Department of Primary Industries

primefact

Desmanthus

December 2021, Primefact PUB21/778, First edition

Suzanne Boschma, Senior Research Scientist, Pastures Unit, Tamworth

Introduction

Desmanthus (*Desmanthus* spp.) is a non-bloating tropical legume providing high quality feed for cattle and sheep. It is native to northern America, Central and South America and the Caribbean and commonly used as a companion legume in tropical perennial grass pastures. Being a tropical legume, it grows during the warmer months of the year (Figure 1).

Figure 1. Desmanthus cv. Marc grows to 0.6 m. (Tamworth, NSW).

Advantages

- Drought persistent.
- Cold/frost tolerant. It drops all leaves following frost but regrows from the crown in spring.
- Can withstand heavy grazing.
- Non-bloating and anti-methanogenic.
- Leaf protein content is comparable to lucerne.
- Seeds prolifically and regenerates readily from seed.
- Deep-rooted with ability to extract soil water to 1.8 m on a clay loam.

Disadvantages

- Short lived (3-4 years) perennial.
- Rhizobia specific.
- Does not tolerate prolonged waterlogging.
- Reported host of alfalfa mosaic virus (AMV).

Adaptation in NSW

Desmanthus is well suited to the North West Slopes and Plains of NSW. It is best suited in areas with annual rainfall greater that 550 mm. It is adapted to heavier-textured neutral to alkaline soils; growing

on a wide range of soils from sandy loam to clay and from slightly acid to alkaline. Desmanthus was found to be persistent in early experiments on a sandy soil at Gilgandra (pH_{Ca} 5.1) and hard setting red Chromosol soil at Trangie (pH_{Ca} 5.4).

Species and cultivars

The cultivars available in Australia consist of several species of *Desmanthus*. As a result, there is variation in the growth habit of the different desmanthus cultivars. Some are low growing reaching around 0.6 m in height (Figure 1) while other cultivars are more upright growing to around 3.0 m tall (Figure 2). The cultivars available are:

Marc – Early flowering cultivar of *D. virgatus* with fine stems. It sets large quantities of seed and can readily recruit from seed. Plants can grow to a height of 0.6 m. Found to be persistent in recent experiments at Bingara and Manilla and Tamworth. Public variety. For more information: https://progressiveseeds.com.au/desmanthus/

Progardes® – Comprised of a mix of selected desmanthus cultivars with varying maturities and growth habits. The blend of cultivars may vary depending on the location and environment the seed is to be sown. Cultivars in the mix could include JCU 1 (*D. leptophyllus*), JCU 2 (*D. virgatus*), JCU 3 (*D. virgatus*), JCU4 (*D. bicornutus*), JCU 5 (*D. virgatus*), JCU 6 (*D. bicornutus*), JCU 7 (*D. leptophyllus*), JCU8 (*D. virgatus*), or JCU9 (*D. pernambucanus*). For more information: https://www.progardes.com.au/

Figure 2. Desmanthus cv. JCU 4 can grow to 3 m under ideal conditions. This stand was grown under centre pivot irrigation at Townsville, Queensland. Photo: H. Fleury, Agrimix Pastures.

Ray desmanthus® – Mid-flowering cultivar (42 days later than cv. Marc in Brisbane) of *D. virgatus* with upright growth habit to 1–1.5 m tall with fine stems. For more information: Barenbrug Australia // Forage & Pasture > Tropical > Tropical Legumes

Cowpower® – Fine stemmed, early flowering cultivar of *D. virgatus* with heavy seed set. A selection from plants that had germinated in cowpats from a 20 year old grazed stand of cv. Jaribu (cultivar that is no longer available. Consisted of a mix of cvv. Marc, Bayamo and Uman) at Roma, Queensland. For more information: https://www.cowpower.com.au/

Establishing desmanthus

Prior to sowing. Prepare a weed free seedbed and conduct a soil test to identify limiting elements, in particular, phosphorus, sulfur and potassium.

Sowing window. Sow when soil temperatures are increasing and the average 3 day temperature is over 15°C. For example, in the Tamworth district this

would typically occur during November. Sowing early in the sowing window provides the best opportunity for plants to develop and set seed in the first year, especially for the long season cultivars. Sowing after mid-February may not allow time for plants to fully establish before first frost and can result in plant losses.

Sowing rate. Sow 2–3 kg/ha (pure swards) or 2 kg/ha (mixtures) of germinable seed (Figure 3).

Figure 3. An establishing stand of desmanthus and digit grass sown in alternate rows.

Seed quality. The seed has extremely high levels of hard seed and scarification is essential. Ensure the scarified seed has a germination of at least 50–70%. This can be checked on a seed certificate (ensure it is less than 6 months old). The remaining hard (dormant) seed will soften and germinate over multiple years.

Inoculation. Desmanthus is rhizobia specific and seed should be inoculated with strain CB3126 just before sowing. Pelleted seed that contains the rhizobium should be sown soon after pelleting to maximise rhizobia survival. Sowing just before an expected rainfall event will enhance the inoculant survival. Poor nodulation will lead to reduced plant production and nitrogen fixation.

Desmanthus appears to nodulate freely when sown into locations where the native legume neptunia occurs, however effective nitrogen fixation is not guaranteed. *Neptunia* sp. is a legume that is closely related to desmanthus. Inoculation with the commercial rhizobia strain is cheap insurance (Figure 4).

Figure 4. Nodules of CB3126 are located along the lateral roots and easily dislodged when removing plants to check nodulation.

At sowing. Sow seed shallow, at 10 mm (5–15 mm), as desmanthus seed is small (~350,000–400,000 seeds/kg).

Sowing into dry soil prior to a rainfall event allows for good seed placement and maximises the effectiveness of the rain. Have at least 60 cm of stored soil moisture in the profile to support rapid seedling growth.

Maximise seed-soil contact with press wheels or a roller. Avoid placing seed directly into the soil surface unless it is lightly incorporated with harrows and/or rolled to improve seed-soil contact.

Sowing desmanthus seed into an established grass pasture is not

recommended due to high competition from the mature plants (Figure 5). Without control of the summer grass pasture prior to sowing desmanthus the likelihood of successful establishment is low. Research is underway to develop strategies to establish desmanthus into established and native pastures.

Figure 5. Sowing into an established tropical grass pasture will result in poor establishment and stunted desmanthus plants. Studies are underway to develop strategies to improve establishment in these situations.

Companion species

Desmanthus is suitable for sowing as a mixture with a tropical perennial grasses especially panic grasses and Bambatsi panic, also digit grass. Pure Rhodes grass stands can be highly competitive and capable of out competing desmanthus.

When establishing desmanthus as a mix with digit grass only, reduce the grass seeding rate to 0.5-0.75 kg/ha (germinable bare seed). It will allow the desmanthus to establish while the digit grass will thicken over time.

Soil fertility

Soil tests will highlight many soil deficiencies. Plants may respond to sulfur, molybdenum, phosphorus, copper and manganese on neutral to alkaline dark clay soils, particularly those formed on basalt. Plants suffering from poor nodulation, sulfur and molybdenum deficiency typically have yellow leaves and poor growth. Some deficiencies, such as sulfur may not be detected by soil test and tissue testing may be required. A critical leaf tissue concentration of 0.2% sulfur is required for optimum productivity. Alternatively, a test strip applying 20 kg/ha sulfur (e.g. as gypsum or superphosphate) should indicate if there is a deficiency. Applying molybdenum at 100 g/ha as sodium molybdate (soluble, 300 g/ha) or molybdenum trioxide (insoluble, 150 g/ha) will usually correct a molybdenum deficiency. Phosphorus should be applied as indicated by soil test, or at 20–30 kg/ha.

Grazing management

First year. In newly sown pastures, allow plants to fully establish and set seed before commencing grazing. In a favourable season, a light grazing can encourage branching, but ensure the plants are well anchored in the soil.

The following spring after frosts cease, allow the plants to regrow to at least 30 cm (taller for upright cultivars) before commencing grazing.

From the second year. Plants are robust with deep roots (Figure 6) and can be

grazed short. Leaving at least 10 cm residual assist rapid regrowth, even more so following a good summer rainfall event.

Figure 6. Desmanthus plants are deep rooted. The root pictured was about 0.8 m long. Photo: M Brennan, NSW DPI.

Desmanthus is palatable to both sheep and cattle (Figure 7). However, once the plants become large and woody, sheep tend to graze the leaves and finer stems while cattle are not selective.

Rotational grazing with high stock numbers for a short duration is recommended as livestock preferentially graze desmanthus. This will result in better pasture utilisation and prevent overgrazing. A lengthy rest period is recommended to allow plant recovery.

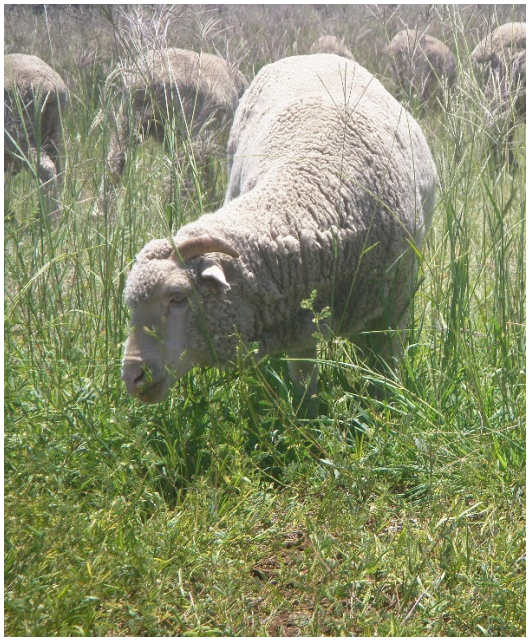

Figure 7. Desmanthus-grass pastures are readily grazed by sheep and cattle.

Individual plants will commonly persist for 3–4 years. For long term persistence of a desmanthus stand, seedling recruitment is required every 1–2 years (Figure 8). This will allow a large seed bank to be maintained with seed at different stages of hardseed breakdown.

Figure 8. Desmanthus seedlings emerging from the seed bank following significant summer rainfall.

Under light grazing, short to medium season cultivars will flower in both spring and autumn. Desmanthus can produce large quantities of seed; around 200 kg/ha to 500 kg/ha in seed crops that are

directly harvested (Figure 9). Seed production can be limited by heavy grazing, also low rainfall and/or frost.

Stems of some cultivars can become woody if they are not grazed or when frosted. These stems protect the regenerating buds in spring. Slashing frosted stems can damage plant crowns leading to plant death.

Figure 9. Desmanthus is a prolific seeder. (a) Pods are initially green, turning brown as they ripen (Photo: J Hosking, NSW DPI). (b) Once ripe, the pod splits into two halves allowing seed to drop to the soil surface.

Production potential

Desmanthus is moderately productive in mixes with tropical grasses, although it is not as productive as lucerne-tropical grass mixes. On the North-West Slopes of NSW, desmanthus was persistent under drought conditions with moderate productivity for the rainfall received. Annual production in mixed swards with digit grass ranged 1.1–2.1 t DM/ha with desmanthus contributing an average of 35% of the total pasture production.

Nutritive value and animal production

Crude protein concentration of the entire plant ranges from 10–20% of DM, with leaves higher ranging 18–30% of DM and stems 6–16% of DM. Composition of desmanthus plants are shown in Table 1.

Table 1. Composition of whole plants of desmanthus (leaves + stems).

Component	Range in values
Crude protein	10–20% DM
Metabolisable energy	6.5–7.3 MJ/kg DM
Neutral detergent fibre	58–67% DM
Acid detergent fibre	37–46% DM

In Queensland, liveweight gains of steers grazing tropical grass-desmanthus pastures range 160–240 kg/head/year. In one study, steers grazing a desmanthus-grass pasture gained 40 kg/head over the 90 day cool/dry season, while those on grass alone had a net gain of 10 kg/head.

Pests and disease

There are no known major pests of desmanthus. A small native psyllid (*Acizzia* spp.) can cause leaf yellowing late in the season in coastal areas. Desmanthus is reported as a host of alfalfa mosaic virus (AMV) which can cause biomass production losses in cv. Marc (Figure 10).

The susceptibility of the other cultivars is currently being tested.

Figure 10. Desmanthus is a reported host of alfalfa mosaic virus (AMV). Symptoms of AMV include leaf yellowing and productivity losses in cv. Marc.

Livestock health

No known health issues have been identified. Plants have high levels of condensed tannins (2–3% of total DM as tannic acid equivalent) but this does not affect either palatability or livestock production. In desmanthus these tannins have two advantages: bloat prevention and reduced methane emission. When fed as 30% of the diet, desmanthus can reduce methane emissions from cattle by up to 10% when quality of the grass is low (e.g. 5–8% crude protein).

Herbicides

No herbicides are currently registered to control weeds in desmanthus in NSW. Studies are underway to broaden the range of chemicals permitted for use.

Desmanthus seedlings are susceptible to 2,4-D, 2,4-DB, dicamba, MCPA and MCPB and are not recommended for use. They can also affect mature plants (Figure 11).

Figure 11. Herbicide 2,4-D causes plant stems and growth of mature plants to become distorted.

Weed potential

Desmanthus has minor weed potential. Desmanthus seed is able to pass viable through the rumen and has potential to spread under grazing given reasonable rainfall conditions. Faecal seeding is used as a method for seeding desmanthus in the Queensland rangelands. While it has potential to become a minor weed its habit and palatability restrict its ability to dominate.

For more information

For more information on desmanthus contact Local Land Services, seed suppliers or your preferred agricultural advisor.

For updates and other information on pastures go to https://www.dpi.nsw.gov.au/pastures or

Useful resources and references

Anon (2014) Desmanthus. Department of Agriculture and Fisheries, Queensland. https://www.daf.qld.gov.au/business-priorities/agriculture/plants/crops-pastures/pastures/desmanthus

Anon (n.d.) Desmanthus: A promising summer pasture legume for clay soils. Progressive Seeds https://progressiveseeds.com.au/desmanthus/

Anon (2020) Ray Desmanthus®. Barenbrug. Barenbrug Australia // Forage & Pasture > Tropical > Tropical Legumes

Boschma SP, Harris CA, Brennan MA, Harden S (2021) *Medicago sativa* and *Desmanthus virgatus* – suitable perennial legumes in mixes with *Digitaria eriantha* cv. Premier in Australia during drought. *Crop and Pasture Science*. https://doi.org/10.1071/CP20291.

Boschma SP, Harris CA, Brennan MA, Murray C, Baker SJ, Harden S (2021) Desmanthus is more persistent than lucerne through drought on the North-West Slopes of NSW. In 'Proceedings of the 32nd Conference of the Grassland Society of NSW Inc' (Eds C. Houghton, R Hoare, H Warren). pp 82–86. (Grassland Society of NSW Inc.: Orange).

Cook B, Pengelly B, Schultze-Kraft R, Taylor M, Burkart S, Cardoso Arango JA, González Guzmán JJ, Cox K, Jones C, Peters M (2020) *Desmanthus virgatus*. *Tropical Forages: an interactive selection tool – Digital*. ISBN 978958694234-8 https://apps.lucidcentral.org/tropical_forages/text/entities/desmanthus_virgatus.htm

Clem B (2009) *Desmanthus*. Pastures Australia. https://keys.lucidcentral.org/keys/v3/pastures/Html/Desmanthus.htm

Murphy SR, Boschma SP, Harden S (2022) A lucerne-digit grass pasture offers herbage production and water productivity equal with a digit grass pasture fertilized with applied nitrogen. *Agricultural Water Management* 259, 107266. Available online 23 October 2021. https://doi.org/10.1016/j.agwat.2021.107266

Suybeng B, Charmley E, Gardiner CP, Malau-Aduli BS, Malau-Aduli AEO (2020) Supplementing northern Australian beef cattle with *Desmanthus* tropical legume reduces in-vivo methane emissions. *Animals* 10, 2097. https://doi.org/10.3390/ani10112097

Warning

Pasture improvement cautions

Pasture improvement may be associated with an increase in the incidence of certain livestock health disorders. Livestock and production losses from some disorders are possible. Management may need to be modified to minimise risk. Consult your veterinarian or adviser when planning pasture

improvement. The Local Land Services Act 2013 restricts some pasture improvement practices where existing pasture contains native species. Inquire through your local office of Local Land Services NSW for further details.

Acknowledgements

Some of the findings reported in this publication are collected in collaborative projects between the NSW Department of Primary Industries, Meat and Livestock Australia and Meat and Livestock Australia Donor Company. The latter as part of the Livestock Productivity Partnership.

Your Reference number (PUB21/778)

© State of New South Wales through Regional NSW 2021. The information contained in this publication is based on knowledge and understanding at the time of writing (December 2021). However, because of advances in knowledge, users are reminded of the need to ensure that the information upon which they rely is up to date and to check the currency of the information with the appropriate officer of the Department of Regional NSW or the user's independent adviser.