate.

The volume of diluted herbicide for each Management Area can be collated. Analysis and comparison with the amount of herbicide used in previous years programs can be conducted to determine treatment efficiency.

This information is used to maintain an ongoing chemical register for the duration of the Weed Treatment Strategy and which contains the volume of diluted herbicide (Glyphosate 360, Access & Amicide) or weight of Brush Off for each Management Area for each year's implementation.

3.5 WEED PREVENTION STRATEGY

The Rum Jungle Environmental Officer will be required to research and develop education and awareness initiatives to aid sustainable weed management at the former Rum Jungle Mine Site.

3.5.1 Adjoining Landholder Liaison and Coordination

To facilitate weed control beyond the Rum Jungle Mine Site boundaries, the weeds contractor is to provide technical assistance to the Rum Jungle Environmental Officer in developing effective strategies for liaison and coordination with neighboring landholders.

3.5.2 Training / Information for Internal Ground Maintenance Staff & Contractors

Internal ground maintenance staff and contractors should be trained in weed identification and weed prevention protocols. Information provided by the Rum Jungle Environmental Officer to ground maintenance staff should include but not be limited to the following:

- Weed threats such as vehicle movement and imported landscaping materials such as sand, gravel, road base etc;
- Existing weed infestation sites designated as 'no go areas' for maintenance activities, such as slashing;
- Good weed management practices such as washing down vehicles and equipment used in areas of different weed status; and
- Promotion of vigilance in identifying and reporting weeds.

New employee inductions, staff briefings or training sessions, and quick reference weed identification information such as a specific Guide to Weeds at Rum Jungle, and accompanying posters and pamphlets can all serve as effective tools for providing education and awareness to ground maintenance staff.

Contractors entering and working on site should be briefed by the Rum Jungle Environment Coordinator on weed prevention threats and practices relevant to Rum Jungle Mine Site, and as applicable to contractor’s activities. Contractors should be made aware of the importance of vehicle hygiene, location of wash down points and any restriction of movement around and between work sites. This information can be incorporated into a site-specific Briefing Package for Contractors.

Table 3 - Yearly Guide to Weed Treatment Schedule

PRIORITY	WEED SPECIES	COMMON NAME	RECOMMENDED TREATMENTS	TIMING					
				Early Wet	Mid Wet	Late Wet	Early Dry	Mid Dry	Late Dry
High	*Andropogon gayanus*	Gamba Grass	- Hand pulling, grubbing - Glyphosate 360 1:100	Burn					
	Pennisetum polystachion	Mission Grass	- Hand pulling, grubbing - Glyphosate 360 1:100				Burn		
	Themeda quadrivalvis	Grader Grass	- Hand pulling and slashing - Glyphosate 360 1:100						
	Leucaena leucocephala	Coffee Bush	- Access and Diesel 1:60 - Regrowth with Brush Off						
	Mimosa pigra	Mimosa	- Hand pulling, grubbing or chaining - Fluroxypyr 1:300 with wetting agent Uptake 1:200 (Foliar Spray) - Fluroxypyr 1:60 mixed with Diesel (Basil Bark)						
	Hymenachne amplexicaulis cv Olive	Olive Hymenachne	- Slashing or cultivation - Glyphosate 360 1:100						
	Hyptis suaveolens	Hyptis	- Hand pulling and burning - Amicide 500 1:100 - Glyphosate 360 1:100		Burn				

PRIORITY	WEED SPECIES	COMMON NAME	RECOMMENDED TREATMENTS	TIMING					
				Early Wet	Mid Wet	Late Wet	Early Dry	Mid Dry	Late Dry
Low	*Sida acuta &* *Sida rhombifolia*	Spiny Head Sida & Paddy's Lucerne	- Hand pulling, grubbing - Glyphosate 360 1:100 - Amicide 500 1:200						
	Stachytarpheta australis	Snakeweed	- Hand pulling, grubbing - Brush Off						
	Passiflora foetida	Wild Passion Fruit	- Glyphosate 360 1:100 - Amicide 500 1:200						
	Urochloa maxima	Guinea Grass	- Hand pulling, slashing - Glyphosate 360 1:100						
	Calopogonium mucunoides	Calopo	- Hand pulling, grubbing - Glyphosate 360 1:100						
	Senna alata	Candle Bush	- Hand pulling, grubbing - Glyphosate 360 1:100						
	Brachiaria mutica	Para Grass	- Glyphosate 360 1:100						
	Centrosema pubescens	Centro	- Hand pulling, grubbing - Glyphosate 360 1:100						
	Phalaris aquatica	Phalaris	- Slashing - Glyphosate 360 1:100						
	Brachiaria humidicola cv Tully	Tully Koronivia Grass	- Glyphosate 360 1:100						

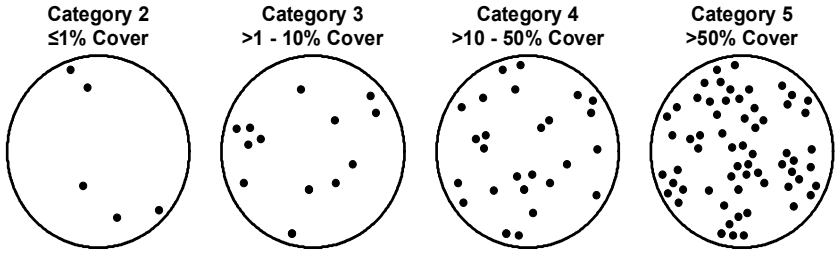
PRIORITY	WEED SPECIES	COMMON NAME	RECOMMENDED TREATMENTS	TIMING					
				Early Wet	Mid Wet	Late Wet	Early Dry	Mid Dry	Late Dry
Low	*Sida cordifolia*	Flannel Weed	- Hand pulling, grubbing slashing, cultivation - Amicide 500 1:200 - Glyphosate 360 1:100						
	Melinis repens	Red Natal Grass	- Hand pulling - Glyphosate 360 1:100						

Table 4 - Weed Mapping Data Collection Sheet Template

Name		**Location**	

Date	**Point ID**	**Management Area**	**Latitude**	**Longitude**	**Species**	**Diameter of Infestation**	**Density (Category 2 -5)**	**Treatment (Chemical and Application Type/Hand pulling etc)**

Density



Diameter

5 metres in diameter;
20 metres in diameter;
50 metres in diameter; and
100 metres in diameter.

4.0 EVALUATION AND MONITORING

4.1 DATA ORGANISATION

Field data collected during the inspections and treatment is to be entered into the weed database. Ongoing treatment details are to be appended to existing weed infestations and new records for new infestations created. Importation in *dBASE IV* format into an *ArcView* Geographic Information System (GIS) project file is to be conducted.

Spatial distribution of weed infestations is to be mapped as point data and correlated to Weed Management Areas.

Weed Management Areas and survey/treatment data derived must be displayed in WGS84 Datum - Geographic projection.

A weed data table is to be presented in *Microsoft Excel* format (see Section 5.0).

A new field added to the Management Area table of attributes will display the amount of herbicide used in each area.

4.2 DATA INTERPRETATION

To determine the results of the weed management program, both quantitative and qualitative information are to be collated to assess program efficiencies and develop justifiable conclusions regarding the objectives of the program.

A number of performance indicators are to be used to assess data collected in the field. Simple analysis of these indicators will provide a descriptive measure of the weed communities at the former Rum Jungle Mine Site. Analysis is to be carried out at the Weed Management Area level.

These performance indicators include:

- Weed species diversity;
- Weed distribution and density; and
- Herbicide usage/Management Area.

Comparison of each year's results with previous year's programs is to be conducted to determine the temporal changes in weed distribution and abundance.

4.3 CONCLUSIONS / RECOMMENDATIONS

Justifiable and transparent conclusions must be developed from the results of evaluation and monitoring efforts at the completion of each year's implementation. Conclusions must be based on the quantitative and qualitative data analysis to determine Program efficiencies relating to the objectives of the year's implementation and the 5 Year Plan.

Future management recommendations, based on conclusions reached, must be made for future year's implementation. Once again these recommendations need to specifically relate to the objectives of the specific year's implementation as well as the overall 5 Year Plan.

5.0 REPORTING

For each year's implementation the following report should be prepared and submitted.

5.1 IMPLEMENTATION REPORT

An ***Implementation Report - 20XX/XX*** for the former Rum Jungle Mine Site, documenting the results of the implementation phase, the conclusions of the program, and recommendations for future management of the facility is to be produced at the conclusion of works. The report should also include monitoring results and assessment of the success and adequacy of the program with recommendations for adjustments if required.

6.0 REVIEW AND IMPROVEMENT

Weed management is a dynamic process with a wide range of influencing factors, including both environmental variation and anthropogenic impacts. The changes in weed infestations brought about by weed management should also change the requirements of further weed management.

The implementation of each year's weed management needs to be quite specific, but flexibility is also essential should inspections indicate changes are necessary. Appropriate adjustment throughout the duration of each yearly program will be required and will be largely up to the discretion of the weed contractor.

6.1 YEARLY REVIEW AND IMPROVEMENT

A structured review and improvement process is to be carried out on a yearly basis. At the beginning of each year's implementation the weed contractor is required to conduct elements of the Planning stage described in Section 2.0. This is not only to familiarise the contractor with the context and management of weeds at the former Rum Jungle Mine Site, but also to review the management approach detailed in this Plan. An evaluation of these components, such as desktop analysis, weeds prioritisation, etc, must be conducted and cross referenced with the objectives of the 5 Year Management Plan.

New information, for example, the identification of new infestations or of a new weed species, needs to be incorporated into the year's implementation. Indeed the objectives of the 5 Year Plan may require adaptation to accommodate this. The Plan is a flexible guideline for the 5 years, not a set of static procedures.

The main sources of new information will be the previous year's Final Report, which will include recommendations for future weed management at the former Rum Jungle Mine Site.

Changes to the methodology of any year's implementation and the implications to the 5 Year Plan must be justifiable and documented.

6.2 5 YEAR ASSESSMENT AND FUTURE PLAN DEVELOPMENT

At completion of the fifth year, a comprehensive review and analysis of the entire 5 years of implementation is to be conducted. This process will determine the effectiveness of the 5 Year Plan as a whole.

Based on these conclusions, a 5 Year Weed Management Plan for the following duration is to be developed. A similar planning process is required to accomplish this.

7.0 FIVE YEAR PLAN

The general objectives of each year's implementation plan at the former Rum Jungle Mine Site are to:

- Develop and implement Year X of the 5 Year Weed Management Plan;
- Provide quantitative and qualitative data on prioritised weed infestations;
- Analyse and interpret data for any population changes and causes, including the efficiency of treatment; and
- Make recommendations on management principles, including requirements for future weed control.

An outline of the yearly work task schedule incorporating the elements detailed in Section 3.0 is as follows:

7.1 YEAR 1 (2011/2012 Wet Season)

Review and Program Development

At the beginning of the contract the weed contractor is required to carry out elements of the Planning stage described in Section 2.0. This is not only to familiarise the contractor with the context and management of weeds at the former Rum Jungle Mine Site, but also to review the management approach detailed in this Plan.

Weed Treatment Strategy

The treatment of the external boundaries is of high priority and is to be implemented by both ground and aerial application. This will help to secure the former Rum Jungle Mine Site from any further weed infestations entering the property.

Buffers should be established along roads and tracks and around infrastructure through ground treatment applications. This will help to break up the country in preparation for future management objectives.

Treatment of Olive Hymenachne, Mimosa and Gamba Grass will be targeted in the first year through both ground and aerial treatment applications.

Data collection, evaluation and monitoring procedures associated with the treatment are to be completed and reported.

Weed Prevention Strategy

The Guide to Weeds at the former Rum Jungle Mine Site, Briefing Package for External Contractors and internal ground maintenance staff are to be developed and distributed to the relevant parties. Technical assistance to the Rum Jungle Environmental Officer regarding adjoining landholder liaison and coordination is to be conducted.

Evaluation, Monitoring and Implementation Report

The weed data organisation and interpretation process is to be completed. Together with monitoring results, justifiable and transparent conclusions are to be developed and recommendations made for future weed management at the former Rum Jungle Mine Site. These findings are to be presented as the Implementation Report.

7.2 YEAR 2 (2012/2013 Wet Season)

Review and Program Development

At the beginning of the contract the weed contractor is required to carry out elements of the Planning stage described in Section 2.0.

Weed Treatment Strategy

Follow up treatment along the external boundaries and buffers established along roads and tracks and around infrastructure through ground treatment applications in the previous year.

Follow up treatment of new and previously treated Gamba Grass, Olive Hymenachne and Mimosa sites through both ground and aerial treatment applications.

Target and treat weed infestations growing on mining waste dumps. Weeds growing in elevated areas need to be targeted in the initial stages of the weed management plan as run off from these areas can continue the spread of weeds to lower ground.

All data collection, evaluation and monitoring procedures associated with the treatment are to be completed and reported.

Weed Prevention Strategy

Review and improvement of the weed prevention component is to be conducted. Technical assistance to the Rum Jungle Environmental Officer regarding adjoining landholder liaison and coordination is to be conducted.

Evaluation, Monitoring and Implementation Report

Weed data collected during implementation is to be organised for presentation and interpretation completed. Justifiable and transparent conclusions are to be developed from the data and recommendations made for future weed management at the former Rum Jungle Mine Site. These findings are to be presented as the Implementation Report.

7.3 YEAR 3 (2013/2014 Wet Season)

Review and Program Development

At the beginning of the contract the weed contractor is required to complete elements of the Planning stage described in Section 2.0.

Weed Treatment Strategy

Follow up weed treatment areas for Year 1 and 2.

The treatment of weed sites in Management Area 1 is the focus of this year's treatment strategy. High and low priority weeds within this management area will be targeted.

All data collection, evaluation and monitoring procedures associated with the treatment are to be completed and reported.

Weed Prevention Strategy

Technical assistance to the Rum Jungle Environmental Officer regarding adjoining landholder liaison and coordination is to be conducted. Review and improvement of the weed prevention component is also to be conducted.

Evaluation, Monitoring and Implementation Report

Weed data collected during implementation is to be organised for presentation and interpretation completed. Justifiable and transparent conclusions are to be developed from the data and recommendations made for future weed management at the former Rum Jungle Mine Site. These findings are to be presented as the Implementation Report.

7.4 YEAR 4 (2014/2015 Wet Season)

Review and Program Development

At the beginning of the contract the weed contractor is required to complete elements of the Planning stage described in Section 2.0.

Weed Treatment Strategy

Follow up weed treatment areas for Year 1, 2 and 3.

The treatment of weed sites in Management Area 2 is the focus of this year's treatment strategy. High and low priority weeds within this management area will be targeted.

Data collection, evaluation and monitoring procedures associated with the treatment are to be completed and reported.

Weed Prevention Strategy

Technical assistance to the Rum Jungle Environmental Officer regarding adjoining landholder liaison and coordination is to be conducted.

Review and improvement of the weed prevention component is also to be conducted.

Evaluation, Monitoring and Implementation Report

Weed data collected during implementation is to be organised for presentation and interpretation completed. Justifiable and transparent conclusions are to be developed from the data and recommendations made for future weed management at the former Rum Jungle Mine Site. These findings are to be presented as the Implementation Report.

7.5 YEAR 5 (2015/2016 Wet Season)

Review and Program Development

At the beginning of the contract the weed contractor is required to complete elements of the Planning stage described in Section 2.0.

Weed Treatment Strategy

Follow up weed treatment areas for Year 1, 2, 3 and 4.

The treatment of weed sites in Management Area 3 and 4 are the focus of this year's treatment strategy. High and low priority weeds within this management area will be targeted.

Data collection, evaluation and monitoring procedures associated with the treatment are to be completed and reported.

Weed Prevention Strategy

Technical assistance to the Rum Jungle Environmental Officer regarding adjoining landholder liaison and coordination is to be conducted.

Review and improvement of the weed prevention component is also to be conducted.

Evaluation, Monitoring and Implementation Report

Weed data collected during implementation is to be organised for presentation and interpretation completed. Justifiable and transparent conclusions are to be developed from the data and recommendations made for future weed management at the former Rum Jungle Mine Site. These findings are to be presented as the Implementation Report.

5 Year Assessment and Future Planning

The 5 Year Assessment and Future Planning component is to be conducted.

Table 5 - 5 Year Weed Treatment Strategy Guide is attached at the end of the section (Page 38).

Table 5 - 5 Year Weed Treatment Strategy Guide

	YEAR 1 (2011/12)	YEAR 2 (2012/13)	YEAR 3 (2013/14)	YEAR 4 (2014/15)	YEAR 5 (2015/16)
External Boundaries	Initial treatment	Follow-up treatment	Follow-up treatment	Follow-up treatment	Follow-up treatment
Create Buffers Along Roads, Tracks & Infrastructure	Initial treatment	Follow-up treatment	Follow-up treatment	Follow-up treatment	Follow-up treatment
Treat Gamba Grass, Olive Hymenachne & Mimosa	Initial treatment	Follow-up treatment	Follow-up treatment	Follow-up treatment	Follow-up treatment
Mining Waste Dumps		Initial treatment	Follow-up treatment	Follow-up treatment	Follow-up treatment
Management Area 1			Initial treatment	Follow-up treatment	Follow-up treatment
Management Area 2				Initial treatment	Follow-up treatment
Management Area 3					Initial treatment
Management Area 4					Initial treatment

= High Priority = Medium Priority = Low Priority

8.0 REFERENCES

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Attachments

Map 2 – Rum Jungle Mine Total Weed Sites

Table 6 – Rum Jungle Collated Weed Survey Data 2010/11

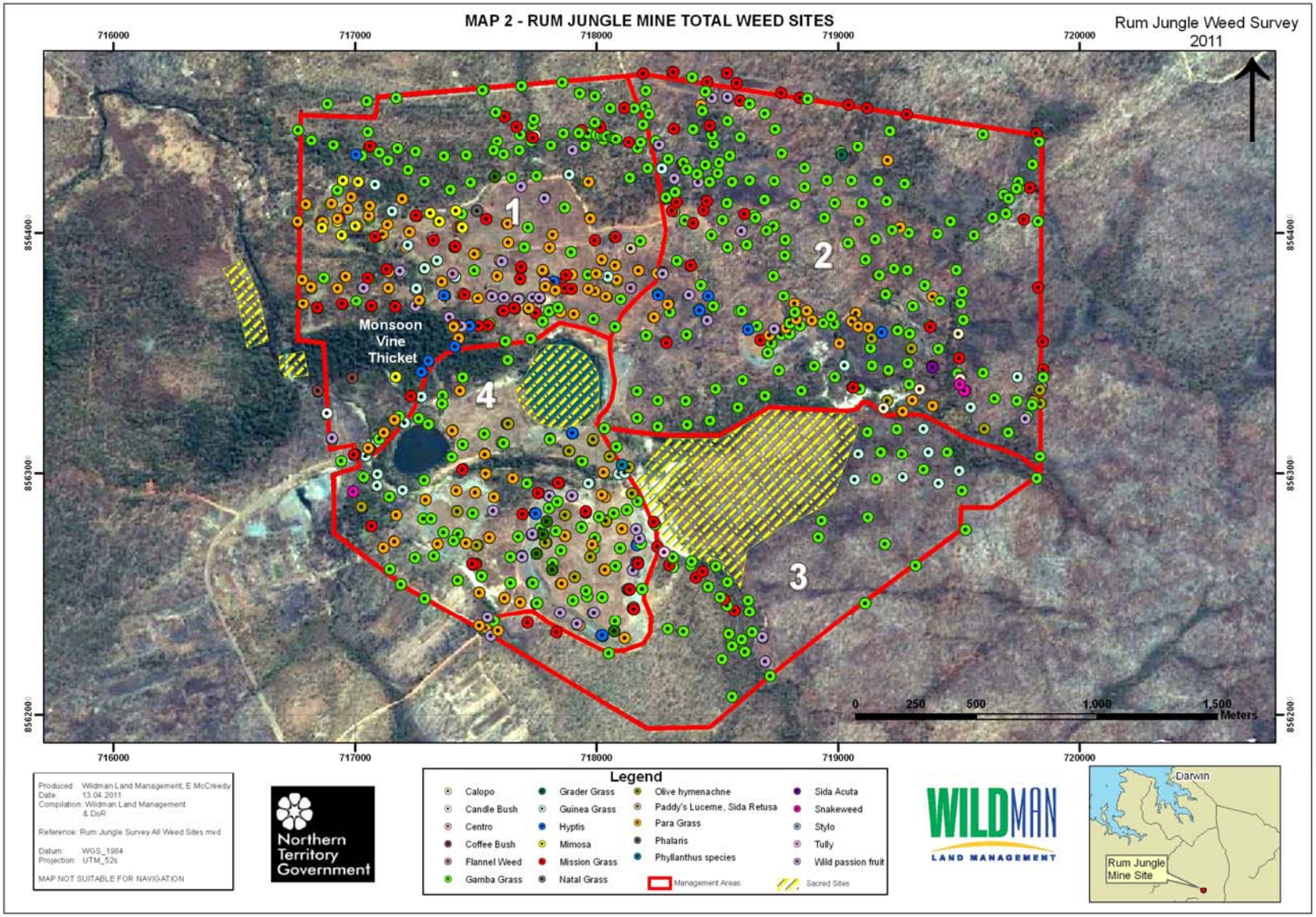
MAP 2 - RUM JUNGLE MINE TOTAL WEED SITES
Rum Jungle Weed Survey 2011
716000
717000
718000
719000
720000
856400
856300
856200
1
2
3
4
Monsoon Vine Thicket
0 250 500 1,000 1,500 Meters
Produced: Wildman Land Management, E McCreedy
Date: 13.04.2011
Compilation: Wildman Land Management & DoR
Reference: Rum Jungle Survey All Weed Sites.mxd
Datum: WGS_1984
Projection: UTM_52s
MAP NOT SUITABLE FOR NAVIGATION
Northern Territory Government
Legend
Calopo
Candle Bush
Centro
Coffee Bush
Flannel Weed
Gamba Grass
Grader Grass
Guinea Grass
Hyptis
Mimosa
Mission Grass
Natal Grass
Olive hymenachne
Paddy's Lucerne, Sida Retusa
Para Grass
Phalaris
Phyllanthus species
Sida Acuta
Snakeweed
Stylo
Tully
Wild passion fruit
Management Areas
Sacred Sites
WILDMAN LAND MANAGEMENT
Darwin
Rum Jungle Mine Site

Table 6 - Rum Jungle Collated Weed Survey Data 2010/11

WP	SPECIES	DENSITY	DIAMETER	EASTING	NORTHING	MGT AREA
1	Mission Grass	5	100	716763	8564039	1
2	Para Grass	3	100	716763	8564046	1
3	Gamba Grass	5	100	716765	8564042	1
4	Gamba Grass	5	100	716765	8564426	1
5	Gamba Grass	4	100	716780	8563702	1
6	Sida	4	100	716782	8563702	1
7	Para Grass	5	100	716782	8563804	1
8	Gamba Grass	5	100	716783	8563802	1
9	Para Grass	3	100	716785	8563705	1
10	Para Grass	3	100	716796	8564116	1
11	Gamba Grass	5	100	716797	8564115	1
12	Para Grass	4	100	716818	8563775	1
13	Gamba Grass	4	100	716819	8563768	1
14	Gamba Grass	4	100	716820	8564382	1
15	Gamba Grass	5	100	716844	8563683	1
16	Mission Grass	5	100	716844	8563687	1
17	Gamba Grass	5	100	716846	8563339	1
18	Para Grass	4	50	716846	8563344	1
19	Coffee Bush	3	20	716846	8563344	1
20	Mission Grass	4	100	716859	8564043	1
21	Gamba Grass	5	100	716862	8564048	1
22	Para Grass	5	100	716866	8564043	1
23	Gamba Grass	5	100	716871	8563812	1
24	Gamba Grass	5	100	716880	8563247	1
25	Candle Bush	5	100	716883	8563250	1
26	Gamba Grass	4	100	716886	8564534	1
27	Gamba Grass	5	100	716898	8564116	1
28	Para Grass	3	100	716903	8564120	1
29	Gamba Grass	5	100	716904	8563141	1
30	Wild Passion Fruit	2	50	716904	8563147	1
31	Gamba Grass	4	100	716911	8564363	1
32	Gamba Grass	5	100	716927	8564176	1
33	Gamba Grass	4	100	716928	8563769	1
34	Para Grass	4	50	716928	8563768	1
35	Mimosa	5	100	716928	8564046	1
36	Para Grass	5	100	716928	8564057	1
37	Mission Grass	3	100	716936	8564058	1
38	Guinea Grass	4	50	716943	8563049	1
39	Gamba Grass	4	50	716943	8563051	1
40	Mission Grass	4	50	716947	8563705	1
41	Gamba Grass	5	100	716948	8563700	1
42	Gamba Grass	5	100	716948	8564215	1
43	Para Grass	3	50	716949	8564215	1
44	Mimosa	3	100	716950	8564215	1
45	Gamba Grass	5	100	716958	8563817	1
46	Mission Grass	3	100	716958	8563819	1
47	Para Grass	3	100	716962	8563819	1
48	Para Grass	5	100	716969	8564098	1
49	Gamba Grass	5	100	716970	8564095	1

50	Gamba Grass	5	100	716984	8564145	1
51	Para Grass	5	100	716985	8564146	1
52	Guinea Grass	4	100	716993	8562925	4
53	Snakeweed	4	50	716993	8562923	4
54	Mission Grass	4	100	716995	8562919	4
55	Calopo	5	100	716995	8562919	4
56	Centro	2	50	716996	8563079	1
57	Wild Passion Fruit	3	20	716996	8563074	1
58	Mission Grass	2	50	716996	8563079	1
59	Gamba Grass	5	100	717001	8563081	1
60	Hyptis	3	20	717001	8563077	1
61	Mimosa	5	100	717002	8564028	1
62	Hyptis	3	50	717004	8564322	1
63	Gamba Grass	5	100	717005	8563715	1
64	Gamba Grass	3	100	717006	8564025	1
65	Mission Grass	3	100	717009	8564021	1
66	Para Grass	5	100	717009	8564028	1
67	Mimosa	3	50	717014	8564209	1
68	Guinea Grass	5	100	717017	8564208	1
69	Mission Grass	4	50	717025	8562858	4
70	Snakeweed	3	100	717026	8562856	4
71	Gamba Grass	4	100	717026	8562856	4
72	Olive Hymenachne	3	100	717026	8562860	4
73	Gamba Grass	4	100	717026	8564317	1
74	Sida	3	50	717028	8562856	4
75	Guinea Grass	5	100	717029	8562988	4
76	Gamba Grass	5	100	717031	8563769	1
77	Olive Hymenachne	5	100	717033	8562983	4
78	Para Grass	5	100	717035	8562982	4
79	Calopo	4	100	717035	8562980	4
80	Gamba Grass	4	100	717035	8562984	4
81	Para Grass	3	20	717035	8563771	1
82	Wild Passion Fruit	3	50	717035	8563771	1
83	Guinea Grass	2	100	717043	8563071	4
84	Mission Grass	4	100	717045	8563074	4
85	Gamba Grass	4	100	717045	8563071	4
86	Coffee Bush	3	100	717046	8563071	4
87	Gamba Grass	4	100	717049	8564546	1
88	Gamba Grass	4	100	717053	8564418	1
89	Mission Grass	5	100	717053	8563812	1
90	Para Grass	4	100	717055	8563105	1
91	Para Grass	5	100	717057	8564068	1
92	Gamba Grass	5	100	717058	8563101	1
93	Gamba Grass	5	100	717059	8563809	1
94	Gamba Grass	5	100	717059	8564062	1
95	Gamba Grass	5	100	717059	8564110	1
96	Gamba Grass	4	100	717059	8564353	1
97	Coffee Bush	3	50	717059	8563105	1
98	Para Grass	5	100	717061	8564110	1
99	Coffee Bush	5	50	717063	8563104	1
100	Mission Grass	3	100	717063	8564357	1

101	Guinea Grass	3	100	717064	8562779	4
102	Calopo	3	100	717064	8562783	4
103	Gamba Grass	5	100	717064	8563690	1
104	Gamba Grass	2	100	717066	8562781	4
105	Mission Grass	2	100	717068	8562781	4
106	Mission Grass	4	100	717068	8563694	1
107	Para Grass	5	100	717075	8563980	1
108	Guinea Grass	5	50	717077	8564202	1
109	Mimosa	3	50	717079	8564201	1
110	Gamba Grass	3	50	717080	8564198	1
111	Calopo	3	100	717083	8562948	4
112	Mission Grass	4	100	717083	8563984	1
113	Guinea Grass	5	100	717083	8564199	1
114	Coffee Bush	4	50	717088	8563133	1
115	Olive Hymenachne	2	100	717089	8562945	4
116	Mission Grass	2	100	717089	8562946	4
117	Gamba Grass	4	50	717089	8563134	1
118	Para Grass	5	100	717089	8563984	1
119	Coffee Bush	4	100	717090	8562994	4
120	Gamba Grass	4	100	717091	8562948	4
121	Guinea Grass	3	100	717091	8562948	4
122	Guinea Grass	4	50	717091	8563132	1
123	Guinea Grass	4	100	717093	8562996	4
124	Gamba Grass	5	100	717100	8563144	1
125	Gamba Grass	4	100	717101	8564331	1
126	Para Grass	4	100	717113	8563992	1
127	Gamba Grass	3	100	717115	8562691	4
128	Para Grass	3	100	717116	8563995	1
129	Para Grass	3	100	717118	8562691	4
130	Para Grass	5	100	717120	8563170	1
131	Gamba Grass	5	100	717123	8563169	1
132	Coffee Bush	4	20	717123	8563170	1
133	Mission Grass	5	100	717130	8563848	1
134	Guinea Grass	5	100	717132	8564034	1
135	Para Grass	5	100	717134	8564032	1
136	Gamba Grass	5	100	717136	8564297	1
137	Gamba Grass	5	100	717138	8563839	1
138	Para Grass	5	100	717138	8563771	1
139	Mission Grass	5	100	717138	8563837	1
140	Para Grass	3	50	717138	8563841	1
141	Para Grass	3	50	717138	8563837	1
142	Gamba Grass	5	100	717139	8563768	1
143	Olive Hymenachne	4	100	717141	8562902	4
144	Guinea Grass	4	100	717143	8562904	4
145	Gamba Grass	3	100	717143	8562902	4
146	Gamba Grass	3	50	717144	8562602	4
147	Wild Passion Fruit	4	100	717147	8564089	1
148	Gamba Grass	5	100	717152	8564085	0
149	Calopo	4	50	717154	8564084	0
150	Guinea Grass	3	100	717154	8564087	0
151	Guinea Grass	4	100	717162	8562718	4

152	Para Grass	5	100	717163	8563224	1
153	Gamba Grass	3	100	717164	8562716	4
154	Para Grass	4	100	717164	8562716	4
155	Gamba Grass	5	100	717165	8563694	1
156	Gamba Grass	5	100	717165	8563217	1
157	Mission Grass	3	50	717167	8563691	1
158	Olive Hymenachne	5	100	717171	8562828	4
159	Para Grass	4	100	717171	8562827	4
160	Gamba Grass	4	100	717171	8564560	1
161	Gamba Grass	4	100	717177	8564349	1
162	Gamba Grass	4	100	717183	8563237	1
163	Wild Passion Fruit	3	100	717185	8563841	1
164	Wild Passion Fruit	3	100	717189	8563830	1
165	Guinea Grass	3	100	717189	8563837	1
166	Gamba Grass	3	50	717190	8562539	4
167	Gamba Grass	3	100	717192	8564143	1
168	Guinea Grass	3	100	717193	8563837	1
169	Gamba Grass	5	100	717194	8563833	1
170	Guinea Grass	4	100	717195	8564139	1
171	Para Grass	3	100	717196	8564139	1
172	Guinea Grass	4	100	717197	8562930	4
173	Gamba Grass	4	50	717201	8563208	4
174	Guinea Grass	4	20	717204	8563210	4
175	Para Grass	3	100	717211	8563940	1
176	Gamba Grass	3	100	717215	8563943	1
177	Guinea Grass	5	100	717218	8563947	1
178	Gamba Grass	5	100	717221	8564259	1
179	Gamba Grass	5	100	717223	8564004	1
180	Para Grass	5	100	717226	8564002	1
181	Mission Grass	2	50	717231	8563321	1
182	Gamba Grass	5	100	717233	8563324	1
183	Para Grass	5	50	717233	8563324	1
184	Gamba Grass	5	100	717233	8563321	1
185	Gamba Grass	3	100	717248	8562650	4
186	Gamba Grass	5	100	717250	8563695	1
187	Gamba Grass	4	100	717250	8564335	1
188	Gamba Grass	2	100	717251	8564067	1
189	Wild Passion Fruit	3	100	717251	8563764	1
190	Wild Passion Fruit	4	100	717251	8563694	1
191	Guinea Grass	3	100	717251	8564069	1
192	Mission Grass	3	100	717252	8564070	1
193	Guinea Grass	3	100	717255	8563768	1
194	Para Grass	5	100	717255	8564067	1
195	Gamba Grass	4	100	717259	8563756	1
196	Para Grass	5	100	717259	8563757	1
197	Mission Grass	3	100	717259	8563764	1
198	Gamba Grass	4	100	717264	8563230	4
199	Para Grass	3	50	717266	8563720	1
200	Gamba Grass	3	50	717267	8563716	1
201	Gamba Grass	5	100	717272	8563314	4
202	Para Grass	3	100	717273	8563320	4

203	Guinea Grass	3	100	717275	8563318	4
204	Hyptis	2	50	717275	8563422	1
205	Gamba Grass	4	100	717276	8563421	1
206	Wild Passion Fruit	2	50	717280	8563422	1
207	Gamba Grass	3	100	717282	8562812	4
208	Guinea Grass	4	100	717284	8563852	1
209	Para Grass	5	100	717284	8563852	1
210	Gamba Grass	3	100	717285	8563849	1
211	Gamba Grass	3	100	717286	8562970	4
212	Gamba Grass	3	20	717288	8562481	4
213	Gamba Grass	5	100	717288	8564211	1
214	Para Grass	5	100	717288	8563856	1
215	Guinea Grass	3	100	717288	8563852	1
216	Para Grass	4	100	717293	8562889	4
217	Gamba Grass	3	100	717303	8563205	4
218	Hyptis	3	20	717303	8563466	1
219	Mission Grass	3	100	717305	8563205	4
220	Para Grass	2	50	717305	8563465	1
221	Guinea Grass	3	50	717306	8563200	4
222	Para Grass	2	50	717306	8563466	1
223	Wild Passion Fruit	3	20	717308	8563464	1
224	Gamba Grass	2	100	717316	8562812	4
225	Wild Passion Fruit	3	100	717321	8563977	1
226	Gamba Grass	5	100	717322	8563973	1
227	Mission Grass	3	100	717325	8563969	1
228	Gamba Grass	3	100	717327	8562657	4
229	Para Grass	3	100	717336	8563881	1
230	Gamba Grass	3	100	717338	8563881	1
231	Guinea Grass	3	100	717339	8563885	1
232	Para Grass	4	100	717342	8562706	4
233	Gamba Grass	4	100	717345	8564046	1
234	Para Grass	5	100	717347	8564046	1
235	Mimosa	4	50	717350	8564046	1
236	Para Grass	3	100	717358	8563797	1
237	Mimosa	3	50	717361	8563290	4
238	Gamba Grass	4	100	717361	8563291	4
239	Gamba Grass	5	100	717361	8563798	1
240	Para Grass	3	100	717361	8563797	1
241	Gamba Grass	4	100	717363	8563325	4
242	Gamba Grass	2	100	717367	8562755	4
243	Hyptis	4	50	717369	8563738	1
244	Gamba Grass	4	100	717369	8564315	1
245	Para Grass	4	100	717372	8563738	1
246	Gamba Grass	4	100	717373	8563740	1
247	Wild Passion Fruit	4	100	717391	8563647	1
248	Gamba Grass	4	100	717392	8563647	1
249	Gamba Grass	5	100	717394	8564178	1
250	Gamba Grass	4	100	717401	8563067	4
251	Mission Grass	5	100	717403	8563176	4
252	Para Grass	4	100	717403	8563178	4
253	Gamba Grass	5	100	717405	8563179	4

254	Flannel Weed	3	20	717405	8563830	1
255	Gamba Grass	2	100	717408	8562720	4
256	Wild Passion Fruit	4	50	717409	8563608	1
257	Mission Grass	3	20	717409	8563614	1
258	Para Grass	5	50	717409	8563607	1
259	Gamba Grass	3	100	717411	8563940	1
260	Mimosa	3	50	717413	8563815	1
261	Guinea Grass	3	100	717413	8563815	1
262	Guinea Grass	3	100	717413	8563819	1
263	Para Grass	5	100	717413	8563940	1
264	Gamba Grass	4	20	717414	8563612	1
265	Wild Passion Fruit	3	20	717414	8563614	1
266	Hyptis	2	50	717414	8563525	1
267	Para Grass	5	100	717415	8563523	1
268	Gamba Grass	4	100	717416	8563815	1
269	Flannel Weed	3	20	717416	8563815	1
270	Mimosa	3	50	717416	8563819	1
271	Mission Grass	3	100	717416	8563944	1
272	Mission Grass	2	50	717416	8563527	1
273	Para Grass	4	100	717419	8562927	4
274	Olive Hymenachne	5	50	717423	8562841	4
275	Para Grass	3	100	717424	8562557	4
276	Gamba Grass	3	100	717426	8562557	4
277	Gamba Grass	2	100	717428	8562748	4
278	Para Grass	5	100	717429	8564023	1
279	Para Grass	5	20	717430	8563560	1
280	Gamba Grass	3	100	717432	8564023	1
281	Wild Passion Fruit	2	50	717432	8563560	1
282	Gamba Grass	5	100	717434	8563341	4
283	Snakeweed	3	100	717434	8563344	4
284	Para Grass	3	100	717434	8563344	4
285	Gamba Grass	4	100	717434	8564023	1
286	Gamba Grass	2	50	717434	8563561	1
287	Gamba Grass	4	20	717436	8563610	1
288	Para Grass	5	100	717437	8564023	1
289	Mission Grass	3	100	717439	8564023	1
290	Wild Passion Fruit	3	20	717440	8563609	1
291	Gamba Grass	3	100	717441	8564077	1
292	Mimosa	4	50	717444	8564022	1
293	Mission Grass	3	100	717445	8563015	4
294	Guinea Grass	4	100	717446	8563015	4
295	Gamba Grass	5	100	717447	8563121	4
296	Hyptis	3	100	717447	8563017	4
297	Gamba Grass	4	100	717447	8563399	4
298	Para Grass	4	100	717449	8563746	1
299	Mission Grass	3	50	717453	8563742	1
300	Gamba Grass	3	100	717454	8563743	1
301	Para Grass	3	100	717459	8562710	4
302	Gamba Grass	3	100	717461	8564320	1
303	Mission Grass	3	20	717475	8563614	1
304	Hyptis	3	20	717475	8563612	1

305	Gamba Grass	5	100	717479	8564207	1
306	Gamba Grass	2	20	717479	8563612	1
307	Gamba Grass	2	20	717479	8563616	1
308	Wild Passion Fruit	2	20	717479	8563614	1
309	Mission Grass	2	100	717487	8562626	4
310	Gamba Grass	3	100	717488	8562622	4
311	Gamba Grass	3	100	717488	8562834	4
312	Para Grass	5	100	717493	8563911	1
313	Gamba Grass	4	100	717494	8563842	1
314	Para Grass	4	50	717498	8562920	4
315	Mission Grass	3	100	717499	8562624	4
316	Gamba Grass	3	100	717502	8562626	4
317	Gamba Grass	4	100	717502	8563911	1
318	Para Grass	4	100	717504	8562701	4
319	Olive Hymenachne	3	100	717504	8562701	4
320	Phalaris	5	100	717505	8564090	1
321	Gamba Grass	5	100	717507	8563727	1
322	Guinea Grass	3	100	717508	8562701	4
323	Para Grass	5	100	717508	8563727	1
324	Gamba Grass	4	20	717508	8563611	1
325	Mission Grass	4	20	717510	8563612	1
326	Para Grass	2	100	717514	8562506	4
327	Gamba Grass	3	20	717514	8562364	4
328	Para Grass	3	20	717514	8562366	4
329	Mission Grass	3	100	717525	8562575	4
330	Gamba Grass	3	100	717525	8562574	4
331	Gamba Grass	2	100	717527	8564592	1
332	Gamba Grass	2	5	717533	8564594	1
333	Wild Passion Fruit	4	100	717534	8562346	3
334	Gamba Grass	2	5	717534	8562353	4
335	Stylo	3	20	717535	8562352	4
336	Gamba Grass	5	100	717535	8563164	4
337	Guinea Grass	4	100	717537	8563083	4
338	Gamba Grass	3	100	717537	8563080	4
339	Para Grass	3	100	717537	8563080	4
340	Para Grass	5	100	717541	8562357	4
341	Para Grass	5	100	717541	8562997	4
342	Mission Grass	3	100	717543	8564055	1
343	Gamba Grass	3	50	717544	8563609	1
344	Wild Passion Fruit	4	100	717548	8562402	4
345	Olive Hymenachne	5	100	717550	8562401	4
346	Gamba Grass	4	100	717550	8562400	4
347	Guinea Grass	4	100	717550	8562402	4
348	Mission Grass	3	30	717550	8563613	1
349	Gamba Grass	3	100	717556	8562732	4
350	Para Grass	2	100	717556	8562733	4
351	Gamba Grass	2	20	717557	8563620	1
352	Wild Passion Fruit	4	20	717562	8562325	3
353	Para Grass	4	50	717563	8563738	1
354	Wild Passion Fruit	3	20	717567	8563735	1
355	Gamba Grass	4	20	717570	8563734	1

356	Wild Passion Fruit	3	100	717571	8562843	4
357	Gamba Grass	4	20	717574	8562385	3
358	Gamba Grass	4	100	717574	8564341	1
359	Para Grass	5	100	717576	8562901	4
360	Gamba Grass	4	100	717583	8564500	1
361	Para Grass	5	100	717589	8563821	1
362	Gamba Grass	4	100	717589	8564379	1
363	Para Grass	5	50	717592	8562346	3
364	Para Grass	5	100	717600	8563885	1
365	Gamba Grass	3	100	717605	8563879	1
366	Wild Passion Fruit	3	100	717607	8563881	1
367	Wild Passion Fruit	2	20	717607	8563673	1
368	Olive Hymenachne	3	100	717608	8563128	4
369	Gamba Grass	5	100	717609	8563675	1
370	Wild Passion Fruit	2	10	717611	8563673	1
371	Mission Grass	3	100	717612	8563128	4
372	Para Grass	3	100	717613	8563126	4
373	Guinea Grass	4	100	717614	8563128	4
374	Para Grass	5	50	717614	8563731	1
375	Mission Grass	3	20	717615	8563673	1
376	Gamba Grass	3	50	717615	8564323	1
377	Gamba Grass	4	100	717616	8563126	4
378	Wild Passion Fruit	4	50	717618	8563731	1
379	Gamba Grass	4	50	717619	8562480	4
380	Para Grass	5	100	717619	8562482	4
381	Gamba Grass	4	50	717619	8563732	1
382	Para Grass	4	50	717620	8563546	1
383	Mission Grass	3	100	717620	8564481	1
384	Gamba Grass	2	50	717623	8563548	1
385	Coffee Bush	2	100	717629	8563207	4
386	Gamba Grass	3	100	717629	8564036	1
387	Hyptis	2	100	717631	8563208	4
388	Para Grass	3	50	717631	8563469	4
389	Gamba Grass	5	100	717632	8563206	4
390	Gamba Grass	4	20	717632	8563470	4
391	Para Grass	3	100	717632	8564036	1
392	Gamba Grass	3	100	717634	8563959	1
393	Para Grass	5	100	717634	8563958	1
394	Olive Hymenachne	2	100	717635	8563207	4
395	Gamba Grass	4	100	717643	8562653	4
396	Gamba Grass	3	100	717644	8562546	4
397	Gamba Grass	3	100	717650	8564229	1
398	Para Grass	5	100	717654	8562978	4
399	Wild Passion Fruit	2	10	717655	8563685	1
400	Mission Grass	3	20	717659	8563685	1
401	Gamba Grass	4	50	717661	8563687	1
402	Para Grass	3	20	717663	8563681	1
403	Mission Grass	4	50	717669	8564439	1
404	Mission Grass	3	50	717673	8563724	1
405	Gamba Grass	4	50	717677	8562737	4
406	Wild Passion Fruit	3	50	717677	8563724	1

407	Gamba Grass	3	50	717680	8564340	1
408	Gamba Grass	3	50	717682	8563725	1
409	Para Grass	3	100	717683	8562466	4
410	Gamba Grass	3	100	717683	8563807	1
411	Gamba Grass	3	50	717684	8564408	1
412	Para Grass	5	100	717684	8563806	1
413	Mission Grass	4	50	717684	8563809	1
414	Gamba Grass	3	100	717687	8563852	1
415	Gamba Grass	3	100	717687	8564190	1
416	Wild Passion Fruit	2	100	717687	8564191	1
417	Para Grass	4	100	717688	8563852	1
418	Mission Grass	3	100	717688	8563859	1
419	Gamba Grass	2	100	717690	8564608	1
420	Gamba Grass	4	100	717692	8562653	4
421	Hyptis	3	100	717692	8562657	4
422	Wild Passion Fruit	3	100	717692	8562653	4
423	Mission Grass	4	100	717693	8562654	4
424	Gamba Grass	4	100	717694	8562831	4
425	Mission Grass	2	100	717694	8562831	4
426	Gamba Grass	3	100	717700	8563939	1
427	Gamba Grass	4	100	717712	8562958	4
428	Mission Grass	2	5	717714	8562380	3
429	Gamba Grass	3	50	717715	8564021	1
430	Gamba Grass	3	10	717717	8563682	1
431	Para Grass	3	20	717720	8563685	1
432	Gamba Grass	4	50	717728	8563558	1
433	Gamba Grass	5	100	717729	8564379	1
434	Hyptis	2	100	717732	8562547	4
435	Hyptis	4	100	717732	8562745	4
436	Mission Grass	5	100	717732	8564402	1
437	Wild Passion Fruit	3	100	717734	8562749	4
438	Gamba Grass	5	100	717734	8564392	1
439	Gamba Grass	4	100	717735	8564447	1
440	Wild Passion Fruit	3	50	717735	8563731	1
441	Para Grass	3	100	717736	8562546	4
442	Gamba Grass	3	100	717736	8562546	4
443	Mission Grass	3	100	717736	8564393	1
444	Gamba Grass	3	100	717738	8562747	4
445	Para Grass	2	100	717738	8562745	4
446	Gamba Grass	5	100	717741	8564472	1
447	Gamba Grass	3	50	717742	8563731	1
448	Mission Grass	3	100	717744	8562835	4
449	Gamba Grass	4	100	717745	8562834	4
450	Calopo	4	50	717747	8564403	1
451	Hyptis	2	100	717748	8562833	4
452	Gamba Grass	5	20	717748	8563664	1
453	Hyptis	5	20	717749	8563664	1
454	Mission Grass	2	5	717749	8563664	1
455	Hyptis	3	100	717750	8562460	4
456	Gamba Grass	4	100	717752	8564234	1
457	Wild Passion Fruit	3	100	717753	8562461	4

458	Gamba Grass	3	100	717753	8562461	4
459	Mission Grass	4	100	717757	8562917	4
460	Gamba Grass	3	100	717761	8562917	4
461	Olive Hymenachne	3	100	717762	8562918	4
462	Wild Passion Fruit	2	10	717764	8563730	1
463	Mission Grass	3	10	717766	8563726	1
464	Gamba Grass	4	100	717767	8562769	4
465	Gamba Grass	2	20	717776	8563631	1
466	Mission Grass	3	100	717776	8563841	1
467	Para Grass	4	100	717776	8563845	1
468	Gamba Grass	3	100	717781	8563837	1
469	Wild Passion Fruit	3	50	717784	8564142	1
470	Gamba Grass	4	50	717786	8563777	1
471	Gamba Grass	4	100	717786	8564144	1
472	Wild Passion Fruit	3	20	717787	8563793	1
473	Mission Grass	4	50	717787	8563774	1
474	Wild Passion Fruit	3	50	717787	8563776	1
475	Olive Hymenachne	4	100	717788	8562712	4
476	Para Grass	3	100	717788	8563776	1
477	Para Grass	3	100	717790	8562710	4
478	Mission Grass	4	50	717790	8563793	1
479	Hyptis	3	100	717792	8562712	4
480	Gamba Grass	3	50	717794	8563790	1
481	Para Grass	3	100	717801	8562906	4
482	Hyptis	3	100	717803	8562904	4
483	Gamba Grass	3	20	717803	8563672	1
484	Gamba Grass	3	100	717804	8562904	4
485	Gamba Grass	3	100	717804	8562856	4
486	Wild Passion Fruit	3	100	717805	8562904	4
487	Hyptis	3	50	717805	8563672	1
488	Para Grass	3	100	717806	8563937	1
489	Gamba Grass	3	100	717807	8563141	4
490	Coffee Bush	2	100	717808	8563145	4
491	Gamba Grass	4	50	717808	8563676	1
492	Gamba Grass	3	100	717811	8564362	1
493	Gamba Grass	3	100	717816	8563992	1
494	Para Grass	3	50	717818	8563992	1
495	Gamba Grass	4	100	717819	8562627	4
496	Hyptis	3	20	717823	8563797	1
497	Wild Passion Fruit	2	10	717829	8563762	1
498	Para Grass	4	20	717829	8563762	1
499	Gamba Grass	5	100	717830	8563762	1
500	Gamba Grass	4	100	717831	8562760	4
501	Gamba Grass	3	50	717831	8563792	1
502	Mission Grass	2	50	717831	8563793	1
503	Mission Grass	2	5	717834	8562341	3
504	Gamba Grass	2	100	717838	8562881	4
505	Olive Hymenachne	3	100	717840	8562959	4
506	Gamba Grass	4	50	717841	8563688	1
507	Mission Grass	3	100	717842	8562959	4
508	Hyptis	3	100	717843	8562957	4

509	Para Grass	3	100	717843	8562961	4
510	Guinea Grass	3	100	717843	8562959	4
511	Gamba Grass	3	100	717847	8562958	4
512	Wild Passion Fruit	3	100	717847	8562961	4
513	Hyptis	3	100	717848	8562422	4
514	Gamba Grass	3	100	717849	8562421	4
515	Para Grass	3	100	717849	8562421	4
516	Wild Passion Fruit	2	100	717849	8562421	4
517	Para Grass	3	20	717851	8563669	1
518	Gamba Grass	3	100	717853	8562544	4
519	Gamba Grass	3	100	717853	8562681	4
520	Para Grass	3	100	717857	8562544	4
521	Gamba Grass	2	5	717859	8564623	1
522	Gamba Grass	4	100	717863	8564412	1
523	Gamba Grass	4	100	717867	8564103	1
524	Mission Grass	3	50	717867	8563771	1
525	Olive Hymenachne	5	100	717870	8562740	4
526	Mission Grass	4	100	717870	8562741	4
527	Para Grass	3	100	717870	8562741	4
528	Olive Hymenachne	4	50	717870	8562826	4
529	Gamba Grass	4	100	717872	8562741	4
530	Gamba Grass	3	50	717873	8563768	1
531	Gamba Grass	3	100	717873	8563822	1
532	Mission Grass	3	100	717874	8563824	1
533	Gamba Grass	5	100	717883	8563095	4
534	Mimosa	3	100	717883	8564242	1
535	Para Grass	3	100	717884	8563095	4
536	Olive Hymenachne	4	100	717886	8563095	4
537	Guinea Grass	4	100	717887	8564240	1
538	Gamba Grass	3	100	717895	8563919	1
539	Gamba Grass	3	100	717896	8562905	4
540	Para Grass	4	50	717897	8563826	1
541	Guinea Grass	3	20	717897	8563766	1
542	Mission Grass	3	20	717897	8563766	1
543	Gamba Grass	4	100	717898	8563826	1
544	Mission Grass	4	100	717899	8562904	4
545	Wild Passion Fruit	3	100	717899	8562906	4
546	Olive Hymenachne	4	100	717899	8563166	4
547	Para Grass	4	100	717899	8563166	4
548	Gamba Grass	4	50	717899	8563766	1
549	Wild Passion Fruit	4	20	717900	8564341	1
550	Hyptis	3	100	717901	8562906	4
551	Hyptis	2	100	717901	8563168	4
552	Gamba Grass	3	100	717901	8564340	1
553	Gamba Grass	3	100	717902	8563166	4
554	Gamba Grass	4	100	717903	8562473	4
555	Gamba Grass	3	100	717905	8563661	1
556	Para Grass	3	100	717905	8563661	1
557	Olive Hymenachne	5	50	717909	8562570	4
558	Gamba Grass	3	100	717920	8562371	4
559	Wild Passion Fruit	2	100	717920	8562375	4

560	Gamba Grass	4	100	717926	8564414	1
561	Hyptis	3	100	717928	8562369	4
562	Para Grass	3	100	717928	8562368	4
563	Mission Grass	3	100	717929	8562368	4
564	Gamba Grass	2	5	717931	8564578	1
565	Natal Grass	3	20	717932	8563051	4
566	Gamba Grass	4	100	717933	8564409	1
567	Mission Grass	3	100	717937	8564426	1
568	Gamba Grass	4	100	717939	8562777	4
569	Gamba Grass	5	100	717939	8562776	4
570	Gamba Grass	3	100	717941	8563048	4
571	Para Grass	4	100	717942	8563049	4
572	Gamba Grass	4	100	717943	8564407	1
573	Gamba Grass	4	50	717953	8564360	1
574	Gamba Grass	4	100	717953	8564406	1
575	Gamba Grass	3	100	717955	8562837	4
576	Mission Grass	4	100	717955	8562841	4
577	Hyptis	4	100	717956	8562839	4
578	Gamba Grass	3	100	717958	8562514	4
579	Gamba Grass	4	100	717959	8564409	1
580	Gamba Grass	3	100	717961	8562491	4
581	Gamba Grass	4	100	717962	8564411	1
582	Gamba Grass	3	100	717963	8564208	1
583	Gamba Grass	4	100	717964	8564413	1
584	Gamba Grass	3	100	717965	8563825	1
585	Mimosa	3	100	717965	8564209	1
586	Guinea Grass	3	100	717966	8562958	4
587	Para Grass	3	100	717966	8564209	1
588	Para Grass	3	20	717966	8563766	1
589	Gamba Grass	2	50	717968	8563765	1
590	Wild Passion Fruit	2	100	717970	8562961	4
591	Gamba Grass	5	100	717973	8562960	4
592	Gamba Grass	4	100	717973	8564062	1
593	Olive Hymenachne	5	100	717974	8562653	4
594	Para Grass	3	100	717975	8564058	1
595	Para Grass	5	100	717981	8562705	4
596	Gamba Grass	4	100	717983	8562420	4
597	Gamba Grass	3	100	717984	8563137	4
598	Hyptis	3	100	717985	8563141	4
599	Para Grass	4	100	717985	8563138	4
600	Olive Hymenachne	4	100	717985	8563141	4
601	Gamba Grass	3	100	717987	8563640	1
602	Gamba Grass	4	100	717989	8562688	4
603	Wild Passion Fruit	2	100	717989	8562421	4
604	Gamba Grass	2	100	717993	8563968	1
605	Gamba Grass	4	100	717994	8562732	4
606	Gamba Grass	3	100	717994	8564567	1
607	Mission Grass	3	100	717994	8563969	1
608	Para Grass	3	50	717994	8563758	1
609	Gamba Grass	2	100	717994	8564459	1
610	Gamba Grass	3	50	717995	8563757	1

611	Para Grass	3	50	717999	8563830	1
612	Gamba Grass	4	100	718001	8564407	1
613	Guinea Grass	4	100	718007	8563826	1
614	Gamba Grass	3	100	718009	8563826	1
615	Gamba Grass	4	100	718010	8562819	4
616	Mission Grass	2	100	718017	8564438	1
617	Gamba Grass	4	100	718018	8564405	1
618	Para Grass	3	100	718020	8562326	4
619	Gamba Grass	3	100	718021	8563885	1
620	Para Grass	3	100	718021	8563888	1
621	Para Grass	4	100	718022	8562910	4
622	Hyptis	3	100	718023	8562327	4
623	Olive Hymenachne	3	100	718023	8562910	4
624	Gamba Grass	4	100	718024	8562486	4
625	Gamba Grass	4	100	718025	8562323	4
626	Gamba Grass	5	100	718026	8562910	4
627	Gamba Grass	3	20	718027	8564385	1
628	Gamba Grass	4	100	718029	8563000	4
629	Mission Grass	4	100	718029	8563003	4
630	Para Grass	4	100	718029	8563003	4
631	Para Grass	4	100	718031	8562601	4
632	Gamba Grass	3	100	718032	8562904	4
633	Guinea Grass	4	100	718032	8563004	4
634	Gamba Grass	4	100	718033	8562602	4
635	Olive Hymenachne	3	100	718033	8562601	4
636	Gamba Grass	3	100	718033	8563187	3
637	Gamba Grass	4	100	718033	8564403	1
638	Olive Hymenachne	3	100	718035	8562599	4
639	Para Grass	4	100	718035	8562601	4
640	Para Grass	3	100	718035	8562902	4
641	Para Grass	2	50	718038	8563734	1
642	Olive Hymenachne	4	100	718039	8562800	4
643	Olive Hymenachne	4	100	718039	8562802	4
644	Para Grass	3	100	718040	8562803	4
645	Gamba Grass	4	100	718042	8564402	1
646	Para Grass	3	100	718043	8563819	1
647	Gamba Grass	2	50	718043	8563733	1
648	Guinea Grass	3	100	718047	8563819	1
649	Gamba Grass	3	100	718049	8563812	1
650	Gamba Grass	2	5	718051	8562252	3
651	Para Grass	4	100	718054	8563071	4
652	Olive Hymenachne	4	100	718054	8563069	4
653	Gamba Grass	4	100	718055	8563068	4
654	Gamba Grass	2	100	718056	8564518	1
655	Gamba Grass	4	100	718066	8564392	1
656	Gamba Grass	4	20	718072	8562834	4
657	Gamba Grass	4	100	718073	8564390	1
658	Gamba Grass	3	100	718074	8563982	1
659	Gamba Grass	3	100	718076	8562386	4
660	Para Grass	3	100	718076	8563863	1
661	Gamba Grass	3	50	718076	8563607	1

662	Gamba Grass	3	100	718077	8563865	1
663	Gamba Grass	3	100	718079	8562615	4
664	Mission Grass	3	100	718079	8563981	1
665	Gamba Grass	4	100	718080	8564389	1
666	Gamba Grass	4	100	718083	8563112	3
667	Para Grass	3	50	718084	8563804	1
668	Gamba Grass	3	50	718085	8563798	1
669	Guinea Grass	3	20	718092	8562996	4
670	Gamba Grass	4	100	718097	8562690	4
671	Gamba Grass	3	50	718099	8563724	1
672	Para Grass	5	100	718105	8562770	4
673	Olive Hymenachne	3	100	718112	8563005	4
674	Para Grass	4	100	718114	8563005	4
675	Gamba Grass	4	100	718115	8563002	4
676	Mission Grass	3	100	718115	8564517	1
677	Guinea Grass	4	100	718116	8563002	4
678	Para Grass	3	100	718117	8562316	4
679	Gamba Grass	4	20	718127	8562848	4
680	Hyptis	2	100	718129	8562519	4
681	Coffee Bush	3	100	718133	8562520	4
682	Gamba Grass	3	100	718133	8562517	4
683	Olive Hymenachne	4	100	718133	8563025	3
684	Mission Grass	4	100	718134	8564375	1
685	Mission Grass	3	100	718138	8562519	4
686	Gamba Grass	4	100	718138	8564226	1
687	Flannel Weed	3	50	718142	8563771	1
688	Gamba Grass	3	50	718143	8563773	1
689	Guinea Grass	3	50	718145	8562915	4
690	Olive Hymenachne	5	100	718148	8562915	4
691	Gamba Grass	2	100	718149	8562440	4
692	Wild Passion Fruit	5	100	718151	8562599	4
693	Para Grass	3	100	718152	8562444	4
694	Hyptis	2	100	718152	8562438	4
695	Mission Grass	3	100	718154	8562438	4
696	Gamba Grass	4	100	718156	8564515	1
697	Hyptis	2	100	718165	8562630	4
698	Wild Passion Fruit	2	50	718165	8562767	4
699	Gamba Grass	4	100	718166	8562704	4
700	Gamba Grass	4	100	718168	8562624	4
701	Gamba Grass	5	100	718168	8563342	2
702	Gamba Grass	5	100	718168	8563231	2
703	Mission Grass	4	100	718169	8562707	4
704	Hyptis	3	50	718169	8562701	4
705	Gamba Grass	3	50	718170	8562883	4
706	Gamba Grass	4	100	718170	8564350	1
707	Para Grass	4	100	718171	8562630	4
708	Mission Grass	3	100	718171	8562626	4
709	Gamba Grass	4	100	718172	8563844	1
710	Para Grass	3	100	718173	8563843	1
711	Wild Passion Fruit	4	20	718178	8562730	4
712	Gamba Grass	3	50	718182	8563965	1

713	Gamba Grass	3	50	718184	8562708	4
714	Gamba Grass	3	100	718184	8564375	1
715	Gamba Grass	2	5	718189	8562520	4
716	Gamba Grass	2	20	718192	8564449	1
717	Mission Grass	4	100	718193	8564659	2
718	Gamba Grass	4	100	718202	8564524	2
719	Gamba Grass	2	100	718204	8564590	2
720	Gamba Grass	5	100	718207	8563572	2
721	Gamba Grass	4	100	718212	8564266	1
722	Gamba Grass	2	100	718218	8564492	2
723	Gamba Grass	4	100	718234	8563648	2
724	Mission Grass	2	5	718237	8562798	3
725	Para Grass	3	100	718238	8563648	2
726	Gamba Grass	2	5	718242	8562789	3
727	Mission Grass	3	100	718246	8564379	2
728	Gamba Grass	3	100	718246	8564380	2
729	Gamba Grass	3	50	718251	8564365	2
730	Para Grass	4	50	718251	8563832	2
731	Mission Grass	3	20	718252	8562696	3
732	Gamba Grass	4	50	718253	8563831	2
733	Gamba Grass	5	100	718254	8563746	2
734	Gamba Grass	5	100	718254	8563195	2
735	Gamba Grass	5	100	718254	8563304	2
736	Hyptis	2	50	718255	8563741	2
737	Gamba Grass	2	100	718258	8564360	2
738	Wild Passion Fruit	2	100	718260	8564364	2
739	Gamba Grass	3	100	718268	8564268	2
740	Gamba Grass	3	100	718271	8563833	2
741	Mission Grass	4	100	718271	8564268	2
742	Guinea Grass	3	100	718271	8564265	2
743	Mission Grass	2	100	718274	8563838	2
744	Para Grass	2	50	718274	8563838	2
745	Guinea Grass	4	40	718274	8563833	2
746	Wild Passion Fruit	3	50	718274	8563829	2
747	Tully	50	3	718280	8562673	3
748	Gamba Grass	5	100	718287	8563546	2
749	Mission Grass	3	100	718287	8564141	2
750	Gamba Grass	4	100	718288	8564145	2
751	Mission Grass	4	100	718289	8563541	2
752	Gamba Grass	3	50	718296	8562353	3
753	Para Grass	3	50	718296	8563700	2
754	Gamba Grass	3	100	718297	8564304	2
755	Gamba Grass	4	100	718300	8563701	2
756	Mission Grass	3	100	718301	8562619	3
757	Gamba Grass	5	100	718302	8563669	2
758	Gamba Grass	3	100	718312	8564667	2
759	Mission Grass	4	100	718313	8564090	2
760	Gamba Grass	3	100	718316	8562611	3
761	Gamba Grass	4	50	718317	8562651	3
762	Mission Grass	4	100	718318	8564666	2
763	Mission Grass	3	100	718320	8564431	2

764	Gamba Grass	4	100	718321	8564087	2
765	Gamba Grass	5	100	718322	8564220	2
766	Wild Passion Fruit	2	100	718322	8564222	2
767	Gamba Grass	5	100	718325	8564168	2
768	Mission Grass	5	100	718331	8564125	2
769	Gamba Grass	2	50	718333	8563882	2
770	Wild Passion Fruit	4	100	718350	8564284	2
771	Mission Grass	4	100	718357	8564285	2
772	Gamba Grass	3	50	718360	8562342	3
773	Gamba Grass	3	100	718360	8564289	2
774	Gamba Grass	3	100	718366	8564049	2
775	Gamba Grass	4	100	718370	8563302	2
776	Gamba Grass	5	100	718373	8563575	2
777	Gamba Grass	5	100	718373	8564260	2
778	Gamba Grass	5	100	718374	8563202	2
779	Gamba Grass	3	100	718379	8563739	2
780	Wild Passion Fruit	3	50	718383	8563743	2
781	Gamba Grass	3	50	718389	8563862	2
782	Mission Grass	2	20	718390	8563863	2
783	Gamba Grass	4	50	718391	8562620	3
784	Gamba Grass	4	50	718395	8562634	3
785	Gamba Grass	3	100	718396	8564645	2
786	Mission Grass	3	50	718400	8564038	2
787	Gamba Grass	3	100	718400	8564430	2
788	Mission Grass	4	100	718411	8562568	3
789	Gamba Grass	4	100	718417	8564242	2
790	Mission Grass	4	100	718420	8564207	2
791	Wild Passion Fruit	3	100	718420	8564208	2
792	Gamba Grass	5	100	718423	8564217	2
793	Gamba Grass	2	100	718424	8563682	2
794	Hyptis	2	50	718426	8563676	2
795	Gamba Grass	3	50	718433	8563783	2
796	Para Grass	3	100	718433	8564529	2
797	Wild Passion Fruit	2	100	718437	8564507	2
798	Gamba Grass	3	100	718438	8564505	2
799	Mission Grass	2	50	718439	8562593	3
800	Para Grass	4	100	718439	8564508	2
801	Mission Grass	3	100	718444	8564091	2
802	Gamba Grass	3	100	718451	8564280	2
803	Gamba Grass	2	100	718452	8564585	2
804	Gamba Grass	4	100	718455	8563638	2
805	Mission Grass	4	100	718456	8564130	2
806	Mission Grass	4	100	718458	8564626	2
807	Wild Passion Fruit	4	100	718459	8563634	2
808	Hyptis	0	100	718462	8563737	2
809	Gamba Grass	3	20	718463	8562531	3
810	Mission Grass	4	100	718468	8564212	2
811	Mission Grass	2	100	718468	8564445	2
812	Gamba Grass	4	100	718469	8564210	2
813	Gamba Grass	3	100	718470	8564564	2
814	Gamba Grass	4	100	718470	8564441	2

815	Gamba Grass	5	100	718470	8563220	2
816	Gamba Grass	4	100	718475	8563990	2
817	Wild Passion Fruit	3	100	718477	8564560	2
818	Gamba Grass	2	100	718478	8564408	2
819	Gamba Grass	2	20	718482	8563691	2
820	Gamba Grass	2	50	718484	8563692	2
821	Gamba Grass	2	100	718485	8564367	2
822	Gamba Grass	5	100	718492	8563351	2
823	Gamba Grass	4	20	718494	8562613	3
824	Gamba Grass	3	50	718502	8564245	2
825	Gamba Grass	3	100	718508	8564289	2
826	Gamba Grass	4	50	718512	8562486	3
827	Gamba Grass	3	100	718520	8562229	3
828	Gamba Grass	3	100	718521	8564051	2
829	Mission Grass	4	50	718529	8562477	3
830	Mission Grass	3	100	718539	8564123	2
831	Gamba Grass	3	100	718540	8564122	2
832	Gamba Grass	4	50	718541	8562453	3
833	Mission Grass	3	100	718541	8564662	2
834	Gamba Grass	3	50	718542	8562549	3
835	Wild Passion Fruit	3	50	718542	8564562	2
836	Gamba Grass	3	100	718543	8564560	2
837	Gamba Grass	3	100	718543	8563940	2
838	Gamba Grass	4	100	718543	8564464	2
839	Gamba Grass	4	50	718548	8562332	3
840	Gamba Grass	4	100	718551	8564318	2
841	Gamba Grass	3	20	718561	8562073	3
842	Gamba Grass	4	100	718561	8562281	3
843	Gamba Grass	5	100	718561	8564209	2
844	Mission Grass	4	50	718570	8562429	3
845	Mission Grass	2	100	718581	8564619	2
846	Gamba Grass	5	100	718585	8563275	2
847	Gamba Grass	3	20	718591	8563672	2
848	Mission Grass	3	50	718594	8564548	2
849	Gamba Grass	3	100	718595	8564397	2
850	Wild Passion Fruit	2	100	718600	8564007	2
851	Gamba Grass	4	50	718601	8562309	3
852	Gamba Grass	2	50	718601	8563674	2
853	Gamba Grass	3	100	718602	8564008	2
854	Gamba Grass	5	100	718605	8563386	2
855	Mission Grass	4	100	718612	8564076	2
856	Gamba Grass	4	50	718614	8562259	3
857	Gamba Grass	4	100	718623	8563950	2
858	Gamba Grass	4	50	718627	8562474	3
859	Gamba Grass	2	50	718627	8563597	2
860	Hyptis	2	20	718627	8563595	2
861	Gamba Grass	4	50	718633	8562426	3
862	Gamba Grass	3	50	718633	8564535	2
863	Gamba Grass	5	100	718634	8564216	2
864	Gamba Grass	2	50	718645	8562341	3
865	Gamba Grass	5	100	718651	8564073	2

866	Gamba Grass	3	100	718659	8564062	2
867	Gamba Grass	2	20	718664	8563612	2
868	Mission Grass	3	20	718679	8563552	2
869	Wild Passion Fruit	3	20	718687	8562319	3
870	Gamba Grass	3	100	718689	8562315	3
871	Gamba Grass	3	50	718696	8564494	2
872	Gamba Grass	5	100	718697	8564136	2
873	Wild Passion Fruit	3	100	718698	8562219	3
874	Gamba Grass	3	100	718699	8562216	3
875	Gamba Grass	5	100	718699	8563322	2
876	Gamba Grass	3	50	718703	8564008	2
877	Para Grass	4	20	718707	8563499	2
878	Gamba Grass	3	100	718709	8563501	2
879	Para Grass	2	20	718716	8563574	2
880	Hyptis	3	100	718717	8563571	2
881	Gamba Grass	4	20	718719	8562158	3
882	Gamba Grass	2	20	718722	8563538	2
883	Gamba Grass	5	100	718732	8563821	2
884	Gamba Grass	4	100	718732	8564028	2
885	Wild Passion Fruit	2	20	718737	8563598	2
886	Gamba Grass	5	100	718737	8564213	2
887	Para Grass	2	20	718738	8563595	2
888	Hyptis	2	20	718740	8563598	2
889	Gamba Grass	5	50	718740	8564430	2
890	Gamba Grass	5	100	718754	8563426	2
891	Mission Grass	2	100	718764	8564580	2
892	Gamba Grass	3	20	718765	8563575	2
893	Gamba Grass	4	100	718766	8564327	2
894	Gamba Grass	5	100	718774	8563737	2
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896	Gamba Grass	3	100	718782	8563970	2
897	Para Grass	3	50	718786	8563603	2
898	Para Grass	2	50	718798	8563626	2
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900	Gamba Grass	3	20	718801	8563623	2
901	Gamba Grass	2	20	718819	8563665	2
902	Para Grass	2	50	718819	8563705	2
903	Gamba Grass	3	100	718821	8564116	2
904	Gamba Grass	2	20	718822	8563668	2
905	Hyptis	2	100	718824	8563636	2
906	Para Grass	4	20	718827	8563640	2
907	Gamba Grass	3	50	718843	8563613	2
908	Mission Grass	3	100	718843	8564559	2
909	Gamba Grass	5	100	718848	8563344	2
910	Gamba Grass	3	50	718861	8564269	2
911	Gamba Grass	5	100	718861	8564189	2
912	Para Grass	2	50	718871	8563673	2
913	Gamba Grass	4	100	718874	8564556	2
914	Gamba Grass	4	20	718877	8563668	2
915	Gamba Grass	4	20	718892	8563635	2
916	Para Grass	2	50	718892	8563633	2

917	Hyptis	3	20	718895	8563634	2
918	Gamba Grass	5	100	718901	8563446	2
919	Gamba Grass	3	100	718918	8562735	3
920	Gamba Grass	3	100	718932	8562804	3
921	Gamba Grass	3	20	718940	8563623	2
922	Gamba Grass	4	50	718943	8564062	2
923	Gamba Grass	5	100	718954	8564218	2
924	Gamba Grass	3	50	718971	8563651	2
925	Gamba Grass	3	50	718985	8563619	2
926	Gamba Grass	5	100	718986	8563400	2
927	Gamba Grass	5	100	718988	8564122	2
928	Para Grass	3	100	719006	8563539	2
929	Gamba Grass	4	100	719008	8563543	2
930	Gamba Grass	3	100	719011	8564333	2
931	Guinea Grass	3	100	719012	8563539	2
932	Grader Gr	3	50	719015	8564321	2
933	Guinea Grass	4	50	719026	8563447	2
934	Gamba Grass	4	100	719042	8563957	2
935	Mission Grass	3	100	719043	8564530	2
936	Gamba Grass	5	100	719054	8564216	2
937	Para Grass	5	50	719058	8563631	2
938	Gamba Grass	5	100	719059	8563358	2
939	Gamba Grass	3	20	719060	8563633	2
940	Mission Grass	3	100	719063	8563356	2
941	Guinea Grass	5	100	719068	8562973	3
942	Gamba Grass	5	100	719072	8563664	2
943	Para Grass	5	100	719075	8563664	2
944	Gamba Grass	4	50	719081	8564355	2
945	Guinea Grass	5	100	719083	8563082	3
946	Para Grass	4	100	719084	8563609	2
947	Gamba Grass	3	20	719085	8563612	2
948	Gamba Grass	4	100	719086	8564048	2
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951	Gamba Grass	3	20	719112	8562461	3
952	Gamba Grass	4	100	719114	8563889	2
953	Mission Grass	4	100	719120	8564517	2
954	Gamba Grass	5	100	719121	8563173	3
955	Gamba Grass	3	50	719123	8562817	3
956	Para Grass	5	100	719126	8563605	2
957	Gamba Grass	4	50	719128	8563604	2
958	Para Grass	5	100	719134	8563521	2
959	Gamba Grass	3	50	719135	8563520	2
960	Gamba Grass	2	50	719137	8563558	2
961	Olive Hymenachne	2	50	719138	8563560	2
962	Gamba Grass	3	100	719140	8563447	2
963	Para Grass	3	100	719141	8563446	2
964	Gamba Grass	4	100	719154	8563972	2
965	Gamba Grass	5	100	719159	8562977	3
966	Para Grass	3	100	719165	8563823	2
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968	Gamba Grass	3	100	719172	8563823	2
969	Gamba Grass	3	100	719177	8563583	2
970	Gamba Grass	5	100	719177	8563089	3
971	Gamba Grass	3	100	719180	8563586	2
972	Hyptis	3	20	719180	8563584	2
973	Calopo	5	100	719188	8563271	2
974	Gamba Grass	3	100	719193	8562707	3
975	Gamba Grass	4	100	719198	8563744	2
976	Gamba Grass	5	100	719201	8564129	2
977	Olive Hymenachne	5	100	719204	8563302	2
978	Para Grass	4	100	719206	8564299	2
979	Para Grass	4	100	719209	8563423	2
980	Gamba Grass	5	100	719210	8563429	2
981	Gamba Grass	3	20	719214	8564422	2
982	Gamba Grass	3	100	719225	8564010	2
983	Gamba Grass	3	100	719232	8563851	2
984	Gamba Grass	5	100	719243	8563184	3
985	Para Grass	5	50	719246	8563596	2
986	Gamba Grass	4	100	719248	8563593	2
987	Para Grass	3	100	719257	8564022	2
988	Gamba Grass	4	100	719265	8563082	3
989	Olive Hymenachne	4	100	719266	8563256	2
990	Para Grass	4	100	719268	8563257	2
991	Guinea Grass	5	100	719268	8562984	3
992	Gamba Grass	5	100	719276	8564202	2
993	Mission Grass	3	100	719285	8564491	2
994	Gamba Grass	4	100	719287	8563845	2
995	Gamba Grass	5	100	719289	8563457	2
996	Gamba Grass	3	100	719292	8563998	2
997	Para Grass	4	100	719294	8563578	2
998	Gamba Grass	5	100	719295	8563369	2
999	Gamba Grass	5	100	719297	8563579	2
1000	Para Grass	2	50	719301	8563515	2
1001	Gamba Grass	5	100	719302	8563518	2
1002	Olive Hymenachne	2	50	719304	8563518	2
1003	Para Grass	5	100	719308	8563304	2
1004	Gamba Grass	5	100	719309	8563693	2
1005	Gamba Grass	3	50	719321	8562617	3
1006	Calopo	3	100	719338	8563349	2
1007	Gamba Grass	3	50	719354	8563014	3
1008	Guinea Grass	5	100	719354	8563186	3
1009	Gamba Grass	3	100	719360	8563782	2
1010	Guinea Grass	5	100	719374	8563089	3
1011	Gamba Grass	3	100	719379	8563613	2
1012	Mission Grass	4	20	719382	8563608	2
1013	Gamba Grass	4	100	719388	8563446	2
1014	Sida	2	20	719391	8563441	2
1015	Para Grass	4	100	719391	8563735	2
1016	Mission Grass	3	50	719392	8563444	2
1017	Para Grass	4	100	719392	8563280	2
1018	Olive Hymenachne	4	100	719394	8563278	2

1019	Gamba Grass	3	100	719411	8563994	2
1020	Guinea Grass	5	100	719416	8562957	3
1021	Gamba Grass	5	100	719417	8563517	2
1022	Gamba Grass	3	100	719422	8563715	2
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1024	Gamba Grass	3	100	719465	8564047	2
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1026	Gamba Grass	5	100	719495	8563414	2
1027	Calopo	3	100	719498	8563578	2
1028	Wild Passion Fruit	2	100	719499	8563575	2
1029	Gamba Grass	4	100	719500	8563575	2
1030	Mission Grass	3	100	719501	8563479	2
1031	Guinea Grass	5	100	719501	8563009	3
1032	Gamba Grass	3	100	719502	8563480	2
1033	Snakeweed	3	100	719504	8563370	2
1034	Para Grass	3	100	719505	8563391	2
1035	Calopo	3	100	719506	8563391	2
1036	Wild Passion Fruit	4	100	719507	8563393	2
1037	Gamba Grass	3	100	719508	8563707	2
1038	Gamba Grass	3	100	719509	8563396	2
1039	Gamba Grass	3	100	719513	8562928	3
1040	Gamba Grass	4	100	719514	8563756	2
1041	Gamba Grass	4	100	719519	8563636	2
1042	Gamba Grass	5	100	719521	8563344	2
1043	Snakeweed	4	50	719523	8563343	2
1044	Calopo	4	100	719526	8563340	2
1045	Wild Passion Fruit	3	50	719528	8563344	2
1046	Gamba Grass	3	100	719528	8562766	3
1047	Guinea Grass	5	100	719550	8563275	2
1048	Gamba Grass	4	100	719562	8563990	2
1049	Gamba Grass	3	20	719600	8564409	2
1050	Gamba Grass	4	100	719601	8563417	2
1051	Olive Hymenachne	3	100	719606	8563186	2
1052	Gamba Grass	4	100	719640	8564062	2
1053	Gamba Grass	5	100	719648	8563311	2
1054	Gamba Grass	3	100	719686	8564157	2
1055	Gamba Grass	4	100	719696	8564078	2
1056	Gamba Grass	3	100	719705	8563171	2
1057	Gamba Grass	3	100	719706	8564142	2
1058	Gamba Grass	3	100	719740	8564183	2
1059	Gamba Grass	5	100	719741	8563302	2
1060	Guinea Grass	5	100	719743	8563400	2
1061	Gamba Grass	3	100	719746	8564210	2
1062	Gamba Grass	3	100	719749	8564182	2
1063	Mission Grass	2	100	719769	8564054	2
1064	Wild Passion Fruit	3	100	719776	8563227	2
1065	Gamba Grass	4	100	719782	8563237	2
1066	Mission Grass	2	100	719795	8564184	2
1067	Gamba Grass	4	100	719803	8563285	2
1068	Gamba Grass	3	100	719805	8564282	2
1069	Olive Hymenachne	3	100	719809	8563299	2

1070	Mission Grass	3	100	719821	8564412	2
1071	Gamba Grass	3	50	719822	8562978	3
1072	Gamba Grass	2	100	719829	8564047	2
1073	Mission Grass	2	100	719829	8563773	2
1074	Gamba Grass	2	100	719833	8564377	2
1075	Wild Passion Fruit	5	100	719835	8563349	2
1076	Gamba Grass	3	20	719836	8563069	3
1077	Olive Hymenachne	3	100	719836	8563348	2
1078	Olive Hymenachne	3	100	719838	8563290	2
1079	Wild Passion Fruit	3	100	719842	8563361	2
1080	Olive Hymenachne	3	50	719844	8563363	2
1081	Mission Grass	3	100	719848	8563546	2
1082	Mission Grass	2	100	719849	8563430	2
1083	Gamba Grass	4	100	719849	8563399	2
1084	Paddy's Lucerne	4	50	718142	8563935	1
1085	Grader Grass	3	50	717579	8564231	1
1086	Mimosa	4	20	717418	8564090	1
1087	Mimosa	3	20	717312	8564080	1
1088	Mimosa	4	20	716863	8564020	1
1089	Mimosa	4	50	716944	8563988	1
1090	Mimosa	3	20	717169	8563400	1
1091	Coffee Bush	4	100	716989	8563397	1
1092	Grader Grass	4	100	717816	8562600	2
1093	Grader Grass	3	20	717752	8562666	2
1094	Grader Grass	4	50	717779	8562747	2
1095	Grader Grass	4	50	717793	8562800	2
1096	Phyllanthus species	4	100	718106	8563034	3
1097	Grader Grass	4	100	718073	8562344	2

Appendix 1

Herbicide Material Safety Data Sheets

Appendix 2

Technical Weed Information

Du Pont (Australia) Ltd. A.C.N. 000 716 469
168 Walker Street North Sydney, N.S.W. 2060
Telephone (02) 9923 6111 Facsimile (02) 9923 6132
24hr Transport Emergency Number (02) 9963 1301 Medical Emergency 1800 674 415

MATERIAL SAFETY DATA SHEET

® DuPont Registered Trademark
N/R In Product Identification section means Not Regulated as a Dangerous Good and no UN number is allocated.

ISSUED DUPONT 09/03/04

PRODUCT: DUPONT BRUSH-OFF® BRUSH CONTROLLER

Not Classified as Hazardous According to Criteria of NOHSC.

PRODUCT IDENTIFICATION

UN No: N/R

Poisons: UNSCH (Fed)

Tradenames:	Manuf.:	ManCode:
Brush-Off® brush controller	DuPont	

Use:

For the control of certain brush and broadleaf species in native pastures, rights of way and commercial and industrial areas, and for the control of certain broadleaf weeds in grass pastures and pasture renovations.

Ingredients:	CAS No:	Proportion:
Metsulfuron methyl	74223-64-6	60 %
Inert Ingredients		40 %

Physical Description / Properties

Appearance:

Odour: Odourless
Colour: Off-white
Form: Granular solid

Other Properties:

Bulk Density: 0.68 g/cm³
Chemical family: Sulfonylurea
pH: 4.2
Solubility in water: 2.8 g/L at pH 7.
Explosion Limits: Not flammable, Not explosive.

HEALTH HAZARD INFORMATION

Acute Effects

Eye:

Based on animal data, eye contact with metsulfuron methyl may cause eye irritation with tearing, pain or blurred vision. Not classified as an eye irritant according to the criteria of NOHSC.

Skin:

Based on animal data, repeated dermal contact with metsulfuron methyl may cause skin irritation with itching, burning, redness, swelling or rash. Not a primary skin irritant, or skin sensitiser. Not classified as a skin sensitiser according to the criteria of NOHSC.

Inhaled:

May irritate throat. Not classified as hazardous by inhalation according to the criteria of NOHSC.

Swallowed:

Not likely to be hazardous by ingestion. Not classified as hazardous by ingestion according to the criteria of NOHSC.

Continued on next page...

PRODUCT: DUPONT BRUSH-OFF® BRUSH CONTROLLER

HEALTH HAZARD INFORMATION: (Continued)

Chronic Effects

Animal testing indicates that metsulfuron methyl does not have carcinogenic, developmental or reproductive effects. There is a report indicating that metsulfuron methyl produced genetic damage in a mammalian cell culture test, however, other tests with metsulfuron methyl in bacterial and mammalian cell cultures and in animals did not product genetic damage. The weight of evidence suggests that metsulfuron methyl does not cause genetic damage. Long term administration caused body weight loss.

Other Health Effects

No data is available to confidently predict the effects of overexposure to humans, however based on animal studies, overexposure by inhalation, ingestion, or skin or eye contact may initially include eye irritation with discomfort, tearing, or blurring of vision; or irritation of the upper respiratory passages. Repeated dermal exposure may lead to skin irritation with discomfort or rash.

First Aid

Eye:

In cases of contact, immediately flush eyes with plenty of water for at least 15 minutes. Seek Medical attention.

Skin:

In case of contact, immediately wash skin with soap and plenty of water. Wash contaminated clothing before reuse.

Inhaled:

Avoid breathing dust. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Seek Medical attention.

Swallowed:

No specific intervention is indicated, as the compound is not likely to be hazardous by ingestion. However, seek Medical attention if necessary.

Advice to Doctor

No specific requirements. Treat symptomatically.

Toxicity Data

Metsulfuron methyl
Acute Oral LD_{50} (rat): > 5000 mg/kg
Acute Dermal LD_{50} (rabbit): > 2000 mg/kg
4 hr inhalation LC_{50} (rat): > 5.0 mg/L

PRECAUTIONS FOR USE

Exposure Standards:

None established for formulated product.
Metsulfuron methyl:
TWA (NOHSC): 10 mg/m^3, dusts not otherwise classified
AEL (DuPont): 10 mg/m^3 (8 and 12 hr TWA)

Engineering Controls:

Use only with adequate ventilation.

Personal Protection:

May irritate the eyes. Avoid contact with eyes and skin. **DO NOT** inhale dust or spray mist. After use and before eating, drinking or smoking, wash hands, arms and face thoroughly with soap and water.

Flammability

Not a fire and explosion hazard. May be ignited by heat or open flame.

Continued on next page

Material Safety Data Sheet

Infosafe No. 3NU2F Issue Date : June 2004 ISSUED by NUFARM

Product Name : **Roundup PowerMAX**

Classified as hazardous according to criteria of NOHSC

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY

Product Name	Roundup PowerMAX
Product Code	0574
Product Use	Non selective herbicide for the control of many annual and perenial weeds.
Company Name	NUFARM AUSTRALIA LIMITED. (ABN 80 004 377 780)
Address	103-105 Pipe Road Laverton North Victoria 3026 Australia
Emergency Tel.	24hr 1800 033 498
Telephone/Telex Number	Tel: (03) 9282-1000 Fax: (03) 9282-1001
Product Type	Group M Herbicide
Other Information	This MSDS describes, to the best of our knowledge, the properties of the concentrated product. The physical properties and some of the assessments do not apply to the properties of the product once it has been diluted for application. Acute health effects of the diluted product are likely to be much less severe.

2. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Characterization Liquid

Ingredients

Name	CAS	Proportion
Glyphosate (present as the potassium salt)	1071-83-6	540 g/L
Surfactant		~10 %w/v
Water		Balance

3. HAZARDS IDENTIFICATION

Irritating to skin.

Other Information Poisons Schedule 5

4. FIRST AID MEASURES

Inhalation Remove affected person to fresh air until recovered.

Ingestion If swallowed do NOT induce vomiting; seek medical advice immediately and show this container or label or contact the Poisons Information Centre on 13 11 26 (Aust). Make every effort to prevent vomit from entering the lungs by careful placement of the patient.
Do not give anything by mouth to a semi-conscious or unconscious person.
Give a glass of water.

Skin Wash affected areas thoroughly with soap and water.
If irritation persists, seek medical advice.

Eye If in eyes, hold eyelids open and wash with copious amounts of water for at least 15 minutes.
Seek medical advice.

First Aid Facilities If poisoning occurs, contact a doctor or Poisons Information Centre on 13 11 26 (Australia).

Advice to Doctor Treat symptomatically.

5. FIRE FIGHTING MEASURES

Extinguishing Media If involved in a fire, the product will not burn. Choose extinguishing media to suit the burning material.
Water, foam, carbon dioxide or dry chemical.

Hazardous Combustion Products	Keep upwind. This product, or spray solutions of this product, react with galvanised steel or unlined steel (except stainless steel) containers and tanks, to produce hydrogen gas which may form a highly flammable or explosive gas mixture. If involved in a major fire, could evolve oxides of nitrogen or phosphorus.
Protective Equipment	Breathable air apparatus may have to be worn if material is involved in fires especially in confined spaces.

6. ACCIDENTAL RELEASE MEASURES

Spills & Disposal	Contain spill and absorb with clay, sand, soil or proprietary absorbent (such as vermiculite). Collect in sealed open top containers for disposal. Final clean-up with degreasing agent or detergent is advised.
Environmental Precautions	Prevent from entering drains, waterways or sewers.

7. HANDLING AND STORAGE

Handling	For personal protective equipment (PPE) and hygiene advice, refer Section 8.
Storage	Store in the closed, original container in a dry, well ventilated area out of direct sunlight. Keep container tightly sealed and do not store with seed, fertilisers or foodstuffs.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

Exposure Limits	No exposure standard has been established for this product.
Personal Protective Equipment	When opening the container, preparing the spray and using the prepared spray, wear cotton overalls buttoned to the neck and wrist (or equivalent clothing) and a washable hat, nitrile or elbow-length PVC gloves and face shield or goggles.
Eng. Controls	No special ventilation required.
Hygiene Measures	After each day's use, wash contaminated clothing and safety equipment. After use and before eating, drinking or smoking, wash hands, arms and face thoroughly with soap and water.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Dark blue viscous liquid
Odour	No odour
Melting Point	N/A
Solubility in Water	Soluble in water.
Boiling Point	>105°C
Specific Gravity (H2O=1)	1.35 @ 20°C
Vapour Pressure	N/A
Vapour Density (Air=1)	N/A
Volatile Component	N/A
Flash Point	None
Flammability	Non combustible material.
Ignition Temperature	N/A
Flammable Limits LEL	N/A
Explosion Properties	N/A

10. STABILITY AND REACTIVITY

MATERIAL SAFETY DATA SHEET

Emergency Response: 1800 033 111 Phone: (03)5223 3746
Sipcam Pacific Australia Pty Ltd ACN 073 176 888 Fax (03)5223 3756
Suite 11/23-31 Gheringhap St
Geelong, Victoria, 3220 AUSTRALIA

Hazardous according to the criteria of Worksafe Australia.

I IDENTIFICATION

Product Name: Glyphosate 360 Herbicide
Other Names: None.
Product Code: None.
UN No: None allocated Hazchem Code: None allocated
Dangerous Goods Class: None allocated
Sub Risk Class: None allocated
Packaging Group: None allocated
Poison Schedule: S5
Chemical Family: Water solution of ingredients (see below).
Uses: No selective water based herbice. See label for efficacy details.

Physical Appearance & Properties

Appearance & Odour: Green coloured liquid. Mild amine odour.
Melting/softening point: Approximately 0°C.
Boiling point and vapour pressure: Approximately 100°C at 100kPa.
Volatile materials: Water component.
Flashpoint: Does not burn.
Specific gravity: 1.2 approx
Solubility in water: Completely soluble.
Corrosiveness: Not corrosive.

Ingredients			Worksafe Exposure Limits	
Chemical Entity	CAS No	Proportion, %	TWA, mg/m^3	STEL, mg/m^3
Glyphosate, isopropylamine salt	38641-94-0	36	not set	not set
Non hazardous detergents	secret	approx1	not set	not set
Water	7732-18-5	to 100	not set	not set

This is a commercial product whose exact ratio of components may vary. Trace quantities of impurities are also likely.

II HEALTH HAZARD DATA

Health Effects:

No specific data is available for the product for chronic exposure symptoms. The ingredients are not listed as carcinogenic in Worksafe's document "Exposure Standards for Atmospheric Contaminants in the Occupational Environment" (May 1995).

Acute Effects:

Swallowed: Data suggests that this product is harmful if swallowed.
Eye: This product is mildly irritating to the eyes. It is likely to cause mild discomfort such as watering and redness of the eyes. However, this should quickly disappear once exposure is over.
Skin: This product may irritate skin. However, it is unlikely to cause any more than mild transient discomfort. It is also unlikely to cause any significant lasting effects.
Inhalation: Data suggests that this product should present no significant problems to typical persons in normal use.

First Aid:

If poisoning occurs, contact a Doctor or Poisons Information Centre. Phone 13 1126 from anywhere in Australia.
Eyes: If product gets in eyes, wash material from them with running water. If they begin watering or reddening, take special care in washing thoroughly.
Skin: If product gets on skin, thoroughly wash contacted areas. No further measures should normally be required unless irritation is noticed. If irritation persists, seek medical attention.

Inhalation: No first aid measures normally required. However, if vapours or mists have been inhaled, and irritation has developed, remove to fresh air and observe until recovered. If irritation becomes painful or persists more than about 30 minutes, seek medical advice.
Advice to Doctor: Treat symptomatically. Note the nature of this product.

III PRECAUTIONS FOR USE

Risk Phrases are: R22. Harmful if swallowed.

Exposure Standards:

A time weighted average (TWA) concentration for an 8 hour day, and 5 day week has not been established by Worksafe Australia for any of the major ingredients in this product. There is a blanket limit of 10mg/m^3 for dusts or mists when limits have not otherwise been established. The nature of this product makes it unlikely that this level will be approached in normal use. The ADI (Acceptable Daily Intake) for Glyphosate, isopropylamine salt is set at 0.3mg/kg/day. The corresponding NOEL (No-observable-effect-level) is set at 30mg/kg/day. Values taken from Australian ADI List, May 1998.

Engineering Controls:

In industrial situations, concentration values below the TWA value should be maintained. Values may be reduced by process modification, use of local exhaust ventilation, capturing substances at the source, or other methods. If you believe air borne concentrations of mists, dusts or vapours are high, you are advised to modify the process or environment to reduce the problem.

Personal Protection:

Respiratory Protection: It is usually safe to not use a dust mask or respirator protection on account of this product. However, if the product is being used in dusty or confined conditions, use of a mask or respirator may be preferred. For help in selecting suitable equipment, consult AS/NZS 1715.
Protective Gloves: Impermeable protective gloves should be worn when you are using this product, to prevent irritation. For help in selecting suitable equipment, consult AS 2161.
Eye Protection: Protective eyewear is suggested when using this product. It is always prudent to use protective eyewear. Consult AS1336 and AS/NZS 1337 for advice on Industrial Eye Protection.
Clothing: Clean overalls or protective clothing should be worn, preferably with an apron. Consult AS2919 for advice on Industrial Clothing.
Safety Boots: Wearing safety boots in industrial situations is advisory. Consult AS/NZS2210 for advice on Occupational Protective Footwear.
Always wash hands before smoking, eating or using the toilet. Wash contaminated clothing and other protective equipment before storing or re-using.

IV SAFE HANDLING INFORMATION

Safety Phrases are: S20. When using, do not eat or drink.

Storage & Transport

No special storage and transport requirements. This product has no UN classification. This product is a S5 Poison. Observe all relevant regulations regarding sale, transport and storage of this class of product. Containers should be kept closed in order to minimise contamination. Keep from extreme heat and open flames, and make sure that the product does not come into contact with substances listed under "Materials to avoid" below.

Spills & Disposals

In the event of a major spill, prevent spillage from entering drains or water courses. Wear full protective clothing including face mask, face shield and gauntlets. All skin areas should be covered. Thoroughly launder protective clothing before storage or re-use. See above under Personal Protection regarding Australian Standards relating to personal protective equipment. Stop leak if safe to do so, and contain spill. Absorb onto sand, vermiculite or other suitable absorbent material. Sweep up and shovel or collect recoverable product into labelled containers for recycling or salvage. After spills, wash area preventing runoff from entering drains. If a significant quantity of material enters drains, advise emergency services. Full details regarding disposal of used containers, spillage and unused material may be found on the label. If there is any conflict between this MSDS and the label, instructions on the label prevail. Dispose of only in accord with all regulations. Advise laundry of nature of contamination when sending contaminated clothing to laundry.

Fire & Explosion Hazard

There is no risk of an explosion from this product under normal circumstances if it is involved in a fire.
Flashpoint: Does not burn.
Flammability limits: Not applicable. This product does not burn.

Material Safety Data Sheet

Dow AgroSciences

Access* Herbicide

Hazardous according to the criteria of the National Occupational Health & Safety Commission (NOHSC). Risk Phrases: R38: Irritating to skin, R65 - Harmful: May cause lung damage if swallowed.

Date of Issue:	*February 2001*
Page:	*1 of 4*
Company:	*Dow AgroSciences Australia Ltd, ABN 24 003 771 659*
Address:	*Level 5, 20 Rodborough Road, Frenchs Forest NSW 2086*
Website:	*www.dowagrosciences.com.au*
Customer Service Toll Free Number:	*1800 700 096 (Mon-Fri 8am-5pm EST)*
Emergency Telephone Number:	*1800 033 882 (24 hours) (EMERGENCIES ONLY)*

IDENTIFICATION

Product Name:	Access Herbicide
Shipping Names:	None
Product Code:	IWD-4091
UN No:	None allocated
Hazchem Code:	None allocated
Dangerous Goods Class:	None allocated
Sub Risk Class:	None allocated
Packaging Group:	None allocated
Poison Schedule:	S6
Uses:	Selective control of a wide range of woody and noxious weeds in commercial and industrial areas, public lands, fence lines and pastures, by basal bark and cut stump applications as specified on the label

PHYSICAL APPEARANCE & PROPERTIES

Appearance:	Clear brown liquid
Boiling point:	183-210°C (solvent)
Volatile materials:	No specific data, expected to be low at 100°C
Flashpoint:	73°C (PMCC)
Specific gravity:	107 g/mL at 20°C
Solubility in water:	Insoluble
Corrosiveness:	Not corrosive
Vapour Pressure:	375mm Hg at 38°C (solvent) 10×10^{-5} mm Hg at 33°C (triclopyr butoxyethyl ester) 19×10^{-7} mm Hg at 25°C (picloram isooctyl ester)

INGREDIENTS

Chemical Entity	CAS No.	Proportion
Triclopyr butoxyethyl ester (sufficient to give 240 g/L of the acid equivalent	064700-56-7	343 g/L
Picloram isooctyl ester (sufficient to give 120 g/L of the acid equivalent)	026952-20-5	205 g/L
Aromatic solvent	064742-94-5	390 g/L
Other non hazardous ingredients		< 150 g/L

*Trademark of Dow AgroSciences

HEALTH HAZARD DATA

HEALTH EFFECTS

The information provided below is from studies conducted using a formulation similar to Access Herbicide.

Acute	**Swallowed:**	The oral LD_{50} (rat) is above 2000 mg/kg (low toxicity).
	Eye:	May cause slight eye irritation.
	Skin:	The acute dermal LD_{50} (rabbit) is above 2000 mg/kg (low toxicity). Prolonged or repeated contact may cause moderate irritation, drying or flaking of the skin and possible skin sensitisation.
	Inhaled:	The acute inhalation LC_{50} is > 5 mg/mL (very low toxicity). Prolonged exposure to the solvent vapour from the concentrate may cause eye and respiratory irritation, headache, dizziness and narcotic effects.

Chronic Possible chronic health effects from exposure to Access Herbicide are based on studies on the active ingredient. Rats and mice administered the active ingredients, triclopyr and picloram, in chronic carcinogenicity studies showed no increase in tumours when compared to the untreated group. Studies in rats indicated that triclopyr and picloram do not cause birth defects or interfere with reproduction. Triclopyr and picloram do not cause genetic change and do not accumulate in the body. The ingredients are not listed as carcinogenic in NOHSC's document "Exposure Standards for Atmospheric Contaminants in the Occupational Environment" (May 1995).

SAFETY DIRECTIONS AND PERSONAL PROTECTION

Harmful if swallowed. Will irritate the eyes, nose, throat and skin. Repeated exposure may cause allergic disorders. Avoid contact with eyes and skin. Avoid inhaling vapour or spray mist.

When opening the container, preparing the spray and using the prepared spray, wear cotton overalls buttoned to the neck and wrists, a washable hat, elbow-length neoprene gloves and a face shield or goggles. If product in eyes, wash it out immediately with water. If product on skin immediately wash area with soap and water. After use and before eating, drinking or smoking, wash hands, arms and face thoroughly with soap and water. Wash hands after use. After each days use wash gloves, face shield or goggles and contaminated clothing.

FIRST AID

General: Consult The National Poisons Information Centre (Ph: 13 11 26) or a Doctor in every case of suspected chemical poisoning. Never give fluids or induce vomiting if a patient is unconscious or convulsing regardless of cause of injury. If breathing difficulties occur seek medical attention immediately.

Swallowed:	If swallowed, contact the Poisons Information Centre or a doctor immediately.
Skin:	If on skin, remove contaminated clothing and wash skin thoroughly with soap and water.
Eyes:	If in eyes, hold eyes open and flood with water for at least 15 minutes and see a doctor.
Inhalation:	If affected, remove from contaminated area to fresh air.
Advice to Doctor:	Access Herbicide contains petroleum solvents. If lavage is performed, endotracheal or oesophagioscopic control is advisable.

PRECAUTIONS FOR USE

EXPOSURE STANDARDS

A time weighted average (TWA) has been established for picloram, present in significant quantities in this product. This value is 10 mg/m^3. The corresponding STEL level is "not set". The exposure value at the TWA is the average airborne concentration of a particular substance when calculated over a normal 8 hour working day for a 5 day working week. The ADI (Acceptable Daily Intake) for triclopyr is set at 0.005 mg/kg/day. The corresponding NOEL (No-observable-effect-level) is set at 0.5 mg/kg/day. The ADI for picloram is set at 0.07 mg/kg/day. The corresponding NOEL is set at 7 mg/kg/day. Values taken from Australian ADI List, January, 2001.

Agnote

No: E50
November 2003

Calopo

A.G. Cameron, Principal Agronomist Pasture Development, Darwin

INTRODUCTION

Calopo (*Calopogonium mucunoides*) is an annual pasture legume for the Top End of the Northern Territory. It was sown for a number of years in the late 1970s and early 1980s when there were few alternative legumes available to producers. Calopo has not been sown in recent years because there are better pasture legumes available, and seed has not been produced locally or interstate. It still persists in many of the areas where it was planted.

DESCRIPTION

Calopo is a vigorous annual twining legume with long stems which root at the nodes in contact with the soil or moist leaf litter. It is a good climber, growing up trees, shrubs and other vegetation.

The leaves have three leaflets (trifoliate). Leaflets are oval in shape, and up to 5 cm long. Stems and leaves are hairy. Flowers are small, and pale blue. Pods are 2.5-5 cm long, brown and hairy. Pods contain four to eight yellowish-brown seeds.

There are approximately 73,000 seeds per kilogram.

Calopo commences flowering each year in late April - early May and produces large quantities of seed. Flowering continues into the dry season until it runs out of soil moisture.

CLIMATE AND SOILS

Calopo is a native of tropical South America.

It will persist in areas receiving 1,300 mm or more of average annual rainfall. It is adapted to a wide range of soil types. Calopo is tolerant of water logging but not extended periods of flooding.

SOWING

Seed should be sown at 2-6 kg/ha depending on seedbed preparation and proposed end use. For best results, seed should be sown into a well-prepared seedbed.

Some soil disturbance, such as a rough cultivation is the minimum requirement to ensure establishment.

Inoculation to ensure nodulation is not necessary as calopo nodulates effectively with native soil rhizobia.

FERTILISER REQUIREMENTS

The type and rate of fertiliser to apply depends on soil type, but generally superphosphate at a rate of 100-250 kg/ha should be applied on virgin or previously unfertilised areas at sowing.

In subsequent years further fertiliser should be applied as maintenance dressings of 50-100 kg/ha of super per year.

Applications of potassium, molybdenum or zinc fertilisers may be necessary on some soils.

If you are unsure of the fertiliser requirements, check with a DBIRD Advisory Officer for advice before sowing.

YIELD

In pure swards under good growing conditions, calopo provides 4-10 tonnes of herbage.

Suction harvested seed yields of 500 kg/ha have been recorded.

GRAZING

Calopo is relatively unpalatable but stock gradually develop a taste for it. While young seedlings are palatable and can be killed by heavy grazing, it is generally only lightly grazed during the wet season. Calopo is well grazed only when it is maturing and drying out at the end of the wet season (April - June). During May/June it may constitute 50-60% of cattle diet. After June cattle again find calopo relatively unpalatable. Annual applications of superphosphate increase the palatability of calopo to livestock.

MIXTURES

Grasses with which calopo could be sown are Kazungula setaria, Guinea grass, pangola grass or Tully. It is difficult to maintain a calopo/grass sward because stock tend to graze the grass to the exclusion of the calopo during the wet season. Use of lower stocking rates will favour the grass.

HAY

For the best quality hay, cut early, at 10-20% flowering. Use a conditioner to reduce curing time and cart the bales away to storage before they are exposed to dew cycles or rain.

Stock generally do not immediately take to calopo hay, particularly if they have not previously been exposed to calopo.

The cause of this is not toxic factors or low digestibility, but factors such as smell, taste and hairiness which affect acceptability. An alkali treatment, a dressing of molasses or other additives may overcome this problem.

SMOTHERING

Calopo is an excellent pioneer/smothering legume. It will, over a number of years climb up, smother and choke out weeds. At the same time it fixes nitrogen, builds up soil nitrogen and soil organic matter. After a number of years, and following cultivation, a grain crop or a strong perennial grass which can utilise the fixed nitrogen should be sown.

Sowing calopo into an area after cultivation is a good long term low cost strategy to rejuvenate weedy areas and bring them back into production.

Calopo is not suitable as a cover crop in orchards because of its aggressive twining and climbing nature.

WARNING

Pasture plants have the potential to become weeds in certain situations. To prevent that, ensure that pasture seeds and/or vegetative materials are not inadvertently transferred to adjacent properties or road sides.

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PRIMARY INDUSTRY AND FISHERIES

NORTHERN TERRITORY OF AUSTRALIA

Agnote

No. 464
F18
April 1998

CANDLE BUSH

(Senna alata)

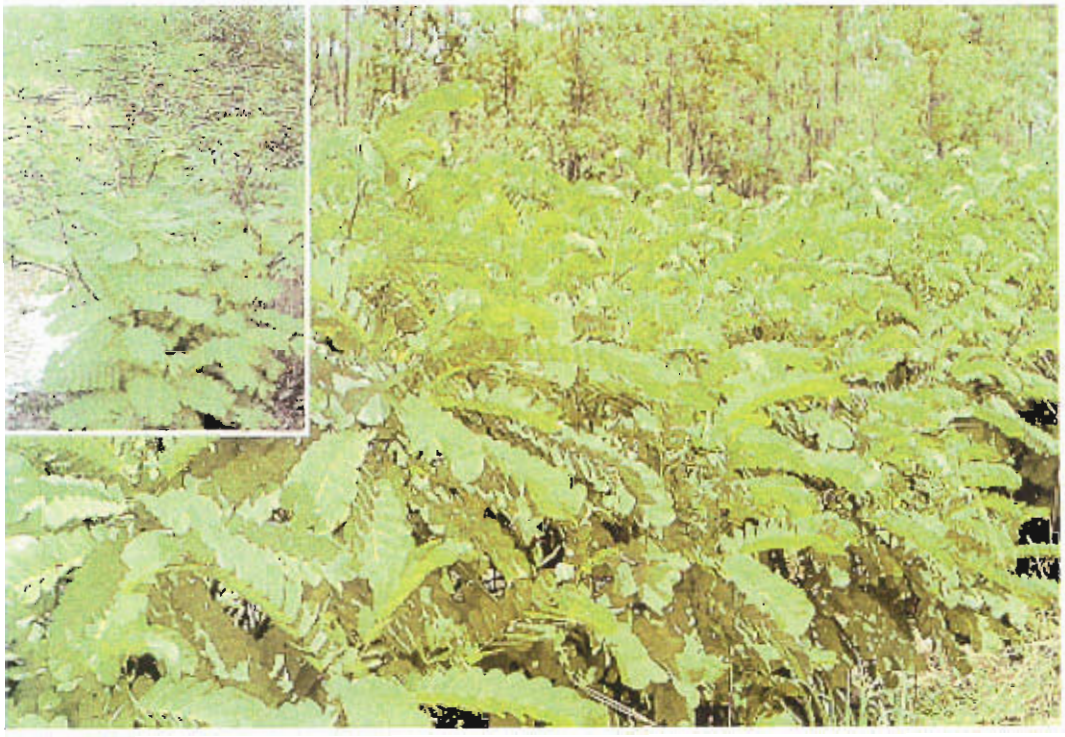
By L.A. Hills, Weeds Branch, Darwin

Family: Caesalpiniaceae
Class of Noxious Weed: B (spread to be controlled - outside of town areas) and C (not to be introduced to the Territory)

DESCRIPTION

Candle bush is a shrubby perennial growing up to 4 m in height. The flowers are a distinctive yellow colour and clustered in vertical spikes. The seed pods are elongate, angular and grow upwards from the stems. They are 15 to 25 cm long, 1.8 cm wide and have two prominent wings extending along their length.

The compound leaves are up to 60 cm long and consist of 8 to 14 pairs of leaflets. The leaflets are large, 5 to 15 cm long and 3 to 18 cm broad, and are rounded at the tips.



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DISTRIBUTION

Candle bush is a native of South America that has now spread throughout the tropics. It is often found on newly cleared land in high rainfall areas, especially on heavier soils with a high water table. It can be found in Australian gardens and has become naturalised in the north. In the Darwin area, candle bush is grown quite commonly as an ornamental plant, but is spreading into bushland.

IMPORTANCE

Candle bush has the capacity to infest cleared land and to spread along creek lines. It is suspected that it is toxic to stock.

The leaves have been reported to have anti-tumour, insecticidal and laxative qualities. Some patients have been reported as developing chronic diarrhoea from over-use of the plant. Other diseases such as ringworm, scabies and ulcers have also been treated by the leaves of the plant in the South Pacific.

RELATED PLANTS

Candle bush a close relative of coffee senna and sicklepod, but can easily be distinguished from these two weeds by using the following characteristics:

Sicklepod (*Senna obtusifolia*) - this weed has 2 to 3 pairs of leaflets, compared with 8 to 14 pairs for candle bush. The seed pods are approximately 12 cm long, slender, round in cross section and curl downwards from the stems.

Coffee senna (*Senna occidentalis*) - this weed has 3 to 5 pairs of leaflets with pointed tips, whereas candle bush leaflets have rounded tips.

CONTROL

Isolated plants can be dug out but it is important to remove the roots. Candle bush has a very strong root system with growing points below the soil surface. If cut at ground level, new shoots quickly appear. Therefore conventional mechanical control methods are not practicable for large infestations. Chemical control methods are available for this weed.

For further information, contact the nearest office of the Department of Primary Industry and Fisheries.

Agnote

No: E3
August 2010

Caribbean Stylo

(Stylosanthes hamata)

A. G. Cameron, Principal Pastures and Extension Agronomist, Darwin

DESCRIPTION

The two cultivars released in Australia are Verano and Amiga, which to the naked eye, are identical in appearance. The main difference between the two is that Amiga produces more perennial plants and more seed than Verano.

Amiga and Verano are annual or a short-lived perennial herbaceous legumes. In the Northern Territory (NT), they behave either as a self-regenerating annual or a biennial plant. Up to 40 percent of plants survive from one wet season to the next. They are is a multi-branched, semi-erect plant that grows to a height of 75 cm.

The stems have short white hairs down one side. The leaves are trifoliate; the leaflets are lanceolate in shape, generally 19 to 37 mm long and 3 to 6 mm wide.

Figure 1. Close up Verano flowers, stems and leaves

The inflorescence consists of a compact head containing eight to 14 small yellow flowers. Flowering commences in February and continues until soil moisture is exhausted. Pods consist of two single-seeded segments, which readily separate. The upper segment, including a slightly curled beak (hook) is 6 to 8 mm long. The lower segment is not hooked. The seeds are small, 2 to 5 mm long, kidney-shaped and medium-brown to dark-brown in colour. There are about 270 000 seeds in 1 kg of pods; without the pods, about 450 000 seeds weigh 1 kg.

The species Caribbean stylo *(S. hamata)* is similar in appearance to the species Townsville stylo (*S. humilis*). The most obvious differences are that Townsville stylo has long bristles (hairs) on its stems and its pods are longer (9 to11 mm) with a longer beak.

CLIMATE AND SOILS

Caribbean stylo is a native of the Caribbean Islands and Tropical Central and South America.

Verano and Amiga are suitable in the Top End of the NT in areas that receive 600 mm or more, average annual rainfall. Amiga is expected to perform in an identical way to Verano north of Katherine. However, south of Katherine, Amiga should perform better than Verano due to its higher perennial plant numbers and higher seed yield.

While both Verano and Amiga are drought-tolerant and can survive long dry seasons, if they are not grazed, they tend to drop their leaves towards the end of the wet season, which is from April to June, when only bare green stems are left standing.

The fallen leaves are susceptible to mould due to dew and out-of-season showers.

Caribbean stylo is well-adapted to a wide range of soil types in the Top End and has grown well on most, except on the heavier clay soils. Verano has grown well on waterlogged, but not flooded soils.

Verano will generally not survive a fire unless there is still moisture in the ground from the wet season. The pasture however, usually regenerates well from seed in the wet season following burning.

Establishment

Verano has been successfully established in drier areas by over-sowing into a burnt area of native pasture. A similar trend is also expected from Amiga.

In the wetter areas of the Top End, establishment has been more successful when seed is sown into a well-prepared seedbed, or into an area that has been disturbed at least once by rough cultivation.

The sowing rate is 2 to 4 kg seed/ha. Caribbean stylo can be inoculated with a special *S. hamata* inoculant to ensure nodulation. However, this has not been necessary in the NT up to now since nodulation occurs naturally in both Verano and Amiga with native soil rhizobia.

MANAGEMENT

Fertiliser Requirements

Although Caribbean stylo can grow and persist on infertile soils, it responds well to phosphorus and sulphur in the Top End, producing high yields.

Generally, superphosphate, or its equivalent, should be sown with the seed at 50 to 150 kg/ha. Maintenance dressings of 25 to 100 kg/ha superphosphate should be applied annually.

Potassium, molybdenum or zinc may be necessary on some soils.

Yield

Dry matter yields up to 10 000 kg/ha and seed yields up to 900 kg/ha have been achieved in the NT.

Where dry matter yields are high (7000 to 10 000 kg/ha), due to high fertiliser use, the quality of standing material is usually reduced because as the pasture lodges during wet weather, the lower leaves rot, leaving a higher proportion of stem material.

Grazing

Caribbean stylo is well accepted by stock where it has received phosphorus. However, where it has not received phosphorus, stock will often avoid it.

Generally, Caribbean stylo should not be grazed in the year of establishment, before it has set seed. This is because the yield in the first year is usually low (2000 to 3000 kg/ha dry matter) and new seed needs time to set to produce a larger mass of pasture.

Heavy grazing is recommended following burning and over-sowing for early establishment to reduce competition from established perennial grasses. This works particularly well with animals which are familiar with *S. hamata* as they will graze it when it is young and green, but animals not familiar to it, will not do so.

If it is not grazed, Caribbean stylo is more likely to behave as an annual plant.

Even after a stand has dropped most of its leaves, it is still well-grazed by stock, including horses, which graze the standing green stems and lick up fallen leaves and seed heads from the ground, as long as they have not become mouldy following dew or rain.

Mixtures

Amiga and Verano can be sown in mixtures with all of the grasses used on upland soils in the Top End of the NT.

Hay

Good quality hay can be made from Caribbean stylo if it is cut early while it is still green and leafy. Later cuts will be of a lower quality because at least some of the leaves will have dropped off.

PESTS AND DISEASES

Both Verano and Amiga are fairly resistant to the fungal disease anthracnose (*Colletotrichum gleosporioides*). In the field, they will show some anthracnose lesions on stems and leaves but it causes no plant deaths.

WARNING

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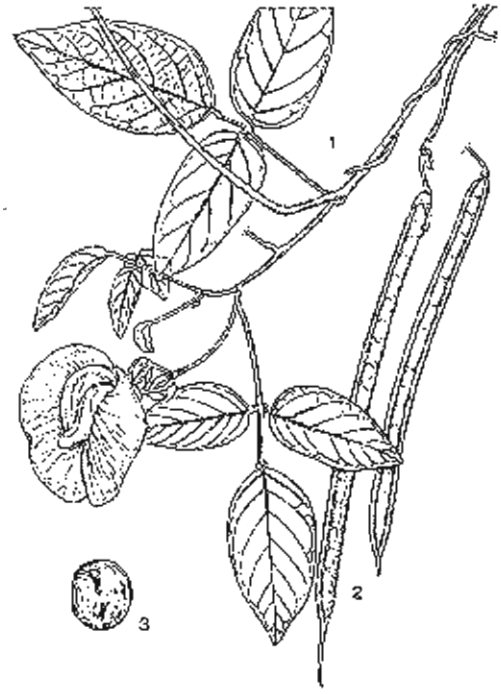
DPI note
Department of Primary Industries QUEENSLAND

Legumes for the Tropics
Centro *(Centrosema pubescens)*

Reproduced with permission from A Guide to Better Pastures for the Tropics and Subtropics *(revised 5th edition 1995) by L.R. Humphreys and I.J. Partridge, published by NSW Agriculture.*



Centrosema pubescens Benth. –
1 flowering branch; 2 fruits; 3 seed.

Key Points

- climbing, twining perennial
- for high rainfall tropical coast
- suitable for medium fertility acid soils
- shade tolerant

Common centro was the foundation of fattening and dairying pastures in the wet tropics. It prefers soils of medium to high fertility, but is fairly tolerant of poorly drained conditions and low pH. It can be sown on alluvial lands subject to short-term flooding.

However, it has now been replaced by species more suited to lower fertility. Centro combines well with tall grasses such as guinea grass, but has also grown satisfactorily with pangola and para grass. While moderately palatable, centro can withstand heavy grazing.

Although it has rarely been successful in areas receiving less than about 1,250 mm of rainfall, centro has a good rooting system and will withstand a long dry season. In lower rainfall areas, siratro is more productive, while in cooler areas it has been displaced by the desmodiums, siratro and glycine.

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Centro has specific rhizobium requirements, and, on poorer soils, it responds well to superphosphate .

Centro seedling growth is slow, and it needs light grazing for the first six months if it is not to be over-run by grasses or weeds. It tolerates shade well, but its use as a cover crop in plantations has been restricted because it will grow up trees and bushes.

Imported seed of common centro is only available at times.

Cv. Belalto has better cool season growth. It also spreads more effectively, and roots more strongly at the nodes, with less tendency to climb. It can be distinguished from common centro by its more slender stems, rounder leaflets and purplish-brown young growth, but locally produced seed is rarely available now.

Cv. Cardillo is a new selection that roots well from the nodes, and hence is much more resistant to grazing. It will combine with signal grass or humidicola, as well as with tussock grasses such as guinea or setaria. It is also compatible with most of the other legumes for this area.

Cardillo is more tolerant of cold and poorer soils than common centro, and can be planted in well drained soils in the wet coastal areas, from the tropics south to Mackay, and in some high-rainfall areas in south-east Queensland.

Further information

- L.R. Humphreys and I.J. Partridge (1995) **'A Guide to Better Pastures for the Tropics and Subtropics'** (revised 5th Edition) published by NSW Agriculture.
- **DPI Call Centre**: phone 13 25 23 (within Queensland)
- **Prime Notes** CD-ROM available from DPI Books, GPO Box 46 Brisbane, Qld 4001or email books@dpi.qld.gov.au
- DPI's Infopest CD-ROM. The Infopest CD-ROM contains current national information on registered agricultural chemicals and is available from: Infopest, DPI, GPO Box 46, Brisbane Qld 4001 or by email from Infopest@dpi.qld.gov.au

Acknowledgment

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NSW Agriculture

Agnote

482

No. F47

March 2002

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Flannel Weed

(Sida cordifolia)

J. L. Pitt, formerly Weeds Branch, Darwin

Family: Malvaceae

Class of Declared Weed: B (spread to be controlled) and
C (not to be introduced to the Territory)

DESCRIPTION

An erect herbaceous shrub growing to a height of about 1 metre. The stem is woody, branching several times and with a well developed tap root. The leaves of *Sida cordifolia* are heart shaped with serrated margins and have a dense covering of hairs which give a light green, felt-like appearance. Flowers are yellow, usually borne in dense clusters at the end of branches. Seed capsules divide into 10 portions and have two fine bristles at one end.

DISTRIBUTION

Originally from tropical America, flannel weed is now widespread in the tropics. In Australia it occurs in the Northern Territory, Queensland, New South Wales and Western Australia.

In the Northern Territory flannel weed is widely distributed throughout the Darwin, Katherine, Gulf and Victoria River districts.

IMPORTANCE

Flannel weed occurs on degraded land and cultivated areas, particularly where improved pastures have been over utilised. It competes with desirable species and the seed may contaminate harvested material.

CONTROL

As it is declared a Class B and C weed, the spread of flannel weed should be controlled and further introduction prevented.

Control of sida species can be achieved by managing stocking rates to maintain pasture cover or by repeated slashing or cultivation. In addition, several herbicides are registered for control of sida in the Northern Territory.

For further information regarding control of sida species, please contact the Weeds Branch of DIPE in Darwin, Jabiru, Borroloola, Timber Creek, Katherine, Tennant Creek or Alice Springs.

Please visit us on our website at www.primaryindustry.nt.gov.au

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Agnote

No: E29
November 2008

Guinea Grass

(A pasture grass for deep, well-drained soils)

A. G. Cameron, Principal Pastures Agronomist and B. Lemcke, Principal Livestock Management Officer, Darwin

DESCRIPTION

Guinea grass (*Panicum maximum*) is a tall perennial grass that forms dense tussocks. Its leaves are broad, flat, and long; they taper to a fine point. The leaf blades and sheaths have soft hairs.

Flowering stalks of taller varieties can reach up to 3 to 4 m in height.

Seeds are small, numbering 2.4 million/kg.

The recommended cultivars for sowing in the Top End are Common Guinea, Coloniao, Hamil and Riversdale.

Common Guinea: It is the most widely planted cultivar in northern Australia. It was introduced before 1900. At Coastal Plains Research Farm, cattle on Common Guinea grass have consistently gained 20 to 30 percent more live-weight than on either Coloniao or Hamil

Coloniao: It was introduced around 1930; it is a very tall cultivar, which is coarser and more vigorous than Hamil.

Hamil: It is a tall cultivar, which is more robust and much coarser in appearance than Common Guinea grass. During the growing season, its performance is equal to, or better than, that of Common Guinea grass. However, it is less palatable in the dry season after it hays off. It was introduced in 1935. It is suitable for making hay.

Figure 1. Guinea grass and the seed hulls of giant panic (1), green panic (2) and Guinea grass (3)

Riversdale: It was selected as a pure and uniform line of Common Guinea grass, which is often contaminated with a weedy, unpalatable coarse Guinea grass.

CLIMATE AND SOILS

Guinea grass is a native of tropical and sub-tropical Africa.

It is suited to areas with an annual rainfall of over 1100 mm, but grows better with higher rainfall.

There is naturalised "Darwin" Guinea grass in the wetter areas around Darwin, along creeks and in low-lying areas. This form of Guinea grass was introduced to Darwin before 1900. It is similar to Common Guinea grass.

Guinea grass adapts to a wide range of soils, but grows best on deep, well-drained soils of medium to high fertility.

It has a deep root system, which allows it to tolerate some drought. However, it does not survive long dry spells.

Guinea grass will persist on deep, well-drained soils, which stay wet longer into the dry season, such as the more fertile levee soils.

SOWING

A well-prepared, weed-free seed-bed is required for good establishment. For best results, the seed should be sown by a combine or a drum seeder, by dropping seed onto the soil surface and rolling.

A seeding rate of 2-6 kg/ha is common. Use the higher rate if weed competition is likely to be strong. Use the lower rate if it is in mixtures with other grasses or legumes.

MANAGEMENT

Fertiliser requirements

Fertiliser requirements have not been studied in the Top End. Types and amounts of fertilisers required will depend on the soil type, rainfall, pasture mix and intended use of the pasture.

Generally, seed should be sown with 100 - 200 kg/ha of super phosphate. Maintenance applications should be 50 - 100 kg/ha, yearly.

Potassium may be required on some soils and for a more intensive production, such as haymaking.

As Guinea grass responds strongly to nitrogen, the fertiliser should be applied to pure grass swards in split applications during the wet season

Grazing

Guinea grass should not be stocked during the wet season of establishment, except in mixtures where the grass is severely out-competing legumes. In such cases, heavy grazing for a short period is recommended.

Try not to graze until well into the first dry season, to allow the plants to establish and set seed. Normal grazing can be started in the mid wet season of the second year.

Guinea grass will withstand heavy stocking, except during the storm period early in the wet season. Hamil in particular will not tolerate continuous grazing early in the wet season. A grazing system which carries more stock during the wet season than during the dry season is recommended. It is better not to graze the tussocks below 15 - 25 cm.

Mixtures

The following legumes can be included in mixtures: Amiga, Verano, Cavalcade, Bundey, Maldonado, Glenn. Siran, Seca, Wynn and Calopo.

Hay

Good quality hay can be made from Guinea grass, particularly from Common Guinea grass and Riversdale.

Tolerance

Guinea grass will tolerate burning and it is extremely tolerant to shading by trees and other pasture species.

PESTS AND DISEASES

Leaf spot (*Bipolaris hawaiiensis*) is often found on leaves during the wet season. There is no evidence that this disease affects production.

Ergot (*Claviceps* sp) can infect seed heads in some years. This disease destroys the seed and can greatly reduce the quality of harvested seed.

ACKNOWLEDGMENT

The authors wish to thank the Westpac Banking Corporation for permission to reproduce Figure 1 from the publication 'Pastures, Legumes and Grasses', Bank of New South Wales, Sydney, 1965.

WARNING

Pasture plants have the potential to become weeds in certain situations. To prevent that, ensure that pasture seeds and/or vegetative material is not inadvertently transferred to adjacent properties or road sides.

For further information please contact your nearest Weeds Branch of the Northern Territory Government by calling (08) 8999 5511.

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Department of Regional Development, Primary Industry, Fisheries and Resources

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Agdex 641

DPI note

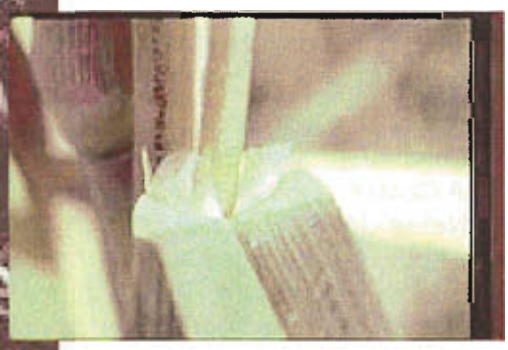
Department of Primary Industries QUEENSLAND

Grader Grass

Themeda quadrivalvis – Poaceae (grass family)

*From **'Crop Weeds of Northern Australia'**, by BJ Wilson, D Hawton and AA Duff*

Mature Plant



Ligule

Occurrence

This grass, a native of India, readily colonises bare, open areas and is a major weed of pastures. Seedlings germinate in large numbers after early wet season rains. It is a major weed in northern Queensland and coastal central Queensland. It is a minor weed in the Burnett region, other parts of central Queensland and in the Northern Territory.

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Seedlings

Early seedling

Late seedling

These are erect with a first leaf about 2.4 mm wide and a distinct purplish-red base. The tillers in older seedlings are flat (in cross-section) and purplish-red at the base only. The ligule is papery and 2-3 mm long in the mature leaf.

Mature plants

Grader grass is a robust annual grass with hairless, cane-like stems, often growing in dense patches to heights of 1-2 m. The leaves are well-spaced, up to about 30 cm long by 4-7 mm wide, with a pronounced keel. The seed heads are up to 60 cm long and branched, interspersed with short leaves. The seeds have bent, brown awns. The general appearance of the plant is similar to that of kangaroo grass *(T. triandra)* but grader grass is usually much taller and more robust.

Further information

- BJ Wilson, D Hawton and AA Duff (1995) '**Crop Weeds of Northern Australia** – identification at seedling and mature stages'; Department of Primary Industries, Queensland Information Series QI95017
- **DPI Call Centre**: phone 13 25 23 (within Queensland)
- **Prime Notes** CD-ROM available from DPI Books, GPO Box 46 Brisbane, Qld 4001 or email books@dpi.qld.gov.au
- DPI's Info**pest** CD-ROM. The Info**pest** CD-ROM contains current national information on registered agricultural chemicals and is available from:
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Agnote

No: E33
November 2003

Hymenachne

A.G. Cameron, Principal Agronomist Pasture Development, Darwin

DESCRIPTION

Two hymenachne varieties are present in the Northern Territory.

Native hymenachne (*Hymenachne acutigluma*) is a native perennial aquatic or semi-aquatic grass. It is a trailing grass and roots at the lower nodes. The stems are thick, and can be over 4 m long, containing 10 or more nodes.

Leaves are 15-30 cm long and 2-3 cm wide. The plant generally has a dark green appearance.

The seed head is a spike 8-10 cm long. Seeds are small (1-2 mm).

Olive hymenachne (*Hymenachne amplexicaulis* cv Olive) is a grass introduced from South America and tested as a species for ponded pastures. Olive hymenachne appears almost identical to native hymenachne, except for shorter and broader leaves.

Olive hymenachne has been declared a Weed of National Significance. It is not recommended for sowing as a pasture in the Northern Territory.

ADAPTION

Native hymenachne is found on the black cracking clay soils in permanent swamps, on the margins of permanent water-holes and on the coastal and sub-coastal riverine plains of the Top End of the NT where flooding occurs for 6-12 months of the year. It has been recorded on the subcoastal plains between the Goyder River in Arnhem Land in the east and the Moyle River in the west, and on Croker Island.

It does not grow in areas where seasonal flooding is shallow, i.e. less than 1 metre, but it has been found growing in thick stands where the height of the wet season flood has reached at least 4 metres above the surface of the plain. In permanent waters it is rooted to the banks above the low water line and the stems float out onto the water. Seasonal variation in water depth increases the density and spread of the plants.

Natural stands normally form a monoculture, completely covering the soil in the dry season.

ESTABLISHMENT

Cuttings

Hymenachne can be planted by dropping cuttings containing 2-3 nodes into water over 10 cm deep, during the wet season.

Because of its ability to spread by runners, hymenachne can be sown or planted in wide spaced (i.e. 5 m) rows and allowed time to fill in the spaces by itself.

Seed

Hymenachne has been successfully established by dropping seed onto shallow water by helicopter or air-boat.

Native hymenachne produces little viable seed. Each seed head contains 500 florets but only 1% of florets produce seed. Regeneration from seed is significant in natural stands where, after big floods, new seedlings can be found from the high water mark down. Seed is difficult to harvest as it produces seed heads and flowers in February/June when flooding prevents access in the NT. Seed has been harvested using a catcher on the front of an airboat and in shallow water by a brush harvester towed by a small tractor. Seed harvest rates are extremely low at approximately 1 g of pure seed per hour.

Sowing rates recommended for native hymenachne are 1 to 2 kg of seed per hectare.

MANAGEMENT

Fertiliser Requirements

Nitrogen and phosphorus fertilisers applied at the beginning of the wet season have not increased dry matter yield or plant content of nitrogen or phosphorus at the end of the wet season. This is because the grasses are only adapted to the more fertile clay floodplain soils.

Nitrogen fertiliser (25-50 kg/ha) can be applied to sparse or newly established stands to promote the number and growth of tillers to increase population density.

Grazing

Hymenachne is a valuable fodder resource for the dry season in coastal areas of the NT. It should be used solely as a dry season feed due to the harmful effects of grazing at other times of the year. Grazing in the late wet-early dry period particularly causes destruction of stands by trampling, puddling and plants being pulled out of the wet soil. The intensity of this type of damage increases towards the edge of the floodplains.

A stocking rate of one beast per 1.5 to 2 ha is recommended as a safe stocking level for hymenachne stands.

Yield

Hymenachne is a very lush plant, containing low levels of dry matter, generally 20 to 47%.

Yields of 2,000-3,500 kg/ha of dry matter can be expected at the end of the wet season for native hymenachne. There is also regrowth following grazing or cutting in the dry season, as hymenachne occupies the deep flooding areas of the floodplains where the water table is close to the soil surface in the dry season.

Quality

Nitrogen contents of whole plants have averaged 2.2 to 3.3% (13.8 to 20.6% crude protein (CP)) in December, 1.8% (11.3% CP) in May and 1.4% (8.8% CP) in September. Up to 4.2% (25% CP) nitrogen has been recorded in leaves of regrowth early in the wet season (September - November).

Phosphorus contents are generally 0.20% or over during the wet season and 0.16% or over during the dry season.

Haymaking

Good quality hay has been made from native hymenachne.

PESTS AND DISEASES

Tar spot (*Phyllachora* spp.) has been recorded on *Hymenachne acutigluma* in the NT. Symptoms are numerous small (1.5 mm) black, shiny raised spots, round to oval in shape. This disease causes little damage and is not important.

The caterpillars of *Marasmia* spp, a leaf roller of rice and other grasses attack both native and Olive hymenachnes. Symptoms are dead and dying leaf tips. A small caterpillar can generally be found in the rolled up leaf.

WARNING

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Agnote

477

No. F25

March 2002

Agdex No: 642

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Hyptis or Horehound

(Hyptis suaveolens)

I. L. Miller and G. C. Schultz, Weeds Branch, Darwin

Family: Lamiaceae

Class of Declared Weed: B (spread to be controlled - all of the Territory) and
C (not to be introduced to the Territory)

DESCRIPTION

Hyptis is an annual or perennial upright branched plant with a characteristic aromatic minty smell, generally growing 1 to 1.5 metres high, but at times reach 2 metres. Under favourable conditions it can act as a perennial plant. Stems are square with opposite leaves which are broader at the base than at the tip, varying from 2.5 to 7 cm long and 1 to 5 cm wide, with serrated margins. Small lavender blue flowers occur in clusters in the leaf axils. Seeds are dark brown to black in colour, shield shaped, 3.5 to 4 mm long and 2.5 to 3 mm wide.

DISTRIBUTION

Hyptis is a native of South America and was first recorded in the Northern Territory by the explorer Leichhardt in about 1845. It is now widespread in the Darwin, Katherine, Gulf and Victoria River Districts. This weed is continuing to invade through natural spread and is a contaminant in hay, on livestock, clothing, native animals and vehicles. Isolated infestations have been found as far south as Barrow Creek.

As hyptis is unpalatable to most types of livestock, it has the ability to take over improved and native pastures, especially when overgrazed, forming dense thickets. it will grow on most soil types, except those which become waterlogged. It favours disturbed areas such as roadside and overgrazed areas around cattle yards. It is resistant to fire.

RELATED PLANTS

Hyptis is related to knobweed (*Hyptis capitata*) and lion's tail (*Leonotis nepetifolia*). Knobweed can be distinguished from hyptis by its white spherical flower head (1.5 cm diameter) on 5 cm stalks. Lion's tail flowers are orange and in large spiky flower heads 5 to 6 cm in diameter.

CONTROL

Small new infestations on clean properties should be removed manually and all plant material burnt prior to seeding. Slashing will help new pastures compete. Chemical control is available and investigations are continuing on the biological control of hyptis. For further information please contact your nearest Weeds Branch of the Department of Infrastructure, Planing and Environment at Darwin, Katherine, Borroloola, Timber Creek, Tennant Creek and Alice Springs, or call (08) 8999 5511.

Please visit us on our website at www.primaryindustry.nt.gov.au

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Agnote

No: E8

November 2006

Kent Gamba Grass

A. G. Cameron, Principal Agronomist Pasture Development and B. Lemcke, Principal Livestock Management Officer, Darwin

INTRODUCTION

While gamba grass can be a beneficial pasture plant on pastoral properties, it is difficult to manage for this purpose.

There are legitimate concerns that this grass may create management problems if it spreads from sown paddocks into non-grazing land.

DPIFM does not support new sowings of gamba grass.

DESCRIPTION

Gamba grass (*Andropogon gayanus* cv Kent) is a tall perennial grass which forms large dense tussocks up to 70 cm in diameter.

Leaf blades are long, linear, up to 45 cm long and 1.5 to 3 cm wide, with a strong white midrib. Leaves are pubescent (covered with fine soft hairs).

Foliage height can be up to 180 cm in un-grazed, well fertilised swards. Flowering stems are erect and up to 4 m high.

The "seed" consists of a hairy spikelet, which gives it a fluffy appearance. There are approximately 450 000 seeds/kg. The caryopses contained in the "seed" are small, 2-3 mm long, 1 mm wide, about 890 000 per kg, light brown to brownish black in colour.

CLIMATE AND SOILS

Gamba grass is a native of tropical Africa and is adapted to areas with a 3-6 month dry season and an annual rainfall of over 600 mm.

Kent will grow on most soils of the Top End, except those which are flooded. It is particularly suited to gravel type upland soils where other grasses find it hard to persist.

MANAGEMENT

Fertiliser requirements: Requirements have not been studied in the Top End. Types and amounts of fertilisers required will depend on soil type, rainfall, pasture mix and intended use of the pasture.

Generally, maintenance applications of superphosphate should be 50-100 kg/ha yearly. Potassium may also be required on some soils, particularly with more intensive use, such as haymaking.

Gamba grass will respond to split applications of nitrogen during the wet season, producing yields similar to pangola grass.

Yield: Dry matter yield of up to 15 t/ha have been recorded in the Top End, in un-grazed pastures.

Grazing: Kent is highly palatable to livestock. It is a species which requires grazing management. It should only be used where there is good control of grazing, and where stock numbers can be effectively varied.

Gamba grass is particularly valuable early in the wet season due to its ability to grow green feed rapidly in response to early rainfall. However, stocking rates should not be high enough to reduce new shoot growth.

Once the wet season is well established Gamba grass is valuable as long as it is kept short; 60 - 90 cm appears to be the ideal height range. It may need heavy stocking rates of four to five animals/ha in the January-March period or heavier rates of "crash" grazing over shorter periods, to keep the grass at no more than 1 metre high through the wet season. Once the grass becomes tall, mature and coarse at the end of the wet season, cattle tend to leave it and concentrate on green shoots from smaller clumps. Problems with mustering can be experienced as cattle and buffalo quickly become "rogues" if the grass is allowed to grow taller than the animals.

As Kent is tolerant of burning, fire can be used to rejuvenate paddocks to remove tall rank dry growth, after storms early in the wet season.

Gamba grass does not provide good feed once it is dry except for green shoots and stocking rates should be reduced to less than one animal/ha from mid dry season until the next wet season. More effective dry season utilisation of standing dry matter may be obtained using lick blocks containing a urea/molasses/mineral mix.

Mixtures: Legumes which can be included in mixtures are Seca, Amiga, Verano and Wynn.

Pests and diseases: None have been identified which affect the production of Kent in the NT.

Bushfires: Because of its height and dry matter yield, Gamba grass which has not been heavily grazed during the wet season presents a high fire danger. Effective firebreaks should be put around Gamba paddocks.

WARNING

Pasture plants have the potential to become weeds in certain situations. To prevent that, ensure that pasture seeds and/or vegetative materials are not inadvertently transferred to adjacent properties or road sides.

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Department of Primary Industry, Fisheries and Mines

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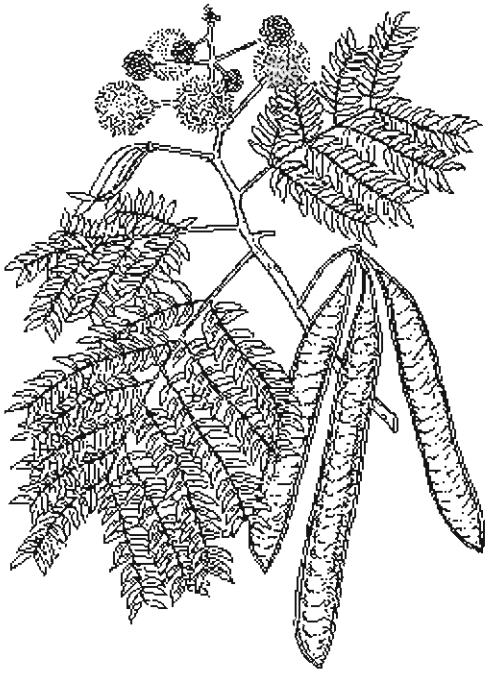
DPI note
Department of Primary Industries QUEENSLAND

Legumes for the Tropics and Subtropics

Leucaena *(Leucaena leucocephala)*

Reproduced with permission from A Guide to Better Pastures for the Tropics and Subtropics *(revised 5th edition 1995) by L.R. Humphreys and I.J. Partridge, published by NSW Agriculture.*



Leucaena leucocephala (Lamk) de Wit - flowering and fruiting branch

Key Points

- perennial shrub legume
- deep-rooted anddrought-tolerant
- for well-drained soils in warm regions
- more than 750 mm of annual rainfall.
- highest digestibility of tropical legumes
- high mimosine content.

Leucaena has the highest quality feed of any tropical legume, and the potential to produce the highest high weight gains. Steers can gain 300 kg of live weight in a year with adequate leucaena, and irrigated leuceana in the Ord River has produced over 1000 kg of LWG per ha per year.

Leucaena is best suited to deep well-drained fertile soils of neutral to high pH; its deep root allows it to produce new leaf after shallow-rooted grasses have run out of moisture. Its leaf is not frost-tolerant, but its height protects it from ground frosts.

Since 1980s, leucaena has been attacked by the psyllid insect (Heteropsylla cubense) especially in hot humid conditions. As a result, the main regions for leucaena are now in drier inland Queensland, often on fertile brigalow soils where some tens of thousands of hectares have been sown.

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Hard seed must be treated with hot water (80oC for 4 minutes or boiling water for 4 seconds); seed must be inoculated with specific rhizobium, and can be pelleted with lime for acid soils.

In the dry regions, leucaena is planted as a crop 2-4 cm deep in a fully cultivated seed-bed in rows 5-9 metres apart. The inter-row area is kept cultivated and weed-free for the first year as the legume seedlings are very susceptible to competition. Nitrogen-loving grasses (green panic, Bambatsi panic and Callide rhodes) can be sown in the second year.

Leucaena is usually rotationally grazed because it is so palatable, or grazing is deferred over summer to provide highquality feed in autumn. The young leaflets of leucaena contain an alkaloid, mimosine. With abundant leucaena in the diet, excessive mimosine causes loss of weight and hair. CSIRO researchers isolated a rumen microbe that can break down mimosine, or its product (DHP), and this should be introduced to stock eating vigorous stands of the legume.

The main cultivars are Peru and Cunningham, with Cunningham being slightly more vigorous, but a new cultivar Tarramba is claimed to be more productive and will grow under cooler conditions.

Plant breeders are crossing Leucaena leucocephala and other Leucaena species to develop psyllid-resistant and more cold-tolerant varieties. However, their feed quality is lower than that of *leucocephala*, and weight gain of steers may be better on leucaena affected by psyllids than on the hybrids.

Naturalised leucaena is considered an environmental weed where it has formed thickets. Planted leucaena should be managed to reduce flowering and seeding. Patches of dense seedlings should be grazed or slashed.

Die back of leucaena from a root fungus has been experienced in the Ord; die-back has also occurred in central Queensland but the cause of this is not yet known.

Further information

- L.R. Humphreys and I.J. Partridge (1995) **'A Guide to Better Pastures for the Tropics and Subtropics'** (revised 5th Edition) published by NSW Agriculture.
- **DPI Call Centre**: phone 13 25 23 (within Queensland)
- **Prime Notes** CD-ROM available from DPI Books, GPO Box 46 Brisbane, Qld 4001or email books@dpi.qld.gov.au
- DPI's Info**pest** CD-ROM. The Info**pest** CD-ROM contains current national information on registered agricultural chemicals and is available from: Info**pest**, DPI, GPO Box 46, Brisbane Qld 4001 or by email from infopest@dpi.qld.gov.au

Acknowledgment

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NSW Agriculture

Agnote

466

No. F2

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Mimosa or Giant Sensitive Plant

(Mimosa pigra)

I. L. Miller and S. E. Pickering, Weeds Branch, Darwin

Family: Mimosaceae

Class of Declared Weed: A (to be eradicated - south of 14°S latitude);
B (spread to be controlled - north of 13°S latitude) and
C (not to be introduced to the Territory)

DESCRIPTION

Mimosa grows as a single prickly stem when young, and when mature is a branched prickly bush reaching a height of up to 6 metres. Stem prickles are 5 to 10 mm long. Leaves are bipinnate, consisting of a central prickly rachis 20 to 25 cm long with up to 16 pairs of pinnae 5 cm long, each divided into pairs of leaflets 3 to 8 mm long. Leaves are sensitive and fold up when touched and at nightfall.

Flower heads are round fluffy balls consisting of up to 100 small pink to mauve coloured flowers. Each flower head produces a cluster of 10 to 20 seed pods, 6 to 8 cm long. The pods turn brown when mature and break into segments, each containing an oblong shaped seed, 4 to 5 mm x 2 mm in size. Hairs on the segments allow them to float on water and stick to hair or clothing, hence aiding in dispersal. The plant forms aerial roots when it is growing in standing water.

DISTRIBUTION

Mimosa is a native of Mexico, Central and South America. It is believed to have been introduced to the Northern Territory before the 1890s. Up until the late 1950s mimosa populations seemed stable and not very invasive, as the plant had not reached its favoured habitat - the open floodplains. Since then, however, mimosa has spread rapidly, particularly since the mid 1970s. It is now one of the worst weeds of the Top End, infesting land from near the Fitzmaurice River in the west to Arnhem Land, and it is still spreading. It has the potential to colonise all the wetlands of tropical Australia.

IMPORTANCE

Mimosa forms dense thickets, making areas inaccessible to animals and man and smothering pastures. It is a menace to pastoralists and farmers as it is found in damp places, beside billabongs and along river banks, blocking off access to irrigation and stock watering points. Mimosa can move from these to drier areas. Mustering buffalo and cattle is difficult in paddocks heavily infested with mimosa.

Mimosa is a particularly invasive plant. It displaces native vegetation and animals from large areas of land, seriously affecting conservation, tourism and traditional use of wetlands by Aboriginal people.

RELATED PLANTS

Mimosa pigra is closely related to *Mimosa pudica* (common sensitive plant) which is also a declared noxious weed in the Northern Territory. *Mimosa pigra* can be distinguished by its larger size, erect, woody growth habit, large pods (6 to 8 cm long as opposed to 2.5 cm long) and by having 6 to 15 pairs of pinnae per leaf as opposed to one to two pairs.

Mimosa is often confused with *Leucaena leucocephala* (coffee bush), *Aeschynomene* spp. and *Sesbania* spp. Mimosa can be distinguished from those plants by its sensitive leaves, prickles and mauve flowers.

CONTROL

The spread of mimosa must be controlled. You can assist by not removing soil or sand from areas where infestations are known to occur and by not driving off-road through infested areas. Machinery used in mimosa areas must be thoroughly cleaned before moving it to clean areas.

Small mimosa plants can be killed by hand pulling or by grubbing them out with a mattock, making sure to leave the roots clear of the soil. Larger infestations should be treated with a registered herbicide. Regular follow-up applications of herbicide are required because mimosa seeds can survive for long periods in the soil. The residue should be mechanically cleared and burnt, and pastures planted to help control seedlings. Pastures should not be overgrazed as this may allow for re-invasion by mimosa. Alternatively the area cleared can be left to allow for re-establishment of native flora.

To augment mechanical and chemical measures, the Department of Business, Industry and Resource Development is collaborating with CSIRO on a biological control program for mimosa. To date, nine insects have been released including seed feeders, a foliage feeder, stem borers and flower feeders. Two plant pathogens have been released.

For further information please contact your nearest Weeds Branch of the Department of Infrastructure, Planing and Environment at Darwin, Katherine, Borroloola, Timber Creek, Tennant Creek and Alice Springs, or call (08) 8999 5511.

Please visit us on our website at www.primaryindustry.nt.gov.au

Published: Thursday 16 August 2001.

CHARACTERISTICS TO DISTINGUISH BETWEEN SOME PRICKLY BUSHES

Plant	Mimosa (*Mimosa pigra*)	Needle Bush (*Acacia farnesiana*)	Parkinsonia (*Parkinsonia aculeata*)	Prickly Acacia (*Acacia nilotica*)	Mesquite (*Prosopis limensis*)
Pod shape	Up to 8 cm long, thin strap like and curved with constrictions between seeds; pods breaking into individual segments when mature	Cigar shaped, up to 6 cm long and slightly curved	Up to 10 cm long, long thin constrictions between seeds; straight	Up to 25 cm long, necklace like, with deep constrictions between seeds	Up to 20 cm long, slight constrictions between seeds; straight or slightly curved
Pod Colour	Green when immature; brown and hairy at maturity	Brown to black; no hairs	Straw coloured pod; no hairs	Blue-grey, fine hairs	Straw coloured, sometimes purple; no hairs
Leaves	Leaves fernlike and sensitive to touch; six to 14 pairs of leaves with gap in between leaves	Leaves fernlike; two to four pairs of leaves with a gap between leaves	Leaves with long flattened leaf stalk with tiny oblong leaflets along each side	Leaves fernlike; four to 10 pairs of leaves, often overlapping	Leaves fernlike; two to five pairs of leaves, often with a gap between leaves
Leaflets	20 to 42 pairs of leaflets	8 to 18 pairs of leaflets	Small tree or shrub usually to 5 m tall	10 to 25 pairs of leaflets	10 to 15 pairs of leaflets
Tree Shape	Erect shrub to 6 m; often multistemmed	Usually rounded shrub to 3 m tall	Small tree or shrub usually to 5 m tall	Spreading three to 10 m tall	Variable shape, usually a spreading tree to 15 m tall
Bark	Brown; smooth	Bark grey with prominent white spots	Bark smooth and green; straw coloured and lightly textured at base of older trees	Bark on saplings has tinge of orange and/or green. Mature trees have dark rough bark	Bark rough, grey; smooth dark red or green on small branches
Branch Shape	More or less straight; gently curving	Branches zigzag shaped	Branches slightly zigzagged	Branches more or less straight	Branches zigzag shape

NORTHERN TERRITORY OF AUSTRALIA

PRIMARY INDUSTRY AND FISHERIES

Agnote

No. 453
F38
April 1998

MISSION GRASS

(Pennisetum polystachion)

By L.A. Hills, Weeds Branch, Darwin

Family: Poaceae
Class of Noxious Weed: B (spread to be controlled - all of the Territory) and C (not to be introduced to the Territory)

Mission grass is a large, tough, perennial, bunched grass. The grass is not creeping but forms a loose dump. The stems are slender and fairly straight, sometimes rooting at the lower nodes and are up to 3 m long. The leaf blades are simple, elongate blades 5 to 45 cm long, 5 to 18 mm wide and smooth to hairy. Flower heads appear in the early dry season and are a dense spike, purple tinge, yellow - brown, 5 to 26 cm long and 1.3 to 2.6 cm wide. Bristles are hairy on the lower half making them ideal for dispersal by wind, and on animals and vehicles. Flowering to seed maturity can occur in 14 days.

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DISTRIBUTION

Mission grass is native to tropical Africa and rarely extends beyond latitude 23°N and 23°S. It is now considered a weed of several countries including India, Thailand and Fiji. Mission grass was introduced into Australia for testing as a pasture species. It was first noticed in the Darwin area in the early 1970s and has since spread throughout the Darwin rural area and along the major roads. It occurs at Nabarlek in Arnhem Land and has been found in Katherine.

IMPORTANCE

This perennial grass readily competes with native annual species and occupies disturbed areas along roads. By remaining green until the late dry season, this grass provides fuel for much hotter fires than would otherwise occur at that time of year. Elsewhere burning is known to promote its establishment, and in the NT it is of concern to conservation authorities. In Fiji it is used as a pasture, but may sometimes become dominant in hilly former forest lands that do not support livestock.

RELATED WEEDS

There are three other closely related species of *Pennisetum in the NT.*

Pennisetum glaucum (Pearl millet): annual, culms robust, panicle cylindric, stiff and very dense. Grown as a cultivated crop.

Pennisetum pedicellatum: annual, up to 1 m in height with fluffy white to purple flower heads, often dominant on disturbed land.

Pennisetum purpureum (elephant grass): perennial, large, with cane-like stems 4-8 m high, leaves long, flower heads yellow, tinged with purple.

CONTROL

This weed can be controlled by the appropriate application of herbicides. For further information contact the Weeds Branch of the Department of Primary Industry and Fisheries.

Agdex 642

DPI note

Department of Primary Industries QUEENSLAND

Paddy's lucerne

(Sida rhombifolia) (Malvaceae - cotton family)

*From **'Crop Weeds of Northern Australia'**, by BJ Wilson, D Hawton and AA Duff*

Mature plant

Early seedling

Occurrence

There are several species of Sida and two species of Malvastrum, which are often confused.

Paddy's lucerne *(S. rhombifolia)*, a native species, is a major weed in northern Queensland and in the Northern Territory, a moderate to major weed in central Queensland, a moderate weed on the Western Downs and in the Burnett region, a minor to moderate weed in the Moreton region and a minor weed on the Darling Downs. Paddy's lucerne is also known as sida retusa and common sida.

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Late seedling

Seedlings

Paddy's lucerne seed leaves are broadly elliptic to egg-shaped about 9.5 mm long by 9 mm wide at the two true-leaf stage, on stalks about 3 mm long. The first true leaf is almost diamond-shaped and toothed except close to the base. Subsequent leaves are elliptic to diamond-shaped.

The following is a guide to distinguishing the species at about the five- to ten-leaf stage shown in the photographs:

1 Leaves circular to broadly egg-shaped	2
1 Leaves broadly elliptic or elliptic to diamond- or egg-shaped	3
2 Leaves greyish-green, stems and leaf stalks covered in dense fine white hairs	Flannel weed
2 Leaves bright green, stems and leaf stalks may have hairs but not very short or very dense	Prickly malvastrum
3 Leaves with very few or no hairs, yellowish-green, pointed tips	Spiny-headed sida
3 Leaves pale colour underneath due to dense hairs	4
4 Leaves not serrated towards the base, tips tend to be blunt, dull green colour	Paddy's lucerne
4 Leaves serrated right to the base, tips tend to be pointed, yellowish-green	Spiny sida

Mature plants

Paddy's lucerne is a erect perennial with tough stems, brownish-green bark and a strong taproot, usually 0.6-1.0 m tall. The leaves are alternate, dark green above, greyish-green beneath, irregularly diamond-shaped, toothed on the edges close to the tip, 1.5-8.5 cm long and 0.6-4 cm wide, with stalks 3-10 mm long with two slender rabbit's ear-like appendages (stipules) at the base. The flowers are pale yellow, borne singly in the leaf forks on slender stalks, 1-2.5 cm long. The fruits separate into nine to twelve parts arranged in a circle enclosed by the papery, persistent flower cup (calyx). Each part has two sharp points at the top.

The sidas and malvastrums can be distinguished as follows:

1 Bracts 5-10 mm long at the base of the flower/seed capsule cup (the bracts are obvious leaf-life structures below the leaf-life components that form a cup around the flower or seeds) - Malvastrums	2
1 No bracts at the base of the flower or seed head cup - Sidas	3
2 Flowers/seed capsules usually grouped to form a short dense spike, leaves are hairy on top and very hairy underneath, seed capsules about 4-5 mm diameter	Spiked malvastrum
2 Flowers/seed capsules are single (no obvious flower spike although flowers sometimes clustered), leaves are sparsely hairy, seed capsules about 7 mm diameter	Prickly malvastrum
3 Leaves and stems obviously covered in dense, fine, white hairs	Flannel weed
3 Leaves and stems not evenly and obviously hairy	4
4 Leaf tip blunt, stalk of the flower/seed capsule 1-3 cm long with a single flower/seed capsule	Paddy's lucerne
4 Leaf tip pointed or nearly so, stalk of the flower/seed capsule 0.2-0.6 cm long with a cluster of flowers/seed capsules, usually two to five	5
5 Leaves with no hairs or sparsely hairy, usually a characteristic yellowish-green	Spiny-headed sida
5 Leaves with sparse hairs on top, densely hairy underneath. Note: there are several other species of sidas that will be found as weeds in crops.	Spiny sida

Agnote

No: E30
December 2008

Para Grass

(A pasture grass for wet and flooded soils)

A. G. Cameron, Principal Pastures Agronomist and B. Lemcke, Principal Livestock Management Officer, Darwin

DESCRIPTION

Para grass (*Brachiaria mutica*) is a coarse, vigorous, trailing perennial which is useful for wet and flooded soils in the higher rainfall areas of the Top End of the Northern Territory (NT).

It has stout runners (stems, stolons) which branch and root readily at all nodes. The runners grow up to 5 m long, but the sward grows only to a height of 1 m. Leaves and leaf sheaths are generally hairy; leaves are 6-20 cm long and 1-2 cm wide. The seeds are small, numbering about 935 000/kg.

CLIMATE AND SOILS

Para grass is a native of tropical Africa and South America. It was introduced into Australia in 1880, and into the NT between 1905 and 1910.

It prefers annual rainfall of more than 1000 mm.

There are naturalised areas of a "local" Para grass in the Top End of the NT, including at Oenpelli, Labelle Station and wet and low-lying areas around Darwin, including the Narrows, Winnellie and the Botanical Gardens. The 'local' Para grass does not produce viable seed and must be planted with cuttings.

Para grass will grow on a range of soil types, including solodic and cracking clays, but its adaptability to a range of water conditions is its most important characteristic. It is adapted to wet conditions, water-logging and prolonged flooding. It is suitable for shallow, flooded areas, provided the depth of water does not exceed 1 m. It is also very drought hardy and can survive long dry spells.

It is only recommended for wet or seasonally flooded areas in the Top End. Areas need to stay wet until June for Para grass to persist.

ESTABLISHMENT

Seed

Para grass can be sown by seed at 1-2 kg/ha. However, seed is expensive, germination is low and small seedlings can be killed by flooding. For good establishment, seed must be sown into a well-prepared weed-free seedbed and lightly rolled. Sowing should be in early to mid December to allow germination and growth before floods occur. Freshly-harvested seed has a low germination rate because of seed dormancy. Germination improves after six to eight months.

Sowing Para grass by seed has generally not been successful in the NT.

Cuttings

Establishment has been mostly with cuttings, containing two to three nodes, with at least one node being buried.

Para grass requires protection from excessive weed competition. A well-prepared seedbed is therefore an advantage.

Cuttings are generally planted in mud or shallow water (up to 15 cm). Planting occurs in January and February, depending on rainfall. Cuttings should be planted on a square grid at 2-4 m intervals.

MANAGEMENT

Fertiliser requirements

Para grass pastures are generally not provided with fertiliser on fertile clay floodplain soils. However, they need fertiliser on less fertile soils, at least initially.

Para grass is very responsive to nitrogen (N) fertilisers. An application of N in the first season is useful to improve establishment and help young plants to overcome weed competition.

N fertiliser gives increased yields. However, the greatest returns are achieved at lower levels of fertiliser use (100-200 kg N/ha). But crude protein content is not increased at this rate of N application.

The application of phosphate fertilisers by themselves has not been shown to increase dry matter content of Para grass.

Yield

Dry matter yield of 4-7 t/ha has been achieved in pastures with no N application. Yields of 10-15 t/ha have been achieved when 100-200 kg/ha N fertiliser was used early in the wet season.

Seed yield of 11-27 kg/ha has been achieved in the Top End in May.

Grazing

As Para grass is very palatable, grazing of new plantings should be delayed until the cuttings are well rooted and well developed. It is desirable not to graze the pasture in the first year because early grazing results in the pulling out and destruction of cuttings. It generally takes 12 months for a stand to develop properly.

Para grass is normally used during the dry season as saved fodder. Allowing animals onto ground which is too wet can damage the stand through pugging.

Para grass should be regarded as a browse grass. Grazing should be controlled to prevent excessive damage to runners. With light stocking, animals eat only the leaves. With heavy stocking, stems are destroyed to the crown or roots, which results in a very slow recovery. Para grass can withstand heavy grazing while the soil moisture is high and the plants are actively growing. Under normal conditions it will not stand continuous grazing.

A stocking rate of one animal/1.5-2 ha is recommended as a safe stocking rate for Para grass.

Mixtures

The following legumes may be included in mixtures: Glenn, Lee, Murray phasey bean, Cavalcade, Bundey and Maldonado.

Ponding

Banks can be constructed to create artificial ponds to store runoff water to grow Para grass in areas where rainfall is too low, or to extend the growth period in other areas. Para grass can be planted in ponded areas as they dry out, thus extending planting until July. The legumes Glenn, Lee and Murray are more suitable in ponds.

Other

Para grass is tolerant of soil salinity. It will withstand flooding for a number of weeks provided some green material is above the water surface. Stands of Para grass can thin out if flooded, grazed, cut very short or burnt.

A hot fire can make Para grass vulnerable to drought, overgrazing or flooding. Stands can be dramatically thinned and regeneration is very slow after a hot fire. Therefore, it should not be burnt.

PESTS AND DISEASES

None have been identified which affect production in the NT.

WARNING

Pasture plants have the potential to become weeds in certain situations. To prevent that, ensure that pasture seeds and/or vegetative material is not inadvertently transferred to adjacent properties or road sides.

For further information please contact your nearest Weeds Branch of the Northern Territory Government on (08) 8999 5511.

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DPI note
Department of Primary Industries QUEENSLAND

Red Natal Grass

Melinis repens – Poaceae (grass family)

*From **'Crop Weeds of Northern Australia'**, by BJ Wilson, D Hawton and AA Duff*

Mature plant

Ligule

Occurrence

This summer-growing, perennial grass is a native of tropical Africa. It is a major weed in northern Queensland, moderately important in the Moreton region and the Northern Territory, minor to moderately important in central Queensland and minor on the Western Downs.

Seedlings

Early seedling

Late seedling

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These are erect, hairy and have dark-coloured veins on the leaf sheaths. The first leaf is about 1.5 mm wide and the ligule is a rim of long hairs. When compared with summer grass (*Digitaria ciliaris*), which grows in similar situations, seedlings of red natal are more erect and do not have papery ligules.

Mature plants

Red natal grass is an annual or perennial grass, up to 1 m tall, with erect, slender stems which often root at the lower nodes forming rather open tussocks. The leaves and stems are a bluish-green, sometimes with purple blotches. The leaves are 5-30 cm long and 2-10 mm wide, tapering towards the tip. The inflorescence is spreading and branching (a panicle) and is 5-20 cm long by 2-10 cm wide, with a general fluffy appearance and of a distinct pink to red colour. The 'seeds' are covered with long, silky, red or pink hairs and are 2.5-6 mm long.

Further information

- BJ Wilson, D Hawton and AA Duff (1995) '**Crop Weeds of Northern Australia** – identification at seedling and mature stages'; Department of Primary Industries, Queensland Information Series QI95017
- **DPI Call Centre**: phone 13 25 23 (within Queensland)
- **Prime Notes** CD-ROM available from DPI Books, GPO Box 46 Brisbane, Qld 4001 or email books@dpi.qld.gov.au
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Natural Resources and Environment

Agriculture Notes

Phalaris

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This note describes phalaris - the pasture grass - and cultivars of it in common use. It outlines establishment and management options, and discusses phalaris poisoning problems.

Phalaris (*Phalaris aquatica*, previously *Phalaris tuberosa*) is a winter-growing perennial grass with short rhizomes (underground stems which produce new tillers) and erect stems. The species is native to the Mediterranean region and is well suited to Victoria as pasture for sheep and cattle.

In most regions phalaris is dormant over summer. It will tolerate heavy grazing once established. If managed correctly phalaris is a productive, palatable and persistent pasture grass. There are no plant diseases that have a major effect on phalaris. Winter-active cultivars of phalaris, such as Sirosa and Holdfast, spread their crown less than cultivar Australian.

In Victoria, phalaris is the second most widely sown perennial grass, playing an increasingly important role in controlling soil erosion and stabilising water tables. It is our most drought tolerant pasture grass and is suited to many areas where the summer is too hot for perennial ryegrass to persist.

Soil type

Phalaris is tolerant of moderate levels of salinity. It withstands waterlogging and is suited to a wide range of soil types. Phalaris grows best on heavy textured, fertile soils. It is more sensitive to soil acidity than perennial ryegrass, tall fescue and cocksfoot. It is difficult for phalaris to establish and persist on highly acid soil except where the sub soil is only mildly acid. Soil testing to 60 cm depth, where acidity is likely to be a concern, is an important step when planning pasture establishment. Phalaris is poorly suited to highly acid soil where the pH test in calcium chloride is less than 4.2. Aluminium toxicity can limit root development. Such situations may be encountered, for example, on some granitic soils in Northern Victoria or on deep acid sand in Western Victoria for example. The use of lime will help overcome this limitation. Landmaster (acid tolerant) and Australian (spreading ability) are the most useful cultivars to use where establishment is required on strongly acid soil.

Phalaris poisoning

Phalaris is an extremely valuable species. Occasionally however some toxicity problems are experienced. A number of toxic alkaloids are associated with phalaris poisoning which may occur in sheep, and very occasionally in cattle. There are two syndromes, phalaris nervous syndrome/phalaris staggers, and phalaris sudden death syndrome.

Phalaris staggers develops gradually and is caused by the ingestion of methylated tryptamine and beta-carboline alkaloids - which can be found in all cultivars. In the chronic disease, phalaris staggers, persistence of the signs, tremors, head nodding, incoordination, collapse and an inability to keep legs straight, may be observed in sheep. These may persist for several weeks after the sheep are removed from the pasture. With cattle signs include difficulty in chewing/swallowing, protruding tongue and some drooling of saliva. Hind limbs may be weak. Sometimes they may become excited and crash through fences. Phalaris staggers does not occur regularly in most districts of Victoria.

Sudden death syndrome has two forms: The heart failure/cardiovascular form may be associated with phenylethylamine compounds. Relatively few animals in a flock are affected. It is usually precipitated when the sheep become excited, eg. at mustering. Collapse, have breathing trouble and often die on the spot. The Polioencephalomalacia form is the more common. It often is linked to animals having been deprived of food for short periods, and then – within two days - put on short sparse phalaris that is stressed (by lack of moisture/light/frost) but has recently had a fresh shoot of growth. Hundreds of sheep have died in some instances of this form. Awareness and careful management can avoid the circumstances that lead to this form of sudden death syndrome.

Through careful management phalaris poisoning can be largely avoided. Across the state, the benefits gained from phalaris pasture far outweigh the losses from phalaris poisoning. Removing stock from the paddock is generally sufficient to avoid the temporary problem of phalaris poisoning/pasture toxicity. All phalaris cultivars can cause poisoning; newer cultivars are less of a problem.

Like many pasture plants and weeds of pasture, phalaris can accumulate high concentrations of nitrates and hydrocyanic acid. In some circumstances they may also cause stock losses.

Establishment

Establishing the cultivars, Australian or Uneta is especially difficult because of their slow seedling growth and their intolerance of competition from other sown and weed species. The newer winter-active cultivars have more vigorous seedlings. Thorough planning and preparation is always vital for achieving good establishment of pasture.

Autumn sowing is best in regions receiving less than 600 mm of rain per year. Early spring sowing in higher rainfall areas avoids the cold wet winter and competition from annual weeds and gives excellent results. If sowing cultivar Australian or Uneta, spring sowing is much the preferred option.

Phalaris can be established using conventional methods, direct drilling or aerial seeding. Direct drilling is the preferred method because there is less weed competition. Depth of sowing should be very shallow - no more than 15 mm. Aerial seeding is only appropriate on steep non-arable areas where winter and spring rainfall is reliable.

Phalaris is sown at 1-3 kg/ha. Where a mixture of phalaris and perennial ryegrass is sown, the ryegrass seed rate should be limited to 2-3 kg/ha.

Management of a phalaris pasture in its first year is absolutely critical. Some grazing in winter should encourage more tillers per plant. Once tillers begin reproductive development grazing is best kept to a minimum until the autumn after sowing. This will enable roots and basal buds to develop. Buds develop at the base of each reproductive tiller. Buds are carbohydrate storage organs and are vital for survival over summer and vigorous growth in the following autumn-winter.

Grazing hard too soon after sowing is a common cause of poor establishment in situations where good sowing practice resulted in an excellent strike.

A phalaris pasture takes two to three years to reach its peak. During this time, conservative stocking over winter and mid spring, adequate and appropriate fertiliser application, and the control of annual weeds can all contribute towards the successful establishment of what should then become an extremely long-term productive pasture.

Management

Environmental conditions, and the management of phalaris over October-December, affect its persistence over summer and its production in the following year. Phalaris seed heads start to elongate within the plant stalks in September-October. At this time, new buds start to develop at the base of the stalk. Survival of the buds over summer ensures the resurgence of the grass in the next season. The number and size of the buds influences future herbage yield. If seasonal conditions favour growth, and if the management of the plant allow the seedhead to fully develop and mature, the buds will be large and exhibit a high level of dormancy. Only in autumn, when soil temperature falls and as soil moisture levels increase, will the bud great its dormancy and initiate new season's growth. If subsequent conditions then remain favourable for growth, the new tiller will grow and survive.

Where the seedhead does not fully develop and produce mature seed, basal buds will be smaller and have a lower level of dormancy. Low dormancy means summer rain may break it; tillers that commence growth in summer are likely to die young as hot dry conditions set in.

The cultivars, Holdfast, Sirosa, Sirolan, and Australian are the most likely to grow after rain in summer - rather than cv. Atlas PG that is more summer dormant.

Once phalaris is well established, closer grazing will be needed during spring and early summer to prevent it becoming rank and unpalatable. Spelling phalaris pasture for 6-8 weeks during winter increases the density of the phalaris. In drier areas (400-550 mm mean annual rainfall) grazing pressure in spring should be adjusted to permit head development.

Hard grazing just before stem elongation starts is often a good means to reduce weeds. In cooler districts hay and silage can be made from phalaris pasture in spring once the seedhead emerges.

Cultivars

Plant breeders in CSIRO have especially improved Phalaris cultivars by concentrating on reducing alkaloids, and on increasing seedling vigour, winter growth and seed retention. The most recent releases are as follows:

Holdfast

Holdfast is the preferred cultivar for most purposes. It is similar to the previously available Sirosa cultivar. These cultivars have excellent seedling vigour, winter growth and persistence. Rotational grazing is needed to capture the yield potential and longevity of winter-active cultivars. Use in 450-800 mm/year rainfall areas.

Uneta

Uneta is a semi winter-active cultivar similar to the previously available Australian cultivar. Both give less winter growth than other cultivars. They are suited to continuous stocking. They have a prostrate growth habit and broad crown. These cultivars have poor seedling vigour, good persistence and represent a higher risk of phalaris poisoning.

Atlas PG

Like the previously available Sirolan cultivar, Atlas PG is suited to short growing season areas but it is more summer dormant than Sirolan. An erect growth habit. Use in 400-650 mm/year rainfall areas.

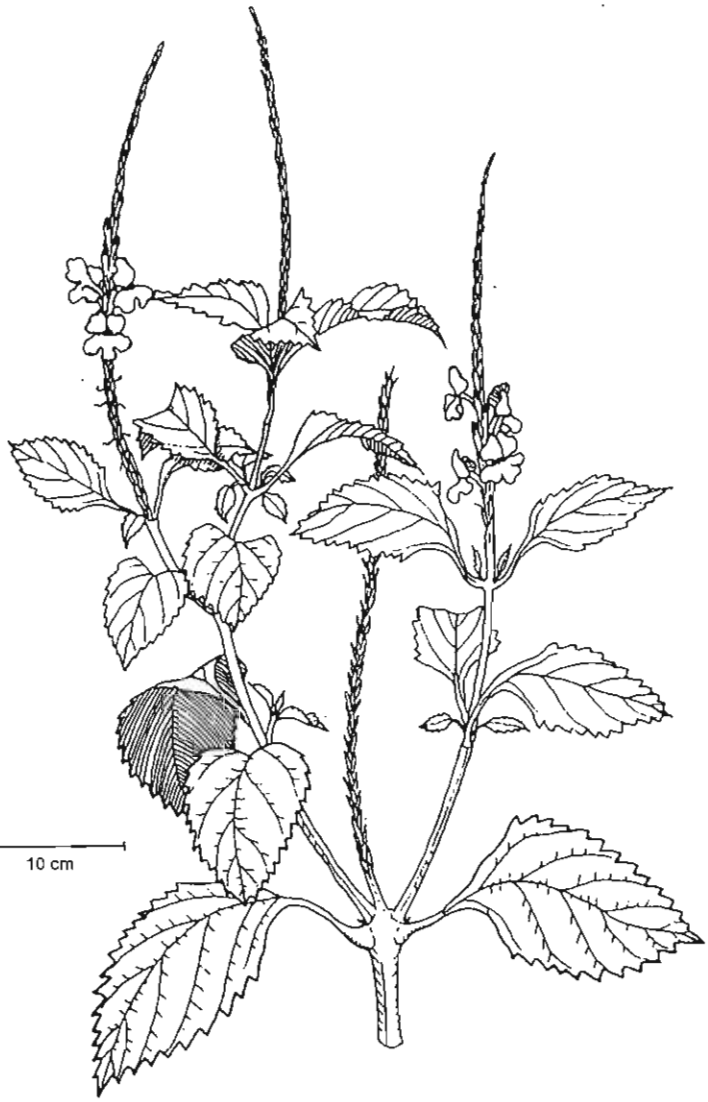
Landmaster

Landmaster is the most tolerant phalaris cultivar for the more acid soils. It has intermediate seedling vigour.

DNR facts
Queensland Government
Department of Natural Resources
pest series

Snakeweed and its control

Stachytarpheta spp



Description

Snakeweeds also known as Porter weeds (*Stachytarpheta spp.)* are all clumping perennial plants, with rather tough, branched stems and woody roots. Four snakeweeds are found in Queensland varying in flower colour and leaf shape - some hybridisation has also been reported.

Leaves are in pairs along the stem. They are 10cm long and are more or less oval shaped, either toothed or untoothed along the edges and usually tapering at the base into a short stalk.

The flowers are borne on stiff spikes are 25 cm long. These spikes are slightly curved rather than straight.

Flower colour varies with the species from white to pale blue, light blue, dark blue to purple and pink to red. Each flower is a slender 0.5 cm wide tube opening into five petals.

The lower part of the flower is sunk into a depression in the flower stalk. A pointed bract protects the point where the flower joins the spike. The distinctive 'snake skin' appearance of the flower spike develops as the flowers dry and fall as the seeds develop beneath the 'scale'.

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Distribution and habitat

Snakeweeds are native to the tropical Americas, and 8 species have become weeds in tropical areas around the pacific. They were introduced as garden plants from where they have spread and become a serious weed along coastal Queensland.

Different species favour different environments:

- dark blue snakeweed is most common in the wetter coastal areas of the north Queensland, seldom found inland
- light blue snakeweed is hardier and grows in sandy soils
- pink snake weed is found only in the wet cool area around Kuranda and Atherton Tableland areas.

Snakeweeds are weeds of roadsides, neglected areas and pastures as well as sugar cane.

Problem

Snakeweed becomes a problem when ground cover is eliminated or reduced. In pastures, it is a definite indication of overstocking. Snakeweed is usually only seen when pasture is grazed down to ground level, becoming most evident in November-January.

Soil disturbance such as tree clearing can allow snakeweed to invade.

Control

Chemical control

2,4-D amine is the only herbicide registered for control of snakeweed in non-agricultural land (see table). Note it is only effective actively growing plants. Spraying in summer is most effective.

Management strategies

Snakeweed, like most other weeds, becomes a problem only when pastures are overgrazed. If an area has become open to snakeweed infestation, the following plan is recommended:

- destock paddocks where snakeweed is a problem
- Slash snakeweed before it reaches seed set or
- Spray plants with 2,4-D amine (see table). For best results spray:
  - light blue snakeweed at the seedling stage
  - dark blue, cayenne or pink snakeweeds when mature but actively growing
- If you are unable to slash the infestation before seeding or spray when actively growing, wait for the plants to die back and seed to drop, then slash.
- Promote pasture growth; native pasture is usually not competitive enough once snakeweed has established itself; improved pasture grasses may have to be sown.
- When pasture grasses are reestablished, snakeweed will eventually be sufficiently suppressed to cease being a problem; but until then follow-up slashing or spraying before seeding will be required.
- Reintroduce stock only to the carrying capacity of the land - do not overstock or the snakeweed problem will reoccur.

Species description

- Dark blue snakeweed (*Stachytarpheta urticifolia*) has a smooth stem and soft leaves with a lumpy or rough surface. The leaves have strongly toothed edges and pointed tips and are similar to lantana. The flowers are dark blue to purple.
- Cayenne snakeweed (*Stachytarpheta cayennensis)* has stems and leaves similar to the dark blue snakeweed, but the flowers are pale blue to white.
- Pink snakeweed *(Stachytarpheta mutabilis)* looks very similar to a giant version of dark blue snakeweed growing to 2m or more. Leaves are very similar to the dark blue snakeweeds, but bigger and the flowers are bigger and bright pink to red.
- Light blue snakeweed *(Stachytarpheta jamaicensis)* has smooth stems. The leaves are very different to other snakeweeds, making it difficult to recognize until flowering. The leaves are leathery with a waxy smooth surface with a rounded tip and the edges are finely toothed. The flowers are pale blue to blue.
- *Stachytarpheta dichotoma* is found in the Northern Territory and closely resembles light blue snakeweed but has rough hairy stems.

Further information

Is available from Land Protection Officers, Department of Natural Resources 1800 803 788 (local call) or 07 3227 7111 (Brisbane) can provide the telephone number for your nearest office.

Brochure partly funded by Rural Lands Protection Fund.

TABLE 1 - HERBICIDES REGISTERED FOR THE CONTROL OF SNAKEWEED

Situation	Chemical	Rate	Comments
Land - non-agricultural	2,4-D amine (various trade names)	2.2l/ha 22ml/10L to cover 100m^2	Seedlings or young stages only

Agnote

No: F44
March 2002

Spinyhead Sida

(Sida acuta)

J.L. Pitt, formerly Weeds Branch, Darwin

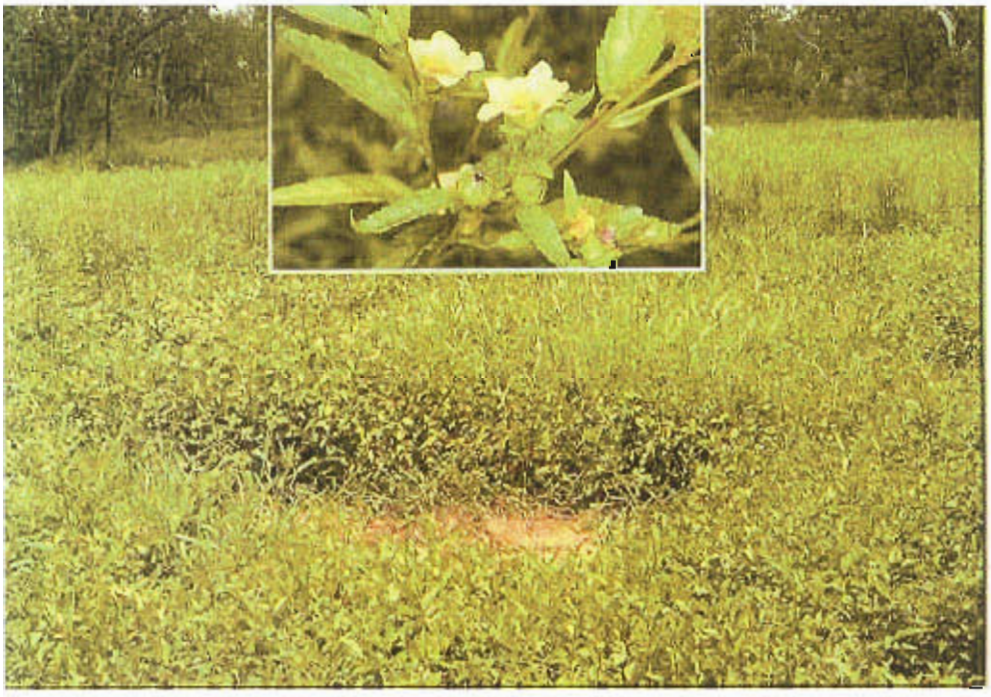
Family: Malvaceae
Class of Declared Weed: B (spread to be controlled - all of the Territory) and C (not to be introduced to the Territory)

DESCRIPTION

Spinyhead sida is an erect annual or perennial shrub, usually growing to a height of about 1 metre. The stems are woody, branching several times, and there is a well developed tap root. The leaves are lance-shaped (tapered at both ends) with serrated margins. The flowers are yellow, usually solitary or growing in pairs in the leaf axils. Seed capsules divide into five to eight portions, each of which has two sharp points approximately 1.5 mm long at one end.

DISTRIBUTION

A native of Central America, spinyhead sida has spread throughout the tropics and sub-tropics in the Pacific, Asia, Africa and Australia. In Australia, spinyhead sida is widespread in the higher rainfall areas from Brisbane in Queensland to the Ord River region of Western Australia. In the Northern Territory it is common in the Darwin, Katherine, Gulf and Victoria River regions.



IMPORTANCE

Probably introduced late last century by the Chinese who made brooms from its fibrous stems, spinyhead sida has become a common weed of degraded land and cultivated areas. It competes with desirable species and the seed may contaminate harvested material.

RELATED PLANTS

Two other sida species, flannel weed (*Sida cordifolia*) (see Agnote F47), and Paddy's lucerne (*Sida rhombifolia*), (see Agnote F46) are declared Class B and C weeds in the Northern Territory. They can be distinguished from spinyhead sida in the following ways:

- Flannel weed is a taller plant. Its stems and leaves have a felt-like appearance and its leaves are lighter in colour and broader than those of spinyhead sida. The flowers are produced in clusters and the seed capsules divide into 10 segments. The two sharp points or awns on the end of each seed segment are longer than those of spinyhead sida.

- Paddy's lucerne has leaves in which the under surface is paler in colour than the upper surface, whereas the leaves of spinyhead sida are dark green on both sides. Paddy's lucerne produces pale yellow flowers which grow singly on stalks 1.0 to 3.5 cm long. The flowers of spinyhead sida are on stalks 0.3 to 0.8 cm long. The seed capsules of Paddy's lucerne also divide into 10 segments, each segment having two blunt points.

CONTROL

As a Class B and Class C weed, the introduction of spinyhead sida must be prevented and its spread controlled.

Control of spinyhead sida can be achieved by managing stocking rates to maintain a dense pasture cover. It can be controlled by repeated slashing or cultivation. In addition, several herbicides are registered for control of sida in the Northern Territory.

A biological control agent, *Calligrapha pantherina*, has been introduced to augment control of spinyhead sida and Paddy's lucerne. This beetle feeds on the leaves, flowers and growing tips.

For further information regarding control of spinyhead sida, please contact the Weeds Branch of DIPE in Darwin, Jabiru, Borroloola, Timber Creek, Katherine, Tennant Creek or Alice Springs.

Please visit us at our website:

www.nt.gov.au/dpifm

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Agnote

No: E31
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Tully

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DESCRIPTION

Tully koronivia grass (*Brachiaria humidicola* cv Tully) is a strong creeping perennial which roots vigorously from lower nodes and forms a dense matted sward.

Leaf blades are 12-15 cm long, expanded, rounded at the base, lanceolate and tapering to an acute point. They are 8-10 mm wide. Flowering stems are erect, and up to 60 cm high.

The seed is similar to that of signal grass. There are 200,000 seeds per kilogram.

CLIMATE AND SOILS

Tully grass is a native of East and Southeast tropical Africa and has been widely used in Fiji. Koronivia is the Fijian name.

It is suitable for areas receiving more than 1,000 mm average annual rainfall.

Tully is adapted to the same environments as signal grass, but is more tolerant of poor drainage. Its growing season is more compressed into the wet season than signal grass but will grow longer into the dry season than pangola grass.

There are suggestions that Tully tolerates lower soil phosphorus levels than signal grass. It will remain productive under heavy grazing without being fertilised.

ESTABLISHMENT

Tully establishes readily from either cuttings or seed. Minimum standards for seed are 40% pure seed and 15% germination.

A well-prepared, weed-free seedbed is preferred to ensure good establishment. Seed should be sown by combine or drum seeder and lightly rolled. Sow as early as possible in the wet season on good soil moisture and when there is a likelihood of follow up rain.

Tully has been successfully sown by combine into a dry seedbed when follow up rain has been within one week of sowing.

Seed can be sown at 2-6 kg/ha. The higher rates should be used if weed competition is likely to be strong. While Tully is slow to establish because of native grass and weed competition or if a low seeding rate is used and it is

not well fertilised, many sowings have produced good stands by the end of their second wet season after a poor first year.

MANAGEMENT

Fertiliser Requirements

Tully is very responsive to applied fertilisers, particularly nitrogen.

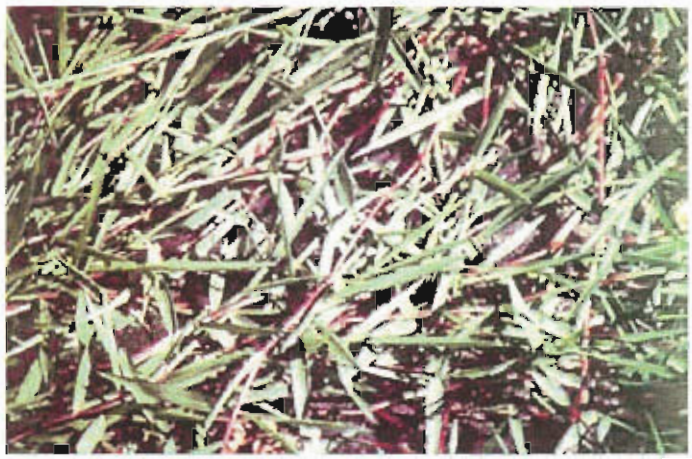
Annual forage yield and quality are similar to those of signal grass, that is 4-6 t/ha dry matter without nitrogen fertiliser and over 12 t/ha dry matter with 100-200 kg nitrogen fertiliser. It produces more herbage during the wet season than signal grass.

Sow seed, or plant cuttings or runners with 100-200 kg/ha of superphosphate and apply maintenance dressings of 50-100 kg/ha yearly.

Potassium may be required on some soils and with more intensive use, such as areas where hay is regularly cut.

Grazing

Heavy grazing for a short period in February or March during the wet season of establishment, promotes the production of runners. The stand can be lightly grazed during the first dry season.



It can tolerate heavy wet season grazing on poorly drained soils where signal grass and Guinea grass will not persist.

Animal acceptability of Tully can vary for no apparent reason. Tully is more readily grazed by cattle and buffalo if it is fertilised with a small dressing of nitrogen fertiliser i.e. 25-50 kg/ha. Acceptance is best when it is well grazed and short rather than tall, rank and hayed off.

Horses vary greatly in their acceptance of Tully as green feed or hay. Some horses graze green feed and/or hay readily while others will eat green feed only, hay only or neither.

At a stocking rate of one yearling steer per hectare, annual live-weight gains of 100-120 kg per head can be expected.

Mixtures

Tully's vigorous and dense habit makes it difficult for weeds or legumes to grow with it. While palatable legumes tend to be selectively grazed in preference to Tully, Glenn, Amiga, Verano and Wynn may be suitable.

PESTS AND DISEASES

In the Darwin area, Tully has disappeared in patches up to 10 metres in diameter in apparently healthy pastures. These patches normally occur during the late dry season under high grazing pressure, particularly from horses. The most likely cause of these patches are larvae of a root eating curl grub (cockchafer or cane grub *Lepidiota* sp). The grubs can be found eating roots on healthy plants bordering the killed area.

There have been no other pests or diseases observed to cause economic problems.

WARNING

Pasture plants have the potential to become weeds in certain situations. To prevent that, ensure that pasture seeds and/or vegetative materials are not inadvertently transferred to adjacent properties or road sides.

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www.nt.gov.au/dpifm

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