NSW GOVERNMENT
Department of Primary Industries

Pasture varieties used in New South Wales 2012–13

EDITED BY MARY-ANNE LATTIMORE & LESTER McCORMICK

The Grassland Society of NSW Inc.

www.dpi.nsw.gov.au

11518

Legume Inoculant

Inoculant **Selector**

Strain	Host Plant - Common Name	Seed Treated Per Pack: Nodule N Peat Standard	Nodule N Peat Jumbo	Easy Rhiz Vial
AL, "Lucerne"	Lucerne, Strand medic, Disc medic	25kg	125kg	100kg
AM, "Medic"	Barrel medic, Burr medic, Snail medic, Sphere medic, Gama medic, Murex medic	50kg	250kg	200kg
B, "White clover"	White clover, Red clover, Strawberry clover, Alsike clover, Berseem (Egyptian) clover, Cluster or Ball clover, Suckling clover	25kg	125kg	100kg
C, "Sub clover"	Crimson clover, Cupped clover, Helmet clover, Purple clover, Rose clover, Sub clover, Bladder clover	50kg	250kg	200kg
	Arrowleaf clover, Balansa clover, Gland clover, Persian (Shaftal) clover	25kg	125kg	100kg
E, "Pea"	Field pea, Grass pea, Common vetch or Tare, Bitter vetch, Lathyrus, Purple vetch, Pea, Woolly pod vetch		500kg	500kg
F, "Faba"	Faba, Tick or Broad bean		500kg	500kg
	Lentil		250kg	250kg
G, "Lupin"	All lupin		500kg	500kg
H, "Soy"	Soybean	100kg	500kg	500kg
I, "Mung Bean"	Cowpea, Mung bean, Moth bean, Dune bean, Rice bean, Snake bean, Creeping vigna	100kg	500kg	500kg
J, "Lablab"	Dolichos lablab, Pigeon pea, Hyacinth bean,	100kg		500kg
	Perennial horse gram, (Axillaris)	50kg		250kg
M, "Siratro"	Butterfly pea, Atro, Tropical kudzu, Puero,	50kg		200kg
	Glycine, Siratro, Jack bean, Calopo, Gambia pea, Phasey bean, Velvet bean, Banana bean, Wing bean or Goa, Wynn Cassia, Kudzu	25kg		100kg
N, "Chickpea"	All Chickpea		500kg	500kg
P, "Peanut"	Peanut or Groundnut			500kg
S, "Serradella"	All Serradella	50kg	250kg	200kg
Special Inoculants				
5G1B	Adzuki bean			200kg
WSM1497	Biserrula			50kg
SU343	Birdsfoot trefoil (*Lotus corniculatus*)			25kg
CB1717	Burgundy bean			100kg
CC283b	Caucasian (Kura) clover			50kg
CB1923	Centro, Centurion			200kg
CB3126	Desmanthus			100kg
	Leucaena			250kg
CB627	Desmodium			50kg
SU277	Fenugreek			200kg
CC511	French or Common bean, Navy, Kidney, Dry, Lima beans			250kg
CB3035	Guar or Cluster bean			250kg
CB2312	Jointvetch, Aeschynomene			100kg
CB782	Kenya white clover (*Trifolium semipilosum*)			50kg
CB376	Lotononis			25kg
CC829 (Lotus)	Lotus (*Lotus pedunculatus*)			25kg
CIAT3101	Pinto peanut			250kg
CC1099	Sainfoin			100kg
CB1650	Stylo - Caribbean stylo (*Stylosanthes hamata*)			50kg
CB3481	Stylo - Caatinga stylo (*Stylosanthes seabrana*)			50kg
CB82	Stylo - All other Stylo (Fine stem, Shrubby, Townsville)			50kg
WSM 1592	Sulla			100kg
CC1502	Tree lucerne or Tagasaste			25kg

- **Nodule N** - peat cultures
- **EasyRhiz** - soluble powder
- All strains in stock and NSW Department of Primary Industries approved

New Edge Microbials Pty Ltd
p. 02 6025 0044
e. newedge@microbials.com.au
w. microbials.com.au

Pasture Varieties used in New South Wales 2012 - 2013

Edited by

Mary-Anne Lattimore
District Agronomist, NSW DPI, Yanco

Lester McCormick
Technical Specialist Pastures (North), NSW DPI, Tamworth

DISCLAIMER/CAUTIONS

The information contained in this publication is based on knowledge and understanding at the time of writing (July 2012). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up-to-date and to check currency of the information with the appropriate officer of NSW DPI or the user's independent adviser.

Recognising that some of the information in this document is provided by third parties, the State of New South Wales, the author and the publishers take no responsibility for the accuracy, currency, reliability and correctness of any information included in the document provided by third parties.

The product and supplier trade names in this publication are supplied on the understanding that no preference between equivalent products or suppliers is intended and that the inclusion of a product or supplier does not imply endorsement by NSW DPI or the Grassland Society of NSW Inc. over any other equivalent supplier or product from another manufacturer.

The publishers apologise for omitting the name of any product or seed supplier from this publication. Please advise NSW DPI, so that inclusion can be considered for the next edition.

Animal health disorders

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 (see Appendix VII).

Native vegetation

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 Environment and Heritage (www.environment.nsw.gov.au), Catchment Management Authorities (CMAs) and the Natural Resources Commission (www.nrc.nsw.gov.au) for further details.

Weed threats

Some pasture varieties may pose a weed threat some environments where conditions allow it to grow unhindered (e.g. lovegrass in high rainfall areas). Before sowing a variety, check with your local agronomist that the selected species is suitable to grow in your location.

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Mary-Anne Lattimore, District Agronomist, NSW DPI, Yanco and Lester McCormick, Technical Specialist Pastures (North), NSW DPI, Tamworth.

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Contents

INTRODUCTION

This guide provides information on species and varieties/brands of pasture grasses, legumes and some herbs used in pastures. Forage and fodder crops are not all covered – only those which have a primary role in pastures, including lucerne, ryegrass, chicory, plantain, lablab, burgundy bean and butterfly pea. For information on other fodder species such as forage sorghums, millets, brassicas and winter cereals, contact NSW DPI or seed company agronomists.

Species description and sowing rate

Pasture varieties are listed by type (annual or perennial), common and botanical name of species, maturity, genotype or habit, if relevant, and variety.

The sowing rate is for dryland areas. A sowing rate for irrigated areas (or irrigated / high rainfall or irrigated / tablelands areas) is included where the species is suited to these situations.

The sowing rates given cover a wide range of circumstances. The plant population must match the available moisture. Use the lower rates in lower rainfall situations and the higher rates for high rainfall or irrigation.

In mixtures, use the lower rates and take care with the use of high seeding rates. Pastures sown at high seeding rates in mixtures can be competitive, especially when more than one grass is sown.

If purchased seed is coated, increase sowing rate to allow for seed coat weight.

Varieties/Brand names

Varieties/brand names are listed together with suppliers and other relevant details that may assist in selection. Use the key points provided to decide which variety will suit your situation.

A variety or cultivar is an assemblage of cultivated individuals that is distinguished by any character (morphological, physiological, cytological, chemical or other) significant for the purpose of agriculture, forestry or horticulture which, when reproduced (sexually or asexually), retains its distinguishing features. Material registered under Plant Breeder's Rights complies with the definition of a variety.

Where seed is sold under a brand name, it may or may not be registered as a variety.

Area of adaptation

A guide to the minimum average annual rainfall (mm) required to grow the species is provided. Note that this will normally refer to the limit for the earliest maturing variety. It does not refer to all varieties listed.

Figure 1 includes annual rainfall isohyets. Check rainfall isohyets that cover your location and compare both of these against the minimum rainfall for the species listed.

The words (south) and (north) identify the isohyet suited to a particular species in the south and the north of the state, respectively.

Main seed source

The names of suppliers mentioned are based on the licensee or owner of the variety and are intended as a source of further information. It is not intended to provide a full list of retail outlets.

Where Plant Breeder's Rights, licensing or marketing agreements are not involved, a supplier name may be provided in some instances to give retailers or producers a contact to source the seed or information.

Certified seed/Quality assurance schemes

Use certified seed when possible, as it is guaranteed to be as close as possible to the genetic makeup of the variety, as selected by the breeder. Non-certified seed can change over time due to contamination, cross pollination or natural selection, so may not be the same as the original genotype.

Certified seed also meets strict standards including physical purity (chaff, dirt, sticks, stones, cracked or broken seeds, weed seeds, other crop seeds) and germination rate. When buying seed consider other physical aspects of seed quality (see Appendices I–II).

The Australian Seeds Authority and its certifying agencies oversee internationally accredited seed certification schemes and seed testing services in Australia to ensure that seed produced and sold in Australia is of the highest quality. Strict standards apply and the certifying agencies are independently accredited and audited by NATA (National Association of Testing Authorities). A number of seed companies produce seed under their own quality assurance schemes that provide similar assurances to certified seed.

Variety performance

This list does not give any information about the relative performance of a variety. Seek information from the nearest NSW DPI agronomist, agricultural adviser or seed company representative for comparative trial data on variety performance for your area. Information on attributes listed against varieties is based on a wide range of sources including information provided by plant breeders and seed companies.

General remarks

As each district spans many different environments, the comments on species/varieties are only a guide. Contact your local agronomist or adviser for information about the suitability of the listed pasture varieties for your area.

Important: The minimum average annual rainfall provided for species is only a guide; growing conditions are extremely varied throughout the State. Other important factors include the soil's capacity to hold moisture, slope and aspect, elevation and livestock management.

Temperate pasture species produce most of their feed during winter and spring. They tolerate cold and frost, and are widely adapted.

Tropical species are most productive during the warmer months. In New South Wales, their profitable use is limited by low effective rainfall in summer, low temperatures and frost. They are generally confined to the coastal districts, the northern and more northern central inland areas of the lower slopes and plains, and (with irrigation) the plains of the southern districts.

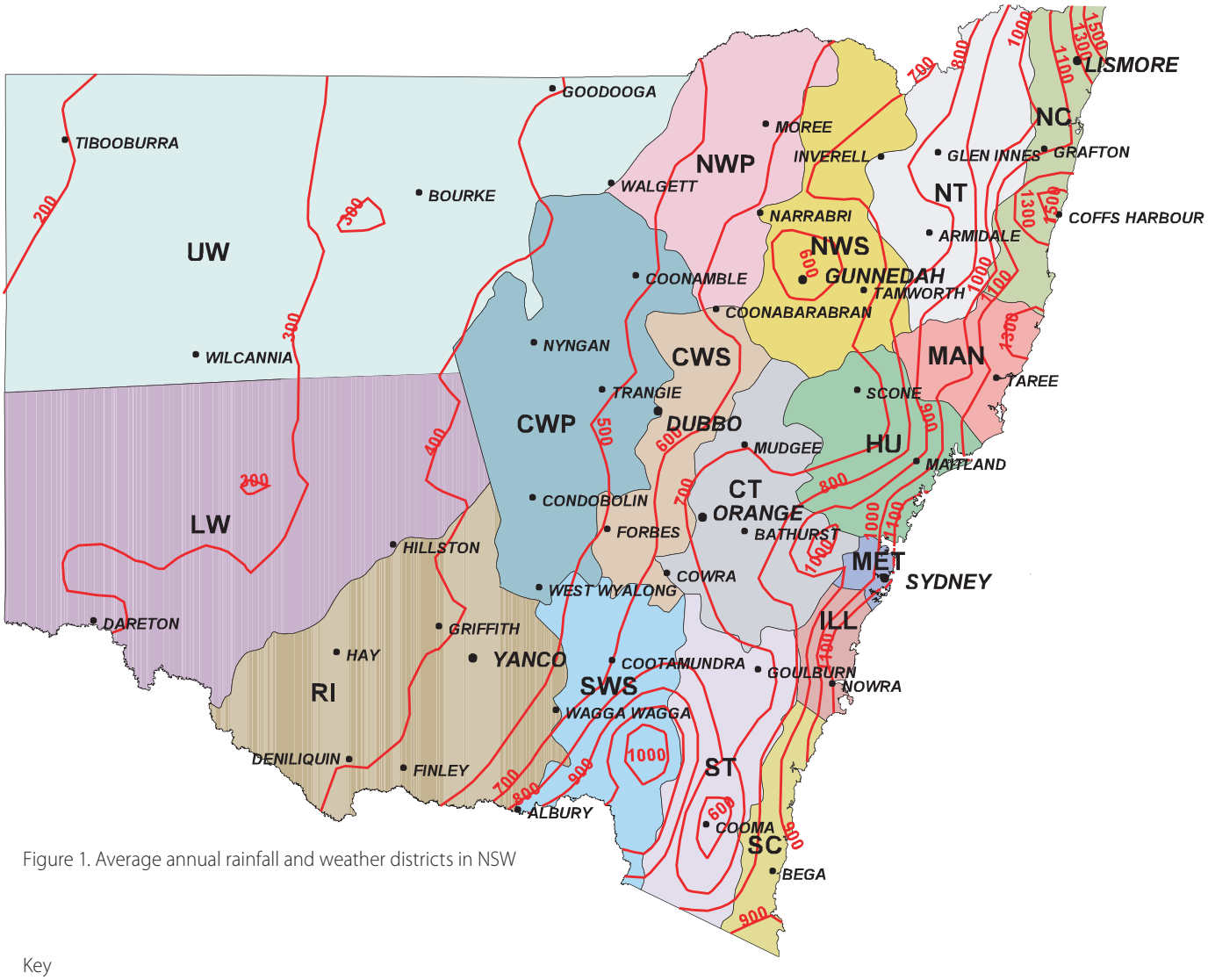


Figure 1. Average annual rainfall and weather districts in NSW

Key

UW	Upper Western	CWS	Central West Slopes	HU	Hunter
LW	Lower Western	SWS	South West Slopes	ILL	Illawarra
NWP	North West Plains	NT	Northern Tablelands	MET	Metropolitan
CWP	Central West Plains	CT	Central Tablelands	SC	South Coast
RI	Riverina	ST	Southern Tablelands		
NWS	North West Slopes	NC	North Coast		

A mixture of temperate and tropical varieties suited to the area may improve the overall quality of the mixture and give a better spread of feed across seasons. For example, tropical grasses on the northwest plains are usually grown with barrel medics (temperate species).

Some areas suited to temperate pastures can also support tropical varieties e.g. a mixture of white clover (temperate) and paspalum (tropical) in southern inland irrigated and coastal districts.

Species in mixtures with different optimum sowing times are often sown separately. For example, an annual temperate legume may be sown with the last winter cereal crop, but the tropical grass needed in the mixture may be sown the following summer. Temperate grasses tend to produce higher quality feed than tropical grasses, especially where pastures are not well managed.

FURTHER INFORMATION

A range of information on pasture species and related subjects is available on the NSW DPI web page: www.dpi.nsw.gov.au

For other pasture references see Appendix IX.

A list of seed and inoculant sources is available in Appendix X.

PLANT BREEDER'S RIGHTS

The symbol (Ⓟ) indicates that a variety is protected by Plant Breeder's Rights (PBR).

PBR is applied for and granted to plant breeders under The Plant Breeder's Rights Act of 1994. It is a type of copyright which protects the breeder's "invention" of a new and uniquely different plant variety. It provides the right of commercialisation of this "new" variety and as a flow on, via grower contracts, provides for the collection of royalties at one point during the production cycle to support the breeding programs.

PBR protection is normally valid for up to 20 years and under registration, the breeder has the exclusive right to sell, produce or reproduce, import, export and hold stock of the variety. Purchase of a PBR protected seed variety means that for individual farmers there are restrictions. The major restriction on a PBR protected line is that the current seed or the produce of subsequent harvests cannot be sold as seed for sowing, without permission from the breeder or his agent. This restriction includes seed sale and trading between farmers.

There are some exemptions to these restrictions. Seed from PBR protected lines may be held over on farm for own use, and may also be used on farm by either or both partners in a bona fide share cropping situation.

Do not rely on logos or a listing under PBR in this publication. Always check with the PBR office as to the registration status of a variety if you intend selling seed of that variety.

For more information on Plant Breeder's Rights contact IP Australia by phone on 1300 651 010 or web: www.ipaustralia.gov.au

Inoculant Choice a Key Factor for Small Seeds Establishment

Many pasture paddocks in NSW have not had inoculant applied for many years. These are often symptomatic of poor nitrogen fixation with root nodule colonies low in number and pale in colour as opposed to the pink nodule colour which signifies the likelihood of good nitrogen capture by the plant. Provided soil pH and other nutrient needs have been addressed, upgrading the sub clover inoculant strain to improve legume content and production is the next logical step to consider.

An improved Group C strain for sub clover, WSM1325, has been developed and tested by the National Rhizobium Program. The WSM1325 strain offers improved nitrogen fixation and nodulation initiation in acidic soils over earlier Group C strains and will also effectively initiate nodulation with a broader range of trifoliate clovers including the commonly grown balansa & Persian clovers.

One of the key developments of the ALOSCA dry formulation granular inoculant was solving the problem of how to successfully inoculate the new generation small seeded pastures species such as biserrula, bladder and gland clovers. These species, along with the more staple species such as sub clover and serradella, have a shallow seeding (less than 15 mm) requirement and will express significant improvements in dry matter and seed production when sown ahead of autumn rain. During this period the warmer conditions can accelerate the decline of inoculant efficacy with moisture-reliant inoculant products as it is common for the soil surface to be dry or dry out following seeding. The ALOSCA patented granule formulation activates on the same seasonal moisture triggers as the germinating seed. This protects the viability of the inoculant from the drying conditions until adequate rainfall occurs making it highly compatible with small seeded legume establishment.

Strain WU95 1968-1994:
The old Group C strain

Strain WSM409 1994-2005
Improved acidity tolerance

Strain WSM1325 *released 2006: Improved acidity tolerance and broader species range*

Group C (sub clover) development paying dividends: The pots are sown with the same species using the improved strains from left to right. New strain developments have improved pasture legume performance under broader soil type conditions across a greater species range. Picture supplied by the Centre for Rhizobium Studies (CRS) Murdoch University

TEMPERATE LEGUMES

ANNUAL SPECIES

Grow during the cooler part of the year and are well adapted to winter rainfall areas in southern NSW. They flower and produce seed in spring, die in summer and new plants grow from seed the following autumn.

BISERRULA
(Biserrula pelecinus)

Deep-rooted, hard-seeded, drought tolerant annual legume, growing in autumn, winter and spring. Performs well on lighter textured soils and will tolerate soil acidity (pH_{Ca} 4.5–7.5). Good tolerance of soils with moderate to high exchangeable soil aluminium (Al) but sensitive to high levels of manganese (Mn). Susceptible to waterlogging. Tolerant of redlegged earth mite as adult plant. Susceptible to aphids. Sensitive to some herbicides. High seed production. Persistent once seed is set. Usually sown in mixtures with serradella and subterranean clover. Suitable to sow as a pure sward using twin sowing (sowing under crop the year prior to pasture). Sow in autumn.

Minimum average annual rainfall:
375 mm – southern NSW; 525 mm – northern NSW

Sowing rate: 5–7 kg/ha alone; 0.5–2 kg/ha in mixtures

Inoculant: WSM 1497

Variety/brand	Comment	Main seed source
Casbah	early-mid maturity, very high hard seed	Ballard Seeds, Seedmark
Mauro (Þ)	mid-maturity, softer seed	Ballard Seeds, Seedmark

CLOVERS
(Trifolium spp.)

Grow and set seed each year, ensuring they survive in areas with long hot summers and low rainfall. Wide range of species available including aerial and subterranean seeding types which are adapted to different locations, soil types and uses. Different inoculants required for different species.

ARROWLEAF CLOVER
(Trifolium vesiculosum)

Erect, hard-seeded, deep-rooted, annual legume, mainly spring-summer growing. Productive and persistent. Suits grazing, hay and silage production. Adapted to a wide range of soil types but avoid alkaline clay soils (pH_{Ca} >7.5). Poor tolerance of waterlogging. Sown in mixtures for short–medium term pastures or as a component of high-density legume crops. Produces good late spring growth. Not suitable for sowing under cereal crops due to late maturity and tough, wiry stems as plant matures. Good soil moisture needed in spring for yield potential to be reached. Rotational grazing required. Seed easily harvested. High hard seed levels. Seed should be scarified to improve germination.

Minimum average annual rainfall:
400 mm – southern NSW; 500 mm – northern NSW

Sowing rate: 6–10 kg alone;
1–4 kg/ha in mixtures with species such as subterranean clover or serradella

Inoculant: C

Select varieties on the basis of maturity–earlier maturing varieties suit drier, more marginal areas.

Variety/brand	Comment	Main seed source
Early maturing		
Cefalu (Þ)		Seedmark
Zulumax		Seed Distributors
Late maturing		
Seelu		Public variety
Zulu II		Seedmark
Very late maturing		
Arrotas (Þ)		Tasglobal Seeds

BALANSA CLOVER
(Trifolium michelianum)

Self-regenerating, hard-seeded, annual legume, growing mainly in spring. Semi-erect with tall, soft hollow stems. Used as pioneering legume or pasture component. Suits acid to neutral soils (pH_{Ca} 4.5–7.0). Resistant to clover scorch and root rot. Tolerates winter waterlogging and is mildly salt tolerant. Produces good quality hay. Slow early growth but increases rapidly in late winter and spring. Prolific seeder with high proportion of hard seed. Graze dry residues in summer to ensure regeneration. (N.B. Hard seed levels can be variable depending on climate and management). Sow in autumn (dryland) with good moisture or early autumn (irrigated).

Minimum average annual rainfall:
350 mm – southern NSW; 650 mm – northern NSW

Sowing rate: 4–7 kg/ha alone; 0.5–1.0 kg/ha in mixtures; 5–10 kg/ha as a one year forage crop (irrigated)

Inoculant: C

Select varieties on the basis of:

Maturity – Earlier maturing varieties are suited to drier more marginal areas.

Seasonal growth – Select varieties to match feed requirements (consult local trial results where available).

Variety/brand	Comment	Main seed source
Early maturing		
Border		Auswest Seeds
Enduro		Seed Distributors
Frontier Ⓟ		Seedmark
Mid season maturity		
Paradana		Public variety
Taipan Ⓟ		Auswest Seeds
Late season maturity		
Bolta Ⓟ	very late	Seedmark
Viper Ⓟ		Auswest Seeds

BERSEEM CLOVER
(Trifolium alexandrinum)

Tall, erect, annual legume, growing in autumn, winter and spring. Used as annual forage crop, with multiple cuts or grazings possible. Does not regenerate well in subsequent years due to low level of hard seed. Suited to fertile, neutral pH soils. Mildly tolerant of waterlogging and salt. Susceptible to blue-green and spotted alfalfa aphids. Susceptible to frost. Sow as a pure stand or in mixtures with annual clovers or oats, or as a high density legume crop in late February to early April.

Minimum average annual rainfall:
600 mm – southern NSW; 750 mm – northern NSW

Sowing rate: 15–25 kg/ha alone (irrigated);
2–6 kg/ha in mixtures as part of a one year high density legume or cereal-legume crop

Inoculant: B

Select varieties on the basis of:

Disease resistance – Resistance to diseases may be important in your situation e.g. clover scorch, phytophthora root rot, pythium rot, leaf rust. Check local requirements for the need for resistance.

Variety/brand	Comment	Main seed source
Mid season to late maturing		
Carmel (Multicut)	susceptible to clover scorch	Public variety
Elite II Ⓟ	tolerant of clover scorch, resistant to pythium & phytophthora root rot	Seedmark
Memphis Ⓟ	resistant to earth mite & disease, frost tolerant	Belair Technology, Upper Murray Seeds
Alexandria	frost tolerant, tolerant of clover scorch	Seed Distributors

BLADDER CLOVER
(Trifolium spumosum)

Semi-erect, productive, hard-seeded, self-regenerating, annual legume. Suits wide range of soil types (pH_{Ca} 5–8.5). Susceptible to waterlogging and salt. Susceptible to redlegged earth mite, blue green aphid, cowpea aphid and lucerne flea. Tolerant of some herbicides. Early to mid maturity, similar to Dalkeith subterranean clover. Suitable for undersowing or in pasture mixtures. High seed yields and high levels of hard seed. Can be used in a 1:1 cropping rotation. Sow in autumn no deeper than 15 mm. Graze leniently in first year.

Minimum average annual rainfall: 350 mm

Sowing rate: 5–10 kg/ha alone; 2–4 kg/ha in mixtures

Inoculant: C

Variety/brand	Comment	Main seed source
Agwest Bartolo Ⓟ		Ballard Seeds, Agricom, Seed Distributors

CRIMSON CLOVER
(Trifolium incarnatum}

Erect, aerial-seeding annual legume with growth in autumn, winter and spring. Good early season growth. Used for grazing, silage and hay production. Suited to low fertility, sandy to loam soils with pH_{Ca} 4.2–7. Tolerant of clover scorch. Susceptible to blue-green aphid and redlegged earth mite. Self-regenerating but soft-seeded; does not persist well. Sow in autumn.

Minimum average annual rainfall:
450 mm – southern NSW, 650 mm – northern NSW.

Sowing rate: 8–10 kg/ha alone;
1–4 kg/ha in mixtures with subterranean clover or oats

Inoculant: C

Variety/brand	Comment	Main seed source
Mid-late season maturity		
Blaza (D	good winter growth	Seedmark
Caprera	good spring growth	Public variety

EASTERN STAR CLOVER
(Trifolium dasyurum syn. *T. formosum)*

Erect, self-regenerating annual legume, growing from late autumn to mid-spring. Suits mildly acid to neutral soils (pH_{Ca} 4.5–8.0) in areas with mainly winter rainfall and short growing season. In NSW, best suited to lower rainfall wheat belt areas. Has delayed germination (up to 6 weeks) following autumn rain in second and subsequent regeneration years. Moderately tolerant of blue-green aphid and lucerne flea, moderately sensitive to redlegged earth mite, sensitive to cowpea aphid. Sensitive to some herbicides. Sow in autumn.

Minimum average annual rainfall: 350–500 mm

Sowing rate: 7–10 kg/ha alone; 2–4 kg/ha in mixtures

Inoculant: C

No varieties currently available.

GLAND CLOVER
(Trifolium glanduliferum)

Semi-erect, hard-seeded, self-regenerating, annual legume. Suited to soils with pH_{Ca} 4.5–8 and grows well on light textured soils. Resistant to redlegged earth mite, aphids and clover scorch. Moderately tolerant of waterlogging. Early maturing species flowering around 100 days after sowing, depending on sowing date and seasonal conditions. Useful in mixtures with other temperate legumes or lucerne. Produces high seed yields. Seed easily harvested. Sow in autumn.

Minimum average annual rainfall:
375 mm – southern NSW; 550 mm – northern NSW

Sowing rate: 0.5–4 kg/ha in mixtures

Inoculant: Group C

Variety/brand	Comment	Main seed source
Prima	early maturity, resistant to RLEM & BGA	Auswest Seeds, Ballard Seeds,New Seeds, Agricom, Seedmark

PERSIAN CLOVER
(Trifolium resupinatum)

Erect, annual legume, growing in autumn, winter and spring. Suits clay and loam soils with pH_{Ca} 5–8. Good waterlogging tolerance and moderately tolerant of salinity. Used as a fodder or forage crop; good feed value as hay, silage or pasture. Also used as a component of high-density legume crops in cropping rotations. Good regrowth after grazing. Suitable in mixtures with short-term ryegrass. Hard-seeded varieties regenerate well but softer seeded varieties must be resown. Sow in mid-late autumn (dryland) or early February (irrigated).

Minimum average annual rainfall:
450 mm – southern NSW

Sowing rate: 4–10 kg/ha alone; 1–3 kg/ha in mixtures

Inoculant: C

There are two types of Persian clover:

Trifolium resupinatum var. *majus* (large-leaved forage type) known in some areas as "Shaftal clover". Erect habit, thick hollow stems and large leaflets. Flowering and maturity is mostly late. Used in high density legume fodder crops. Soft-seeded.

Trifolium resupinatum var. *resupinatum* (early, small-leaved grazing type). More prostrate habit, thinner stems and smaller leaflets. Flowering and maturity mostly earlier than *majus* types. Used in dryland pastures. Higher seed yields and hard seed levels than *majus*. Smaller seed.

Select varieties on the basis of:

Use pattern – Short-term or medium to long-term pasture, or high density annual forage.

Maturity – Later maturing varieties suit irrigation and high rainfall.

Hard seed levels – High hard seed levels give better regeneration. Use soft-seeded varieties for annual forage crop, and hard seeded varieties for self-regenerating pastures.

Seasonal production – Select varieties to match feed requirements (consult local trial results where available).

Disease resistance – Varieties differ in their resistance to disease. Seek local information on the need for resistance, particularly to leaf and stem rust, clover scorch and phytophthora root rot.

Variety/brand	Comment	Main seed source
1. *Trifolium resupinatum* var. *majus* (also known as Shaftal clover) – semi-erect to erect types, suitable for forage/fodder crops		
Early to mid season, high hard seed levels		
Flash	grazing tolerant	Auswest Seeds
Mid season, no hard seed		
Lightning	tolerant of clover scorch, susceptible to leaf rust	Seedmark
Late season, low hard seed levels		
Anchor		Auswest Seeds
Enrich	very late flowering	Seed Force
Laser Ⓟ	tolerant of leaf & stem rust, clover scorch & phytophthora root rot	Seedmark
Lusa Ⓟ		Tasglobal Seeds
Maral (Shaftal)	susceptible to leaf rust	Public variety
RD 8	rust tolerant	Auswest Seeds
Turbo	good frost tolerance	Seed Distributors
Turbo Plus Ⓟ	leaf disease resistant, frost tolerant	Belair Technology, Upper Murray Seeds
2. *Trifolium resupinatum* var. *resupinatum* – self-regenerating, prostrate to semi-prostrate types, suitable for short-term or long-term pastures		
Early to mid season, high hard seed levels		
Morbulk		Auswest Seeds
Nitro Plus Ⓟ	resistant to clover scorch & phytophthora root rot	Seedmark
Prolific	tolerant of clover scorch & phytophthora root rot	Seedmark, Ballard Seeds
Thunder (Storm)		Auswest Seeds
SARDI Persian	semi-prostrate	Seed Distributors

PURPLE CLOVER
(Trifolium purpureum)

Erect, deep-rooted, annual legume, growing in autumn, winter and spring. Suits wide range of soil types, from sandy loams through to clay loams with pH_{Ca} 4.5–8.5. Tolerant of short-term waterlogging. High quality forage prior to flowering. Late flowering. Good dry matter production until late in growing season. High levels of hard seed. Poor seed production.

Minimum average annual rainfall: 550 mm

Sowing rate: 7–10 kg/ha alone; 1–4 kg/ha in mixtures

Inoculant: C

Variety/brand	Comment	Main seed source
Electra	late maturity, disease tolerance, susceptible to aphids	Auswest Seeds, Upper Murray Seeds

ROSE CLOVER
(Trifolium hirtum)

Hairy, self-regenerating annual, legume, growing in autumn, winter and spring. Suits a wide range of soils, especially acid and lighter textured soils. Tolerant of redlegged earth mite. Highly palatable but feed value low after flowering. Sensitive to heavy grazing or cutting at flowering. Flower heads can cause impaction in ruminants if the sole source of feed. Commonly used as a pioneer legume or in mixtures with medics or subterranean clovers. Regeneration is unreliable without management for seed production. Sow in autumn.

Minimum average annual rainfall:
400 mm – southern NSW; 650 mm – northern NSW

Sowing rate: 5–15 kg/ha alone; 0.5–4 kg/ha in mixtures

Inoculant: C

Variety/brand	Comment	Main seed source
Hykon		Public variety
SARDI Rose	higher hard seed	Seed Distributors

SUBTERRANEAN CLOVER (Sub clover)
(Trifolium subterraneum)

Prostrate, self-regenerating annual which buries seed (bracycalycinums do not actively bury seed). Best suited legume for large areas of southern NSW with winter dominant rainfall. Produces high quality forage and hay. Grows mainly in autumn, winter and spring. Regenerates well from buried seed in autumn but false breaks can reduce seedbank. Suited to moderately acid to neutral soils, from sandy soils to clay loams. Tolerant of grazing. Current varieties are low in oestrogen. Choose varieties that match rainfall and soil types of the district for reliable seed set and improved persistence. Early maturing varieties suit drier areas. Mixing varieties can provide more reliable production in variable seasonal conditions e.g. later maturing varieties will perform well in higher rainfall years, while earlier maturing varieties will set seed more reliably in below average rainfall years and be more persistent. Subterranean clover varieties are listed below from late to early maturity. Sow in early to late autumn.

Minimum average annual rainfall:
375 mm – southern NSW; 600 mm – northern NSW

Sowing rate: 4–10 kg/ha alone;
3–6 kg/ha in mixtures with grasses and other legumes

Inoculant: C

Select varieties on the basis of:

Type of subterranean clover – Three main types of subterranean clover:

Subterraneum – black seeds – adapted to neutral to moderately acid soils

Brachycalycinum – mostly black seeds – suited to neutral to alkaline clay soils

Yanninicum – yellow seeds – suited to poorly-drained, waterlogged soils

Hard seed levels – High hard seed levels desirable where persistence needed in drier areas. Low levels suit higher rainfall areas with late maturing varieties (see Appendix VI).

Maturity – Use early maturing varieties in drier, more marginal areas, and later maturing varieties where spring rainfall is reliable or for irrigation (see Appendix VI).

Phytophthora root rot – Tolerance important in poorly drained soils in high rainfall areas and under irrigation. Three known races of Phytophthora affect subterranean clover. Varieties with resistance to fewer than all three races are designated as "partially resistant" in the table below.

Production potential – Especially winter production (which is very dependent on plant density). Long season production important where late spring conditions occur or where irrigation available–consult local trial results where available.

Oestrogen levels – Do not grow older varieties (e.g. Dwalganup, Yarloop) which may have high levels of plant oestrogens that can cause livestock infertility. All listed varieties have low levels and are unlikely to cause clover disease in sheep.

Other diseases – Clover scorch in particular may be a problem in higher rainfall districts.

Variety/brand	Comment	Main seed source
Subterraneum **subspecies – suited to acid to neutral soils**		
Very late maturing, very low hard seed levels		
Leura Ⓟ	partially resistant to root rot, susceptible to scorch	Wrightson Seeds
SF Rosabrook	Tolerant of RLEM, scorch and root rot	Seedforce
Mid – late maturing, low hard seed levels		
Denmark Ⓟ	partially resistant to root rot, resistant to scorch	Seedmark
Karridale	partially resistant to root rot, moderately resistant to scorch	Public variety
Ovaflow	partially resistant to root rot	Seed Distributors
Mid – late season, moderate hard seed levels		
Goulburn Ⓟ	partially resistant to root rot, resistant to scorch	Wrightson Seeds
Mid season, low hard seed levels		
Woogenellup	susceptible to root rot and scorch	Public variety
Mid season, moderate hard seed level		
Junee	susceptible to root rot, resistant to scorch	Public variety
Coolamon Ⓟ		Auswest Seeds, Agricom
Mid season, high hard seed levels		
Campeda Ⓟ	resistant to root rot & scorch	Seedmark
Early–mid season, very high hard seed levels		
York Ⓟ	partially resistant to root rot, susceptible to scorch	Seedmark
Early – mid season, moderate hard seed levels		
Bindoon	improved RLEM tolerance at seedling stage in some conditions	Agricom
Seaton Park LF	resistant to root rot, susceptible to scorch	Public variety
Early season, high hard seed levels		
Dalkeith	partially resistant to root rot, susceptible to scorch	Public variety
Dalsa	partially resistant to root rot	Seed Distributors
Losa	partially resistant to scorch	Seedmark
Urana Ⓟ	resistant to scorch	Auswest Seeds, Agricom
Very early season, high hard seed levels		
Izmir Ⓟ	susceptible to aphids & leaf disease	Auswest Seeds, Ballard Seeds, Agricom
Nungarin	susceptible to root rot & scorch	Public variety
Brachycalycinum **subspecies– suited to neutral to alkaline soils**		
Mid season, low hard seed levels		
Clare	susceptible to root rot and scorch	Public variety
Clare2	tolerant of scorch, BGA, RLEM	Seed Distributors
Mid season, moderate hard seed levels		
Antas Ⓟ	partially resistant to root rot & scorch	Seedmark
Early – mid season, moderate hard seed levels		
Mintaro Ⓟ	resistant to root rot & scorch	Seedmark
Yaninnicum **subspecies – suited to poorly drained waterlogged soils**		
Late season, moderate hard seed levels		
Meteora	partially resistant to root rot, resistant to scorch	Public variety
Napier Ⓟ	resistant to root rot & scorch	Seedmark
Mid season, moderate hard seed levels		
Gosse Ⓟ	resistant to root rot & scorch	Seedmark
Hatrik	partially resistant to root rot	Seed Distributors
Narrikup	resistant to clover scorch and RLEM	Seed Force
Riverina Ⓟ	resistant to root rot & scorch	Auswest Seeds, Agricom
Early – mid season, low hard seed levels		
Monti	tolerant of RLEM, aphids, root rot and clover scorch	Seedmark
Trikkala	partially resistant root rot, moderately resistant to scorch	Public variety

Better Forage Options

Monti NEW Sub Clover

- Flowers 2 days earlier than Trikkala and 8 days earlier than Gosse
- Produces excellent early winter growth
- Excellent adaptation to the shorter growing seasons
- Produces excellent seed yields and regenerates reliably
- Has better tolerance to phytophthora root rot and clover scorch disease than Trikkala

Bolta Balansa Clover

- Tolerates waterlogging and mild soil salinity
- Superior late spring growth – 40% more than Paradana in Oct/Nov
- Highly tolerant to clover scorch
- Particularly well suited to high production ryegrass/clover blends
- High quality hay or standing feed

Mintaro Sub Clover

- Very vigorous establishment and amazing winter dry matter production
- Mid-season maturity – 114 days to flowering
- High hard seed (45%) & very good regeneration
- Large leaved, upright very productive variety
- Particularly well suited to slightly acidic to alkaline soils

Atlas PG Phalaris

- Winter active variety with erect growth habit
- High summer dormancy to stop summer shoot growth
- Improved persistence in dry marginal phalaris areas
- Strong seedling vigour and high winter production
- Suited to higher rainfall parts of the wheat belt

Pegasis Lucerne

- Highly winter-active lucerne bred for excellent production and persistence in dryland cropping rotations
- Excellent option for when very productive plant stands need to be maintained for 3-4 years under rain fed conditions
- Newly released alternative to other highly winter active cultivars like L90, SARDI 10, Cropper 9.5 etc.
- Highly resistant to spotted alfalfa aphid and moderately resistant to phytophthora root rot

Antas Sub Clover

- Exceptionally vigorous establishment
- Amazing winter growth and total production
- Most productive sub clover available
- Higher level of hard seed offering better persistence
- Widely adapted – mildly acid to alkaline soils
- Has very large leaves offering good grazing and hay production

Holdfast GT Phalaris

- Grazing tolerant, winter active phalaris
- Selected for long term persistence under grazing
- Significant improvement over Holdfast and Sirosa in both grazing tolerance and production
- Lower levels of stagger causing alkaloids
- Holdfast GT exhibits excellent seedling and winter vigour to aid successful establishment
- Bred by the CSIRO breeding program
- Good tolerance to acid soils

NSW Contacts

Northern NSW: Todd Jones
0428 255 753

Central NSW: James Stonestreet
0437 950 496

Southern NSW: Reece Hardwidge
0428 178 719

NSW DRI Nov 2011

seedmark

Level 1/145 South Terrace Adelaide, SA 5000
P 1800 112 400 **F** 1800 677 805 **www.seedmark.com.au**

MEDICS
(Medicago spp.)

Self-regenerating, semi-prostrate, annual legumes, adapted to areas with a predominantly winter rainfall. Mainly adapted to neutral to alkaline soil types. Good quality forage for grazing. Useful in pastures alone or in mixtures with annual grasses. High levels of hard seed. Regenerates well from seed even after 1–3 years cropping. Susceptible to waterlogging. Range of species available, suiting different niche environments. Sow in autumn. Minimum average rainfall, sowing rate and inoculant group vary with variety.

Select varieties on the basis of:

Maturity – Use earlier maturing varieties in drier, more marginal areas of medic zone.

Adaptation to soil type – e.g. Jemalong and Jester are particularly suited to red clay loams; Mogul is adapted to heavy alkaline soils.

Hard seed – Use high hard seed levels where persistence needed; softer seeded types enhance regeneration, especially in the year after establishment.

Aphid resistance – Blue-green aphid tolerance highly desirable.

Yield and persistence – Consult local trial results where available.

BARREL MEDIC
(Medicago truncatula)

Prostrate, trailing, hard-seeded annual legume with barrel-shaped pods. Grows mainly in autumn, winter and spring. Suited to long-term pastures on neutral to alkaline soils in lower rainfall areas of the wheat belt and further west. Not well adapted to deep sands, waterlogged or moderately saline areas. More productive and persistent in low rainfall areas than subterranean clover. Susceptible to redlegged earth mite, lucerne flea, lucerne aphids, cowpea aphid, sitona weevil, phoma black-stem, rhizoctonia bare-patch, root lesion nematode and powdery mildew. Intolerant of some herbicide residues from cropping phase, especially sulfonylurea in low rainfall areas with alkaline soils. Palatable at all growth stages, including dead leaves and stems, and seedpods over summer. High nutritive value. Once established, regenerates from seed bank after short cropping phases (1 – 3 years). Slightly spiny pods but not hooked, so do not cling to wool of sheep but spread by livestock eating seed. Herbicide options for broadleaf weed control limited. Companion species include annual ryegrass, volunteer or sown cereals and various summer growing grasses in the subtropics; Legumes include other annual medics, subterranean clover and lucerne. Sow on good moisture in autumn.

Minimum average annual rainfall:
275 mm – southern NSW; 400 mm – northern NSW

Sowing rate: 2–6 kg/ha in mixtures, 4–10 kg/ha alone

Inoculant: AM

Variety/brand	Comment	Main seed source
Early – mid maturity, high hard seed		
Caliph Ф	tolerant of BGA & SAA	Seed Distributors
Mid – late maturity, moderate hard seed		
Paraggio	BGA tolerant	Public variety
Mid – late maturity, high hard seed		
Sephi	tolerant of BGA & SAA	Public variety
Jester Ф	tolerant of BGA & SAA	Seedmark
Mid – late maturity, high hard seed		
Jemalong	susceptible to aphids	Public variety

BURR MEDIC (Spineless burr medic)
(Medicago polymorpha var. *brevispina)*

Trailing prostrate medic, growing mainly in the autumn, winter and spring. Suits soil types from mildly acid red-brown sandy loams to red clay loams pH_{Ca}>5.2. In NSW, suits areas similar to Caliph barrel medic. Tolerates waterlogging and mild salinity but susceptible to aphids. Unlike naturalised burr medic, var. brevispina has spineless pods which do not hook to the wool of sheep. High seed yield and hard seed levels; persist well in low rainfall areas.

Sowing rates: 2–5 kg/ha in mixtures

Inoculant: AM

Variety/brand	Comment	Main seed source
Early maturity, high hard seed		
Santiago		Public variety
Saracen	moderately tolerant of acid soils	Seed Distributors
Mid-maturity, moderate hard seed		
Scimitar Ф	tolerant of BGA	Seedmark
Cavalier Ф	tolerant of acid soils	Seed Distributors

BUTTON MEDIC
(Medicago orbicularis)

Semi-prostrate, trailing, early flowering medic with distinctive flattened, button-shaped pods, growing mainly in the autumn, winter and spring. Well adapted to low rainfall and marginal cropping and grazing environments in the subtropical pastoral zone (north-west plains) of NSW. Suits a wide range of soil types from self-mulching and black earth soils, to sandy and loamy alkaline soils. Tolerant of frosts. Susceptible to lucerne aphids, redlegged earth mite, cowpea aphid and powdery mildew. Susceptible to residual herbicides from a cropping phase, especially sulfonylurea on alkaline, sandy soils. Palatable, high quality feed for livestock. High seed producer, with more seed produced in dry and marginal environments than barrel medics. Sets seed readily under grazing. High hard seed levels and slow to soften, so quickly builds up seed reserves. Spreads slowly but could be spread through livestock. Companion species in the subtropics include any of the adapted tropical and temperate grasses, other adapted medics (especially early flowering barrel and spineless burr medics) and Desmanthus a tropical legume. In southern NSW may be sown with other early flowering medics. Sow in early autumn to early winter. Delay grazing until plants are well established.

Minimum average annual rainfall:
200 mm – southern NSW; 300 mm – northern NSW

Sowing rate: 2–3 kg/ha of scarified seed

Inoculant: AM

Variety/brand	Comment	Main seed source
Bindaroo	early maturity, high hard seed	Seed Distributors

DISC MEDIC
(Medicago tornata)

Prostrate trailing medic with disc-shaped pods which grows well on neutral to slightly acid soils. Mid-maturing with high levels of hard seed. High forage quality and hay production. High seedling vigour. Higher rate of seed set than most other medics. Avoid heavy grazing during flowering and pod fill.

Minimum average annual rainfall: 350 mm

Sowing rate: 10–15 kg/ha alone, 2–4 kg/ha in mixtures

Inoculant: AL

No varieties currently available

GAMA MEDIC
(Medicago rugosa)

Erect medic with disc-shaped pods, growing mainly in the autumn, winter and spring. Suited to the western edge of the cropping zone (similar area to Cyprus barrel medic) and calcareous clay and loam soils (alkaline). Very tolerant of blue-green aphid and tolerant of spotted alfalfa aphid pre-flowering. Tolerant of redlegged earth mite and lucerne flea. Vigorous seedlings but intolerant of heavy grazing pressure or waterlogging. Suits hay production.

Minimum average annual rainfall: 300 mm

Sowing rates: 10–15 kg/ha alone

Inoculant: AM

Variety/brand	Comment	Main seed source
Paraponto	early-mid maturity	Public variety

HYBRID MEDIC
(M. tornata × M. littoralis)

Hybrid between disc and strand medic, with similar performance to disc medic. Selected for neutral to alkaline sandy soils, especially deep sands. Resistant to blue-green aphid, moderately resistant to spotted alfalfa aphid but susceptible to lucerne flea. Early maturing. Usually used in mixtures.

Minimum average annual rainfall: 275 mm – southern NSW

Sowing rate: 3–8 kg/ha

Inoculant: AL

No varieties currently available

MUREX MEDIC
(Medicago murex)

Prostrate medic which grows mainly in winter and spring. Suited to long-term pastures. Adapted to red-brown earths to cracking clay soils with pH_{Ca} > 4.5 and Al <15%. The most acid tolerant commercially available medic species. Compared with subterranean clovers of similar maturity, has higher proportion of hard seeds, stays greener for longer (particularly during a dry spring) and residue breaks down more slowly over summer. Spineless pods. High hard seed levels. Regeneration in subsequent years is variable. Tolerant of redlegged earth mite but susceptible to aphids. Susceptible to extended waterlogging and frost. Sow on good moisture in autumn.

Minimum average annual rainfall:
500 mm – southern NSW

Sowing rate: 2–6 kg/ha

Inoculant: AM

Variety/brand	Comment	Main seed source
Zodiac	mid-late maturity	Public variety

SNAIL MEDIC
(Medicago scutellata)

Erect medic, with large snail-like pods, growing mainly in autumn, winter and spring. Best suited to heavy neutral to alkaline soils in lower rainfall areas of the wheat belt and further west. Suited to long-term pastures. Tolerant of spotted and blue-green aphid, redlegged earth mite and lucerne flea. Vigorous seedlings and good growth the first year. Moderately acceptable to stock. Pods grazed in summer and variable regeneration from seed reserves in soil (best on self-mulching soils). Suits hay production. Sow on good moisture between mid-April and end of May.

Minimum average annual rainfall:
400 mm – southern NSW; 500 mm – northern NSW

Sowing rate: 3–7 kg/ha

Inoculant: AM

Variety/brand	Comment	Main seed source
Sava	early maturity	Public variety
Silver	early-mid maturity, resists SAA & BGA	Seed Distributors

SPHERE MEDIC
(Medicago sphaerocarpus)

Semi-prostrate to semi-erect medic with spherical pods. Tolerant of acid soils (pH_{Ca}>4.8). Remains green and flowers longer in spring than other annual legumes of similar flowering time. Vigorous seedlings. Tolerant of redlegged earth mite at seedling stage. Susceptible to aphids. Tolerant of foliar diseases and phytophthora root rot. Moderate level of hard seed. Suitable for crop rotations. Sow in autumn.

Minimum average annual rainfall:
350 mm – southern NSW

Sowing rate: 8 kg/ha alone

Inoculant: AM

Variety/brand	Comment	Main seed source
Orion	mid-maturity	Ballard Seeds

STRAND MEDIC
(Medicago littoralis)

Hard-seeded, prostrate medic with small barrel-shaped pods. Grows mainly in winter and spring. Best suited to neutral to alkaline soils (pH_{Ca}>5.8 and Al >5%) in lower rainfall areas of the wheat belt and further west. Only suited to well-drained soils of sandy texture. Sensitive to waterlogging. Small, spineless barrel-shaped pods. Good regeneration from seed after 1–2 years cropping. Suited to long-term pastures. Sow on good moisture in autumn.

Minimum average annual rainfall:
275 mm – southern NSW

Sowing rate: 2–6 kg/ha in mixtures

Inoculant: AL

Variety/ brand	Comment	Main seed source
Early maturing, moderately hard-seeded		
Angel Φ	tolerant of soil residues from SU herbicides, resistant to BGA & SAA	Seedmark
Jaguar Φ		Auswest Seeds
Mid-season, hard-seeded		
Harbinger	susceptible to blue green aphid	Public variety
Mid-season, moderately hard-seeded		
Harbinger AR	tolerant of blue green aphid	Public variety

SERRADELLA

Deep-rooted, self-regenerating annual legume, growing in autumn, winter and into spring. Suited to deep, sandy to sandy loam acid soils (pH_{Ca}<6.5) with moderate to high levels of exchangeable soil aluminium (Al) (except Madeira). Sensitive to high levels of exchangeable manganese (Mn). Tolerant of aphids. Non-bloating. Withstands heavy winter grazing. Persistent once seed bank established. Less herbicide options available than subterranean clover. Seed in pods needs to undergo a breakdown period, so establishment slow if using in-pod unscarified seed. Can sow pods under cereal crop for regeneration in following year (twin sowing). Mixtures of varieties of different maturities and hard seed levels useful. Dehulled, scarified seed preferred if a stand is required immediately. Enhanced pod (i.e. partially processed, consisting of mix of pod and clean seed) is also available. Sow in autumn.

Select varieties on the basis of:

Maturity – Earlier maturing varieties suit drier more marginal areas; late varieties suit high rainfall areas.

Hard seed levels – Medium hard seed levels tend to increase second year production.

Soil aluminium – All varieties have high tolerance of exchangeable soil aluminium, except Madeira (low tolerance) and Elgara (moderate to high tolerance).

Note: Elgara seed may be in short supply.

YELLOW SERRADELLA

(Ornithopus compressus)

Suits acid sands to neutral loams. Not suited to poorly drained or waterlogged soils.

Minimum average annual rainfall:
400 mm – southern NSW; 450 mm – northern NSW

Sowing rate: 7–10 kg/ha (dehulled); or 10–30 kg/ha (in-pod); 2–5 kg/ha in mixtures

Inoculant: S

Variety/brand	Comment	Main seed source
Mid – late season, high hard-seed levels		
Avila		Public variety
Early – mid season, high hard-seed levels		
Charano (D)		Seedmark
Elgara	mod to high tol Al	Public variety
Madeira	sensitive to Al	Public variety
Santorini (D)		Ballard Seeds
Yelbini (D)		Ballard Seeds
Early season, medium hard-seed levels		
King	suits acid sands with high Al	Ballard Seeds, GN Lummis
Yellotas	50:50 hard seed	Auswest Seeds, Tasglobal Seeds

PINK SERRADELLA (French serradella)
Ornithopus sativus

Early to mid season maturity with good winter growth. Adapted to sandy acid, low fertility soils. Tolerates some waterlogging. Some tolerance of earth mites as adult plant. Does not tolerate simazine. Soft-seeded varieties suited to short-term production (1–2 years) or in pasture mixes to improve production in initial years. New hard-seeded varieties provide better regeneration in the second year than yellow serradella. High hard seed varieties are suitable for twin sowing and in short crop rotations. Sow in autumn.

Minimum average annual rainfall:
350 mm – southern NSW; 400 mm – northern NSW

Sowing rate: 7–10 kg/ha (dehulled); 10–30 kg/ha (in-pod); 2–5 kg/ha in mixtures

Inoculant: S

Variety/brand	Comment	Main seed source
Soft-seeded, erect growth habit		
Cadiz Ⓓ	mid maturity, extended flowering	Ballard Seeds, Seedmark
Eliza Ⓓ	early–mid maturity, RLEM tolerant, Moderately tolerant of aphids	Ballard Seeds
Hard-seeded, prostrate growth habit		
Erica Ⓓ	mid maturity, grazing tolerant, moderately tolerant of RLEM	Ballard Seeds, Seedmark
Hard-seeded, erect growth habit		
Margurita Ⓓ	mid maturity, hard-seeded	Ballard Seeds
Serratas	soft-seeded	Tasglobal Seeds, Auswest Seeds

WOOLLY POD VETCH
(Vicia villosa)

Hairy, climbing, self-regenerating, annual legume, growing in autumn, winter and spring. Used as pasture, forage, hay and green manure crop. Suited to wide range of soil types, especially well-drained soils. Tolerates acid soils with moderate levels of exchangeable soil aluminium (Al). Susceptible to waterlogging. Resistant to chocolate spot and rust. Susceptible to redlegged earth mite. High level of hard seed; can be a weed problem in winter crops. (N.B. Grain may be toxic to livestock). Sow in autumn. There are some other species of vetch available that are not self-regenerating and are used primarily as forage crops, rather than for self-regenerating pastures.

Minimum average annual rainfall:
550 mm – southern NSW; 650 mm – northern NSW

Sowing rate: 4–10 kg/ha

Inoculant: E

Select varieties on the basis of:

Hard seed level – Soft seeded varieties useful for short crop rotations. Higher hard seed levels increase regeneration potential.

Productivity – Especially in winter (consult local trial results where available).

Variety/brand	Comment	Main seed source
Low hard-seed		
Capello Ⓓ	mid season	Seedmark
High hard-seed		
Haymaker Plus Ⓓ	mid season	Seedmark
Namoi	mid-late	Public variety

PERENNIAL SPECIES

Grow all year round if moisture available and usually survive for more than one year. Potentially fix more nitrogen than many annual species because they grow for longer.

CLOVERS
(Trifolium spp.*)*

Suit areas where moisture is available during summer (rainfall or irrigation). Provide good quality feed and used for grazing or for hay and silage. Vast range of types to suit different situations.

ALSIKE CLOVER
(Trifolium hybridum)

Erect, biennial or short-lived perennial clover. Adapted to wide variety of soils in cool moist tableland areas. Best growth in spring and autumn. Very winter hardy. Sow in autumn or spring.

Minimum average rainfall: >600 mm

Sowing rate: 1–3 kg/ha alone

Inoculant: B

Variety/brand	Comment	Main seed source
Hytas		Tasglobal Seeds

RED CLOVER
(Trifolium pratense)

Erect, short-term (2–3 years) perennial legume, growing mainly in summer and autumn. Suited to high rainfall areas with summer dominance. Performs best in cool coastal and tablelands areas. Some varieties used in irrigated pasture mixtures. Prefers well-drained, fertile, slightly acid to neutral soils (pH_{Ca} 5.2–7). Resistant to spotted alfalfa aphid. Susceptible to earth mite and root rot. Can cause bloat in cattle. Habit varies with variety. Erect types useful for hay; prostrate types resist grazing. Sow in autumn or spring (irrigation and tablelands).

Minimum average annual rainfall:
700 mm – southern NSW; 800 mm – northern NSW

Sowing rate: 4–5 kg/ha alone; 1–2 kg/ha in mixtures

Inoculant: B

Select varieties on the basis of:

Oestrogen level – Older varieties have higher oestrogen levels which can adversely affect performance of breeding stock; new varieties generally low in oestrogen.

Maturity – Earlier maturing types provide earlier feed in the spring.

Ploidy – Tetraploid types have larger leaves than diploid types.

Seasonal growth – Select high productivity to match livestock demand, especially winter growth. Consult local trial results where available.

Stoloniferous habit – May assist spread and increase persistence.

Variety/brand	Comment	Main seed source
Early maturing diploids		
Grasslands Colenso (Ⓓ)	medium oestrogen	Agricom
Grasslands Hamua 'Cowgrass'	old cultivar, high oestrogen	Public variety
Grasslands Sensation (Ⓓ)	medium oestrogen	Agricom
Renegade	medium oestrogen, erect	Seed Distributors
Early maturing, stoloniferous diploids		
Astred (Ⓓ)	low oestrogen	Wrightson Seeds
Grasslands Broadway (Ⓓ)	low oestrogen	Agricom
SF Rossi	low oestrogen, disease tolerant, hay type	Seed Force
Red812	low oestrogen, erect hay type	Upper Murray Seeds
Mid-season maturing diploids		
Redquin	low oestrogen, erect	Public variety
Tuscan	medium oestrogen, grazing tolerant	Heritage Seeds
Late season diploids		
Grasslands Turoa	high oestrogen, semi-erect	Public variety
Rajah	low oestrogen, grazing tolerant	Seed Distributors
Late season tetraploids		
Grasslands Pawera	high oestrogen, erect	Public variety

STRAWBERRY CLOVER
(Trifolium fragiferum)

Prostrate perennial legume with similar growth habit to white clover but not as productive. Most growth in spring, summer and autumn. Tolerant of waterlogging, salt and persists well in high temperatures. Useful in seepage areas in lower rainfall areas mixed with salt tolerant grasses. Sow in autumn (dryland), or autumn or spring (irrigated). Often sown with white clover.

Minimum average annual rainfall:
600 mm – southern NSW; 650 mm – northern NSW

Sowing rate: 1–2 kg/ha alone (dryland); 2–4 kg/ha alone (irrigated); 0.5–1 kg/ha in mixtures

Inoculant: B

Variety/brand	Comment	Main seed source
Grasslands Upward Ð	erect, high winter production	Wrightson Seeds
O'Connors	prostrate small leaf, poor spring growth	Public variety
Palestine	erect, large leaf	Public variety

WHITE CLOVER
(Trifolium repens)

Prostrate perennial legume with most growth in spring, summer and autumn. Useful in high rainfall, coastal and tableland districts, and under irrigation for short or medium-term pasture. Suits wide range of soil types and relatively tolerant of acidic soils (pH_{Ca}>4.5 with Al <20%). High nutritive value and some varieties tolerate heavy grazing. High bloat risk. Intolerant of drought and high temperature; requires good summer rainfall or irrigation for survival. Can be grown with tropical or temperate grasses. Sow on good moisture in mid-autumn to early winter (dryland), and/or spring (irrigation and tablelands).

Minimum average annual rainfall:
700 mm – southern NSW; 775 mm – northern NSW

Sowing rate: 4–5 kg/ha alone (irrigated); 0.5–4 kg/ha in mixtures

Inoculant: B

Select varieties on the basis of:

Plant habit – Larger-leaved varieties yield more than smaller-leaved types.

Note that these categories are broad and the characteristics of leaf size and stolon density are continuous (i.e. variety listed as 'medium' leaf size may be between a medium and a large leaf size). Prostrate types tend to be more tolerant of sheep grazing, while more erect varieties tend to be more suited to dairy cattle. The greater the stolon density, the greater the ability to spread and survive, especially under close grazing (e.g. sheep versus cattle).

Seasonal production – Overall productivity (especially winter) and persistence. Consult local trial results where available.

Variety/brand	Comment	Main seed source
Large-leaved		
Braidwood	good winter growth, frost tolerant	Auswest Seeds
Excel Ladino Ð	good winter growth, early flowering, high seed yield	Auswest Seeds
Grasslands Kopu II	good production & persistence	Wrightson Seeds
Haifa	good heat tolerance, production & persistence	Public variety
Jumbo	good winter growth, heat tolerant, resists RLEM	Seed Distributors
Osceola	summer active	Wrightson Seeds
Quest Ð	good production, persistence	Seedmark, Seed Force
RD 19 Taree Ladino Ð	erect, good winter growth, good seed production	Seed Genetics
Winter White (Super Haifa) Ð	good winter growth, early flowering, high seed yield	Auswest Seeds
Super Ladino Ð	prostrate, good winter growth, early flowering	Auswest Seeds
Waverly	low stolon density	Upper Murray Seed
Will Ladino	erect, good spring - summer growth, heat tolerant, disease resistant	Agricom
Medium to large-leaved		
Grasslands Bounty	good autumn production	Wrightson Seeds
Grasslands Tribute Ð	semi erect, persistent, good, autumn-winter growth, drought tolerant, leaf disease tolerant	Agricom
Grasslands Trophy	drought tolerant, mid flowering, persistent	Agricom
Weka	good autumn-winter growth	Heritage Seeds

Medium-leaved		
Altitude	moderately frost tolerant	Seedmark
Canterbury Ⓓ	early flowering	Auswest Seeds
Esteem		Upper Murray Seeds
Grasslands Demand Ⓓ	good spring-summer growth, grazing tolerant	Cropmark Seeds
Grasslands Huia	poor winter growth, persistent	Public variety
Grasslands Pitau	good autumn-winter -spring growth	Public variety
Grasslands Sustain Ⓓ	erect, grazing tolerant, persistent	Seed Force
Irrigation	poor winter growth, persistent	Public variety
Mink Ⓓ	heat tolerant, persistent	Heritage Seeds
Super Huia Ⓓ	good winter growth, early flowering, high seed yield	Auswest Seeds
Storm Ⓓ		Heritage Seeds
Small-leaved, medium stolon density		
Colt		Upper Murray Seeds
Grasslands Prestige Ⓓ	grazing tolerant, heat & drought tolerant	Agricom
Grasslands Tahora Ⓓ	prostrate, persistent	Wrightson Seeds
Riesling	heat tolerant, grazing tolerant	Seed Distributors
Tahora II		Wrightson Seeds

LOTUS (Birdsfoot trefoil)

(Lotus corniculatus)

Semi-erect to erect, summer-active perennial legume, especially suited to acidic (pH_{Ca}>4.7) and lower fertility soils. Low bloat risk. Plants generally short-lived; reseeding needed for long-term persistence. Will not tolerate overgrazing. Sow in autumn.

Minimum average annual rainfall: 700 mm

Sowing rate: 2–3 kg/ha

Inoculant: Lotus coniculatus

Variety/brand	Comment	Main seed source
Leo Lotus		JH Williams & Sons

LUCERNE
(Medicago sativa)

Erect, leafy perennial legume, providing excellent quality feed as standing forage, hay or silage. Most widely grown perennial legume in pure swards or mixtures. Main growth in spring, summer and autumn when moisture is available. Very productive under irrigation. Suits wide range of well-drained, slightly acid to alkaline soils (pH_{Ca} 5.2–7.5). Drought tolerant. Becomes dormant under moisture or severe heat stress. Deep taproot can dry out soil profiles to depth. Does not tolerate waterlogging. Can cause bloat in cattle. Must be rotationally grazed or cut for good persistence. Varieties differ in insect and disease resistance and winter growth. Usually sown in autumn or spring (irrigated) when the soil temperature is warm and there is sufficient moisture for establishment.

Minimum average annual rainfall:
375 mm – southern NSW; 400 mm – northern NSW

Sowing rate: 1–5 kg/ha (dryland, depending on rainfall); 10–15 kg/ha (irrigated)

Inoculant: AL

Select varieties on the basis of:

Late autumn/winter growth – Select winter active varieties where winter feed/production required in cooler months or where seedling vigour essential for establishment. Semi-dormant and winter dormant types persist longer under grazing.

Insects resistance

Spotted alfalfa aphid – (SAA) kills seedlings and established lucerne; resistance is essential. Most varieties are resistant to SAA, except Hunter River.

Blue-green aphid – (BGA) kills lucerne seedlings and reduces production. Resistance highly desirable. Not all varieties marketed have resistance.

Disease resistance – More important when lucerne is grown under irrigation, is cut for hay, or in warm humid environments.

Phytophthora root rot – Resistance essential under irrigation and desirable on poorly drained soil types dryland.

Anthracnose/Colletotrichum crown rot – Moderate resistance desirable under irrigation and in humid environments. (N.B. Anthracnose is the stem symptom of the disease Colletotrichum crown rot).

Bacterial wilt – Resistance desirable on some river systems only (seek local advice).

Stem nematode – Resistance desirable on some river systems only (seek local advice).

Potential hay quality – Leafy varieties with fine stems are desirable for hay production. Highly winter active varieties may be more stalky, especially as lucerne stands thin. Some varieties claim to have more leaf and be of higher quality than others.

Local productivity and persistence – Consult local trial results where available.

There are many commercial varieties available. See Table 1 on pages 22–23.

SULLA
(Hedysarum coronarium)

Tall, erect, very productive, biennial or short-lived perennial legume with a deep taproot. Suitable for grazing, silage and hay. Suits warm temperate, Mediterranean and subtropical climates with warm winters. Adapted to neutral to alkaline clay and loam soils. Tolerant of aphids, moderately tolerant of redlegged earth mite and lucerne flea. Contains tannins which reduce bloat. Drought tolerant. May be useful to reduce ground water recharge. Susceptible to waterlogging and salinity. Seed requires dehulling.

Minimum average annual rainfall: 400–800 mm

Sowing rate: 10 kg/ha (dehulled)

Inoculant: WSM 1592

Variety/brand	Comment	Main seed source
Moonbi	early maturity, prostrate, suits grazing	Wrightson Seeds
Wilpena	mid maturity, erect, suits silage& haymaking	Wrightson Seeds

SEED DISTRIBUTORS

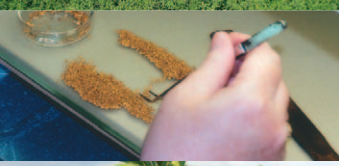
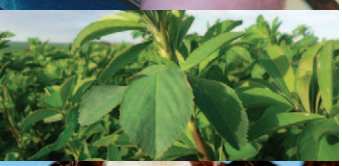
Science based pasture®










Lucerne Range

All **Seed Distributors** proprietary lucernes have a minimum of **90% germination**

Seed Distributors sets new benchmark - 1000 viable Rhizobia per seed on stored Lucerne after 12 months and Medic and Sub Clover, after 6 months

Q31 Lucerne
Winter dormant (3)

- Specialist Lucerne for Serious hay growers
- Bred for Top end hay producers after quality
- Extremely fine stems to meet premium markets
- Excellent grazing tolerance

L56 Lucerne
Semi winter dormant (5)

- Excellent all rounder for hay and grazing
- Offers to meet hay producers quality parameters with the ability for light winter production
- Low crowns for grazing tolerance
- Excellent long term stand life
- Superior disease and pest profile

L70 Lucerne
Winter active (7)

- Higher disease and pest package compared to Aurora
- Derived from Dryland seed production
- Excellent selection for undersowing or short term rotation
- Price competitive compared to Aurora Lucerne

Q75 Lucerne
Winter active (7)

- Bred with Q trait for high quality forage
- Preferential selection for first cut hay coming out of winter
- Excellent leaf holding trait for chaff or hay markets
- High resistance to Multiple pest and diseases

L91 Lucerne
Highly winter active (9)

- Extended grazing and hay in autumn and winter
- Best in cropping rotations for maximum nitrogen fixation
- Outstanding seedling vigor for easier establishment
- Preferred variety for winter sowings

Multileaf ML99 Lucerne
Highly winter active (10)

- Near to 100% true to type multifoliate expression
- Multileaf trait allows grower looking for HWA with excellent hay quality
- Offer first hay cut coming out of winter to meet hay markets
- Frost tolerant to protect cold season production

Paul Sippel 0427 255 292
Tim Francis 0419 995 416
Shannon Cummings
0425 871 968

SEED DISTRIBUTORS
14 -16 Hakkinen Road,
Wingfield, SA 5013
Phone (08) 8445 1111
Fax (08) 8445 7777

www.seeddistributors.com.au

Table 1: Lucerne Varieties 2012

Variety	Winter growth[#]	SAA	BGA	PRR	Anthracnose[+]	SN	BW	Leaf disease[¤]	Principal Seed Source
Winter-dormant									
Q31▲	3	R	MR	HR	HR	HR	HR	~	Seed Distributors
Semi winter-dormant									
Hunter River*	5	S	S	S	S	S	S	LR	Public variety
L56 (Ð)	5	HR	HR	HR	HR	HR	HR	HR	Seed Distributors
SARDI Five (Ð)	5	HR	HR	HR	HR	R	~	~	Heritage Seeds
SF Force 5	5	MR	~	HR	HR	HR	MR	~	Seed Force
Stamina 5▲	5	HR	R	R	HR	HR	~	~	Wrightson Seeds
Venus (Ð)	5	HR	R	MR	LR	~	~	~	Seedmark
Winter-active									
Aurora*	6	HR	HR	R	MR	R	LR	LR	Public variety
Hunterfield*	6	HR	LR	S	S	S	S	~	Public variety
Icon *(SuperAurora)* (Ð)	6	HR	HR	HR	S	~	~	HR	Auswest Seeds
SARDI Grazer	6	HR	HR	R	R	~	~	~	Heritage Seeds
Stamina® GT6	6	HR	R	R	HR	HR	~	HR	Wrightson Seeds
Flairdale (Ð)	7	R	HR	R	LR	R	~	~	Alfagreen
Genesis (Ð)	7	HR	R	R	R	~	~	~	Seedmark
Haymaster7▲	7	HR	HR	HR	MR	R	R	~	Wrightson Seeds
L70▲	7	HR	HR	R	R	R	R	~	Seed Distributors
Q75	7	HR	R	HR	HR	R	MR	~	Seed Distributors
SARDI Seven (Ð)	7	HR	HR	HR	HR	R	~	~	Heritage Seeds
SARDI 7 Series 2[#]	7.5	HR	HR	HR	HR	R	~	~	Heritage Seeds
SF Force 7	7	R	~	HR	MR	HR	R	~	Seed Force
SF 714QL	7	HR	HR	HR	MR	R	R	~	Seed Force
Titan7 ▲	7	HR	R	R	HR	~	~	~	Auswest Seeds
Trifecta*	7	R	HR	MR	R	LR	R	LR	Public variety
UQL-1 (Ð)	7	HR	HR	HR	HR	~	~	~	Auswest Seeds

Variety	Winter growth[#]	SAA	BGA	PRR	Anthracnose[+]	SN	BW	Leaf disease[α]	Principal Seed Source
Highly winter-active									
Aquarius	8	R	HR	HR	LR	R	MR	MR	Seedmark
Australis *(SuperSiriver)*	8	R	HR	R	MR	~	~	~	Auswest Seeds
Hallmark ⓓ	8	HR	R	HR	HR	HR	~	~	Auswest Seeds
Magna 801FQ▲	8	HR	R	HR	MR	R	R	~	Valley Seeds
Multi Foli®-8	8	HR	HR	HR	R	R	R	R	Wrightson Seeds
ALA Pegasis ⓓ	9	HR	LR	R	MR	~	~	~	Seedmark
Alfamaster 9™▲	9	R	MR	MR	R	HR	R	~	Seedmark
Blue Ace *(SuperSequel)* ⓓ	9	HR	HR	R	LR	~	~	~	Auswest Seeds
CUF101*	9	R	HR	MR	S	S	S	~	Public variety
L91 ⓓ	9	HR	HR	HR	HR	R	R	~	Seed Distributors
Sequel*	9	R	R	MR	R	S	S	S	Public variety
Sequel HR ⓓ	9	R	R	R	HR	R	~	~	Auswest Seeds
Silverado ⓓ	9	HR	HR	HR	HR	MR	~	~	Michel Belair Seed Technology
Siriver*	9	HR	MR	S	S	S	S	~	Public variety
Siriver MkII ⓓ	9	HR	R	LR	S	~	~	~	Seed Distributors
SuperSonic ⓓ	9	R	HR	HR	MR	~	~	~	Auswest Seeds
Titan9 ▲	9	HR	R	HR	R-HR	~	~	~	Auswest Seeds
WL 925HQ	9	HR	HR	HR	MR	R	MR	R	Wrightson Seeds
Cropper 9.5®	9.5	HR	HR	HR	MR	R	MR	~	Wrightson Seeds
Alfamaster 10™▲	10	R	R	R	MR-R	R	MR	~	Seedmark
ML99 Multileaf® ⓓ	10	HR	HR	HR	HR	MR	~	~	Seed Distributors
SARDI Ten ⓓ	10	HR	HR	R	R	R	~	~	Heritage Seeds
SF Force 10	10	HR	HR	HR	MR	R	LR	~	Seed Force

KEY TO TABLE

Pest & disease resistance: HR – highly resistant; R – resistant; MR – moderately resistant; LR – low resistance; S – susceptible.

Winter growth[#]: Varieties are listed alphabetically within groups of increasing late autumn–winter growth (i.e. 3 – very slow, 6 – moderate, 10 – very active). Dormancy groupings are not absolutely distinct; the range of dormancy is continuous.

Leaf disease[α]: Combined ratings for Stemphylium and Leptosphaerulina leaf spots. (QDPI&F)

ⓓ Protected by Plant Breeders Rights; ® Registered trademark; ™ Trademark; ▲ New variety; [#] Limited supply 2012; ~ No data available

* Public variety, not covered by Plant Breeders Rights and available from a number of seed companies.

[+] These ratings do not reflect all races of anthracnose (Colletotrichum trifolii). The distribution and importance of all identified races in NSW is not known.

TEMPERATE GRASSES

BROME GRASS
(Bromus spp.*)*

There are four species of brome available: *grazing brome, pasture brome, prairie grass* and a new species, *coloured brome*. Bromes are more heat tolerant than ryegrasses, maintain quality throughout the season, and have potential to persist longer than ryegrass in subtropical pastures.

COLOURED BROME
(Bromus coloratus)

Long-lived perennial grass bred in Tasmania. Highly productive, palatable and persistent. Excellent late spring-early summer growth. Similar maturity to Victorian ryegrass. High feed value. Moderately tolerant of frost, drought and waterlogging. Tolerant of pasture grubs. Sow in mixtures with legumes such as red clover. Sow in autumn and spring ideally at 10 mm, but no deeper than 20 mm.

Sowing rate: 15–25 kg/ha

Variety/brand	Comment	Main seed source
Exeltas (Þ		Auswest Seeds, Tasglobal Seeds

GRAZING BROME
(Bromus stamineus)

Deep-rooted, highly productive perennial grass, with fine leaves and dense tillers. Most growth occurs in winter–spring. Suited to well-drained soils. Resistant to head smut. Tolerant of grass grub and Argentine stem weevil. Requires close frequent grazing to perform well and persist. Compatible with cocksfoot, clover and herbs. Sow in autumn at temperatures above 10°C. Sow seed 5–15 mm deep.

Minimum average annual rainfall:
600 mm – southern NSW; 750 mm – northern NSW

Sowing rate: 25 kg/ha alone; 10 kg/ha in mixtures

Variety/brand	Comment	Main seed source
Grasslands Gala (Þ	strong autumn-winter growth	Agricom
Nandu		Upper Murray Seeds

PASTURE BROME
(Bromus valdivianus)

Highly palatable perennial grass similar to grazing brome with finer leaves and denser tillers. Most growth occurs during spring–summer with moderate growth in winter. Suited to fertile, well-drained soils. Resistant to head smut and tolerates grazing well. Grows well in mixtures with clovers. Sow in spring–early summer.

Minimum average annual rainfall:
600 mm – southern NSW; 750 mm – northern NSW

Sowing rate: 25–30 kg/ha alone; 15–20 kg/ha in mixtures

Variety/brand	Comment	Main seed source
Bareno		Heritage Seeds

PRAIRIE GRASS
(Bromus wildenowii)

Erect, annual or short-lived perennial grass. Most growth in autumn, winter and spring. Suits fertile, well-drained soils. Must be rotationally grazed for good production and persistence. Sow in autumn alone or in mixtures with legumes (e.g. red and white clover) or other grasses.

Minimum average annual rainfall: 850 mm

Sowing rate: Up to 7 kg/ha in grass mixtures (dryland);
20–30 kg/ha with legumes (dryland);
40–60 kg/ha with legumes (irrigated)

Variety/brand	Comment	Main seed source
Ceres Atom	short rotation	Agricom
Easy Drill Matua		Wrightson Seeds
Free Flow Matua		Seed Force
Lakota		Wrightson Seeds

COCKSFOOT
(Dactylis glomerata)

Tussocky perennial grass suited to low fertility soils. Tolerates acid soils (pH_{Ca}>4.0). Sensitive to waterlogging. Good persistence under rotational grazing. Keep short and leafy in spring to maintain quality. Sow in autumn or spring (irrigation and tablelands).

Minimum average annual rainfall:
450 mm – southern NSW; 550 mm – northern tablelands and higher slopes, depending on plant type

Sowing rate: 1–3 kg/ha in mixtures

Select varieties on the basis of:

Plant type – There are three types of cocksfoot, classified by their origin – *Mediterranean* (summer dormant) from Northern Africa and the Middle East, *Temperate* or *European* (summer active) from the cooler northern regions of Europe and Asia; and *Intermediate* from Southern Europe. Growth characteristics and areas of adaptation of these subgroups differ significantly.

Mediterranean (or Spanish) varieties (*Dactylis glomerata* ssp. *hispanica*). Fine leaved. Most growth occurs from autumn to spring. Extremely dormant types grow little from the end of spring and over summer until temperatures decline and sufficient rainfall is received in autumn. These cultivars remain dormant, regardless of how much rainfall is received in summer, unless it is abnormally cool and moist, when a small amount of growth may occur. Persist better under heavy grazing and in dry summer environments (e.g. southern NSW) than the temperate varieties. Suit low to moderate rainfall areas (350–550 mm) or where prolonged (5–6 months) moisture stress occurs during summer–autumn.

Temperate varieties (*Dactylis glomerata* ssp. *glomerata*) are summer active and are generally bigger plants. Poor drought tolerance, so should not be sown where prolonged summer drought is common. They grow actively throughout the year and respond to rainfall in all seasons, so should only be sown in high rainfall areas (>700 mm in southern NSW; >800 mm in northern NSW).

Intermediate varieties have characteristics between the two. They are not summer dormant because they will continue to grow over summer if there is sufficient moisture. They respond to summer rain but cease growth earlier than temperate types if moisture is limiting, which improves their drought survival. Suited to areas with moderate to high rainfall (>550 mm).

Note that the scale of dormancy in cocksfoot is continuous, similar to the scale of winter activity for lucerne. A summer-dormant variety may be more or less dormant than other varieties from the same group. Generally, the harsher the environment (lower rainfall, higher summer temperature), the more dormant the variety should be

Rust resistance – Important in high rainfall areas (e.g. northern tablelands). Rust reduces yield, especially in autumn.

Performance – Persistence and seasonal productivity are important. Consult local trial results where available.

Variety/brand	Comment	Main seed source
Mediterranean, summer dormancy		
Kasbah	very drought tolerant	Seedmark
Sendace Ⓟ	true *hispanica* type, small size, very grazing tolerant, resistant to pasture cockchafer	Tasglobal Seeds, Auswest Seeds
Mediterranean, moderate summer dormancy		
Currie	mod. drought tolerant, mod.–high rainfall	Public variety
Gobur		VicSeeds
Uplands Ⓟ	true *hispanica* type, fine leaves, semi-erect, drought tolerant, resistant to pasture cockchafer	Tasglobal Seeds, Auswest Seeds
Intermediate, summer active		
Ambassador		Seed Distributors
SF Crown Royale		Seed Force
Drover Ⓟ	semi-erect	Upper Murray Seeds
Grassly		Seedmark
Tekapo	prostrate, dense tillers, fine leaves	Wrightson Seeds
Howlong	low re-heading, disease tolerant	Heritage Seeds
Oxen	erect habit	Seed Distributors, Upper Murray Seeds, Ballard Seeds
Yarck	slightly earlier than Porto	VicSeeds
Temperate, summer active		
Grasslands Kara Ⓟ	erect habit, drought tolerant	Agricom
Grasslands Vision Ⓟ	semi-erect, dense tillers, persistent	Cropmark Seeds
Grasslands Wana Ⓟ	prostrate, low crown, dense tillers	Cropmark Seeds
Megatas Ⓟ	low crown, grazing tolerant	Tasglobal Seeds, Auswest Seeds
Porto	semi-erect to erect, later than Currie	Public variety
SF Greenly	soft leaf, sow at high density	Seed Force
SF Lazuly	soft leaf, sow at high density	Seed Force

FESCUE (Tall fescue)
(Festuca arundinacea)

Deep rooted, tussocky perennial grass, suited to wide range of soil types. Tolerant of acid and moderately saline conditions, and short periods of flooding. Moderately persistent and drought tolerant, depending on plant type, soil type and grazing management. Resistant to cold and frost. In drier areas, best suited to high altitudes. Grazing management for temperate and Mediterranean types differs. Graze leniently until established. Sow in a mixture with temperate clovers. Sow in autumn or spring (irrigation and tablelands).

Minimum average annual rainfall:
650 mm (summer dominant) for summer active types;
450 mm (winter dominant) for Mediterranean types *(see below)*

Sowing rate: 6–15 kg/ha

Select varieties on the basis of:

Plant type – There are two main types of fescue available which differ greatly in growth characteristics:

Temperate or Continental (summer active) – originate from temperate Europe or America. Grow actively in spring, summer and autumn but less in winter, providing year-round, quality feed. Adapted to areas with summer dominant rainfall, higher elevation or irrigation. Temperate varieties are the most commonly used in NSW.

Mediterranean (winter active, summer dormant) – active growth in cooler months, dormant in summer. More tolerant of summer drought than temperate types. Grows mainly in winter and early spring, with little growth during summer and early autumn. There is a range of summer dormancy levels – some varieties respond to summer rain while others have high levels of dormancy.

Seedling vigour – Fescue is slow to establish. Varieties with improved seedling vigour may enhance establishment.

Rust resistance – Important in high rainfall districts where rust is known to be a problem.

Performance – Consult local trial results where available for seasonal yields and persistence.

Endophytes – Depends on type of livestock.

Endophytes are fungi living within the tall fescue and ryegrass plant. The wild endophytes are capable of producing alkaloids toxic to animals. Older fescue varieties (i.e. those released before Demeter (e.g. Alta and Kentucky-31)) may contain high levels of wild-type endophytes which are most likely to cause problems in livestock. In areas with a long history (pre-1960) of tall fescue such as the Northern Tablelands of NSW, there is the potential for animal health problems associated with wild endophytes, but reports of such problems are not common.

Current tall fescue pasture varieties available in NSW are free of wild-type endophytes but all turf varieties of tall fescue do contain wild-type endophytes.

Safe or *novel endophyte* varieties endophyte varieties of tall fescues are available in NSW and trade as "MaxP". These endophytes do not produce alkaloids toxic to sheep and cattle but do produce 'plant-friendly' alkaloids that deter insects and have other reported benefits to the plant.

Equine fescue oedema – is a new condition reported only in horses grazing Mediterranean tall fescue cultivars with MaxP endophyte. It is advised that horse owners do not sow Mediterranean tall fescue varieties with MaxP or graze any pasture mixes or feed conserved fodders, containing these endophyte infected tall fescue cultivars.

(see: *NSW DPI Primefact 535—Endophytes of perennial ryegrass and tall fescue* for further information).

Note that all turf varieties of tall fescue contain wild-type endophytes. (see: I&I NSW Primefact 535—*Endophytes of perennial ryegrass and tall fescue* for further information).

Other factors – maturity, leaf digestibility or quality, rhizomatous spread potential may also be important

Variety/brand	Comment	Main seed source
Temperate, very early flowering		
Au Triumph		Public variety
Dovey		Heritage Seeds
Quantum		Wrightson Seeds
Quantum II MaxP		Wrightson Seeds
SF Royal Q-100		Seed Force
Temperate, early flowering		
Pastoral (Ð)		Upper Murray Seeds
SF Festival		Seed Force
Temperate, mid-late flowering		
Grasslands Advance (available with MaxP) (Ð)		Agricom
Demeter		Public variety
SF Finesse-Q	intermediate growth pattern	Seed Force
Grasslands Jesup (Ð)	heat tolerant, persistent	Agricom
Kentucky 32		Seed Force
Savory		Not Available
Temperate, late flowering		
Carmine		Seeds Distributors, Upper Murray Seeds
Martin2		Seed Distributors
Vulcan II	very winter dormant & summer active	Wrightson Seeds
Mediterranean, mid-season flowering		
Charlem (Ð)		Upper Murray Seeds
Grasslands Fletcha		Agricom
Fraydo (Ð)		Seedmark
Origin (Ð)		Seed Distributors, Upper Murray Seeds
Prosper		Heritage Seeds
Resolute (Ð)		Wrightson Seeds
SF Medallion		Seed force

PERENNIAL VELDT GRASS
(Ehrharta calycina)

Tufted perennial grass with most growth in autumn, spring and summer. Suited to light sandy soils and useful for erosion control. Drought resistant. Very palatable. Sensitive to heavy grazing so rotational grazing preferred for good persistence. Considered an environmental weed in some coastal areas. Sow with lucerne, subterranean clover and annual medics. Sow in autumn or early spring.

Minimum average annual rainfall:
550 mm – southern NSW; 600 mm–in northern NSW

Sowing rate: 0.5–3.0 kg/ha

Variety/brand	Comment	Main seed source
Mission		Public variety

PHALARIS
(Phalaris aquatica)

Deep-rooted, tussocky perennial grass, growing mainly in late autumn, winter and spring. Best suited to moderate to high fertility soils. Moderately sensitive to acid soils. Tolerates flooding, wet and moderately saline soils. Drought tolerant. Slow to establish, as seedlings are sensitive to competition. Very persistent with appropriate grazing management. Rotational grazing preferred, especially for semi-erect and erect types. Combines well with white clover, subterranean clover, lucerne, cocksfoot or tall fescue. All varieties can cause phalaris poisoning (phalaris staggers) in sheep. Sow in autumn or early spring (irrigation and tablelands).

Minimum average annual rainfall:
500 mm – southern NSW; 700 mm – northern NSW

Sowing rate: 2–4 kg/ha alone, 1–3 kg/ha in mixtures

Select varieties on the basis of:

Plant habit – Prostrate types compete better with weeds than erect types. They are less productive in winter but persist longer when well established. Erect types require careful grazing management to ensure persistence.

Seedling vigour – Reducing competition from broadleaf weeds and annual grasses is vital during establishment, as phalaris seedlings have poor seedling vigour. Particularly important in low rainfall, marginal areas. Erect varieties have greater seedling vigour than prostrate types.

Summer dormancy – Where summer rainfall is infrequent and erratic, summer dormancy may enhance persistence.

Phalaris poisoning potential – While all varieties can potentially cause poisoning, some have been selected to reduce the risk. In areas with a known problem, low risk varieties may assist, although livestock management of this problem is critical.

Acid soil tolerance – Phalaris is relatively intolerant of soil acidity, especially where exchangeable soil aluminium is high and phosphorus levels are low. Some varieties have been selected for improved acid soil tolerance. In marginal situations, use of these varieties may improve long term productivity and persistence.

Performance – Seek local trial results where available for seasonal yields and persistence.

Variety/brand	Comment	Main seed source
Prostrate, semi winter dormant, low summer dormancy		
Australian		Public variety
Australian II (Þ)		Seedmark
Australian Gold		Upper Murray Seeds
Australis Australian		Seed Distributors
Maru		Wrightson Seeds
Fosterville	prostrate, semi-winter dormant, low summer dormancy	Tasglobal Seeds
Grazier (Þ)		Seed Distributors, Upper Murray Seeds
Uneta		Public variety
Semi-erect to erect, winter active, low summer dormancy		
Advance AT (Þ)	improved acid soil tolerance	Seedmark
Holdfast		Public variety
Holdfast GT (Þ)	grazing tolerant	Seedmark
Landmaster (Þ)	suits light, shallow, acidic soils	Seedmark
Lawson		Heritage Seeds
Sirosa		Public variety
Sirolan		Public variety
Stockman		Upper Murray Seeds
Erect, winter active, medium to high summer dormancy		
Atlas PG (Þ)	lower rainfall	Seedmark

PUCCINELLIA (Sweet grass)
(Puccinellia ciliata)

Tussocky perennial grass, growing in autumn, winter and spring; dormant in summer. Tolerant of waterlogging and salinity. More salt tolerant than tall wheatgrass but less vigorous. Slow to establish, not highly productive and sensitive to heavy grazing. Good seed producer. Stands thicken from self sown seed. Usually sown in mixtures with tall wheatgrass and strawberry clover, except in very saline soils. Sow in autumn (dryland); autumn or late winter to early spring (irrigation). Graze leniently in first year.

Minimum average annual rainfall:
400 mm – southern NSW; 500 mm – northern NSW

Sowing rate: 3 kg/ha

Variety/brand	Comment	Main seed source
Menemen		Public variety

RYEGRASS
(Lolium spp.)

A highly nutritious, diverse species with annual, perennial and hybrid types. Both diploid and tetraploid varieties and different maturities are available within each type.

Select varieties on the basis of:

Length of production required – Annuals last 1–3 years while perennials can last 4–6 years.

Maturity – Earlier flowering varieties suit drier areas of the perennial ryegrass zone and produce more feed early in winter than later in spring. Later maturity allows feed production in summer where moisture (e.g. irrigation) and temperature permit.

Plant type – Diploids have two sets of chromosomes while tetraploids have four.

Tetraploids have larger cells, leaves and seeds, have good seedling vigour and establish quickly, producing early feed. Slightly higher plant sugars and more palatable than diploid types. Produce well under high input management systems.

Diploids tiller well, have finer leaves and still yield well if conditions are unfavourable.

Rust resistance – Very important on the coast and in humid conditions. Check the latest rust resistance information for your area with your seed supplier.

Persistence and seasonal production – Refer to local trial results where available.

Endophyte

Endophytes are fungi which live within the plant in many forage grasses, including ryegrasses and fescues. They sometimes provide advantages to the plant (e.g. may enhance establishment and persistence) but some endophytes can produce toxins which can cause ryegrass staggers or other animal production losses. The effects in NSW are yet to be fully clarified. Endophytes are advantageous on the south coast where black beetle is a problem and on the southern highlands.

Ryegrass varieties are available with or without endophyte. Some varieties contain *novel endophytes* (AR1, AR37) which may enhance production and persistence. These endophytes rely on a substance known as peramine to deter insects; they produce no ergovaline (the potential cause of a number of livestock health disorders) or lolitrem B (cause of ryegrass staggers).

For further information see: *NSW DPI Primefact 535—Endophytes of perennial ryegrass and tall fescue.*

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RYEGRASS – SHORT-TERM FORAGE VARIETIES

Includes annual rygrass (*Lolium rigidum*), Italian ryegrass (*L. multiflorum*), and hybrids of the two species. Wide range of varieties including those suitable as annual forage crops through to those with a high perennial component, which can produce good yields of high quality forage for up to 3 years under good management and growing conditions. These ryegrasses play an important role in providing winter forage in areas where temperate perennial ryegrasses (*Lolium perenne*) fail to persist e.g. NSW Slopes and Tablelands. Require high soil fertility and good moisture for best results.

Some short-term forage varieties contain *novel endophyte (AR1)* which may enhance production and persistence. Other varieties listed may or may not contain endophyte. Sow in autumn.

Minimum average annual rainfall:
750 mm – southern NSW; 800 mm – northern NSW

Sowing rate: 8–25 kg/ha; 25–30 kg/ha (irrigated); 2 kg/ha in mixtures with short-term legumes

ANNUAL RYEGRASS
(Lolium rigidum)

Annual, self-regenerating, winter–spring growing ryegrass. Early maturing. Suited to a wide range of soil types in the drier margin of ryegrass zone. Palatable. Useful as dry feed in summer. Good for hay and silage in mixtures with clover, lucerne or medics. Note that this species is aggressive and can be a weed in winter crops. Annual ryegrass toxicity (ARGT), ergot and herbicide resistance can be problems.

Minimum average annual rainfall:
400 mm – southern NSW; 600 mm – northern NSW

Sowing rate: 15 kg/ha alone; 5–10 kg/ha in mixtures

Variety/brand	Comment	Main seed source
Guard Ⓓ	early, resistant to ARGT	Valley Seeds
Wimmera	susceptible to ARGT	Public variety
Safeguard Ⓓ	very early, resistant to ARGT	Valley Seeds

ANNUAL ITALIAN RYEGRASS
(Lolium multiflorum var. *westerwoldicum)*

This group of ryegrasses are also referred to as Westerwolths or Westerwolds. Limited to one year's production only–grown as a forage crop. Adapted to fertile soils in cool areas. Frost resistant. Early varieties provide quick winter feed and suit lower rainfall areas. Later maturing varieties suit higher rainfall areas, providing higher quality feed later in the season.

Variety/brand	Comment	Main seed source
Early flowering diploids		
DoubleCrop		Vicseeds
SF Flyer™		Seed Force
Griffin Ⓓ		Heritage Seeds
Grassmax™		Seedmark
Early flowering tetraploids		
Betta Tetila		Parkseeds
Drummer Ⓓ ™		Seedmark
New Tetila		VicSeeds
SF Catapult™		Seed Force
SF Sprinter ™		Seed Force
Sungrazer T		Wrightson Seeds
Tetila (USA)		Public variety
Tetila Gold™		Upper Murray Seeds
Mid season flowering diploids		
Aristocrat II Ⓓ		Valley Seeds
Ceres Pronto		Agricom
Fantastic		Upper Murray Seeds
Noble Ⓓ		Valley Seeds
Progrow Ⓓ		Valley Seeds
SF Sultan ™		Seed Force
Surrey 2		Seed Distributors
Mid season flowering tetraploids		
Abundant		Seed Distributors
Atomic		Upper Murray Seeds
Grasslands Tama		Public variety
Jivet		Seed Distributors
Mach1		Auswest Seeds
R2		Seedmark
Robust Ⓓ		Seedmark
Rocket		Seed Distributors
SF Adrenaline		Seed Force
T Rex		Heritage Seeds
Tetrone		Seed Distributors
Winter Star ® II		Wrightson Seeds
Zoom™		Cropmark Seeds
Late season flowering diploid		
Arnie		Heritage Seeds
Late season flowering tetraploids		
Beefbuilder III		JH Williams & Sons
Maximus Ⓓ		Heritage Seeds
SF Speedyl		Seed Force

ITALIAN RYEGRASS
(Lolium multiflorum)

Used as a short term pasture or forage crop. More persistent than Westerwolds; can produce for 1–2 years under suitable growing conditions and management. Later flowering varieties require high rainfall or irrigation for maximum production and persistence. Sowing rates vary from 2–6 kg/ha for biennial types to 5–15 kg/ha for tetraploid annuals.

Variety/brand	Comment	Main seed source
Early season flowering diploid		
Dargo Ⓓ		Vicseeds
Thunder		JH Williams & Sons
Mid season flowering diploid		
Caversham		Wrightson Seeds
Eclipse Ⓓ		Valley Seeds
Icon		Seed Distributors
Mid season flowering tetraploid		
Jeanne		Seed Distributors
Late season flowering diploid		
Awesome Ⓓ		Upper Murray Seeds
Ceres Crusader Ⓓ		Agricom
Charger Ⓓ		Seedmark
Concord®		Wrightson Seeds
Conquest Ⓓ		Wrightson Seeds
Diplex™		Seed Distributors
Grasslands Warrior Ⓓ		Agricom
Hulk Ⓓ		Heritage Seeds
Icon		Seed Distributors
SF Accelerate		Seed Force
SF Indulgence DipQ		Seed Force
Sonik Ⓓ		Cropmark Seeds
Late season flowering tetraploid		
Aston		Heritage Seeds
Denver™		Belair Technology, Upper Murray Seeds
Feast® II		Wrightson Seeds
Nourish®		Wrightson Seeds
SF Emmerson		Seed Force
Surge		Notman Seeds

RYEGRASS – LONG ROTATION FORAGE

PERENNIAL RYEGRASS
(Lolium perenne)

A densely tufted, winter-spring growing perennial grass, suitable for grazing, hay and silage. Best suited to well-drained, fertile soils. Frost resistant. Low drought tolerance. Palatable and highly nutritious. Can be grown dryland or under irrigation. Short-lived on the north coast. In drier situations suits higher altitudes. Goes dormant in hot dry summers.

Some older varieties may cause ryegrass staggers in some situations, if infected with wild type endophytes (see note above). *Novel endophytes* which do not cause ryegrass staggers have been bred into some varieties to confer insect resistance. Perennial ryegrass can have varieties with and without novel endophyte.

Novel endophytes include: AR1, AR37, NEA2 and ENDO5.

Nil endophyte varieties (sold under the brand "Staggers Free™") have no endophyte or lolitrem B.

Other varieties listed may or may not contain endophyte.

Minimum average annual rainfall:
700 mm – southern NSW; 800 mm – northern NSW

Sowing rate: 3–20 kg/ha

Variety/brand	Comment	Main seed source
Very early maturing diploids		
Boomer (Staggers Free™) Ⓓ		Valley Seeds
Everlast		Seed Distributors
Fitzroy Ⓓ		Wrightson Seeds
Kangaroo Valley		Public variety
Matilda		Parkseeds
Meridian (available with AR1) Ⓓ		Heritage Seeds, Seedmark
SF Tenacity	wild endophyte	Seed Force
Skippy		Vicseeds
Valley		Seed Distributors
Early maturing diploids		
Ausvic Ⓓ		Vicseeds
Award ⒹUpper Murray Seeds		Upper Murray Seeds
Camel (Staggers Free™) Ⓓ		Valley Seeds
Drylander		Seed Distributors
Roper (Staggers Free™) Ⓓ		Valley Seeds
Victorian		Public variety
Mid season diploids		
Arrow (available with AR1 & AR37)		Heritage Seeds
Avalon (available with AR1) Ⓓ		Vicseeds
Bolton Ⓓ		Vicseeds
Ceres Kingston		Agricom
Extreme® (available with AR1 & AR37) Ⓓ		Wrightson Seeds
Grasslands Commando (available with AR1 & AR37) Ⓓ		Agricom
Grasslands Nui		Public variety
Grasslands Samson (available with AR1) Ⓓ	crown rust tolerant	Agricom
Helix +AR1		Seed Force
Jumbuck Ⓓ		Upper Murray Seeds
Prolong (Staggers Free™) Ⓓ		Valley Seeds
SF Joule AR1		Seed Force
Tomson		Seed Distributors
Ultra +AR1		Notman Seeds
Wintas II	drought tolerant	Tasglobal Seeds
Mid season tetraploids		
Grasslands Ohau (available with AR1 & AR37)	cool season variety	Agricom
Late season diploids		
Alto (available with AR1 & AR37)		Heritage Seeds
Ceres One50		Agricom
Expo AR1		Wrightson Seeds
Platinum		Valley Seeds
Late season tetraploids		
Base® AR37		Wrightson Seeds
Bealey (available with NEA_2, endophyte) Ⓓ		Heritage Seeds
Brigalow		Upper Murray Seeds
Halo (available with AR37)	year round growth	Agricom
Optima		Seed Distributors
Quartet Ⓓ		Wrightson Seeds

HYBRID RYEGRASS

ITALIAN TYPE (Short rotation)

Italian hybrids have more Italian than perennial ryegrass in their breeding but the proportion of Italian or perennial ryegrass genes varies. Slower winter growth, but can have later maturity with spring–summer growth after heading. Capable of contributing worthwhile production for 1–2 years. In cooler tablelands environments can persist for 2–4 years, but in the coastal subtropics they rarely survive the first summer.

Festulolium is a hybrid between ryegrass (*Lolium* spp.) and meadow fescue (*Festuca pratensis*). **Perun** has similar characteristics and management requirements to Italian type hybrid ryegrass and is therefore included in this category.

Variety/brand	Comment	Main seed source
Mid-season flowering diploid		
Turbo		Valley Seeds
Late season flowering diploid		
Maverick G2 (Þ)		Wrightson Seeds
SF Momentum		Seed Force
Festuolium (meadow fescue × Italian ryegrass)		
Perun	Festulolium, mid maturity	Seed Distributors

PERENNIAL TYPE

Perennial hybrids have more perennial than Italian ryegrass in their breeding. They are generally capable of 2–3 years production with potential for extended life under good management and seasonal conditions.

Matrix has similar characteristics and management requirements to perennial ryegrass and other *Lolium* spp. and is therefore included in this category.

Variety/brand	Comment	Main seed source
Early diploid		
Barberia (Þ)	nil endophyte	Heritage Seeds
Mid season flowering diploid		
SF Audacity	nil endophyte	Seed Force
Mid to late season flowering tetraploid		
Banquet II END05 (Þ)		Wrightson Seeds
Late season flowering diploid		
Impact		Seed Distributors
Impact II		Heritage Seeds
Matrix (Þ)	Festulolium, wild endophyte	Cropmark Seeds
Revolution (Þ) +AR1		Seed Force

TALL WHEATGRASS
(Thinopyrum ponticum)

Tall, tussocky perennial grass, growing mainly in spring and autumn. Useful pioneering species in poorly-drained, saline soils. Slow to establish. Responds to summer rain. Sow in early autumn for best results (dryland) or late winter to early spring (irrigation and high rainfall).

Minimum average annual rainfall:
400 mm – southern NSW; 500 mm – northern NSW

Sowing rate: 3–12 kg/ha

Variety/brand	Comment	Main seed source
Tyrrell		Public variety
Dundas (Þ)	selected for feed quality	Wrightson Seeds

TIMOTHY
(Phleum pratense)

A shallow-rooted, leafy, tufted perennial, adapted to high rainfall, cool temperate conditions. Grows in spring, summer and autumn but growth slows in high temperatures. Grows best in high fertility, high moisture holding capacity soils in areas with reliable summer rainfall. High feed quality and very palatable to livestock. Some varieties are suited to grazing, while others are hay types which require rotational grazing. Compatible with clovers and herbs. Grown in cooler countries (e.g. Europe, USA) but not widely grown in NSW. May have a place in cooler tableland environments.

Minimum average annual rainfall: 900 mm

Sowing rate: 5–8 kg/ha; 1–2 kg/ha in mixtures

Variety/brand	Comment	Main seed source
Grasslands Charlton		Agricom

TROPICAL LEGUMES

ANNUAL SPECIES

AMERICAN JOINTVETCH
(Aeschynomene americana)

Vigorous erect summer-growing perennial legume but prostrate under grazing. Suits wet soils in coastal subtropics. Responds to superphosphate. Tolerant of waterlogging. Susceptible to frost and anthracnose.

Withstands heavy grazing. Valuable as standing feed in autumn-winter. Spread by seed. Companion grasses include paspalum and setaria. Sow in late January–February or broadcast seed into native pasture in late summer.

Sowing rate: 1–3 kg/ha

Inoculum: CB2312

Variety/brand	Comment	Main seed source
Glenn	frost susceptible, late flowering	Auswest Seeds
Lee	more tolerant of cold, late flowering	Auswest Seeds

CARIBBEAN STYLO
(Stylosanthes hamata)

Highly productive, self-regenerating annual for the hot dry tropics and subtropics. Suits deep, sandy soils. Tolerant of frost and drought. Withstands heavy grazing and fire. Does not tolerate waterlogging. Very palatable with high feed value. Good companion legume for tropical grasses. Spread by seed. Sow at the end of the dry season. Limited seed available.

Minimum average annual rainfall:
700 mm (summer dominant)

Sowing rate: 2–4 kg/ha (1–2 kg/ha in mixtures)

Inoculum: CB1650

Variety/brand	Comment	Main seed source
Amiga	frost susceptible, late flowering	Heritage Seeds
Verano	more tolerant of cold, late flowering	Auswest Seeds, Heritage Seeds

COWPEA
(Vigna unguiculata)

Fast-growing, twining, annual legume, suitable for grazing, green manure or crop rotations. Suits a range of soil types. Drought and heat tolerant but requires summer rain. Sensitive to frost and waterlogging. Susceptible to root diseases in wet years. Graze once 400 mm tall. Two to three summer grazings possible. Sow when soil temperature reaches 18°C for 3 days into a well-prepared seedbed.

Minimum average annual rainfall:
500 mm (summer dominant)

Sowing rate: 10–15 kg/ha

Inoculum: I (CB1015)

Variety/brand	Comment	Main seed source
Caloona*	*main cultivars available	Public variety
Ebony Ⓓ		Heritage Seeds
Poona*		Public variety
Red Caloona		Public variety
Black Stallion Ⓓ		Australian Premium Seeds

LABLAB
(Lablab purpureus)

Large-seeded, fast growing annual/biennial legume with large leaves and upright growth habit. Used for grazing and silage. Suits a wide range of soils in coastal districts. Responds to phosphorus fertiliser. Sensitive to frost. Sow when soil temperature reaches 19°C for 3 days. Sow 40–60 mm deep using conventional machinery or direct drill with press wheels.

Minimum average annual rainfall:
550 mm (summer dominant)

Sowing rate: 15–20 kg/ha

Inoculum: J (CB1024)

Variety/brand	Comment	Main seed source
Koala Ⓓ	early maturing, white seed, can be used for human consumption	
Highworth	late maturing, forage, hay or silage, rarely sets seed in NSW	Public variety
Rongai	very late maturing, forage, hay or silage, rarely sets seed in NSW	Public variety

PERENNIAL SPECIES

ATRO (Siratro)
(Macroptilium atropurpureum)

Deep-rooted, highly productive, twining perennial legume, growing mainly in summer and autumn. Suits a wide range of soils in moist subtropical and tropical regions. Tolerates drought but sensitive to frost. Susceptible to halo blight. Rust is a potentially an important disease in subtropical coastal areas of NSW. Not suited to continuous heavy grazing but once established, is more tolerant than many other tropical legumes. Spell from grazing in late summer. Regenerates from seed reserves in soil. Persistent in higher rainfall areas of NSW; sporadic performance elsewhere. Companion legume for tropical grasses. Sow in spring to summer. Treat seed for bean fly.

Minimum average annual rainfall:
800 mm (summer dominant)

Sowing rate: 1–4 kg/ha

Inoculum: M (CB756)

Variety/brand	Comment	Main seed source
Aztec (D)	rust resistant	Selected Seeds, Auswest Seeds, Queensland Agricultural Seeds
Siratro		Public Variety

AXILLARIS
(Macrotyloma axillare)

Twining perennial legume with most growth in spring, summer and autumn. Suited to fertile, well-drained soils on hilltops in northern NSW ranges. Responds to superphosphate. Tolerates drought. Moderate tolerance of frost. Does not tolerate waterlogging. Resistant to amnemus weevil. Low palatability when growing actively but provides high quality dry forage in autumn-winter. Sow in spring and summer with other tropical legumes.

Minimum average annual rainfall:
1000 mm (summer dominant)

Sowing rate: 0.5–1 kg/ha

Inoculum: J (CB1024)

Variety/brand	Comment	Main seed source
Archer		Public variety

BURGUNDY BEAN
(Macroptilium bracteatum)

Semi-erect, deep-rooted, twining and trailing perennial legume. Suits heavy alkaline soils of northern NSW. Drought tolerant. Tolerates colder temperatures better than many of the other tropical legumes. Good seeder with high proportion of soft seed. Regenerates well from regenerating plants and new seedlings. Sold as a pelleted seed mix of two cultivars–Cadarga and Juanita. Cadarga upright, short lived with good seed production and Juanita more prostrate and longer lived. Sow from October to January. Sow 10–20 mm deep.

Minimum average annual rainfall:
500 mm (summer dominant)

Sowing rate: 3–7 kg/ha

Inoculum: CB1717

Variety/brand	Comment	Main seed source
Burgundy	mixture of Cadarga & Juanita	Auswest Seeds
B1 Burgundy	mixture of Cadarga & Juanita	Heritage Seeds
Cadarga	more upright, produces more seed & dry matter	Heritage Seeds
Juanita	prostrate, better mosaic virus resistance, more persistent	

BUTTERFLY PEA
(Clitoria ternatea)

Semi-twining, perennial legume which grows well on heavier soil types. Suits monsoonal regions with strong dry season. Very persistent. Tolerates heavy grazing and drought, but does not tolerate waterlogging, flooding or frost. High quality feed, very palatable, non-bloating and good as dry feed in autumn. Suitable for hay before pods form. Used as rotational legume, lasting 3–4 years and will set seed in NSW. Requires higher temperatures for germination than other tropical species. Does not perform as well in northern NSW as in more tropical regions. Combines well with buffel and sabi grasses.

Minimum average annual rainfall:
650 mm (summer dominant)

Sowing rate: 8–10 kg/ha

Inoculum: M (CB756)

Variety/brand	Comment	Main seed source
Butterfly pea	mixture of various types with large blue & white flowers	Public variety
Milgarra	large blue flowers	Public variety

CREEPING VIGNA
(Vigna parkeri)

Prostrate, twining perennial legume with most growth in cooler parts of summer and autumn. Suited to moist, well-drained soils in the subtropics. Does not tolerate sustained waterlogging. Slow to establish. Moderately susceptible to frost and drought; can regenerate from soil seed reserves after drought. Tolerant of heavy grazing. Forms a dense mat which roots down but also grows upwards. Combines well with kikuyu and bahia grass. Sow September to March (preferably early spring when soil temperatures reach 18°C and mid-summer) into a well prepared seedbed. Scarify seed.

Minimum average rainfall:
1100 mm (summer dominant)

Sowing rate: 0.5–2.0 kg/ha in mixtures (2–3 kg/ha alone)

Inoculum: I (CB1015)

Variety/brand	Comment	Main seed source
Shaw	Seed in short supply	Public variety

DESMANTHUS
(Desmanthus virgatus)

Summer-growing, non-bloating perennial legume, suitable for clay soils with neutral to high pH in tropical and subtropical northern NSW. Productive, persistent and drought tolerant. Tolerant of cold; recovers after frost damage. Highly palatable to livestock. Small seed and high hard seed levels. Allow seed to build up for two years. Marc is well suited for use in extensive grazing areas of native and sown grasses. Can yield 1–2 t/ha dry matter in mixes with perennial grasses and up to 3 t/ha in pure swards. Companion species include buffel grass, Floren bluegrass, Strickland tall finger grass, Swann forest bluegrass and Bambatsi panic.

Minimum average annual rainfall:
550 mm (summer dominant)

Sowing rate: 1–2 kg/ha

Inoculum: CB3126

Variety/brand	Comment	Main seed source
Marc Φ		Progressive Seeds

FORAGE (Pinto) PEANUT
(Arachis pintoi)

Summer growing, non-bloating perennial legume for tropics and subtropics. Suits a wide range of soil types, but not heavy clay soils. Tolerates high levels of aluminium (Al) and manganese (Mn). Has strong taproot and stems can also spread underground. Forms a dense mat. Very persistent; tolerant of drought and shading. Very frost sensitive. Very palatable with high quality forage. Competes well with grasses under heavy grazing. Seed buries itself into the soil. Combines well with signal and bahia grass in tropical regions. Also used as ground cover in orchards. Sow in spring and summer in subtropics at a depth of 2–6 cm.

Minimum average annual rainfall:
1000 mm (summer dominant)

Sowing rate: 10 kg/ha (seed in pod)

Inoculum: Bradyrhizobium CIAT3101

Variety/brand	Comment	Main seed source
Amarillo	resistant to rust & leaf spot	Public variety
Bolton		Auswest Seeds

GLYCINE
(Neonotonia wightii)

Deep-rooted, twining, trailing or climbing perennial legume, growing mainly in spring, summer and autumn. Suits very fertile, well-drained neutral to alkaline soils. Good tolerance of drought and cold. Tolerant of amnemus weevil. Does not tolerate acid soils, frost, waterlogging or continuous heavy grazing. Sow a mixture of glycine varieties to ensure persistence on variable soil types. Combines well with Petrie green panic and Gatton panic. Sow in spring to late summer. Graze leniently in first year.

Minimum average annual rainfall:
1000 mm (summer dominant)

Sowing rate: 2–4 kg/ha

Inoculum: M (CB756)

Variety/brand	Comment	Main seed source
Cooper	early flowering, drought tolerant, seed difficult to obtain	Public variety
Malawi	late flowering, suits low pH soils better than Tinaroo, seed difficult to obtain	Public variety
Tinaroo		Public variety

GREENLEAF DESMODIUM
(Desmodium intortum)

Deep-rooted, twining perennial legume, growing mainly in summer and autumn. Has thick stems that root from nodes. Performs best on well-drained fertile soils. Tolerates acid soils and waterlogging. Responds well to phosphorus fertiliser. Tolerates cold but susceptible to frost. Good palatability and nutritive value but does not tolerate continuous heavy grazing. Combines well with glycine, setaria, Guinea grass, green panic and kikuyu. Hard seed requires treatment. Sow in spring and summer into a prepared seedbed. Graze leniently in first year.

Minimum average annual rainfall:
1100 mm (summer dominant)

Sowing rate: (dryland) 0.5–1 kg/ha

Inoculum: CB627

Variety/brand	Comment	Main seed source
Greenleaf		Public variety

ROUNDLEAF CASSIA
(Chamaecrista rotundifolia)

Hardy summer-growing perennial legume, but self-regenerating annual in frost prone areas. Well suited to acid, low fertility, light-textured soils. Suits well drained soils. Drought tolerant. Frost burns leaves but recovers well. Non-bloating and moderately palatable but has lower protein content than other legumes. Tolerates heavy grazing and can dominate grasses if not grazed. Good dry feed in autumn. Unsuitable for horses. Prolific seeder and establishes quickly from seed. Combines well with other tropical legumes.

Minimum average annual rainfall:
650 mm (summer dominant) inland;
800 mm on North Coast

Sowing rate: 0.5–1.0 kg/ha

Inoculum: M (CB756)

Variety/brand	Comment	Main seed source
Wynn		Public variety, Auswest Seeds, Heritage Seeds

TROPICAL GRASSES

Purchased seed of tropical grasses may be coated. If so, increase sowing rate to allow for seed coat weight. Tropical grasses are all warm season C4 species. See Native Grasses, page 46, for an explanation of C4 species.

BAHIA GRASS
(Paspalum notatum)

Semi-erect, tufted perennial grass with main growth during summer. Suits low fertility, light-textured soils. Tolerant of shade. Spreads by rhizomes and forms a dense mat. Potential weed species which dominate pastures; do not grow on or near fertile soils and streams (especially cv. Pensacola). Intensive grazing management is essential to prevent domination of pastures. Compatible legumes include Amarillo and Bolton peanut, and white clover. Sow in spring–early summer, or late summer–early autumn.

Minimum average annual rainfall:
700 mm (summer dominant)

Sowing rate: 1–2 kg/ha

Variety/brand	Comment	Main seed source
Competidor, Argentine	moderate frost tolerance & palatability	Public variety
Pensacola	poor frost tolerance, low palatability	Public variety

BLUEGRASS

CREEPING BLUEGRASS
(Bothriochloa insculpta)

Stoloniferous, late summer–autumn growing, tussocky perennial. Drought tolerant. Well suited for use in waterways. Moderate production potential on fertile soils. Will persist under low fertility conditions but responds to N fertiliser.

Minimum average annual rainfall:
500 mm (summer dominant).

Sowing rate: 2–4 kg/ha

Variety/brand	Comment	Main seed source
Bisset Ⓓ	fine-leaved, good stolon development & rooting	Selected Seeds, Auswest Seeds
Hatch	inferior palatability to Bissett	Public variety

FLOREN BLUEGRASS (Angleton grass)
(Dichanthium aristatum)

Tufted, perennial grass, adapted to subtropics and tropics. Grows mainly in summer and autumn in summer rainfall areas. Especially well adapted to cracking clay soils. Good ground cover; competes well with weeds and helps prevent soil erosion. Drought, flood and salt tolerant but susceptible to frost. Reasonable seedling vigour. Not a prolific seeder under NSW conditions (very late flowering) but can spread vegetatively in wet seasons. Companion species include Bambatsi panic, creeping bluegrass, purple pigeon grass, desmanthus, lucerne and annual medics. Sow in spring to late summer.

Minimum average annual rainfall:
500 mm (summer dominant).

Sowing rate: 2–4 kg/ha

Variety/brand	Comment	Main seed source
Floren (Ⓓ)		Progressive Seeds, Auswest Seeds

FOREST BLUEGRASS
(Bothriochloa bladhii spp. *glabra)*

Tussocky, perennial summer-growing grass, suited to light textured, low fertility soils in summer rainfall areas. Especially well adapted to coastal forest soils and traprock soils of southern Qld. Drought hardy and moderately frost tolerant. Withstands temporary waterlogging but not permanent flooding. Susceptible to leaf rust. Palatable and tolerant of heavy grazing. Strongly scented but does not taint meat or milk. Competes with weeds. Easy to establish. Used for mine reclamation. Companion species include digit, tall finger and Rhodes grasses, lucerne, annual medics, subterranean clover, yellow serradella and birdsfoot trefoil. Sow spring to late summer.

Minimum average annual rainfall:
600 mm (summer dominant)

Sowing rate: 2–4 kg/ha (1–2 kg/ha in mixtures)

Variety/brand	Comment	Main seed source
Swann (Ⓓ)		Progressive Seeds, Auswest Seeds

INDIAN BLUEGRASS (Indian couch)
(Bothriochloa pertusa)

Tufted, stoloniferous, free-seeding, summer growing perennial grass, naturalised on a wide range of soils in the tropics. Forms a dense mat, providing good ground cover which can reduce soil erosion and compete with weeds. Persists better on moderate to low fertility soils than other grasses. Drought evading species. Fair tolerance of frost. Poor tolerance of waterlogging. Tolerates heavy grazing. Good quality forage. Suitable for hay. Competes strongly with legumes. Fine, fluffy seed makes handling and sowing difficult. Sow spring to late summer.

Minimum average annual rainfall: 600 mm

Sowing rate: 1–3 kg/ha

Variety/brand	Comment	Main seed source
Keppel		Public variety
Medway (Ⓓ)	medium–late maturity	Selected Seeds

BRUNSWICK GRASS (Blue Dawn)
(Paspalum nicorae)

Rhizomatous, perennial grass. Palatable to livestock and wildlife. Becoming important in higher rainfall subtropical climates, replacing kikuyu in many grazing situations. Suited to sandy and friable loamy surface soils. Cold and drought tolerant. Will lose quality after heavy frost but good feed quality during warmer winter weather. Recovers from dry periods rapidly in spring with good rainfall. Tolerant of moderate shade and can suppress weeds such as blue heliotrope. Successfully used as a ground cover on roadsides, sporting ovals, lawns and in high wear areas and for revegetation of mine sites.

Minimum average rainfall: 750 mm

Sowing rate: 3–4 kg/ha

Variety/brand	Comment	Main seed source
Blue Dawn (Ⓓ)		Progressive Seeds

BUFFEL GRASS
(Cenchrus ciliaris)

Deep rooted, tussocky, perennial grass with most growth during summer. Suits subtropical areas in northern NSW. Early maturing varieties are better adapted to lower rainfall areas. Suits a range of soils but prefers well drained soils. Drought resistant and responds quickly to light rain except in the coldest months. Poor tolerance of waterlogging and frost. May out-compete native pastures. Not suited for short-term pasture in cropping rotations due to slow early growth and difficulty of removal by cultivation. Tolerates heavy grazing. Feed quality is poor in low fertility soils. Moderately palatable to stock but unsuitable for horses in monocultures due to oxalates.

Oxalates are found in rapidly growing tropical grasses such as setaria, buffel grass, signal grass and panics, especially in warm weather after fertiliser application and irrigation or rain, in spring and summer. These bind up calcium in the gut and can greatly reduce the intake of calcium over 4–6 weeks of grazing which can cause big head disease of horses. Oxalates can also cause poisoning of cattle.

Seed fluffy and difficult to sow with conventional machinery. Use seed that is one year old to allow dormancy to break down. Barrel medic is the most useful companion legume while serradella is useful in acidic soils. If sowing with lucerne, reduce lucerne sowing rate to 0.75 kg/ha to reduce competition. Sow in spring or late summer–early autumn.

Minimum average annual rainfall:
275 mm in central NSW; 375 mm in northern NSW

Sowing rate: 0.5–3 kg/ha alone (dryland)

Select varieties on the basis of:

Maturity – Early maturing varieties most likely to establish and reproduce in the low rainfall and highly variable climate in the far west of the growing area. Use later maturing varieties in the east.

Plant habit – Tall varieties less suited to sheep production than short varieties.

Soil type – Best suited to lighter textured soils but Biloela suits the heavier textured soils of northwest NSW.

Variety/brand	Maturity	Comment	Main seed source
Tall varieties (350–900 mm)			
Biloela	late	Suits heavier textured soils	Public variety
Short varieties (350–400 mm)			
American	early		Public variety
Gayndah	mid season		Public variety

COUCH GRASS
(Cynodon dactylon var. *aridus)*

Hardy, fine-leafed, stoloniferous, perennial grass, adapted to wide range of soil types. Widely distributed. Performs well on light sandy soils and tolerant of alkaline soils and heat. Spreads aggressively by stolons and rhizomes and forms a dense mat. Excellent turf grass. Dormant in winter but recovers in spring. Sow in spring- early summer.

Minimum average annual rainfall: 625 mm

Sowing rate: 6–10 kg/ha

Variety/brand	Comment	Main seed source
Giant Bermuda		JH Williams & Sons

DIGIT GRASS
(Digitaria eriantha)

Hardy, tufted, spring and summer-growing C4 perennial grass. Used in long term permanent pastures. Suited to wide range of soil types (low fertility, lighter-medium to heavier textured, acid soils) but prefers light to medium soil types. Produces new shoots in winter. Good drought and fire tolerance; some frost and salt tolerance; poor waterlogging tolerance. Very palatable, productive and persistent. Tolerant of heavy grazing but rotational grazing needed to ensure persistence of other species in mixtures. Suitable for hay. Spreads from seed. Sow with legumes. Foliage is low in oxalate, so is suitable for horses. Sow in spring and summer.

Minimum average annual rainfall:
400 mm (summer dominant)

Sowing rate: 1–2 kg/ha

Variety/brand	Comment	Main seed source
Premier		Public variety

FINGER GRASS
(Digitaria milanjiana)

Stoloniferous perennial, summer-growing grass for the subtropics. Suits a range of soils but has special application on fertile, light to medium textured soils. Once established, can survive prolonged periods of drought. Withstands short term waterlogging but not prolonged flooding. Tolerant of fire. High feed value and very palatable to all types of livestock, especially during early stages of growth. Makes excellent quality hay. Establishes quickly and competes well against weeds. Spreads from stolons and seed. Sow as a single grass with tropical legumes. New seed may be dormant for 6 months. Sow in spring and summer. Graze lightly in first year.

Minimum average rainfall: 600 mm

Sowing rate: 2–4 kg/ha bare seed

Variety/brand	Comment	Main seed source
Jarra	suited to the wet tropics	Public variety
Strickland ⓓ	suits tropics & subtropics, more tolerant of cold & drought	Progressive Seeds, Auswest Seeds

KIKUYU
(Pennisetum clandestinum)

Prostrate, summer-growing perennial grass. Suits very fertile, well-drained soils in subtropics and temperate regions. Widely used on the coast and for dairy pastures. Long growing season with high yield potential; dormant in winter. Persistent with an aggressive habit. Spreads rapidly by rhizomes and stolons or seed. Tolerates frost, waterlogging and heavy grazing. Moderate drought tolerance. High fertility and good grazing management required. Responds well to nitrogen fertiliser, irrigation, and intensive grazing (e.g. strip grazing). High palatability and feed value. Becomes rank and unpalatable if ungrazed. A dominant grass species; do not sow with other grasses. Can direct drill with ryegrass or oats in winter to provide a year-round feed supply. Companion legumes include white clover, forage peanut or Shaw creeping vigna (far North Coast only) and lotus on suitable soil types. These can be direct drilled in winter. Pure, well-fertilised kikuyu swards are often preferred. Excellent for erosion control and is also used as a hardy turf grass. Establishes from seed or cuttings. Sow or plant when soil temperature exceeds 20°C in spring–early summer or late summer–early autumn, depending on the district. Kikuyu dominant pastures are unsuitable for horses due to high oxalate levels. It occasionally causes nitrate poisoning in cattle.

Minimum average rainfall:
800 mm (summer dominant) or irrigation in drier climates

Sowing rate: 1–4 kg/ha

By runners: 1 cutting (runner) per square metre

Select varieties on the basis of:

Vegetative or seed propagated – Seed not available for common kikuyu.

Susceptibility to kikuyu yellows – Only important in subtropical areas. All commercially available varieties are susceptible to Kikuyu yellows.

Variety/brand	Comment	Main seed source
Common	vegetative propagation (i.e. runners) only	Public variety
Whittet		Public variety

LOVEGRASS
(Eragrostis curvula var. *conferta)*

Tufted perennial grass with most growth in spring, summer and autumn with slow winter growth. Suited to lighter-textured acid soils with high levels of exchangeable soil aluminium. Drought tolerant. Moderate frost and cold tolerance. Not tolerant of waterlogging. Moderately palatable to stock. Suitable for grazing, silage and hay. Rotational grazing required. Useful for erosion control and for controlling weeds such as spiny burr grass and blue heliotrope on light soils. Suitable companion legumes include serradella and biserrula (acidic soils), and subterranean clover (neutral to moderately acidic soils).

Sow in early spring or late summer–early autumn. (N.B. Annual temperate legumes should only be sown in autumn). Stands thicken over time.

Consol lovegrass was selected especially for grazing and soil conservation in western NSW with rainfall <350 mm. It is not as aggressive as the weed species. Do not sow in local government areas where the weed African lovegrass *Eragrostis curvula* is declared noxious.

Minimum average annual rainfall:
400 mm (summer dominant)

Sowing rate: 0.3–1.0 kg/ha

Variety/brand	Comment	Main seed source
Consol		Public variety

MOLASSES GRASS
(Melinis minutiflora)

Matting to tussocky summer-growing perennial. Used as a pioneer grass and rarely sown in pastures now. Adapted to low to medium fertility soils in warm coastal regions. Exudes a sticky substance from leaf hairs and has a distinctive molasses-like odour but does not taint meat or milk. Spread by stolons and seed. Considered a weed in Queensland.

Minimum average annual rainfall:
800 mm (summer dominant)

Sowing rate: 2–4 kg/ha, 1–3 kg/ha in mixtures

Variety/brand	Comment	Main seed source
Common		Public variety

PANIC GRASSES

Perennial grasses with most growth in spring, summer and autumn. Pastures dominated by panic grasses may cause photosensitisation in livestock. Suitable companion legumes include lucerne, barrel medic and/or subterranean clover, depending on soil type and rainfall. Sow in mid-spring to late summer and early autumn. Combines with tropical or temperate legumes, depending on area. Sow temperate annual legumes such as lucerne medic or subterranean clover only in autumn. When sowing with lucerne, reduce lucerne sowing rate to 0.75 kg/ha to reduce competition.

There are two main types of panic grasses used in New South Wales, Makarikari and the Guinea grasses:

BAMBATSI PANIC (Makarikari grass)
(Panicum coloratum var. *makarikariense)*

Erect to semi-prostrate habit. Particularly suited to fertile, clay soils in subtropical areas. Outstanding tolerance of waterlogging and drought. Frost tolerant. Moderate salt tolerance. Poor seedling vigour but very persistent once established.

Minimum average annual rainfall:
450 mm (summer dominant)

Sowing rate: 2–4 kg/ha

Variety/brand	Comment	Main seed source
Bambatsi		Public variety

GATTON PANIC (Guinea grass)
(Megathyrsus maximus var. *maximus)*

Similar in production to green panic but superior to Petrie green panic on low fertility soils. A palatable species, but will not persist if not managed well, especially under heavy grazing.

Minimum average annual rainfall:
500 mm (summer dominant)

Sowing rate: 3–4 kg/ha

Variety/brand	Comment	Main seed source
Gatton		Public variety
NuCal *(M.maximus x M.infestus)*	Leaf to stem ratio suited to hay production, tolerate of lower fertility and soil pH	Progressive Seeds
G2 (Þ	Gatton type with broader leaf, high dry matter production with good quality	Australian Premium Seeds

GREEN PANIC (Guinea grass)
(Megathyrsus maximus var. *pubiglumis)*

Tufted habit. Suited to a wide range of soils, except very light or very heavy textured soils. Suits wet coastal or tableland areas with high rainfall. Responds well to improved fertility. Moderate tolerance of drought and shade. Responds readily to rainfall. Sensitive to frost. Palatable and grazed preferentially. Will not persist under heavy grazing if not managed well. Use seed that is one year old to allow seed dormancy to break.

Minimum average annual rainfall:
500 mm (summer dominant)

Sowing rate: 3–5 kg/ha

Variety/brand	Comment	Main seed source
Petrie		Public variety

PASPALUM
(Paspalum dilatatum)

Tufted, deep-rooted perennial grass, growing mainly in spring and summer. Suited to fertile soils in subtropical and temperate coastal or inland irrigation areas. Responds well to irrigation and fertiliser. Good waterlogging tolerance. Moderate frost tolerance. Recovers well after grazing. Can become sod-bound in long-term pastures. Manage grazing to maintain feed value. Seed fine and often has low viability. Seed heads infected by ergot can affect stock health. Not normally sown in mixtures with other grasses in irrigated pastures. Suitable companion legumes include white clover, strawberry clover and lotus. Sow in spring–early summer, or late spring–early autumn.

Minimum average annual rainfall:
800 mm (summer dominant)

Sowing rate: 4–10 kg/ha

Variety/brand	Comment	Main seed source
Common		Public variety
Broadleaf *(P. wettsteinii)*	more tolerant of poor soils	Auswest Seeds

PURPLE PIGEON GRASS
(Setaria incrassata)

Erect perennial grass, growing mainly in spring and summer. Suited to wide range of soils, particularly heavy textured soils. Good drought tolerance. Some tolerance of waterlogging. Susceptible to frost. Relatively easy to establish. Suitable medium term pasture for cattle and sheep but not suitable for horses. Companion species depend on soil types and rainfall and can include barrel medic, subterranean clover and/or lucerne. If sowing with lucerne, reduce lucerne sowing rate to 0.75 kg/ha to reduce competition. Temperate legume annual companion species should be sown in autumn. Use seed that is one year old to allow for breakdown of seed dormancy. Sow in mid-spring, or late summer–early autumn.

Minimum average annual rainfall:
450 mm (summer dominant)

Sowing rate: 1–4 kg/ha

Variety/brand	Comment	Main seed source
Inverell		Public variety

RHODES GRASS
(Chloris gayana)

Tufted, stoloniferous perennial grass, with most growth in spring, summer and autumn. Adapted to subtropical and temperate coastal regions. Suits a wide range of soils, from light textured sandy loams to heavy soils. Moderate drought and salt tolerance. Susceptible to frost. Spreads readily by runners (stolons). Good erosion control due to strong stolon growth and vigorous root system. Highly competitive against weeds such as spiny burr grass. Easier to establish than many other tropical grasses although fluffy seed can be difficult to sow with conventional machinery. Responds well to irrigation and fertiliser. Highly palatable. Suitable for grazing and haymaking. Extensively grown on north coast of NSW. Companion legumes for coastal sowing include white clover, atro (Siratro), burgundy bean, glycine and lotus. For inland sowings lucerne, barrel medics, serradella, subterranean clover and woolly pod vetch are suitable. Sow Rhodes grass in spring, or late summer–early autumn and temperate annual species in autumn.

Minimum average annual rainfall:
500 mm (summer dominant)

Sowing rate: 1–4 kg/ha

Select varieties on the basis of:

Maturity – Earlier maturing types better suited to marginal growth areas and/or soils with poor moisture holding capacity. Later maturing lines more suited to higher rainfall areas and respond to higher levels of input (e.g. nitrogen fertiliser, irrigation and intensive grazing).

Local production and persistence trial information – consult local trial results where available.

Variety/brand	Comment	Main seed source
Early flowering diploids		
Gulfcut (D)	improved salt tolerance & forage quality	Selected Seeds
Pioneer		Public variety
Reclaimer (D)	improved salt tolerance & forage quality	Selected Seeds
Late flowering diploids		
Finecut (D)		Selected Seeds, Auswest Seeds
Katambora		Public variety
Nemkat (D)		Seedmark, Auswest Seeds
Topcut (D)		Selected Seeds, Auswest Seeds
Tolgar (D)	Katambora type, later flowering, finer stem, salt tolerance	Australian Premium Seeds
Very late flowering tetraploid		
Callide	large leaves, responds to increased fertility, maintains feed quality if irrigation well managed	Public variety
Toro (D)	Callide type later flowering, broader leaf, finer stem, salt tolerance	Australian Premium Seeds

SABI GRASS
(Urochloa mosambicensis)

Stoloniferous, summer-growing perennial grass, growing to 40 cm high. Suited to wide range of soils. Extremely drought tolerant, palatable and persistent. Susceptible to frost and waterlogging. Best grass species evaluated for mine site rehabilitation in the dry tropics and subtropics. Can germinate and establish on moderately saline soils. Responds well to fertiliser. Good erosion control on sloping land. Saraji (stoloniferous) has better winter growth and lower seed dormancy than Nixon (tufted). Can be oversown. Suitable companion species are stylo and desmanthus.

Minimum average rainfall: 550 mm

Sowing rate: 2–4 kg /ha bare seed

Variety/brand	Comment	Main seed source
Nixon	tufted species, dormant seed	Public variety
Saraji	stoloniferous, salt tolerant, mine reclamation	Progressive Seeds, Auswest Seeds
Supa Sab		Auswest Seeds

SETARIA
(Setaria sphacelata)

Hardy, tall perennial grass, growing mainly in early spring to late autumn. Suited to wide range of soils in subtropical coastal regions. Greater tolerance of cool temperatures than most other tropical grasses. Tolerates frost, acid soils and short term waterlogging. Suitable companion legumes include white clover, lotus or tropical legumes such as atro (Siratro). Setaria dominant pastures are unsuitable for horses due to high oxalate levels.

Sow Setaria in spring to early summer when sowing with tropical legumes or under irrigation; sow in February/March if sowing alone or with white clover (dryland).

Minimum average annual rainfall: 900 mm (summer dominant)

Sowing rate: 1–3 kg/ha

Select varieties on the basis of:

Frost tolerance – Desirable to increase period of green feed availability and produce better winter feed.

Local production and persistence – Consult local trial results where available.

Variety/brand	Comment	Main seed source
Kazungula		Public variety
Splenda (D)	frost tolerant	Heritage Seeds, Auswest Seeds
Narok	frost tolerant	Public variety
Solander	frost tolerant	Public variety

NATIVE GRASSES

When selecting a perennial native grass for sowing it is important to first identify which native grasses are currently growing in the landscape around the area to be sown. More information on perennial native grasses can be found at: *www.dpi.nsw.gov.au/agriculture/field/pastures-and-rangelands/native-pastures*

Perennial native grasses can be classified as either C3 or C4 plant, which refers to differences in the plant's photosynthetic process. All species have the C3 pathway, but an additional C4 pathway has evolved in warm season species which includes tropical grasses.

The two groups are adapted to different growing conditions:

- C3 plants – cool season establishment and growth, in either wet or dry environments.
- C4 plants – warm or hot seasonal conditions, under moist or dry environments.

C3 grasses have greater frost tolerance and higher feed quality, but produce less herbage than C4 species. In natural conditions, C3 species are often more abundant in the shade of trees and on southerly aspects while C4 species often dominate in full-sun conditions and northerly aspects, so provide greater ground cover across a range of conditions. A mixture of C3 and C4 species provides a broad spread of pasture production throughout the year for grazing.

There are a number of native grass species available commercially which are valuable as pasture plants

COOL SEASON (C3) SPECIES

WALLABY GRASS
(Austrodanthonia spp.*)*

Erect, tufted, year-long green C3 perennial grass, with fine leaves, growing 30–80 cm high during the cool season. Occurs naturally in a wide area of NSW, from hot arid to cool moist areas. Suits medium clays to light sandy loam soils. Tolerates low soil fertility but responds to fertiliser if soil deficient in nutrients. Highly tolerant of grazing, frost, drought, heat and acid soils. Will not tolerate waterlogging. A valuable pasture for livestock. Nutritious, productive and persistent when grazed intermittently. Sow in spring or late autumn when moisture from either rainfall or irrigation is available. Sow no deeper than 5 mm. Several species available which suit different conditions. Select varieties on the basis of adaptation to soil type.

Sowing rate for seed in caryopsis form: 0.3–2.0 kg/ha

Variety/brand	Comment	Main seed source
Bidgee *(A. fulva)*	shallow & infertile soils	Native Seeds Pty Ltd
Bunderra (Þ *(A. bipartita)*	heavy clay soils	Native Seeds Pty Ltd
Smallflower wallaby grass *(A. setacea)*	sandy to heavy soils	Native Seeds Pty Ltd
Taranna (Þ *(A. richardsonii)*	medium-textured soils	Native Seeds Pty Ltd
Wirra *(A. tenuior)*	larger growing variety, suits heavy soils	Native Seeds Pty Ltd

WEEPING GRASS (Weeping rice grass)
(Microlaena stipoides)

Tufted, cool-season C3 perennial grass. Produces year-round high quality forage although slow winter growth. Useful as pasture or turf grass. Adapted to higher rainfall areas of the tablelands and alps in NSW, especially damp or semi-shaded areas such as shaded woodlands and open forests. Suits wide range of soils with pH_{Ca}< 5.5, but grows best on loams. Tolerant of acid soil, high soil aluminium, drought, frost and shade. Medium salt tolerance. Spreads by seed and short rhizomes. Seed can germinate in any month but avoid mid-winter and mid-summer sowings. Sow into a weed-free seedbed 10–20 mm deep when soil moisture guaranteed following sowing. Seedlings grow slowly for the first six months. Do not graze over summer to ensure good seed set.

Sowing rate: 5–8 kg/ha

Variety/brand	Comment	Main seed source
Bremmer		Native Seeds Pty Ltd
Ovens(D)		Native Seeds Pty Ltd

WHEAT GRASS (Common wheat grass or Rough wheat grass)
(Elymus scaber)

Short-lived, tussocky C3 perennial grass which grows 30–100 cm high. Suited to districts with cool winters such as the tablelands and coastal ranges. Adapted to soils ranging from sand to clay-loams, and mildly acidic to alkaline pH. High frost tolerance, moderate shade and drought tolerance, and low salt tolerance. Plants remain green throughout summer if sufficient soil moisture is available. High to moderate feed value in winter and spring. Responds to fertiliser and grazing. Rotational grazing ensures persistence. Sow florets at a depth of 10 mm in autumn to winter. Seedlings establish rapidly and have high seedling vigour. Can be used as a cover crop with slower growing grass such as wallaby grass.

Sowing rates: 5–10 kg/ha (as florets)

Variety/brand	Comment	Main seed source
Murray	suits warmer, drier conditions; moderate drought tolerance	Native Seeds Pty Ltd
Oakey	drought resistant, frost tolerant , good winter/ spring growth	Native Seeds Pty Ltd

WARM SEASON (C4) SPECIES

BARBED WIRE GRASS
(Cymbopogon refractus)

Erect, long-lived, C4 perennial grass, growing mainly in spring and summer. Suitable for coastal areas and into the ranges. Also found on ridges and flats across NSW. Suits wide range of soils (sand, loam and clay) including those of low fertility. Can reach 120–150 cm high. Drought tolerant. Low frost tolerance. Yields well under rotational grazing. Sow into weed-free seedbed in early spring, or later with irrigation or summer rainfall. Seed very small; sow with inert carrier such as vermiculite. Seed should be surface sown and rubbed or rolled into the surface.

COTTON PANIC
(Digitaria brownii)

Long-lived, C4 perennial grass with a slowly spreading habit, growing 25–80 cm high. Grows mainly in summer; dormant in winter in inland locations. Adapted to coastal and inland areas, in the tropics and warmer temperate areas. Suits wide range of soils (sand, loam and clay). Very drought tolerant and mildly tolerant of frost. Produces large bulk of valuable, highly palatable green fodder in warmer months after rainfall. May be selectively grazed if set stocked. Spreads by short rhizomes and seed. Sow into weed-free seedbed in early spring, or later with irrigation or summer rainfall. Seed is light and fluffy; pelletise seed for sowing. Sow no deeper than 5 mm on heavier soils.

HAIRY ARMGRASS (Armgrass millet)
(Urochloa piligera syn. *Brachiaria piligera)*

Annual or short-lived C4 perennial grass with warm season growth, growing up to 100 cm high. Suits northern tablelands and slopes, and the central west. Suits wide range of soil types but prefers sandier soils. Heat tolerant. Low tolerance of drought and frost. Valuable fast-growing forage for grazing animals, producing large quantities of feed early in spring. Seed should be sown shallow into a prepared seedbed.

KANGAROO GRASS
(Themeda australis syn. *T. triandra)*

Deep-rooted, C4 perennial grass with erect or sprawling tussocky habit. Noted for active summer growth and upright, reddish-coloured seedheads. Dormant during winter. One of the most widespread native grasses, occurring naturally from alpine to coastal areas, to dry inland NSW. Suits sandy to heavy clays soils of low to moderately high pH. Tolerant of drought and heat. Low frost tolerance. Can grow 60–150 cm high. Can help lower water tables and assist with control of dryland salinity. Has moderate to good feed value when actively growing. Becomes rank and unpalatable if not grazed or mown in summer. Persists well if rotationally grazed. Spreads by seed only. Seed is dormant for 6 months after harvest. Good seedling vigour but plants susceptible to grazing when small. Autumn sowing preferred to prevent seed drying out. Summer rainfall or storms required to ensure full establishment before winter. Seed expensive, as seed production is low and cleaning is difficult. Sow in spring into a prepared seedbed, around 10 mm deep. Eliminate weeds before sowing.

Sowing rate: 1–2 kg/ha

Variety/brand	Comment	Main seed source
Burrill		Native Seeds Pty Ltd

MITCHELL GRASS (Curly Mitchell grass)
(Astrebla lappacea)

Tufted, deep-rooted, C4 perennial grass from 30–90 cm high, growing mainly in summer. One of the most stable and economically important pastures in semi-arid eastern Australia but many areas of natural Mitchell grass pasture have been degraded by overgrazing, trampling, clearing for cereal production or fire. Suits heavy grey cracking clay soils, red alkaline clay soils and desert loams in arid to semi-arid parts of north-western NSW with summer dominant rainfall. Found on flood plains of the upper Darling and its tributaries, north of Broken Hill. Drought resistant due to shallow surface rhizomes which utilise light showers of rain and deeper vertical roots which access subsoil moisture. Low tolerance of frost, flooding and weed competition. Tolerates heavy grazing except in drought times. Is of moderate feed value during the growing season and provides useful standover feed in drier times. Regenerates from the crown and plants can survive 20–30 years if not overgrazed. In natural pastures Mitchell grass is associated with chenopod shrubs and annual medics. Sow seed shallow (< 10 mm) in early or late summer. Broadcast or aerial seed into a prepared a weed-free seedbed or into wheat stubble. Naked and fluffy seed can be sown using conventional machinery or fluffy seed with buffel drum seeders. Harrowing lightly after broadcast or aerial sowing will improve soil/seed contact. Seed should be greater than 12 months old at sowing to overcome seed dormancy. Follow-up rain or irrigation required after 6 weeks to ensure good establishment. Useful for revegetation and land rehabilitation, as long as it is not overgrazed.

Minimum average rainfall: 250 mm (summer dominant)

Optimum germination temperature: 22–38°C

Sowing rate: 1–2 kg/ha dryland (8 kg/ha for seed production under irrigation)

Variety/brand	Comment	Main seed source
Yanda Φ		Native Seeds Pty Ltd

QUEENSLAND BLUEGRASS
(Dichanthium sericeum)

Erect, leafy, tufted C4 perennial grass, growing to 80 cm high. Very similar habit and habitat to Mitchell grass. Suits clay soils of north-west slopes and plains. Moderately tolerant of drought and frost. Palatable and nutritious feed, especially when young. Rotational grazing aids persistence. Sow seed from spring to early autumn. Sow seed on or close to surface (no deeper than 10 mm) and moist soil will ensure germination. Optimum germination temperature 20–30°C

Sowing rates: 5–10 kg/ha (as florets)

REDGRASS (Redleg grass)
(Bothriochloa macra)

Extremely hardy, tufted, short-statured growing to 30–100 cm high, C4 perennial grass which grows mainly in the warm-season and goes dormant during winter. Adapted to a range of environments across NSW and a wide range of soil types, but grows best on the lighter clays and loams with slightly acid to neutral pH. High tolerance of drought and heat. Low to moderate frost tolerance. Moderate grazing value, especially after summer rain. Responds to fertiliser and grazing. Sow by broadcasting in spring or autumn. Rest in late summer to allow seed set.

WARREGO SUMMER GRASS
(Paspalidium jubiflorum)

Tussocky, warm-season, C4 perennial grass, 30–130 cm high. Essentially a tropical genus but extends to temperate regions. Adapted to the western slopes and plains of NSW. Suits a variety of soil types and situations but most productive on heavier soils on lower slopes. In drier areas suits swamps and watercourses, and can survive periods of inundation. Favoured by livestock. Provides useful forage even after it has hayed off (after frost or insufficient soil moisture). Irrigation can prolong growing season. A large amount of seed is produced but progressively falls as it matures. 'Seed litter' is often present in productive stands at end of growing season. Sow shallow, into a weed-free seedbed in spring, using a conventional seedbox or by broadcasting.

WINDMILL GRASS

There are several species of windmill grass, the best known being *Chloris truncata* and *Chloris ventricosa*. Both suited to a wide range of soil types.

WINDMILL GRASS (Umbrella grass)
(Chloris truncata)

Prostrate, short-lived, warm-season, C4 perennial grass which forms a rounded tussock up to 50 cm high. Suits most environments, except the south coast. Grows on clay soils in drier areas, preferring red or black earths. High heat and drought tolerance, moderate salt tolerance and low frost tolerance. Responds to summer rain, producing high amount of feed. Produces palatable fodder of low to moderate feed value when actively growing. Pioneer species that spreads rapidly by seed onto bare soil areas; valuable soil stabiliser. Sow into weed-free seedbed in early spring. Lightly scarify the soil, broadcast seed over surface, then scarify lightly again. Establishes quickly with minimal rainfall.

TALL WINDMILL GRASS
(Chloris ventricosa)

Erect, bunching, summer-growing, C4 perennial grass, growing to 100 cm high. Can live for several years. Widely adapted from to the western plains to coastal areas. Suits a wide variety of soils. Excellent drought and heat tolerance. Is frost sensitive and dormant during winter. Moderate feed value and readily grazed during summer. Often used as pioneer species to stabilise soils whilst other grasses become established. Can be used with grasses such as kangaroo grass and redgrass. Sow seed shallow (no deeper than 10 mm) in warmer months when air temperature is above 25°C. Rotationally graze and rest in summer to ensure establishment and spread.

Sowing rate: 1–5 kg/ha

Variety/brand	Comment	Main seed source
LIG 548		Native Seeds Pty Ltd

PASTURE HERBS

CHICORY
(Chicorium intybus)

Deep-rooted perennial herb, providing potentially high quality feed mainly in spring and summer. Tolerant of soil acidity but prefers deep, fertile, well-drained soils. Susceptible to some herbicides used in pastures. Non-bloating. Used as specialist forage crop for stock finishing or high quality component of mixed perennial pastures, especially where soils are too acidic for lucerne. Suitable for silage but not for hay. Often sown with white clover or red clover. Where legumes are not included, nitrogen fertiliser may be necessary. Free-seeding and able to regenerate where grazing management allows. Requires rotational grazing for persistence. Sow in early autumn to avoid frost or spring (tablelands and irrigation).

Minimum average annual rainfall:
600 mm (south), 750 mm (north)

Sowing rate: 2–5 kg/ha alone; 0.5–2.0 kg/ha in pasture mixtures

Variety/brand	Comment	Main seed source
Balance		Seed Distributors
Chico		Cropmark
Commander		Heritage Seeds
Grasslands Choice (Þ)		Agricom
Puna		Wrightson Seeds
Puna II (Þ)		Wrightson Seeds
Punter		Seed Force

PLANTAIN
(Plantago lanceolata)

Deep-rooted perennial herb growing all year. Highest growth rates in warmer months. Adapted to wide range of soils including low fertility and acid soils but prefers free drainage. Drought and heat tolerant, and can regenerate from seed. Will not tolerate some herbicides commonly used in pastures. Susceptible to slugs. Can be sown as a pure stand, but more often used as component of perennial pasture mixture. Compatible with perennial ryegrass and subterranean clover but does not tolerate competition from competitive grasses. When sown without legumes, nitrogen fertilisers required to maximise yield. Young leaf material is particularly palatable, but rotational grazing required to maintain production. Has potential for hay and silage. Sow autumn or spring (tablelands and irrigation).

Minimum average annual rainfall:
500 mm (south), 650 mm (north)

Sowing rate: 3–8 kg/ha with red or white clover; 1–4 kg/ha in a perennial mixture

Variety/brand	Comment	Main seed source
Ceres Tonic (Þ)		Agricom
Hercules		Seed Force
SF Endurance		Seed Force

APPENDIX I. National Seed Quality Standards for certified seeds

The National Seed Quality Standards are the voluntary minimum standards for physical seed quality agreed to by the Australian Seed Federation of Australia (ASF) and the Grains Council of Australia (GCA). These standards are applied to all certified seed of public cultivars and to seed sold by ASF members. In many cases seed companies will apply physical standards well in excess of these. The national standards may be used as a guide to determine an acceptable level of physical seed quality prior to purchase.

GRASSES

Species	Minimum pure seed % by mass	Minimum germination % by count	Maximum other seeds % by mass
Bahia grass	60	60	2
Buffel grass	90	20	2
Cocksfoot	90	70	3[a]
Creeping bluegrass	50	20	5
Guinea grass	40	25	0.7
Italian ryegrass	97	80	1
Kikuyu	95	60	1
Lovegrass	97	70	0.5
Purple pigeon grass	80	40	3
Phalaris	97	65	1
Perennial veldt grass	65	40	1
Perennial ryegrass	97	75	1[b]
Rhodes grass (diploid)	80	20	4
Rhodes grass (tetraploid)	75	10	4
Setaria	60	20	1.2
Tall fescue	96	70	3[c]
Tall wheat grass	85	65	2

LEGUMES

Species	Minimum pure seed % by mass	Minimum germination % by count	Maximum other seeds % by mass
Annual medics	98	70[d]	2[e]
Arrowleaf clover	98	60	1
Balansa clover	98	65	1
Berseem clover	98	80	1
Biserrula	98	70	0.5
Crimson clover	98	65	1
Joint vetch	95	50	2
Kenya white clover	97	50	1
Lucerne	98	60	0.5
Persian clover	98	65[f]	1
Red clover	97	60	0.5
Rose clover	98	70	1
Strawberry clover	98	60	1
Subterraneum clover	98	70	0.5
Serradella	90	75[g]	1
White clover	97	60	2

a. 3% maximum, of which no more than 1% shall be seeds other than *Lolium* species.

b. In a bad blind seed disease year standards may be adjusted multilaterally.

c. 3% maximum, of which no more than 1% shall be seeds other than *Lolium* species.

d. Germination % does not include hard seeds.

e. 2% maximum, of which more than 0.5% shall be seeds other than burr medic.

f. cv. Kyambro – 50% germination.

g. Minimum germination for certification – includes normal and hard seeds.

APPENDIX II. Reading a certificate of seed analysis found on bags of certified seed

Cultivar
Cannot be assessed by seed analysis. Purchase certified seed or seed produced under a suitable quality assurance scheme to ensure it is the correct cultivar.

Line Number
Unique identifying code used to match seed test results with the seed lot. Branded on all bags of seed and included on all sales documents.

Pure Seeds
Percent of seed of the nominated species i.e. 99.1% subterranean clover.

Abnormal Seedlings
Seed that germinates but is damaged in some way. Unlikely to produce healthy plants.

Inert Matter
Amount of non-seed material or broken seed particles. May include fungal material such as ergot or sclerotia.

Hard Seed
Seed that is dormant.

Other Seeds
Amount of other seed present. Check this carefully for any undesirable weeds.

Normal Seedlings
This is the GERMINATION percentage. Generally valid for up to 12 months from date of testing.

Statement of Seed Analysis

Certificate of Analysis
Number: 1234556

Issued without alteration or erasure

Common Name:	Subterranean Clover	**Line Number:**	AUS/N66/1/742
Cultivar:	Junee	**Other ID:**	East 42
Species:	Trifolium subterranean	**Lab Number:**	78910
Number of Bags:	400		
Weight of Lot:	10,000 kg	**Issue Date:**	15/05/2001

Purity - % weight			GERMINATION - % Number					
Pure seeds	Inert matter	Other seeds	Number of days of test	Normal seedlings final count	Hard seed	Fresh Un-germinated seed	Abnormal seedlings	Dead seeds
99.1	0.6	0.3	10	66	10	0	16	8

Other seeds in 250.0 grams

Format:	Common name	Botanical name	Number
	Red Clover	Trifolium pratense	54
	Millet	Echinochloa spp.	2
	Wireweed	Polygonum aviculare	1

Inert matter: broken seed, dirt, decoated seed

These analysis results relate only to the sample as received by the Laboratory
Sample details as stated by the Applicant

J Smith

OFFICER IN CHARGE

APPENDIX III. Average seed counts for major pasture species

Pasture variety	Seed count (thousand seeds/kg)
Temperate grasses	
Cocksfoot	1344
Perennial veldt grass	712
Phalaris	650
Prairie grass	110
Puccinellia	5000
Ryegrass (perennial)	500–600
Ryegrass Italian	460
Ryegrass hybrid (diploid)	500–600
Ryegrass hybrid (tetraploid)	200–300
Ryegrass annual	418
Tall fescue	404
Tall wheat grass	190
Timothy	250
Temperate legumes	
Balansa clover	1400
Barrel medic	235
Berseem clover	326
Crimson clover	250
Gland clover	1430
Lotus	2062
Lucerne	440–500
Murex medic	262
Persian clover	1456
Red clover (diploid)	528
Red clover (tetraploid)	295
Rose clover	331
Snail medic	390
Strawberry clover	766
Subterranean clover	117
White clover	1572
Woolly pod vetch	25
Yellow serradella	196

Pasture variety	Seed count (thousand seeds/kg)
Tropical Grasses	
Bahia grass	1000
Bambatsi panic	1600
Buffel grass	600
Floren bluegrass	833–1160
Gatton panic	1160
Green panic	1280
Kikuyu	410
Paspalum	570–700
Premier digit grass	1700–2500
Purple pigeon	550
Rhodes grass	2800
Setaria	1300–1900
Swan Forest Bluegrass	3750–5800
Tropical legumes	
Amarillo peanut	6–7
Atro	79
Axillaris	120
Creeping vigna	75
Desmanthus	280–350
Greenleaf desmodium	750
Lotononis	3500
Kenya clover	700–1000
Wynn cassia	250
Pasture herbs	
Chicory	830
Plantain	500

APPENDIX IV. Inoculating legume seed

When sowing legumes bacterial inoculants should always be used to ensure that the plants survive and reach their productive potential. Pasture legumes utilise Rhizobium bacteria which live in root nodules to "fix" nitrogen (N) from the air for the plant to use. Surplus fixed soil N is available for subsequent crops. Inoculating legumes can result in an extra $200–300 worth of nitrogen in the crop or pasture and has played a key role in the success of legumes in Australia.

Inoculation is especially important if:

- A new legume is being sown in a paddock for the first time
- Poor nodulation has occurred in the paddock with the same legume
- The legume follows a non-legume crop
- The land has undergone reclamation

The number of rhizobia in the soil is critical. Published data suggest that a population of >1000 rhizobia / g soil is required for optimum nodulation and nitrogen fixation.

Each legume requires a specific strain of bacterium to maximise N fixation. Commercial legume inoculants contain rhizobial strains that have been selected and recommended by rhizobiologists after many years of research and offer a cheap, effective way of ensuring that the plants receive the correct and most efficient nitrogen-fixing strain. New inoculant strains are usually more effective than any residual bacteria which may be in the soil.

Forms of inoculant

Legume inoculants come in different forms and can be applied in various ways:

1. Peat-based inoculants are applied to the seed by the farmer just before sowing. The peat containing the rhizobia is mixed into water containing glue to form a slurry and applied evenly to the seed and dried. Alternatively, the slurry-inoculated seed can be pelleted with fine agricultural lime while still wet. The lime coat around the seed protects the rhizobia from mild soil or fertiliser acidity close to the seed. It also ensures better survival of the rhizobia when delays between pelleting and sowing are unavoidable. Pelleting is not generally required by most tropical legumes. This is a reliable, easy and cheap method and ensures that inoculant is available to every plant as the seed germinates. Seed should be sown within a few days to ensure survival of rhizobia.

2. Freeze dried inoculants–A relatively new type of inoculant in the form of a soluble freeze-dried powder which can be used as a seed coat or for liquid injection into the soil with the seed. The inoculant comes in a glass vial or foil pack with a pack of protecting agent which assists the bacteria to survive on the seed during planting. The freeze-dried rhizobium bacteria reactivate when mixed with water. To ensure viability of rhizobia freeze-dried inoculants should be stored in a cool place until use and treated seed should be sown into moist soil within 5 hours of application.

3. Pre-coated or pre-inoculated seed is available from most seed merchants. This is different to seed which is coated immediately upon request by the farmer and sown within a couple of days. Pre-inoculation can be done by commercial seed coaters weeks or months prior to sowing. Seed coating with rhizobia in this way is termed "custom inoculation".

Depending on the recipe used, pre-inoculated seed may extend the potential for survival of rhizobia beyond the accepted 7 days for traditional lime pelleting. The coating contains inoculant and may also contain other products such as insecticides, fungicides, stickers and wetters. Note that seed coating increases the seed weight, so there are fewer seeds per kilogram (the seed coat may be 20–50% of the seed weight) but the germination percentage of coated seed is potentially higher than bare seed.

Pre-coated seed is more expensive but is easy, saves time and avoids direct contact with farm chemicals. While it provides more flexibility for farmers, it is still advisable to sow as soon as possible after seed treatment.

4. Granule inoculants–Clay or peat-based granules impregnated with rhizobia can be sown in the soil before or with the seed. Provided the granules are buried, rhizobia can last in the soil for an extended period. This is an expensive form of inoculant but is useful for hard seeded species which do not germinate immediately after rainfall or where nodulation has failed in the first instance.

Precautions

Rhizobia are living organisms and need to be treated carefully to ensure their survival.

- Buy fresh inoculum which has been stored in the refrigerator and keep refrigerated until needed.
- Sow as soon as possible after seed treatment.
- Do not expose treated seed to sunlight or heat.
- Do not allow fertilisers to come in direct contact with the seed.
- If using insecticides or fungicides check that they are compatible with inoculants and ensure that they are applied to the seed the day before inoculation.
- Consider whether soil moisture, temperature and pH are generally suitable for good survival of rhizobia.

Quality assurance of Australian inoculants

Legume microbial inoculants used in Australian crops and pastures are covered by a National Code of Practice set up in July 2010 by the Australian Inoculant Research Group (AIRG). The Code covers both the inoculant manufacturers and the independent quality testing laboratory. Signatories to the Code have obligations in the way inoculants are manufactured, handled and tested for compliance at the point of manufacture and at retail outlets.

AIRG is the independent quality testing (control and licensing) authority. It comprises NSW DPI in collaboration with Sydney University, Becker Underwood Pty Ltd, New Edge Microbials Pty Ltd and Novozymes Biologicals Ltd, with contributions from SARDI, CRS (Murdoch University), DPI Victoria and the GRDC.

Inoculant quality is determined by the effectiveness of the strain of *Rhizobium* to fix nitrogen and the number of live rhizobia. AIRG assesses inoculants produced by Australian and overseas for both of these criteria, as well as the minimal numbers of other contaminant micro-organisms and the optimum moisture potential for growth and survival of the rhizobia after manufacture and during storage. Every batch of inoculant must meet these standards before it is approved for sale, and an expiry date is applied.

Numerical standards

Numerical standards for inoculant products ensure a consistently high quality product. Quality standards listed in the Code for rhizobial inoculants have been developed from many years of research and are subject to regular review. The current numerical standards for legume inoculants in Australia are listed in the table 1.

The AIRG Quality Trademark ensures that inoculant manufacturers provide the most effective strains and that only high quality legume inoculants are sold in Australia. Strains with the quality trademark comply with the Code. They have been independently tested in an ISO9001:2008 certified laboratory and are of highest quality.

Table 1. Current numerical standards for Australian legume inoculants

Product	Fresh count	Expiry count	Expiry (months from date of testing)
Peat (cfu#/g)	$\geq 1 \times 10^9$	$\geq 1 \times 10^8$	12–18*
Liquid (cfu/mL)	$\geq 5 \times 10^9$	$\geq 1 \times 10^9$	6
Granules (MPN^/g)	$\geq 1 \times 10^7$	$\geq 1 \times 10^6$	6
Freeze dried (cfu/vial)	$\geq 1 \times 10^{12}$	$\geq 5 \times 10^{11}$	6

Inoculants must meet AIRG standards for number of bacteria, trueness of strain, moisture content and freedom of contaminants.

cfu = colony forming units – a measure of the number of viable bacteria

^ MPN =most probable number –lab test to assess ability of inoculant to form nodules on an test legume seedling.

Based on current data, 18 months expiry applies for groups E, F, G and N stored at 4°C.

Group G strain is WU425 only.

Numerical standards for CB376 for *Lotononis bainesii* are 2×10^8 cfu/g moist peat (2×10^7 cfu/g at expiry).

Labelling of inoculants

Under the Code, manufacturers must label their products as follows:

- Plant host species
- Batch number
- Product shelf life or expiry date
- Conditions of storage
- Method of application to seed or soil of the product (inoculant)
- Guaranteed minimum number of micro-organisms per unit of product at point-of-sale (minimum standards apply for legume inoculants)

For further information see:

- Inoculating and pelleting pasture legume seed *www.dpi.nsw.gov.au/agriculture/field/pastures-and-rangelands/establishment/inoculating-legume-seed*
- Australian Inoculants Research Group *www.dpi.nsw.gov.au/research/centres/gosford/australian-inoculants-research-group*

APPENDIX V. Commercial inoculants for pasture legumes

Standard Inoculants	Pasture species
AL	Lucerne, Strand medic, Disc medic
AM	Annual medics - Barrel, Burr, Snail, Sphere, Gama, Murex
B	Clovers – White, Red, Strawberry, Alsike, Berseem (Egyptian), Cluster (Ball), Suckling
C	Clovers – Subterranean, Balansa, Gland, Purple, Arrowleaf, Crimson, Rose, Persian ("Shaftal")
E	Woolly pod vetch
I	Creeping vigna, Cowpea
J	Pigeon pea, Lablab, Axillaris
K	Kenya white clover
M	Butterfly pea, Atro, Glycine, Round leaf (Wynn) Cassia
S	Serradella – Yellow, Pink

Special inoculants	Pasture species
WSM1497	Biserrula
CB1717	Burgundy bean
CC283b	Caucasian (Kura) Clover
CB1923	Centro, Centurion
CB3126	Desmanthus, Leucaena
CB627	Desmodium
CIAT3101	Forage (Pinto) peanut
CB2312	Jointvetch - American, Bargoo, Villosa
SU343	Lotus cornicularis (Birdsfoot trefoil)
CC829	Lotus pedunculatus – Maku
CB3481	Stylo – Caatinga
CB1650	Stylo – Caribbean
CB82	Stylo – Fine stem, Townsville, Shrubby
WSM1592	Sulla

APPENDIX VI. Characteristics of some clover varieties#

Brian Dear, Former Senior Principal Research Scientist, NSW DPI, Wagga Wagga

1. Subterranean clovers

Species / Cultivar	Days to flower Wagga	Min. rainfall* (mm) Sth NSW	Hard seed	Attribute
Subterranean clover (*Trifolium subterraneum*)				
Izmir	95	350	VH	
Nungarin	102	375	H	
Losa	105	400	M	
Dalkeith	110	400	H	
Urana	110	400	H	
Seaton Park	125	450	M	
Bindoon	125	450	M	seedling RLEM tolerance
York	125	450	H	
Junee	128	500	M	
Campeda	130	500	M	
Woogenellup	140	500	L	
Coolamon	140	400	M	
Goulburn	145	525	M	
Karridale	146	600	L	
Denmark	149	600	L	
Rosabrook	150	600	M	seedling RLEM tolerance
Mount Barker	143	600	L	
Leura	156	700	L	
Subterranean clover (*Trifolium yanninicum*)				
Riverina	128	525	M	suits wet soils/ irrigation
Gosse	136	600	M	suits wet soils/ irrigation
Larisa	150	800	L	late maturing
Napier	150	800	H	very late maturing
Meteora	158	900	H	very late maturing
Subterranean clover (*Trifolium brachycalycinum*)				
Clare	142	550	L	
Rosedale	120	525	M–H	
Antas	134	550	M	
Mintaro	115	500	M	

2. Other temperate clover species

Species / Cultivar	Days to flower Wagga	Min. rainfall* (mm) Sth NSW	Hard seed	Attribute
French serradella (*Ornithopus sativus*)				
Cadiz	125	450	VL	no hard seed
Margurita	125	400	H	acid and Al tolerant; Mn sensitive
Erica	121	400	H	
Serratas		450		claimed to have better Mn tolerance
Biserrula (*Biserrula pelecinus*)				
Mauro	125	400	VH	acid and Al tolerant; Mn sensitive
Casbah	115	350	VH	
Bladder clover (*Trifolium spumosum*)				
Bartolo	110	350	H	requires good drainage
Gland clover (*Trifolium glanduliferum*)				
Prima	100	390	M	tolerant of poor drainage, insect resistant including RLEM
Balansa clover (*Trifolium michelianum*)				
Frontier	105	375	H	tolerant of poor drainage
Paradana	120	500	H	tolerant of poor drainage
Bolta	130	550	H	tolerant of poor drainage
Eastern star clover (*Trifolium dasyurum*)				
Sothis	100	350	H	very delayed germination

Hard seed: VH–very high, H–high, M–moderate, L–low, VL–very low

Al–Aluminium, Mn–Manganese

* Rainfall figures are a guide only and will vary with aspect, slope, soil type and altitude.

Information presented in the tables above is not a complete list of available varieties and represents only those which have been researched by NSW DPI; other varieties are available.

Please consult the seed supplier for information on maturity, minimum rainfall requirements and levels of hard seed varieties not listed.

APPENDIX VII. Veterinary notes on livestock disorders associated with pasture species

Dr Chris Bourke, Former Principal Research Scientist, NSW DPI, Orange

General health disorders associated with pastures

A number of livestock disorders are associated with pasture improvement, and their occurrence is common across many pasture species. Livestock and production losses can result from some of these disorders. Management may need to be modified to minimise risk to livestock health.

Enterotoxaemia (pulpy kidney)	A constant risk when 'improved' or 'exotic' pasture species are grazed, particularly with rotational grazing management systems.
Polioencephalomalacia (PE)	Sporadic cases may occur when livestock are grazed under a rotational grazing management system.
Hypomagnesaemia (grass tetany)	Can be a seasonal risk for stock on many grass dominant pastures.
Oxalate, nitrate or cyanogenic compounds	Significant accumulations may occur in many pasture species in some seasons. Grazing ruminants usually adapt successfully to such feed, provided they are not suddenly placed on them while in a feed-deprived state. Adaptation to cyanogenic compounds is much more limited, and livestock owners should get a cyanide test done on high risk species such as sorghum and its hybrids before grazing is allowed.
Acute Respiratory Distress Syndrome (Fog fever)	An occasional risk in cattle that have been moved off a poorer pasture and onto a lush green grass or legume pasture.
Bloat	A constant risk in cattle grazing lush pastures consisting of lucerne, medic (*Medicago* spp.) or clover (*Trifolium* spp.).

Livestock health disorders associated with particular pasture species

There are many livestock health disorders associated with a particular pasture species. Fortunately, appropriate management can reduce the risk associated with most of these problems. Consult your veterinarian or livestock adviser for further advice, especially when planning pasture improvement programs.

Annual legumes

Arrowleaf clover (*Trifolium vesiculosum*)	Can cause bloat in cattle.
Balansa clover (*T. michelianum*)	Bloat in cattle; urinary calculi (clover stones) incidence may increase in sheep; occasionally red gut in sheep.
Berseem clover (*T. alexandrinum*)	Bloat in cattle; urinary calculi (clover stones) incidence may increase in sheep; occasionally red gut in sheep.
Biserrula (*Biserrula pelecinus*)	Photosensitisation in sheep has been observed in sheep grazing biserrula pastures in Western Australia.
Barrel medic (*Medicago truncatula*)	Photosensitisation in horses, occasionally red gut in sheep, frequently bloat in cattle.
Burr medic (*M. polymorpha*)	Associated with cases of photosensitisation in sheep, cattle and horses, as well as bloat in cattle. Phytoestrogens can have negative effects on the reproductive process and on the reproductive tract of grazing livestock.
Crimson clover (*T. incarnatum*)	Bloat in cattle is possible, but seldom occurs.
Gama medic (*M. rugosum*)	No known livestock effects but bloat risk likely.
Gland clover (*T. glanduliferum*)	No livestock disorders have been reported but as with most legumes, could be expected to cause bloat in cattle. cv. Prima contains low levels of coumarins which can be converted to dicoumarol in mouldy hay. Care should be taken not to feed mouldy hay to livestock. Pigs are extremely sensitive to dicoumarol.
Hybrid medic	Can cause bloat in cattle.
Murex medic (*M. murex*)	Photosensitisation in horses, occasionally red gut in sheep, frequently bloat in cattle.
Snail medic (*M. scutellata*)	Photosensitisation in horses, occasionally red gut in sheep, frequently bloat in cattle.
Sphere medic (*M. sphaeocarpus*)	Can cause bloat in cattle.
Strand medic (*M. littoralis*)	Photosensitisation in horses, occasionally red gut in sheep, frequently bloat in cattle.
Persian clover (*T. resupinatum*)	Photosensitisation sometimes; bloat in cattle; urinary calculi (clover stones) incidence may increase in sheep; red gut in sheep occasionally.
Rose clover (*T. hirtum*)	The ingestion of old flower heads may be associated with fibre ball (phytobezoar) development in the abomasum of cattle and with wool contamination in sheep. Bloat in cattle; urinary calculi (clover stones) incidence may increase in sheep; occasionally red gut in sheep.
Serradella (*Ornithopus* spp.)	No problems reported.

Subterranean clover (*T. subterraneum*)	Infertility, sometimes due to oestrogenic compounds (in older cultivars such as Dwalganup); bloat in cattle; urinary calculi (clover stones) incidence may increase in sheep; red gut in sheep occasionally. Phytoestrogens can have negative effects on the reproductive process and on the reproductive tract of grazing livestock
Woolly pod vetch (*Vicia villosa*)	'Ill thrift' syndrome in cattle with dermatitis and diarrhoea (sometimes).

Perennial legumes

Birdsfoot trefoil (*Lotu s corniculatus*) (see also *Lotus*)	Known to sometimes produce cyanogenic glucosides but reports of cyanide poisoning associated with it are very rare. Its ingestion can occasionally be associated with cases of photosensitisation.
Caucasian clover (*T. ambiguum*)	Can cause bloat in cattle.
Lotus (*Lotus* spp.)	Sometimes cyanogenetic glycosides (*L. cruentus* syn. *coccineus)*. Milk taint (*L. corniculatus* and *L. major* syn. *pedunculatus* syn. *uliginosus*). Occasionally develops tannin levels high enough to reduce feed intake.
Lucerne (*Medicago sativa*)	Bloat in cattle. Photosensitisation in horses, occasionally red gut in sheep. Infertility in livestock due to oestrogenic compounds has been associated with ingestion of lucerne leaves stressed by leaf diseases or by insect attack. Can contain low levels of coumarins which can be converted to dicoumarol in mouldy hay. Care should be taken not to feed mouldy hay to livestock. Pigs are extremely sensitive to dicoumarol.
Red clover (*T. pratense*)	Infertility sometimes due to oestrogenic compounds in some varieties; bloat in cattle; urinary calculi (clover stones) incidence may increase in sheep; occasionally red gut in sheep.
Strawberry clover (*T. fragiferum*)	Infertility sometimes due to oestrogenic compounds; bloat in cattle; urinary calculi (clover stones) incidence may increase in sheep; occasionally red gut in sheep.
White clover (*T. repens*)	Bloat in cattle; urinary calculi (clover stones) incidence may increase in sheep; occasionally red gut in sheep. Phytoestrogens can have negative effects on the reproductive process and on the reproductive tract of grazing livestock.

Temperate grasses

Brome grass (*B. stamineus* & *B. valdivianus*)	No problems reported.
Cocksfoot (*Dactylis glomerata*)	
Kangaroo grass (*Themeda triandra*)	
Perennial Veldt grass (*Ehrharta calycina*)	
Puccinellia (*Puccinellia ciliata*)	
Tall wheatgrass (*Thinopyrum ponticum*)	
Timothy grass (*Phleum pratense*)	
Weeping grass (*Microlaena stipoides*)	
Phalaris *(Phalaris aquatica)*	Sometimes phalaris staggers; occasionally phalaris sudden death syndrome.
Prairie grass (*Bromus wildenowie*)	Awns may penetrate skin of sheep; possible wool contaminant.
Ryegrass (*Lolium* spp.)	Ryegrass staggers, summer endophyte hyperthermia-ill thrift, ergot of rye poisoning.
Ryegrass – annual (*Lolium rigidum*)	Annual ryegrass toxicity; ergot of rye poisoning.
Tall fescue (*Festuca arundinacea*)	Summer endophyte hyperthermia-ill thrift, or winter lameness (peripheral gangrene), associated with ergot alkaloid production within the grass. Equine fescue odema can occur in horses grazing Mediterranean tall fescue infected with MaxP endophyte.
Wallaby grass (*Austrodanthonia* spp.)	Can occasionally accumulate dangerous amounts of cyanogenic glycosides.

Tropical legumes

Atro (Siratro) (*Macroptilium atropurpureum)* Axillaris (*Macrotyloma axillare*) Forage peanut (*Arachis pintoi*) Glycine (*Neonotonia wightii*) Greenleaf desmodium (*Desmodium intortum*)	No problems reported.
Creeping vigna (*Vigna parkeri*)	Nitrate poisoning has occurred with a related species.
Roundleaf cassia (*Chamaecrista rotundifolia*)	No problems reported so far for *C. rotundifolia*. Some cassia species (e.g. *C. obtusifolia* and *C. occidentalis*) have been associated with poisoning in ruminants and horses – both leaves and seeds were toxic, and muscle damage was the main effect.

Tropical grasses

Creeping bluegrass (*Bothriochloa insculpta*)	No problems reported.
Digit grass (*Digitaria eriantha* ssp. *eriantha*)	
Bluegrass (*Dicanthium aristatum*)	
Consol lovegrass (*Eragrostis curvula* var. *conferta*)	
Forest bluegrass (*Bothriochloa bladhii* ssp. *glabra*)	
Indian bluegrass (*Bothriochloa pertusa*)	
Molasses grass (*Melinis minutiflora*)	
Bahia grass (*Paspalum notatum*)	Not known if there is a risk of nervous ergotism ('staggers').
Bambatsi panic (*Makarikari panic*) (*Panicum coloratum* var. *makarikariense)*	Liver disease with associated photosensitisation (sporadic outbreaks in ruminants).
Bermuda couch grass (*Cynodon dactylon*)	Can be cyanogenic.
Buffel grass (*Cenchrus ciliaris*)	Frequently hyperparathyroidism ('big head') in horses, occasionally nephrosis or hypocalcaemia in ruminants, due to oxalates. This genus can occasionally accumulate dangerously high levels of selenium when grown on some soil types.
Gatton or Green panic (*Megathyrsus maximus*)	Frequently hyperparathyroidism ('big head') in horses, occasionally nephrosis or hypocalcaemia in ruminants, due to oxalates.
Kikuyu (*Pennisetum clandestinum*)	Frequently hyperparathyroidism ('big head') in horses, occasionally nephrosis or hypocalcaemia in ruminants, due to oxalates. Very occasionally nitrate poisoning. Kikuyu poisoning is an unusual rumen disorder that can sporadically occur in cattle, especially where rapid autumn growth follows a protracted dry period.
Mitchell grass (*Astrebla lappacea*)	Can cause blindness and deaths in cattle on the rare occasions when the grass becomes infected with the fungal corals of Corallocytostroma ornicopreoides.
Paspalum (*Paspalum dilatatum*)	Nervous ergotism ('staggers').
Purple pigeon grass (*Setaria incrassata*)	Frequently hyperparathyroidism ('big head') in horses, occasionally nephrosis or hypocalcaemia in ruminants, due to oxalates.
Rhodes grass (*Chloris gayana*)	This genus can occasionally accumulate dangerously high levels of selenium on some soil types.
Setaria (*Setaria sphacelata* var. *sericea*)	Frequently hyperparathyroidism ('big head') in horses, occasionally nephrosis or hypocalcaemia in ruminants, due to oxalates.

Pasture herbs

Chicory (*Chicorium intybus*)	A bitter milk taint has been recognised as a problem when used in some dairy situations (this can be overcome with grazing management). Leaves have been reported to be poisonous to pigs, and roots poisonous to cattle, but these incidents appear to be rare. There have been no reports of poisoning under Australian growing conditions.
Plantain (*Plantago lanceolata*)	No livestock disorders have been encountered.

APPENDIX VIII. Points to consider when selecting a pasture mix

Pastures may consist of a single species (e.g. lucerne) or a mixture of grasses and legumes. Mixtures are often preferred for a number of reasons—production benefits, weed control, erosion control, diversity in relation to pest control, etc.

Assuming that the species and varieties are well adapted to the climate of the area, other factors to consider in sowing mixtures include:

Enterprise

Any pasture must meet the needs of the enterprise in terms of feed quality, feed quantity and animal grazing habit. This may involve using separate paddocks of either a single grass or legume species, or by specific mixtures designed to supply a particular quantity and/or quality of feed at a specific time.

Soils

Pastures often have specific soil requirements. These include:

- **Soil type –** Where there is large variability in soil type in a paddock it is often worthwhile increasing the number of species or varieties. However, minor soil variations will not often warrant increasing the number of species in a mixture.
- **Soil pH –** Differences in pH, may be covered by including a more acid tolerant species to cover areas of low pH in an otherwise neutral to slightly acid soil e.g. serradella in an otherwise sub clover dominant mixture or cocksfoot with phalaris.
- **Drainage and salinity –** Waterlogging and/or salinity tolerant species are often included in mixtures in poorly drained areas. For example, *yanninicum* subterranean clovers such as Riverina will thrive in low lying areas where other varieties of sub clover may fail. Similarly, where salinity is a problem in parts of a paddock, tolerant species such as strawberry clover and tall fescue can be added to a mixture to provide cover in those areas, depending on the level of salinity.
- **Fertility –** This is less of a reason to expand a pasture mixture, as fertility needs can usually be met by legume nitrogen and adding fertiliser. There may be instances where a high fertility demanding species such as phalaris may be added to a mixture otherwise reliant on cocksfoot to take advantage of high fertility areas in a paddock, and vice versa. Similarly, Bambatsi panic, a species suited to high fertility clay soils, is often mixed with Rhodes grass (capable of growing on low fertility soils), to cover soil type variability within a paddock.

Aspect

Drier slopes (e.g. western aspect) may benefit from adding a hardier, persistent perennial or a shorter maturing variety. This may mean simply substituting an early maturing subterranean clover, such as Dalkeith for a portion of the Goulburn or Junee in the mixture, so that it will dominate on the north facing hill, and the Goulburn or Junee on the remainder of the paddock. Similarly, where it is suited to the soil and fertility conditions, the rhizomatous phalaris varieties such as Australian will be far more persistent on western slopes than cocksfoot.

Plant characteristics

There are many reasons for including or excluding species with differing plant characteristics in mixtures.

- Add an annual component to an otherwise perennial mixture to improve persistence in western areas, or vice a versa in higher rainfall areas.
- Stoloniferous species may be a useful in a mixture to increase stability and the likelihood of reliable ground cover, thus reducing erosion risk and weed invasion.
- Varieties with resistance to disease or insect pests may improve the reliability of production and/or persistence from the pasture.
- Plant characteristics such as seedling vigour and competitiveness may be used in a mixture to ensure the botanical composition is suitable. Note that in some situations species vigour can have deleterious effects, such as when perennial ryegrass (with high seedling vigour) is sown with tall fescue – as a result, fescue establishment is often poor, especially from late autumn/ winter sowings.

Livestock health

Species are often included or excluded to reduce the risk of a particular livestock disorder. (e.g. grasses are often added to lucerne or high legume content pastures to reduce the incidence of bloat.) See APPENDIX VII for livestock disorders associated with pasture species.

Grazing management

The optimum grazing management for species differs and may dictate which varieties should be included in a mixture, especially where longevity of the pasture is important. Whilst most species are fairly forgiving of short term mismanagement, most will benefit in the long term from tactical grazing at some stage (e.g. to enhance seed set, recruitment of seedlings, improve tillering, etc.). Some species such as lucerne require rotational grazing management to ensure stand persistence.

APPENDIX IX. Further information on pastures

A wide range of information on pastures is available from the NSW DPI online at: www.dpi.nsw.gov.au .

The NSW DPI bookshop also stocks a wide range of books, DVDs and other products. These products complement the free information available online. Phone: 1800 028 374 (toll free).

Useful pasture references

The NSW DPI website has a range of fact sheets on pasture species and varieties, many of which are included in this book.

Other topics covered include:

- pasture establishment
- grazing management
- production management
- hay and silage
- soils, fertilisers & manures
- control of weeds, pest & diseases
- groundcover & sustainability
- drought, fire & floods
- suggested pasture mixtures for different areas of NSW

Other books from NSW DPI

AgGuide – A guide to pasture species in NSW

Broadleaf weed seedlings of temperate crops and pastures

Fertiliser for pastures

Grassed up – guidelines for revegetating with Australian native grasses

Grasses legumes and herbs

Grasses of coastal NSW

Increasing soil organic carbon under pastures

Insect and mite control in field crops

Management of profitable and sustainable pastures – a field guide

Noxious and environmental weed control handbook

Pasture management for weed control

Pasture varieties used in NSW

Producing quality lucerne hay – RIRDC/NSW DPI

The grazier's guide to pastures

TopCrop Ute guide series – GRDC

- Lucerne pests and disorders
- Pasture legumes for temperate farming systems
- Insects
- Weeds

Topfodder: Successful Silage – DRDC/NSW Agriculture

Weed control in pastures and lucerne

Useful pasture websites

Australian Fodder Industry Association	www.afia.org.au
Australian Inoculants Research Group	www.dpi.nsw.gov.au/research/centres/gosford/australian-inoculants-research-group
Australian Seed Federation	www.asf.asn.au
CSIRO	www.csiro.au
EverGraze	www.evergraze.com.au
Grains Research and Development Corp.	www.grdc.com.au
The Grassland Society of NSW	http://grasslandnsw.com.au
Kondinin Group	www.kondinin.com.au
Meat and Livestock Australia	www.mla.com.au
NSW Department of Primary Industries	www.dpi.nsw.gov.au
PROfarm courses	www.profarm.com.au
Rural Industries Research and Development Corp.	www.rirdc.gov.au
Seed Services Australia	www.ruralsolutions.sa.gov.au/seed_services

NSW DPI PROfarm courses

- Identification and management of native grass pastures
- Introduction to pastures
- Irrigated lucerne for profit
- Paddock Plants – field day
- PROGRAZE®
- Tactical grazing management for semi-arid rangelands
- TopFodder silage

APPENDIX X. Sources of pasture seed and pasture legume inoculants listed in this guide

These sources are the primary sources of seed and pasture legume inoculants. They are in many cases the head licensee for that variety or a contact that will be useful if seed cannot be sourced readily through a retailer.

Agricom

7–9 Distribution Drive
TRUGANINA VIC 3029
Phone: (03) 9394 3415
Mobile: 0400 791 239
Email: glysaght@agricom.com.au
www.agricom.com.au

Alosca Technologies Pty Ltd

PO Box 1761
OSBORNE PARK WA 6017
Ph: (08) 9446 1533
Email: cpoole@alosca.com.au
www.alosca.com.au

Australian Premium Seeds Pty Ltd

42 McRoyle St
WACOL QLD 4076
Ph: (07) 3879 3350
www.apseeds.com.au

Auswest Seeds

2–8 Tobias St
FORBES NSW 2871
Ph: (02) 6852 1500
Fax: (02) 6852 1393
Email:
auswest@auswestseeds.com.au
www.auswestseeds.com.au

Ballard Seeds

PO Box 1137
NARROGIN WA 6312
Ph: (08) 9881 5711
Fax: (08) 9881 5722
Email: leigh@ballardseeds.com.au
www.ballardseeds.com.au

Becker Underwood

1205 Old Pacific Hwy
SOMERSBY NSW 2250
Free Call: 1800 558 399
Email:
info.au@beckerunderwood.com
www.beckerunderwood.com.au

Belair Technology

PO Box 246
BELAIR SA 5052
Mobile: 0418 833 579
Email:
kaehne@belairtechnology.com.au
www.belairtechnology.com.au

Cropmark Seeds Pty Ltd

PO Box 5306
SOUTH MELBOURNE VIC 3205
Free Call: 1800 889 039
Fax: 1800 889 037
www.cropmark.com.au

Heritage Seeds Pty Ltd

PO Box 4020
MULGRAVE VIC 3170
Free Call: 1800 727 007
Fax: (03) 9561 9333
Email:
heritage@heritageseeds.com.au
www.heritageseeds.com.au

GN Lummis

'Wilga View'
415 National Park Rd
CURBAN NSW 2827
Ph: (02) 6848 5010
Fax: (02) 6848 5010
Email: noelinejl44@bigpond.com

Native Seeds Pty Ltd

PO Box 133
SANDRINGHAM VIC 3191
Ph: (03) 9555 1722
Fax: (03)9555 1799
Email: enquiries@nativeseeds.com.au
www.nativeseeds.com.au

New Edge Microbials

951 Garland Ave
ALBURY NSW 2640
Ph: (02) 6025 0044
Fax: (02) 6040 0237
Email: newedge@microbials.com.au
www.microbials.com.au

Newseeds

PO Box 33
BALLDALE NSW 2646
Ph: (02) 6035 1222
Fax: (02) 6035 1229
Email:
wilson.bros.seeds@bigpond.com

Notman Seeds

Nyora Rd
POOWONG VIC 3988
Ph: (03) 5659 2314
Fax: (03) 5659 2336
Email: peter@notmanpasture.com.au

Parkseeds Pty Ltd

129 Olivers Road
MANSFIELD VIC 3722
Ph: (03) 5775 2799
Fax: (03) 5775 1407
Email: parkseeds@parkseeds.com.au

Progressive Seeds Pty Ltd

Lot 2, Lake Manchester Road
MT CROSBY QLD 4306
Ph: (07) 3201 1741
Fax: (07) 3201 1006
Email: info@pseeds.com.au
www.progressiveseeds.com.au

Queensland Agricultural Seeds P/L

366–368 Anzac Ave
TOOWOOMBA QLD 4350
Ph: (07) 4630 1000
Fax: (07) 4630 1005
Email: pastures@qaseeds.com.au
www.qaseeds.com.au

Seed Distributors

14–16 Hakkinen Rd
WINGFIELD SA 5013
Ph: (08) 8445 1111
Fax (08) 8445 7777
Mobile: 0419 995418
Email:
adam@seeddistributors.com.au
www.seeddistributors.com.au

Seed Force

104–106 Drummond St
SHEPPARTON VIC 3630
Ph: (03) 5832 3800
Fax: (03) 5821 8999
www.seedforce.com.au

Seedmark

Level 1, 145 South Terrace
ADELAIDE SA 5000
Free Call 1800 112 400
Fax: 1800 677 805
Email: seedsinfo@seedmark.com.au
www.seedmark.com.au

Selected Seeds

PO Box 210
PITTSWORTH QLD 4356
Ph: (07) 4693 1800
Fax: (07) 4693 1899
Email:
rodneyc@selectedseeds.com.au
www.selectedseeds.com.au

Tasglobal Seeds

43 Oaks Rd
OAKS TAS 7303
Ph: (03) 6397 3184
Fax: (03) 63973101
Email: tasglobalseeds@bigpond.com
www.tasglobalseeds.com

Upper Murray Seeds

1014A Nowra St
ALBURY NSW 2640
Ph: (02) 6040 6464
Fax: 02 6040 6470
Email: albury@uppermurrayseeds
www.uppermurrayseeds.com.au

Valley Seeds Pty Ltd

295 Maroondah Link Hwy
YARCK VIC 3719
Free Call 1800 226 905
Ph: (03) 5797 6203
Fax: (03) 5797 6307
Email: info@valleyseeds.com

Vicseeds Production Pty Ltd

PO Box 1544
GEELONG VIC 3220
Ph: (03) 5221 7577
Fax: (03) 5221 7877
Email: vicseeds@vicseeds.com.au
www.vicseeds.com.au

J H Williams & Sons

(Williams Group Australia Pty Ltd)
PO Box 102
MURWILLUMBAH NSW 2484
Ph: (02) 6672 1313
Fax: (02) 6672 5812
Email: seed@jhwilliams.com.au
www.jhwilliams.com.au

Wrightson Seeds (Aust) Pty Ltd

PO Box 333
LAVERTON NORTH VIC 3028
Free Call 1800 619 910
Fax: 1800 619 940
Email: info@wrightsonseeds.com.au
www.wrightsonseeds.com.au

APPENDIX XI. List of pasture species in this publication

Alsike clover
American jointvetch
Angleton grass
Annual Italian ryegrass
Annual ryegrass
Arrowleaf clover
Atro
Axillaris
Bahia grass
Balansa clover
Bambatsi panic
Barbed wire grass
Barrel medic
Berseem clover
Birdsfoot trefoil
Biserrula
Bladder clover
Bluegrass
Brome grass
Brunswick grass (Blue Dawn)
Buffel grass
Burgundy bean
Burr medic
Button medic
Butterfly pea
Cassia
Caribbean stylo
Chicory
Cocksfoot
Coloured brome
Cotton panic
Couch grass
Cowpea
Creeping bluegrass
Creeping vigna
Crimson clover
Desmanthus
Digit grass
Disc medic
Eastern star clover
Fescue
Finger grass
Floren bluegrass
Forage peanut
Forest bluegrass
French serradella
Gama medic
Gatton panic
Gland clover
Glycine
Grazing brome
Green panic
Greenleaf desmodium
Guinea grass
Hairy armgrass
Hybrid medic
Hybrid ryegrass
Indian bluegrass
Indian couch
Italian ryegrass
Kangaroo grass
Kikuyu
Lablab
Lotus
Lovegrass
Lucerne
Makarikari grass
Mitchell grass
Molasses grass
Murex medic
Panic grasses
Paspalum
Pasture brome
Perennial ryegrass
Perennial veldt grass
Persian clover
Phalaris
Pink serradella
Pinto peanut
Prairie grass
Puccinellia
Purple clover
Purple pigeon grass
Queensland bluegrass
Red clover
Redgrass
Rhodes grass
Rose clover
Roundleaf cassia
Ryegrass
Sabi grass
Serradella
Setaria
Siratro
Snail medic
Sphere medic
Strand medic
Strawberry clover
Subterranean clover
Sulla
Tall wheatgrass
Tall windmill grass
Timothy
Umbrella grass
Wallaby grass
Warrego summer grass
Weeping grass
Weeping rice grass
Westerwolds ryegrass
Wheat grass
White clover
Windmill grass
Woolly pod vetch
Yellow serradella

Notes

THE GRASSLAND SOCIETY OF NSW INC.

A Group of people with a common interest in developing our most important resource, our grasslands

The objectives of the Grassland Society of NSW are:

- to provide an organisation in which landholders are the major participants in the dissemination of pasture production information
- to provide opportunities for those concerned with grassland production to meet and exchange information
- to encourage the investigation of problems affecting grassland management
- to stimulate the incorporation of advances from research and producer experience into practice
- to provide a means of social and business contact for those engaged in grassland production
- to afford pasture production an ordered structure and an industry status

The Grassland Society of NSW was formed in March 1985. The Society membership maintains a unique blend of producers and technologists.

The Society holds a conference each year, publishes a quarterly newletter and has branches across NSW.

Our internet address is www.grasslandnsw.com.au

For further information please contact:

The Secretary
Grassland Society of NSW
PO Box 471, ORANGE NSW 2800
Telephone: (02) 6369 0011
Email: secretary@grasslandnsw.com.au

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Ceres CRUSADER Italian Ryegrass

Flecha Tall Fescue

Ceres one50 perennial ryegrass

Ceres TONIC plantain

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