

## Gland clover

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### Introduction

Gland clover (*Trifolium glanduliferum*) is a self-regenerating annual legume, native to those countries of Eurasia with a Mediterranean climate (Albania, Greece, Israel, Lebanon, Syria and Turkey), where it is commonly found growing in open fields and forests along with other annual legumes.

Gland clover is relatively new to Australian agriculture, with the first commercial cultivar released in 2001. This cultivar, Prima<sup>®</sup>, was developed from germplasm collected by JS Katznelson from the Yehudiyya Forest in Golan, Israel in 1976. This material was then contributed to the Australian Trifolium Genetic Resource Centre in Western Australia in the early 1990s, and further developed and evaluated in several projects including the National Annual Pasture Legume Improvement Program (NAPLIP).

Gland clover has significant potential for use in pasture and cropping systems in NSW, particularly in areas where seasonal waterlogging may be experienced.

### Adaptation

Gland clover has been successfully grown in areas receiving a minimum of 375 mm average annual rainfall (AAR) in southern NSW, and 475 mm in northern NSW.

Gland clover is well adapted to a wide range of soils. In southern NSW, it has been grown on soils with pH (CaCl<sub>2</sub>) of 4.8–7.5. It will grow on well-

drained soils through to those that experience periodic waterlogging.

Gland clover has a delayed pattern of hardseed breakdown. This assists in protecting it from 'false breaks' (out-of-season rainfall without sufficient follow-up rain to allow seedling survival). It is the combination of moderate to high hardseed level, tolerance of insect attack, moderate productivity and tolerance of mild waterlogging that make gland clover suitable for use in pastures across a range of climatic zones in NSW.

Gland clover can be used as a component of long-term pastures or in the pasture phase of cropping rotations to provide high quality fodder for livestock. It may also be used for fodder conservation purposes, although it is not particularly well suited to this role due to its very early maturity and relatively compact growth habit.

### Description

Gland clover is a relatively compact plant, reaching a maximum height of 40–50 cm. Leaflets are rounded, smooth and hairless, becoming more elongated in mature plants. The leaflet margins contain glands, hence the clover's common name. Stems are smooth and green, though some reddening may be seen on the upper surface.

Flowers are pinkish-white when first formed, and develop a deeper pinkish-mauve colour with

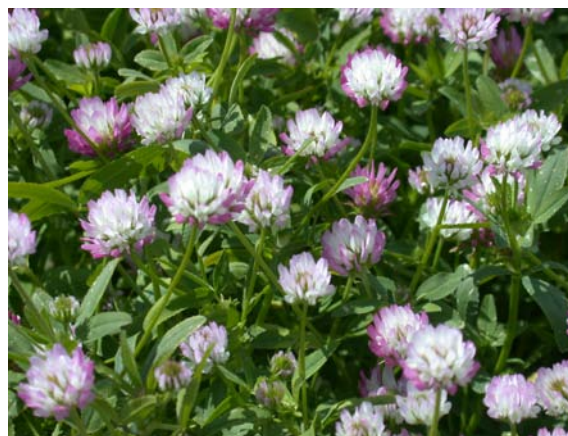


Figure 1. Gland clover



maturity.

Seed is very small, with approximately 1,430,000 seeds/kg, making it similar in size to balansa clover seed.

## Varieties

**Prima**<sup>®</sup> is the only variety of gland clover available. It is very early maturing, with flowering occurring 100–115 days after a mid-May sowing (Wagga Wagga), making it similar in maturity to Nungarin and Izmir sub clover.

## Establishment and management

### Sowing

Paddocks in which gland clover is to be sown should be managed in preceding years to minimise weed and insect burdens. This strategy is not specific to gland clover, and should be used when sowing any pasture species. Gland clover can be sown into a conventional seed bed or direct drilled for good establishment.

Gland clover should be sown at rates of 2–4 kg/ha when used in mixtures with other legumes and grasses. If sowing as a monoculture for seed crop or specific fodder conservation purposes, rates of 6–8 kg/ha may be used.

As seed is very small, it should be sown no deeper than 10 mm into a moist seed bed. The optimum sowing time is mid to late autumn.

### Inoculum

Gland clover requires Group C rhizobium for successful nodulation, the same group as is used for sub clover.

### Fertiliser

Adequate phosphorus (P) is required to optimise legume growth. At least 10 kg P/ha should be used when sowing gland clover. Added sulphur (S) and trace elements such as molybdenum (Mo) may be required in some areas. Consult your local agronomist for further information.

### Grazing

Care should be taken to avoid grazing gland clover too intensively during flowering and seed set in the first year of sowing. This will allow the clover to set large amounts of seed from which to regenerate in subsequent years.

Following the establishment year, pastures containing gland clover may be grazed at moderate grazing pressure through the flowering and seed-set period without adversely affecting persistence.

If the population of gland clover in a pasture appears to be declining, resting the pasture through the flowering and seed-set period will allow soil seedbank reserves to increase and improve density in the following year.

To ensure good regeneration, gland clover residues should be grazed in late summer and early autumn.

Gland clover should not be grazed if intended for use as a seed or fodder conservation crop; its early maturity means there will be insufficient time for recovery prior to harvest.

### Hardseed

**Prima**<sup>®</sup> has moderate levels of hardseed (40%–50%) in late autumn. Seed should be scarified prior to sowing.

### Pests and diseases

Gland clover has a high level of resistance to red-legged earth mite, blue-green aphids and cowpea aphids. It is thought that compounds called coumarins, which occur naturally in gland clover, provide resistance to attack by these insects.

Gland clover is moderately susceptible to attack by spotted alfalfa aphid and lucerne flea.

It is not susceptible to clover scorch (*Kabatiellia caulivora*).

### Seed production

Gland clover is an aerial seeding legume, and can be harvested using a conventional header. Seed should be harvested when 75% of the stem is dry; some greenness of the stem is acceptable. Concave and drum speed settings of the header are not critical, but the fan speed should be adjusted to 50%–60% of that used for wheat, as gland clover seed is very small. Seed harvested on-farm should be scarified prior to sowing, to improve first year germination.



Figure 2. Gland clover seed

## Herbage production and nutritional quality

### Herbage production

Gland clover is capable of moderate to high levels of production when sown in a regenerating pasture. In low and medium rainfall areas, first year production has been found to be similar to or better than sub clover; however, by the third year, gland clover was significantly less productive than sub clover (Figure 3a & 3b). In these environments, sub clover generally replaced gland clover in the sward. In contrast, at higher rainfall sites (Figure 3c), the productivity of gland clover over three years was maintained at similar levels to sub clover.

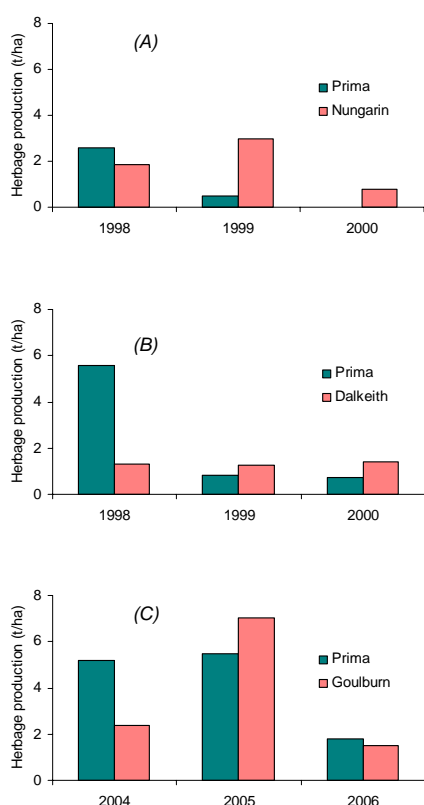


Figure 3. Herbage production of Prima<sup>®</sup> gland clover and sub clover at low (A), medium (B) and high (C) rainfall sites over three years. Note, the low rainfall site was at Barellan (440 mm AAR), medium rainfall at Wagga Wagga (525 mm AAR) and high rainfall at Gerogery (625 mm AAR).

While not particularly well suited to fodder conservation (owing to very early maturity), gland clover may be a useful forage crop for grazing animals, as it provides a bulk of high quality feed in late winter and early spring, before many other pasture species commence rapid growth (Table 1).

### Herbage quality

Under sound management, gland clover is capable of producing high quality herbage. Herbage quality

declines as the plant ages and senesces, as is typical of all temperate annual legumes (Figure 4).

Table 1. Herbage produced by several annual legume species in October<sup>1</sup> following sowing in May at several sites in southern NSW.

	Binalong	Harden	Berridale	Burruga
Average annual rainfall (mm)	625	600	480	750
pH (CaCl <sub>2</sub> )	4.8	5.6	4.2	4.3
Exchangeable aluminum (%)	15	0	5	25
Soil type	Sandy loam	Red earth	Sandy loam	Sandy loam
	Herbage production (t DM/ha)			
Prima <sup>®2</sup>	3.2	5.6	3.4	4.7
Seaton Park <sup>3</sup>	2.4	2.9	1.2	2.4
Coolamon <sup>®3</sup>	2.5	3.4		2.2
Goulburn <sup>®3</sup>	2.5	3.4	0.7	2.7
Bolta <sup>®4</sup>	3.5	6.5	2.1	5.4
Zulu <sup>5</sup>	3.2	5.1	4.0	4.7

<sup>1</sup>Measurements were taken in the first week of October at Binalong and Harden and the third week of October at Berridale and Burruga.

In this experiment, approximately 50% of gland clover plants were flowering when the first forage sampling for feed quality analysis was undertaken (11 October). Although the amount of herbage on offer peaked two weeks later (25 October), plant quality had declined considerably by this time.

The trade-off between herbage availability and herbage quality needs to be considered carefully, because delaying grazing (or fodder conservation) to obtain higher yield may result in a decline in herbage quality, which may impact on animal performance.

### Anti-nutritional factors

Gland clover contains very low levels of coumarins. Coumarins can be converted into a compound called dicoumarol by various moulds that may be present in hay and silage. Dicoumarol has anti-blood clotting characteristics that may cause internal bleeding in animals; however, extensive testing of fresh and conserved gland clover foliage found that the levels of coumarin and dicoumarol were below that considered to cause health problems in sheep and cattle. Coumarin and dicoumarol levels can be increased in some plant

species under stresses such as drought, waterlogging or herbicide application. Where gland clover was grown under these conditions, the level of coumarin and dicoumarol was still well below that considered to predispose health problems in sheep and cattle.

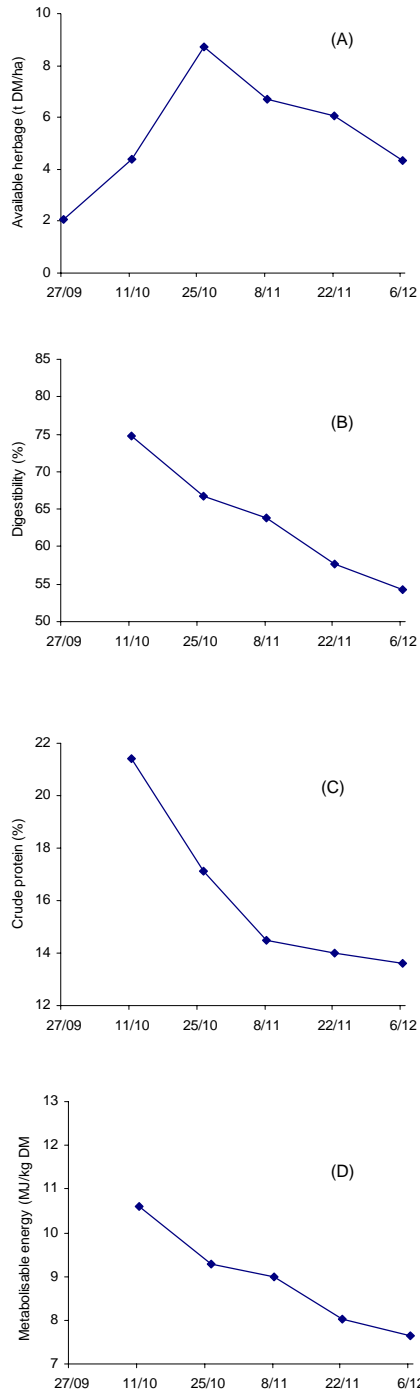


Figure 4. Herbage production (A), digestibility (B), crude protein (C) and metabolisable energy (D) of Prima<sup>®</sup> gland clover in uncut swards, measured on five occasions through spring 2005 at Cootamundra, NSW.

Furthermore, the results of experiments conducted in Western Australia in which sheep were fed either gland clover or sub clover showed no difference in liveweight gain, blood clotting characteristics or meat quality.

Pigs are much more sensitive to dicoumarol than many other livestock species, so it may be wise to avoid feeding gland clover to pigs. The sensitivity of horses to dicoumarol is unknown at this stage; however, as horses are often more sensitive to anti-nutritional compounds than either sheep or cattle, it may also be advisable to avoid feeding gland clover to horses.

Some coumarins, when triggered by sunlight, can cause dermatitis in susceptible humans. Coumarins are commonly found in other agricultural plants, and also in many perfumes and some sunscreens. Coumarin allergy is relatively uncommon in humans. Individuals with known sensitivity to coumarins should avoid handling gland clover. Where gland clover has been conserved as forage, a sensible precaution would be to wear gloves when handling the forage.

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### References and further reading

Dear, BS, Sandral, GA, Wilson, BCD, Rodham, CA & McCaskie, PM 2002, 'Productivity and persistence of *Trifolium hirtum*, *T. michelianum*, *T. glanduliferum* and *Ornithopus sativus* sown as monocultures or in mixtures with *T. subterraneum* in the south-eastern Australian wheat belt', *Australian Journal of Experimental Agriculture*, 42, pp. 549–556.

Radostits, OM, Blood, DC & Gay, CC 1984, *Veterinary Medicine*, 8<sup>th</sup> edn, Bailliere Tindall.

### Warnings

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.

Legislation covering conservation of native vegetation may regulate some pasture improvement practices where existing pasture contains native species. Inquire through your office of the Department of Natural Resources for further information.

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