Agnote

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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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.
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.

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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 curved 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. humata) 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 to 11 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. humata 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 gloeosporioides). In the field, they will show some anthracnose lesions on stems and leaves but it causes no plant deaths.

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Legumes for the Tropics
Centro (Centrosema pubescens)


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

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

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.
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


- 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 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

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Agnote

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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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.

**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 superphosphate. 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 hawaiensis*) 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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Grader Grass
*Themeda quadrivalvis* – Poaceae (grass family)

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

Mature Plant

**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.
Seedlings

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 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

Acknowledgement

This DPI Note was prepared by Client Information Services with the support of the CropLink program of DPI’s Farming Systems Institute.
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.

ADAPTATION

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 acutiloba 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 drying leaf tips. A small caterpillar can generally be found in the rolled up leaf.

WARNING
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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.

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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 caryopse 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.
Legumes for the Tropics and Subtropics
Leucaena (*Leucaena leucocephala*)


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

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

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 liveweight 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 (*Heteropsyila 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.
Hard seed must be treated with hot water (80°C 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**
- 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 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

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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, Planning 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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### CHARACTERISTICS TO DISTINGUISH BETWEEN SOME PRICKLY BUSHES

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

MISSION GRASS
(Pennisetum polystachion)

By L.A. Hills, Weeds Branch, Darwin

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.
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.

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Paddy’s lucerne
(Sida rhombifolia) (Malvaceae - cotton family)

From ‘Crop Weeds of Northern Australia’, by BJ Wilson, D Hawton and AA Duff

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.
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 |
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.

Please visit us at our website:

www.nt.gov.au/d

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Red Natal Grass
*Melinis repens* – Poaceae (grass family)

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

**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](image1)

![Late seedling](image2)
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 Q195017
- 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 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

**Acknowledgement**

This DPI Note was prepared by Client Information Services with the support of the CropLink program of DPI’s Farming Systems Institute.
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 granite 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 nervos 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 seeding 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.
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'.
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 harder and grows in sandy soils
- pink snakeweed 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 recur.

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.

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<thead>
<tr>
<th>TABLE 1 - HERBICIDES REGISTERED FOR THE CONTROL OF SNAKEWEED</th>
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<td><strong>Situation</strong></td>
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<td>Land - non-agricultural</td>
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IMPORTANT: always read the label before using any pesticide. All chemicals MUST be used strictly in accordance with the registered label for the product. While every care is taken to ensure the accuracy of the information in this fact sheet, the Department of Natural Resources does not invite reliance upon it, nor accept responsibility for any loss or damage caused by actions based on it.
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
A.G. Cameron, Principal Agronomist Pasture Development and B. Lemcke, Principal Livestock Management Officer, Darwin

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 *Lepidota* 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.

Please visit us at our website:

**www.nt.gov.au/dpifm**

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