

## Tropical Forages

# *Desmanthus leptophyllus*

### Scientific name



*Desmanthus leptophyllus* Kunth

**Note:** Turner (1950) regarded *Desmanthus virgatus* as an all-encompassing species, comprising *D. virgatus*, *D. pubescens*, *D. pernambucanus*, *D. glandulosus* and *D. leptophyllus*. Despite taxonomic revision by Luckow (1993) that resolved the complex to distinct species, many authors continued to refer to all species as *D. virgatus* in the literature until the late 1990s. Correct nomenclature is now generally used.

### Synonyms

None listed in GRIN

### Family/tribe

Family: *Fabaceae* (alt. *Leguminosae*)

subfamily: *Caesalpinioideae* (mimosoid clade\*) tribe: *Mimoseae*.

\* Azani, N. et al. [97 authors from 54 institutions] 2017. A new subfamily classification of the Leguminosae based on a taxonomically comprehensive phylogeny. *Taxon* **66**: 44–77.

### Morphological description

Erect (rarely prostrate or decumbent) shrub to 3 m tall, woody at the base and generally strongly branched. Young stems green and hairless, angular with golden corky ridges. Older stems hairless, shiny red or brown. Stipules persistent, 3–10 mm long, setiform. Leaf paribipinnate, 4–11 cm long, petiole 3–14 mm long, rachis 11–52 mm long, glabrate; pinnae 4–8 pairs 16–39 mm long, a sessile, elliptical or orbicular, crateriform or flattened nectary 0.9–2.0 mm long inserted between the lowest pair, nectaries rare between upper pinnae; pinnules 16–36 pairs, nearly sessile, 2–6 (–8) mm long, 0.5–1.0 (–1.6) mm wide, narrowly linear, sometimes falcate, square-oblique basally, acute to attenuate apically, glabrous, finely ciliate margin. Capitulum (flower head) 0.5–0.9 cm long, borne singly in leaf axils on peduncles 0.8–2.7 cm long; heads containing 5–12 flowers that may be perfect, functionally male or sterile; sterile flowers usually absent, 1–2 basally when present; male flowers 0–7, towards the base of the head above the sterile flowers, but below the perfect flowers; perfect flowers, 1–11 occur apically. Fruiting peduncles 1.0–3.3 cm long bearing 1–9 pods. Pods (2.2–) 5.5–8.8 cm long and (2.5–) 3.2–4.0 (–4.9) mm wide, linear, recurved, tip usually attenuate to form a short beak to 3 mm long, rarely acute, dehiscent along both sutures; valves chartaceous, convex, glabrous or rarely sparsely pubescent, somewhat wrinkled with raised reticulate veins; red or reddish green when immature, reddish-brown to nearly black at maturity. Seeds 9–27 per pod, (2.1–) 2.4–2.9 (–3.1) mm long, (1.4–) 1.7– 2.4 (–2.7) mm



Erect (rarely prostrate or decumbent) shrub (cv. Bayamo)



Early flowering CPI 82286, Eritrea



Later flowering CPI 92809, Eritrea



Large ecotype, CPI 38351, pre-flowering



CPI 38351, with developing pods



Prostrate form, NARI, Eritrea (CPI 65947)



Leaves 4–8 pairs of pinnae, 16–36 pairs of pinnules (CPI 92809)



Capitula (flower heads) borne singly in leaf axils (CPI 82285/cv. Bayamo)



Pods with short beak (CPI 92746)



Inflorescence, flowers and pods of (from left or top) *Desmanthus pubescens* cv Uman, *Desmanthus leptophyllus* cv Bayamo, and *Desmanthus virgatus* cv Marc

wide, flattened, ovate, reddish- or golden-brown; 188,000–252,000 seeds/kg.

### Similar species

***Desmanthus leptophyllus***: erect (rarely prostrate or decumbent) shrub 0.4–3 m tall; petioles of mature leaves 3–14 mm long; pinnae 4–8 pairs (nectary between lowermost pair); pinnules 16–36 pairs.

***Desmanthus glandulosus***: erect or occasionally decumbent perennial herb to 0.7 m tall; petiole of mature leaves 4–10 mm long; pinnae 3–6 pairs (multiple nectaries common); pinnules 14–26 pairs.

***Desmanthus pernambucanus***: erect to decumbent perennial herbs/subshrubs, mostly 0.5–2 m tall; petioles of mature leaves 6–16 mm long; pinnae 2–4 pairs (nectary between lowermost pair); pinnules 9–21 pairs.

***Desmanthus virgatus***: prostrate, decumbent or erect subshrubs, typically to 1.5 m tall; petioles of mature leaves 1–5 mm long; pinnae 2–5 pairs (nectary between lowermost pair); pinnules 11–23 pairs.



Seeds



cv. Progardes with buffel grass, Central Qld Australia



Selective leaf browsing by goats, Western Lowlands, Eritrea



Established plants and seedlings of cv. Bayamo in an area regularly grazed by many classes of livestock, NARI, Eritrea

## Common names

**English**: desmanthus (Australia); slenderleaf bundleflower (USA)

**Latin America**: malicia de bode (Brazil); desmanto (generic for *Desmanthus*, Puerto Rico); frijolillo (Nicaragua); gashe chico, guashillo (Mexico); urpa micuna (Peru)

## Distribution

### Native:

**Northern America**: Mexico (Campeche, Chiapas, Guerrero, Mexico, Michoacán, Oaxaca, Puebla, Quintana Roo, Tabasco, Veracruz, Yucatán)

**Caribbean**: Cuba; Dominican Republic; Grenada; Guadeloupe; Haiti; Jamaica; Martinique; Netherlands Antilles Curacao; Puerto Rico; Trinidad and Tobago (Trinidad); Virgin Islands (British); Virgin Islands (U.S.)

**Central America**: Belize; Costa Rica; El Salvador; Guatemala; Honduras; Nicaragua; Panama

**South America**: Brazil (Bahia, Ceará, Minas Gerais); Colombia; Ecuador (Esmeraldas); Peru (Piura, San Martín); Venezuela

### Naturalized:

**Australia** (Northern Territory, Queensland); **USA** (Florida)

## Uses/applications

### Forage

Grazed by herbivores in the native range. Exotic component of improved permanent pastures in northern Australia, and protein banks and hedgerows in south-east Asia. Has potential as a long-term (>3 years) phase legume in cropping systems, although the stand should be harvested as necessary to reduce seedset. This species is a prolific seeder and could be a serious weed in a cropping system.

### Environment

Like *D. bicornutus*, *D. leptophyllus* has high anti-methanogenic potential when grazed/browsed by ruminants. Care should be taken to minimise seeding if this species is to be used as an erosion-reducing hedgerow to avoid ingress into the interrow.

### Other

Some genotypes of *D. leptophyllus* could be used as protein bank hedgerows around fencelines, the variety selected depending on the height required.

## Ecology

Occurs naturally in coastal thickets, roadsides and marshes on sandy, rocky limestone and saline soils at altitudes of sea level to 1,500 m.

## Soil requirements

While Luckow (1993) notes that *D. leptophyllus* occurs in marshes and saline soils, none of the accessions in the Australian collection is recorded as being collected in such situations. They were collected from largely well-drained soils with textures from gravels through sands to loams and clays, and pH ranging from (4.5–) 6.0 to 7.5 (–8.5). *Ex situ*, varieties have been primarily selected for persistence and productivity on heavy clays of neutral to alkaline pH. However, this should not preclude assessing this species on a wider range of soil.

## Moisture

*D. leptophyllus* accessions in the Australian forage genebank were collected in regions with average annual rainfall from (300–) 800 to 1,500 (–2,300) mm. While selection in Australia has focused on areas of 550–1,000 mm average rainfall, there are obviously genotypes that are adapted to more humid environments.

## Temperature

Primarily a species of lowland, humid-tropical locations with average annual temperature ranging from 22 to 28 °C and with only minor monthly fluctuations in temperature. It is reasonably cold tolerant however, and has been successfully evaluated in subtropical climates. Although defoliated by heavy frosts, it will regrow from crowns once there is sufficient heat and moisture.

## Light

Best growth with full light or open shade.

## Reproductive development

Flowering and fruiting occurs predominantly throughout autumn and to a lesser extent, in spring.

## Defoliation

Tolerant of regular cutting and grazing by ruminants. Some types can set up a strong crown at the base when heavily grazed or severely cut back, while others die if well-developed plants are cut very low.

## Fire

Will regrow from the crown after moderate fire. Fire can be useful in breaking seed dormancy. Germination of two accessions was increased from <10% to 40–75% after being subjected to temperatures of 60–100 °C (= temperatures that seed buried at 0.5–3.0 cm are subjected to during grass fires).

## Agronomy

Guidelines for establishment and management of sown forages.

## Establishment

Fresh seed is extremely hard-seeded and should be scarified, either abrasively (*e.g.* using a rice polisher) or by hot water treatment (4–10 seconds in boiling water), to raise the germination to a minimum of 50–70%. It is important to achieve good establishment from the plant crop as seed produced from paddock plants will remain hard-seeded for 5–6 years. Freshly scarified seed should be sown at 2 kg/ha or more to a depth of 0.5–2.0 cm into moist soil, with at least 50–60 cm depth of good moist soil to ensure establishment. Deeper planting depths may prevent or delay emergence. Surface broadcasting onto a well-prepared seed-bed, followed by rolling, or sowing using specialised equipment such as the "crocodile seeder" have also given good results. *D. leptophyllus* has been sown successfully into cultivated strips, and sod-seeded into slashed pasture treated with glyphosate to suppress grass growth.

## Fertilizer

Responses to S, Mo, P, Cu and Mn have been obtained. Sulfur deficiency is not uncommon on basalt-derived soils. A critical leaf tissue concentration of 0.2% S is required for optimum productivity. Highest DM yields in *Desmanthus* spp. were achieved in P-deficient soils with the addition of 50 kg/ha P in Maharashtra, India, and 35 kg/ha P in Texas, USA. Higher rates of P-fertilizer decreased DM yields at both sites.

## Compatibility (with other species)

Its deep-rooted habit enables it to be grown with stoloniferous grasses. In northern Australia, plant crops of cv. Bayamo generally persist strongly in buffel grass (*Cenchrus ciliaris*) and other tropical grass pastures, but long term persistence is commonly poor in sub-tropical environments due to low seed production in this late-flowering cultivar and the extreme hardseededness of seed that is produced. *Ex situ*, it has formed productive mixtures when sown into native pastures of *Heteropogon contortus* and *Dichanthium sericeum*.

## Companion species

Grasses: *Cenchrus ciliaris*, *Dichanthium sericeum*, *Panicum coloratum* var. *makarikariense*.

Legumes: *Medicago sativa* in the subtropics.

## Pests and diseases

Occasional, minor damage by psyllid insects (*Acizzia* sp., Psyllidae) has been reported in northern Australia. The psyllids cause more

serious damage in seed crops. Seed-eating bruchid beetles (5 *Acanthoscelides* spp. and one *Stator* sp., Bruchidae) are known to infest *Desmanthus*. No other reports of serious pests and diseases.

### Ability to spread

Being late flowering and producing only limited seed, 'Bayamo' does not generally spread under grazing. Early seeding cultivars capable of moderate to high seed production ensure longer-term persistence in grazed pastures, particularly in the subtropics. Recruitment from seed in grass-legume pastures will not occur until hardseededness has been overcome by weathering. In the absence of fire, this will require several seasons to occur. Grass fires can soften seed of *D. leptophyllus*. Success depends on the intensity of the fire and the depth of seed in the soil.

### Weed potential

Has become a weed of disturbed areas in humid-tropical and subtropical environments due to its high seed production and erect, woody habit. While not currently listed as a major weed, it has been placed on the weed-watch program in NSW, Australia.

## Feeding value

### Nutritive value

Evaluations generally do not distinguish between species of *Desmanthus*, and are based on cvs. Marc, Bayamo and Uman. Crude protein content of the entire plant ranged from 10.5 to 15.5%, with leaves averaging 22.4% and stems 7.1%. A study of 18 accessions grown in India reported an average CP content of 21% (range 15–27%), and average NDF and ADF contents were 42 and 35%, respectively.

*In sacco* digestibility of leaves of CPI 38351 was 51% after 48 hrs and 77% after 96 hrs.

### Palatability/acceptability

Palatable to grazing ruminants and grazed by beef cattle throughout the growing season. *Desmanthus* has been observed to be less palatable than leucaena (*Leucaena leucocephala*) but more readily eaten than *Stylosanthes scabra* cv. Seca. Accession CPI 38351 was similar to *D. virgatus* Q9153, being more palatable than other *Desmanthus* accessions.

### Toxicity

No toxicities to ruminant livestock were reported in the literature. *Desmanthus* spp. do not cause bloat in ruminants because they contain 2–3% (of total DM as tannic acid equivalent) condensed tannins.

## Production potential

### Dry matter

DM yields ranging from 2.4 to 3.9 t/ha/year have been obtained in rain-grown situations in sub-humid climates, and over 9 t/ha DM under irrigation, also in a sub-humid environment. Presentation yields of *D. leptophyllus* in grazed pastures in subtropical Australia ranged from 100 to 500 kg/ha DM during the first 5 years following establishment contributing between 3 and 13% of the total DM yield. Yields will be greatest on soils of at least moderate fertility in the sub-humid tropics, where grass competition is only moderate and *D. leptophyllus* can recruit from high levels of seed produced.

### Animal production

In a pen feeding experiment where a Mitchell grass (*Astrelba* spp.) basal diet was supplemented with *D. leptophyllus*, DM intake of merino wethers increased from 580 to 742 g/head/day, and wool growth increased from 0.48 to 0.66 g/day/cm<sup>2</sup>. Significant increases in liveweight gain have been achieved in steers grazing grass plus 'Progardes', a blend of *Desmanthus bicornutus*, *D. leptophyllus* and *D. virgatus*, compared with grass-only pasture.

## Genetics/breeding

Taxonomic confusion within the genus has led to a vast range of accessions from *D. pernambucanus*, *D. leptophyllus*, *D. pubescens* and *D. virgatus* being evaluated as *D. virgatus*. However, there is a wide range of genetic and morphological diversity within *D. leptophyllus* and many of those accessions have cultivar potential. Evidence from small plot seed production suggests that the species is predominantly self-pollinating. Persistent types have been selected from discontinued evaluation sites.

## Seed production

Seed yields of 500–600 kg/ha have been achieved from direct-headed crops, but considerable seed losses occur due to uneven ripening and early seed fall. The potential seed yield using a suction harvester is in excess of 1,000 kg/ha, however the suction required to collect the dense *Desmanthus* seed can result in large quantities of small stones in the sample.

Late-flowering types require an extended period of favourable moisture conditions to flower and set seed. A high proportion of under-developed, immature embryos that are non-viable or of low vigour can occur in late-flowering types grown in sub-tropical environments where frosting and moisture stress may be experienced during seed development. These seeds are of similar dimensions to fully mature

seeds and are therefore very difficult to remove during conventional seed grading.

A psyllid insect (*Accizia* spp.) can cause severe damage to seed crops in Australia and may need to be controlled using insecticides. Seed production in less fertile soils may be increased by adding up to 25 kg/ha P.

## Herbicide effects

Killed by Access® herbicide (120 g/L picloram and 240 g/L triclopyr).

## Strengths

- High DM productivity.
- High seed production.
- Tolerant of heavy grazing.
- Persistent in low rainfall environments.
- Has potential as a ley legume species due to high DM yields and late flowering.
- Tolerant of alkaline, sodic, saline and heavy clay soils.

## Limitations

- Establishment on heavy soils can be problematic because of small seeds.
- Not suitable for short-term pastures (<3 years) because of establishment risks.
- Highly specific in its rhizobium requirements (CB 3126).

## Internet links

<http://www.agronomyaustraliaproceedings.org/>

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## Cultivars

**'Bayamo'** (CPI 82285) Granted PBR protection in Queensland, Australia (1992). Origin near Santa Rita, Granma Province, Cuba (20° 21' N, 75 m asl, rainfall 1200 mm). A low to medium type (100–150 cm), mid-season cultivar, flowering in 110 days. Among the highest yielding of the *Desmanthus* accessions evaluated in southern and central Queensland. Better suited to southern Texas than *Desmanthus* spp. cv. Marc and Uman.

**'JCU 1'** Granted PBR protection in Queensland, Australia (2015) Derived from a selected plant (putative parent CPI 76053: origin near Conkal, Yucatan, Mexico. 21°05' N, 5 m asl, rainfall 900 mm) growing in a mixed sward of *Desmanthus* spp. in the Townsville suburb of Kelso (19°15' S, rainfall 1,143 mm). A leafy, multi-branched plant, selected on the basis of persistence under grazing and plant density relative to known *Desmanthus* cultivars. Component of the multi-species commercial Progardes™ blend. Used for pasture improvement on dark clay soils in sub-humid – semi-arid zone.

**'JCU 7'** Granted PBR protection in Queensland, Australia (2019) Derived from seed collected in 2007 from selected vigorous plants (putative parent: CPI 38351) growing in an adventive population near Billabong Sanctuary, Townsville (Qld) where it had persisted for many years previously. Single-plant selections were multiplied and culled for any morphological off-types prior to selecting 'JCU7'. In subsequent trials at 6 sites from Townsville through to Goondiwindi (Qld), 'JCU7' was among the highest performing group of *Desmanthus* genotypes, particularly for leafiness and bulk.

**'Ray'** A naturalized ecotype from a seasonally dry area in northern Australia, selected and commercialised by the R.B. Dessert Seed Company at Kununurra, Western Australia.

**'Titaquin'** Released in Argentina (2012) for use in the Submeridional Lowland Region of Santa Fe, Chaco and Santiago del Estero provinces.

**'Velden'** (CPI 55719) Released in South Africa. Origin near Maracaibo, Venezuela (10°30', 80 m asl, rainfall 600 mm)

## Promising accessions

**CPI 38351** Origin near Acarigua, Portuguesa, Venezuela (9°28' N, 250 m asl). Selected in Queensland, Australia. Tall, late-flowering accession. Prolific early seed production, persistence and moderate productivity under heavy grazing during 6 dry years in northern Australia. The highest yielding accession of 47 *Desmanthus* accessions grown at 8 sites in Queensland, Australia, out-yielding accessions of *D. virgatus* and *D. pubescens*.

**CPI 38820** Origin Aragua State, Venezuela (10°28' N, 900 m asl). Selected in Queensland, Australia. High-yielding accessions selected for use as a ley legume for run-down cropping lands in central Queensland, Australia. Produced very high seed yields (1.3–1.5 t/ha), although significant losses from direct heading are expected.

**CPI 63453** Origin Morada Nova, Ceará, Brazil (5°06' S, 50 m asl, rainfall 800 mm). Selected in Queensland, Australia. High-yielding accessions selected for use as a ley legume for run-down cropping lands in central Queensland, Australia. Produced very high seed yields (1.3–1.5 t/ha), although significant losses from direct heading are expected.

**CPI 65947** Origin Baños de San Vicente, Santa Elena, Ecuador (2°15' S, 100 m asl, rainfall 500 mm). Selected in nursery at Halhale, Eritrea, as vigorous, unusually prostrate ecotype for possible grazing tolerance.

**CPI 76064** (CF631, Belize number) Origin Muna de Arana, Yucatán (20°28' N, 55 m asl, rainfall 950 mm). Selected in nursery at Halhale, Eritrea, as vigorous, decumbent ecotype for possible grazing tolerance.

**CPI 92806** (CF701, Belize number). Origin Mato Grosso, Brazil. Selected in Queensland, Australia. Persistent, high yielding accessions in small plot trials in *Heteropogon contortus* pastures in south-east Queensland.

**CPI 92809** (CF764, Belize number) Origin Buena Vista, Corozal, Belize (18°14' N, 13 m asl, rainfall 1,830 mm). Selected in Queensland, Australia. Persistent, high yielding accession in small plot trials in *Heteropogon contortus* pastures in south-east Queensland. Also showing promise in Ethiopia and Eritrea, Africa.

**CPI 92818** (CF811, Belize number). Origin Patchacan, Corozal, Belize (18°22' N, 12 m asl, rainfall 1,830 mm). Selected in Queensland, Australia. Persistent, high yielding accession in small plot trials in *Heteropogon contortus* pastures in south-east Queensland.

**TQ 90.** Origin unknown. Collected from naturalized line near Townsville, N Queensland. Selected in Queensland, Australia. Persistent, high yielding accession in small plot trials in *Heteropogon contortus* pastures in south-east Queensland.

**AC10 and AC11** Selected in Queensland, Australia. Well-adapted to clay soils in north Queensland.

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