BARENBRUG

Lucerne
Production guide

EDITION 4.1

Grow with Confidence

Barenbrug SARDI breeding program

The South Australian Research and Development Institute (SARDI) manages the largest and longest running lucerne breeding program in the country. It is at the forefront of developing new Australian-bred varieties for Australian conditions.

Barenbrug has a long, proud history with the program and has been an important part of its success. Since 1992, Barenbrug has worked closely with SARDI to help ensure new varieties are developed based on market requirements, so only the best are chosen for commercial release.

SARDI's industry-leading research and development facilities are like no other. Every year, over 50 new lines are tested using a network of up to 40 locations. After 6 – 7 years of continuous trialling in harsh, real farm situations, the best of these lines are selected from the field and subjected to intensive disease and pest resistance screening, before being incorporated into a new variety.

Crucial to the success of a lucerne cultivar is choosing one that has been developed for the unique Australian environment. Many other varieties are bred overseas where environmental conditions, pests, disease strains and management practices are very different. While some are subjected to localised trialling, many have limited (if any) testing in this country.

The years of commitment by both SARDI and Barenbrug has resulted in the collection of an extensive pool of outstanding lucerne genetics. These broadly adaptable varieties are uniquely placed offering proven performance, grazing persistence, and pest and disease resistance, making them the number one choice for Australian farmers.

The Barenbrug SARDI breeding program produces lucerne varieties that can offer:

- **A range of winter activity and dormancy**
- **Superior yield and after-cutting growth**
- **Resistance to lucerne pests and diseases**
- **Adaptability to varying climates and soil types**
- **High forage quality**
- **Persistence under extreme grazing management**
- **Suitability for mixed farm situations.**

Contents

Barenbrug SARDI breeding program **2**

Lucerne research update **4**

Agronomy notes to aid preparation, establishment and management **5**

Dormancy groups 5

Sowing rates 6

As a pasture mix 6

Undersowing in cereals 6

Fertility 6

Establishment 7

Seed coating 7

Weed control 8

Pests 8

Increasing plant numbers in a thin stand 8

Root reserves 9

Cutting 9

Grazing 10

Nutrition and fertiliser 11

Terminating a lucerne stand 11

Grazing-tolerant lucerne **12**

SARDI-Grazer 12

Winter active lucerne **13**

SARDI 7 Series 2 13

Highly winter active lucerne **15**

SARDI 10 Series 2 15

Lucerne variety adaptation chart **16**

Common lucerne pests **18**

Common lucerne diseases **20**

Lucerne decision suite **22**

Lucerne Production Guide
Edition 4.1

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Regional Agronomist – Southern Australia

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Lucerne research update

Barenbrug continues to lead the improvement of lucerne forage solutions through a number of exciting projects including an important partnership with SARDI, for the continual development of cultivars for the Australian environment. New varieties of lucerne are continually being assessed in the field via replicated trials and laboratory screening for improvement on aspects such as overall yield, seasonal yield, persistence, forage quality and disease and pest tolerance. Development work is concurrently underway with new strains of rhizobium that may confer improved rhizobium activity at lower soil pH levels.

Barenbrug has also worked with Grasslanz in New Zealand, with the main focus on breeding highly winter-active varieties for the international market. This work was undertaken in the heartland of the Australian lucerne seed production region at Keith, South Australia, and several new varieties have now been released.

Work is also continuing with some other international partners including Forage Genetics International (FGI). FGI, through Barenbrug, conduct out-of-season lucerne seed production in Australia for re-export and, through this collaboration, some new and innovative varieties are being assessed for forage yield and seed production objectives.

Critical plant density trial

Lucerne plant density will have implications for the yield and fodder quality of a stand. A trial at the Howlong research farm over 2016-2019 was conducted with sowing rates varied to mimic declining stand density. This information will help empower producers and agronomists to make decisions around retaining, terminating or oversowing lucerne stands that may have declined over time or failed to establish satisfactorily. Whilst this trial was conducted in one location under a specific management regime, it allows for a starting point when decisions around stand viability need to be made.

Grazing tolerance trials

Grazing tolerance (GT) has been soundly validated in some very good cultivars—notably SARDI-Grazer and SARDI 7 Series 2. A series of rigorous grazing trials continue to be conducted at Howlong, New South Wales. Whilst we know that SARDI-Grazer is a well tested and reliable option, there is opportunity to demonstrate the relative merits of a properly developed GT variety compared to old common types such as Aurora. At the same time, other offerings in the seed market that make claims to grazing tolerance are being assessed. As this trial work progresses, SARDI-Grazer remains absolute stand-out, with Aurora plant density and performance well behind. Other competitor cultivars making claims to GT also appear to have less tolerance than common Aurora. These trials continue to give producers added confidence of properly developed grazing tolerance traits and put some additional clarity on the true nature of other offerings.

Agronomy notes to aid preparation, establishment and management

Lucerne is a highly productive perennial plant that will generally out-yield most other pasture species in light-medium soils in dry environments. It provides excellent, palatable, nutritious feed, and should be a strong consideration where site factors and management provide the opportunity for production.

Lucerne is deep-rooted, very drought hardy and provides benefits such as high animal performance and nitrogen fixation (for itself and subsequent crops). It also offers an opportunity for a productive break crop or long-term pasture that may also aid the management of weedy grass species.

Dormancy groups

There are three main dormancy groupings for lucerne. The ratings are based on how much growth the variety produces in the winter months (all dormancy groups grow actively in summer if moisture is available). The suitability for purpose of each is largely dependent upon its dormancy rating.

Winter dormant lucerne with a rating of 5 or less are sometimes considered for low-stock density, extensive systems or specialty hay cutting. However, they are infrequently used due to lower overall productive potential when compared to contemporary dormancy 6–10 rated varieties.

Varieties with a dormancy rating of 1–5 are only suitable for early autumn or spring sowing. Those with a rating of 6–10 are suitable for later autumn sowing under most circumstances.

Dormancy 6–7 varieties are generally termed winter active (WA) or alternatively semi-winter active. This group offers the most flexibility and productive potential longer-term, general purpose grazing or fodder production. Furthermore, in circumstances where a winter dominant rainfall pattern is the norm, 6–7 rated lucerne probably has the opportunity to capture the potential growth in cooler seasons compared to those rated 5 or lower.

Dormancy 8–10 types are termed highly winter active (HWA). They may suit a short-term pasture phase to capture some year-round grazing opportunity, although are most frequently used where fast rotation fodder production is being practiced. HWA lucerne will typically have a shorter life-span of around 3–4 years, although some varieties, including SARDI 10 Series 2, have exhibited improved persistence in many circumstances.

Dormancy 6–7

- Grazing tolerance + fine hay quality
- SARDI-Grazer, SARDI 7 Series 2, Genesis II
- Lucerne for 5-8 years or longer

Dormancy 8–10

- High hay yields
- Short-medium term winter grazing
- SARDI 10 Series 2

Dormancy ratings

4 6 8 10

Examples of relative growth following cutting after autumn equinox.

Sowing rates

Sowing rates for lucerne depend mostly on available moisture (rain or irrigation):

Rain	kg/ha	Plant counts/m^2 (after 1st summer)
Marginal dryland (350–450mm)	4–6	15–40
Dryland (450–600mm)	6–8	50–70
Favourable dryland (600–800mm)	10–12	80–100
High rainfall/irrigated (800mm+/irrigated)	15–25	130–150

Note: The sowing rate is determined by the soil type.

On heavier soils use the higher end of the rate range.

Higher sowing rates will lead to thinner stems – this technique may be employed for irrigated hay production.
Allow for germination percentage and an establishment factor of 65–75%.

As a pasture mix

When sowing lucerne in southern regions as a pasture mix, establish it with a low seedling vigour grass such as a winter active fescue, phalaris or a winter cocksfoot. It may be better to establish the lucerne first and introduce the companion varieties a season or two later, especially for producers unfamiliar with lucerne management.

For northern regions, sowing lucerne and grass at the same time is usually very reliable.

Undersowing in cereals

Whilst it is not considered best practice, if undersowing lucerne with a cereal grain crop, cut the cereal sowing rate back to 35–40% to ensure a good lucerne stand is maintained. Anticipate lower cereal yields as a consequence.

Fertility

It is important to test the soil for phosphorus, potassium, aluminium and calcium. Lime is also critical to adjust soil pH, so ensure to conduct a soil test to check if it is needed. pH ($CaCl_2$) should be > 5.4, ideally > 5.8. Aluminium at depth should also be considered and paddock avoided if judged potentially problematic. A lower pH with low Al^{3+} (< 5%) may still be a suitable site.

Sow with low nitrogen, good phosphorus and possibly potassium fertiliser. Molybdenum and boron should be considered where soils are typically low or application has not occurred for some years.

A small amount of nitrogen may be needed until plants are established, but excessive nitrogen at sowing can have a negative impact on rhizobia recruitment and nodulation of the lucerne roots.

Soil fertility is important for establishment. This SARDI 7 Series 2 was tissue tested and subsequently had foliar Mo and B applied, resulting in broad, healthy leaves and improved productivity.

Establishment

The ideal soil temperature for establishing lucerne is 12°C and rising. Lucerne seed is small, so ensure to sow close to the surface at approximately 10 –15mm deep. It is also important that there is enough soil moisture to support germination. Roll lightly prior to sowing if the soil is fluffy.

For spring-sown dryland crops, sow late August – early October (target the earlier end of the range in regions with higher temperatures and shorter springs). In mild summer areas with irrigation, lucerne can be sown right through spring and summer. In hot summer areas, lucerne is best sown through autumn. Direct drilling or full cultivation are both suitable.

Young lucerne plants are fairly sensitive to frosts. However, once established, plants can survive temperatures below zero Celsius.

Seed coating

It is recommended to use a coated seed that includes the correct inoculants, essential trace elements and an insecticide for early protection from red legged earth mites (RLEM) and lucerne flea. With sensible storage, AgriCote seed coating will last for six months and will be useful for up to 12 months or longer.

Seed coating will decrease the seed count from approximately 400,000/kg to 330,000/kg, but this should not affect the sowing rate as establishment should be higher due to the benefits and protection afforded by the seed coating.

Weed control

A lucerne crop needs to be well managed to out-compete weeds and producehigh yields for hay and or grazing.

Any problems should be identified and rectified promptly.

Possible weed control spray options:

Pre-planting	First year - post-emergence	Second and subsequent years
Knock down spray to remove actively growing weeds. Trifluralin may be used to curtail early weed competition at rates depending on soil type. Pendimethalin can also be considered in some circumstances.	The following options can be used up to the 8th trifoliate leaf stage: 1st trifoliate leaf – 2,4-DB, bromoxynil. 2nd trifoliate leaf – Flumetsalum, Imazamox, Imazethapyr. 3rd trifoliate leaf – bromoxynil, + diflufenican, prometryn.	Spray-seed + Diuron (take some care with the winter active varieties). Simazine (may be a better option for winter actives). Saflufenacil and Terbuthylazine may also be considered. Options as per 1st year, but check for weed size and rates vary. Group A grass herbicides.

Pests

A lucerne crop takes a year to fully establish and a young lucerne crop needs to be monitored for pests. Using resistant varieties and coated seed should be strongly considered. Always check for red legged earth mites (RLEM) and use bare earth insecticide controls. Once established, lucerne may be afflicted by a number of pests including mites, lucerne flea, aphids, cockchafers, armyworm and, in some environments, slugs. Monitoring and swift treatment should be adopted to help assure productivity and feed quality.

Increasing plant numbers in a thin stand

After a lucerne stand has been established for a year or two, there usually tends to be an accumulation of toxins in the soil from plant litter and trash. This process of autotoxicity from the exudates of decaying plant material can prevent the establishment or recruitment of new lucerne seedlings. If required, re-sowing is best attempted in autumn due to competition from the existing crop in spring growth.

Usually, however, the best plan is to start again as there is likely a disease, pest or nutrition problem which has led to low plant numbers. Alternatively, a thinning stand can be over-sown with an alternative species to complement production and give extended life and performance. Examples are given in a following table on page 23.

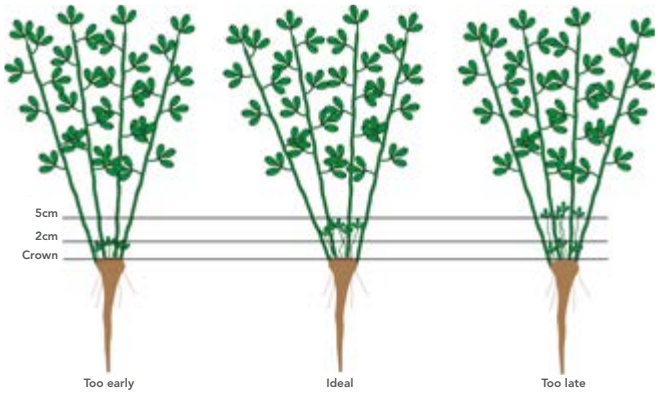
Root reserves

Allowing the crop to have at least one good flowering per year will aid replenishment of root reserves. Ideally use the appearance of new shoots at the base of the plant (approximately 10% flowering) to determine cutting/grazing timing – this will help top up root reserves during the year. This will ideally take place in mid-late autumn, as the plant will then contain good reserves to come away the following spring. The feed reserve built up over the rest period in autumn can be fed off as valuable early winter feed, prior to winter cleaning sprays.

Dormancy	Days (potential cutting interval under ideal summer growing conditions)
Semi winter active	30 – 34 days
Winter active	27 – 30 days
Highly winter active	25 days

Cutting

Cutting lucerne needs to be done at or a bit before 10% flowering, but note the height of new shoots at the base of the crop, and ensure that they are not damaged as they will be the next crop (best method of assessing cutting timing). Conditioner rollers are useful for quick drying. Double conditioning has been used. Re-cutting depends on seasonality, climate and dormancy.



Grazing

Ideal management of grazing would require a short-sharp grazing period of 2 – 3 days, followed by a rest and regrowth period of around 20 – 25 days over summer and longer over winter, with the stock introduced at around 5 –10% flowering and the crop evenly defoliated. This, however, is rarely achievable due to various factors, but the principles borne in mind and grazing management adopted which tends towards this regime. In practice, lucerne will handle limited set-stocking for a period of weeks or a month or two. If periods of set-stocking or lax rotational grazing are likely to occur, there are a number of key things to bear in mind and include in the program:

Stock will have a strong tendency for grazing the leaves in preference to the stems. This may lead to excessive protein intake leading to issues such as red-gut, and potentially bloat. In terms of stock performance, lax grazing may see an initial increase in performance, then the production levels fall off as stock are left with a high proportion of stalks on offer. Try to adopt a system where the entire stalk is consumed along with the leaves. Stock density will be important. Modern cultivars selected for high leaf:stem ratio such as the SARDI range, will also help. Consumption of the leaf and stalk together is a relatively balanced diet for ME, CP and fibre.

Allowing the crop to have at least one good flowering per year will aid replenishment of root reserves. Ideally use the appearance of new shoots at the base of the plant (approximately 10% flowering) to determine cutting/grazing timing – this will help top up root reserves during the year. This will ideally take place in mid-late autumn, as the plant will then contain good reserves to come away the following spring. The feed reserve built up over the rest period in autumn can be fed off as valuable early winter feed, prior to winter cleaning sprays.

Indicative feed value of lucerne (5 – 10% flowering):

Metabolisable Energy (ME):	10½ MJ ME/kg DM
Crude Protein (CP):	18 – 20%
Neutral Detergent Fibre (NDF):	50 – 55%

Nutrition and fertiliser

Regular soil tests should be taken to monitor nutrient levels and maintain or enhance production. Tissue testing can also be used as an aid in understanding macro and micro nutrient deficiencies.

Lucerne can produce a wide range of yields potentially ranging up to 10 – 25 tonnes DM/ha/yr. For each 10t DM this equates to 200 kg Ca, and when compared to 360 kg Ca in one tonne of limestone lime, indicates that on average one tonne lime/ha every 2 years or so is required to maintain calcium nutrition as well as to help manage pH and aluminium. Fertiliser is generally applied at intervals that suit the grower. Ideally this is programmed with each cut, but may be only once or twice a year. Molybdenum (Mo) is essential for plant growth and healthy nitrogen fixation. Consider applying 300 – 500 g/ha of sodium molybdate (or equivalent) every 4 – 5 years where levels are typically low or Mo is neglected from other parts of the system or rotation. Mo should always be applied with copper included in the program to help avoid animal health issues.

Terminating a lucerne stand

If it is necessary to terminate a lucerne stand, glyphosate, clopyralid, dicamba or Grazon Extra can be used. For best results, this should occur when the lucerne is actively growing, before it starts going dormant/less active. The plant also needs to have a good leaf area of up to 30–40cm high, typically 18–24 days after defoliation. Avoid the temptation to graze the stand before terminating, as control is often unsatisfactory.

Crop removals. For each tonne of dry matter (DM) removed, the following nutrients are lost:	
Nitrogen	20–30 kg
Phosphorus	2–3 kg
Potassium	15–20 kg
Sulphur	2–4 kg
Calcium	10–17 kg
Magnesium	2–4 kg
Zinc	20–50 g
Copper	5–10 g
Boron	25–40 g
Manganese	35–50 g
Iron	50–150 g

Grazing-tolerant lucerne

Most lucerne cultivars can be grazed with success. However, periods of continuous or repeated close grazing will quickly thin out stands of varieties not specifically developed and evaluated for this purpose.

True grazing-tolerant varieties have been screened and re-selected under protocols which provide such features as a low and broad crown, high numbers of crown buds and have been subjected to very high grazing pressure for extended periods. This does not mean that such varieties ought to be treated in such a brutal fashion as a rule, but allows the producer a longer-term stand that will have greatly improved capacity to survive and produce where periods of set-stocking and/or lax grazing are likely. Appropriate fertiliser, weed and pest maintenance will still be required for best results. Also consider that some level of winter growth activity is appropriate, as this will enable forage production through the typically cool-season dominant rainfall pattern of much of Australia. A properly evaluated cultivar developed for and selected under grazing in Australia with a 6 or 7 dormancy rating is often most appropriate for a long-term grazing option.

SARDI-Grazer *Lucerne*

325mm+

5.4–8.0

Deep & well drained

AL or AgriCote

SARDI-Grazer is the most persistent and grazing-tolerant lucerne in Australia. It was established primarily for use in cropping rotations, where large paddocks limit the use of rotational grazing. It delivers superior persistence where uneven grazing causes areas of paddocks to be heavily grazed before others can be properly utilised. It is also useful in permanent pastures in the medium to high rainfall areas where long periods of continuous grazing (more than four weeks) by sheep or cattle is common practice.

SARDI-Grazer was developed by SARDI and the Department of Agriculture and Food, Western Australia, with funding from the GRDC. The final parental plants used to develop this variety were selected based on resistance to aphids and diseases (BGA, SAA, PRR, and Anth), herbage yield and quality, plus winter activity rating.

SARDI-Grazer is the ideal choice for grazing enterprises where mob sizes reduce rotational grazing opportunity and when a long-term stand is required. Hay yield and quality is excellent as there is no yield penalty for using SARDI-Grazer.

Key features:

- The most grazing-tolerant commercial lucerne variety in Australia
- Persists under periods of set-stocking up to two months once established
- Requires minimal rotational grazing management
- Exceptional persistence across a range of environments from low to high rainfall, dryland and irrigation
- Broadly adapted to a variety of farming systems
- Highly regarded for hay quality hay production
- Well suited to mixed swards with perennial grasses such as winter active tall fescue, cocksfoot, phalaris or sub-tropical grasses

Grazing tolerance and recovery of SARDI-Grazer

1. SARDI-Grazer continuous grazing trial near Roseworthy, SA.

2. SARDI-Grazer after eight months of continuous grazing.

3. Recovery from grazing six weeks later.

Winter active lucerne

Winter active (WA) lucernes are often the most versatile option, providing good growth into late autumn. WA varieties are very well suited to medium-term mixed farming situations that require grazing tolerance and the ability to make good quality hay. They are ideal for either irrigated or dryland production and are useful as a pure stand or as a perennial legume component in pasture blends for regions with 450–650mm winter dominant rainfall. These lucernes also make excellent permanent summer forage crops in the high rainfall and finishing dairy regions because they provide feed over a longer period than summer brassicas without the same insect problems or annual establishment challenges.

SARDI 7 Series 2 *Lucerne*

350mm+

5.0–8.0

Deep & well drained

AL or AgriCote

SARDI 7 Series 2 is the next generation winter active lucerne. It is even more versatile, broadly adapted and persistent than SARDI 7 offering greater performance in cold, wet environments where lucerne can struggle. It has been bred specifically for the Australian climate and farming operations and will perform well in both dryland and irrigated systems. It offers superior performance where persistent, high producing lucerne stands are required and in grazing situations where winter produced feed can be utilised. SARDI 7 Series 2 is also the only lucerne in Australia with any tolerance to the new highly virulent BGA strain.

Coupled with a new dual strain of nitrogen fixing rhizobia, SARDI 7 Series 2 is now suited to applications requiring improved acid tolerance, allowing for a productive lucerne stand to lower pH levels than was previously feasible.

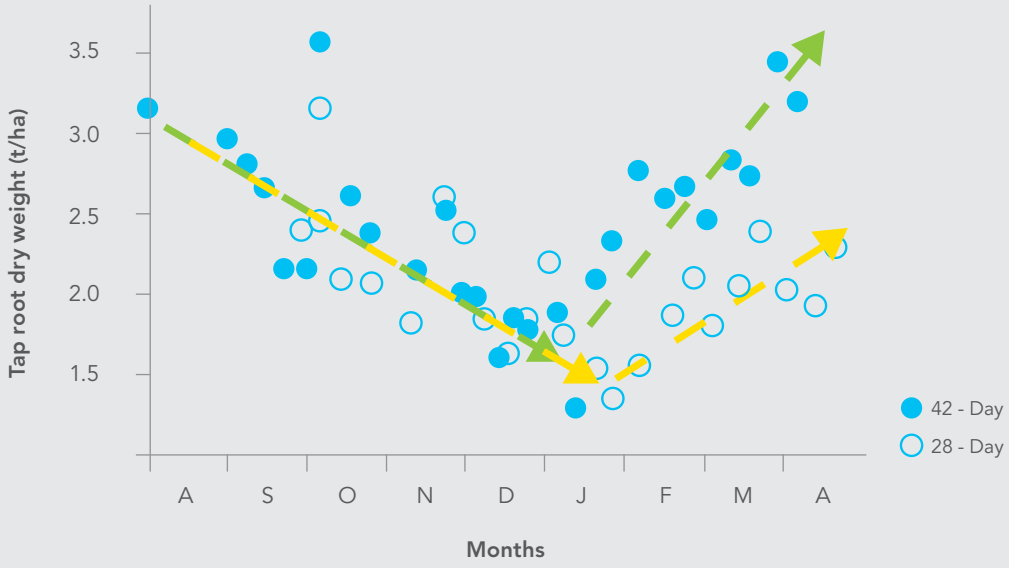
Key features:

- Even more broadly adapted and grazing-tolerant than SARDI 7
- High yielding, multi-purpose with excellent persistence
- More acid tolerant than other varieties to a 5.0 pH
- Strong pest and disease resistance and good grazing tolerance
- Improved performance in cold, wet environments
- Well suited to grazing and hay production with a broad crown and high leaf to stem ratio

Lucerne autumn recharge phase

Allowing the lucerne crop to have at least one good flowering per year will aid replenishment of root reserves. This will ideally take place in mid-late autumn, as the plant will then contain good reserves to come away the following spring. The feed reserve built up over the rest period in autumn can be fed off as valuable early winter feed, prior to winter cleaning sprays.

The autumn rest phase appears to be most important to build root reserves. A 6 week rest period in autumn appears to increase root mass by around 100% over a 4 week rest phase. A rest phase is of lesser or negligible value over spring or early summer. Lucerne with a good root reserve will be stronger over winter and rebound more readily in the following spring.



Lucerne tap root mass under two defoliation regimes, showing little if any difference in late winter-spring-early summer, but important to recharge root mass in autumn with a rest phase.

From Moot et al, Lincoln University 2003

Highly winter active lucerne

Highly winter active lucernes are bred for late autumn/early winter sowing and have excellent seedling vigour for undersowing. They have a more upright crown, erect growth habit and are well suited to a 2 – 4 year cropping rotation system in 300 – 500 mm rainfall zones. They provide maximum growth from winter dominant growing season rainfall. Some of the newer Australian-bred varieties in this group have increased grazing tolerance because they were selected from and developed for broadacre grazing systems.

SARDI 10 Series 2 *Lucerne*

350mm+

5.4–8.0

Deep & well drained

AL or AgriCote

SARDI 10 Series 2 is a highly winter active lucerne with the greatest activity rating over any other SARDI variety. During its development, the breeder was successful in focusing on improving the very popular SARDI 10. The greatest emphasis was on increasing forage production and quality, pest and disease resistance, persistence and grazing tolerance. A key physical feature is the greatly improved leaflet density down the length of each stem. These advancements allow for even greater adaptability to Australian farming systems.

Key features:

- Suited to cropping rotations, pasture mixes and year-round hay production systems
- Improved forage production and persistence over SARDI 10
- High winter growth and grazing tolerance
- Very good seedling vigour
- Highly productive 3 – 4 year+ option
- Multiple screens for excellent disease and insect resistance.

Lucerne with dormancy rating higher than 10

Highly winter active lucernes (8–10 dormancy) are largely intended for a large number of cuts per year. Whilst there is some grazing opportunity and some variation in grazing tolerance, stand life is usually in the realm of around three to four years. Interpreting the dormancy number may be done in two ways:

- Dormancy number equals the potential number of harvests or grazings per year; or
- The potential growth on offer in inches, after the stand is cut at the autumn equinox.

There is a small number of varieties being offered now with a dormancy rating of 11. There are very limited circumstances in Australia where an 11 rating would be of material benefit, as suitable conditions for such a variety are largely limited to specific environments with a warm winter season where the growth can occur.

Trialling by Barenbrug has not shown any benefit of using an 11 dormancy lucerne over 10 dormancy. Dormancy 11 lucernes also tend to have higher stem content and consequently lower feed value too.

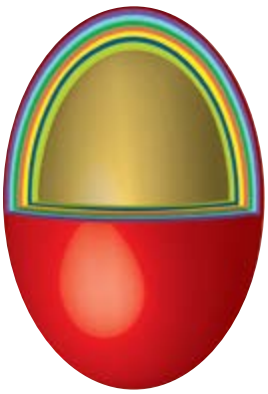
Lucerne variety adaptation chart

Product	Dormancy Rating	Rainfall (min)	Region	Sowing rate (low-med rainfall)	Sowing rate (med-high rainfall)	Sowing rate (irrigation)
SARDI-Grazer ***Lucerne***	6	325 mm–400 mm	All states	4–10 kg/ha	4–12 kg/ha	12–25 kg/ha
SARDI 7 ***Lucerne***	7	350 mm–425 mm	All states	4–10 kg/ha	5–15 kg/ha	12–25 kg/ha
SARDI 10 ***Lucerne***	10	350 mm+(sth) 425 mm+(nth)	All states	4–10 kg/ha	5–15 kg/ha	12–25 kg/ha

Seed coating

Using coated seed when sowing lucerne has become the accepted best practice in Australia for many years.

Lucernes are available from Barenbrug with the proprietary AgriCote seed coating technology. AgriCote is designed to deliver enhanced seedling establishment through the inclusion of growth promotants, essential micro-nutrients and fungicide seed protection. In addition, AgriCote provides seedlings with protection from biting and sucking insects through the inclusion of Gaucho® insecticide seed treatment. For lucerne seed, AgriCote also contains encapsulated rhizobia bacteria, meaning your seed is pre-inoculated and ready to sow.



AgriCote®

Gaucho® is a Registered Trademark of the Bayer Group

pH ($CaCl_2$)	Soil Type	Inoculant	Suitability	Disease and pest resistance			
				Spotted Alfalfa Aphid	Blue Green Aphid	Phytophthora Root Rot	Anthracnose
5.4–8.0	Light-to-medium and heavy, deep, well-drained soils	AL or AgriCote	H S G C	HR	HR	R	R
5.0–8.0	Light-to-medium and heavy, deep, well-drained soils	AL or AgriCote	H S G C	HR	HR	HR	HR
5.4–8.0	Light-to-medium and heavy, deep, well-drained soils	AL or AgriCote	H S G C	HR	HR	R	R

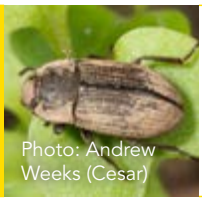
Suitability key:

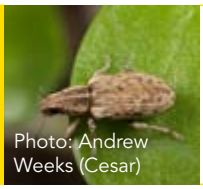
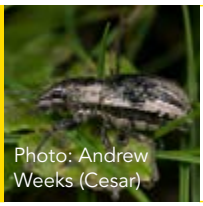
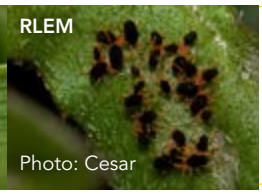
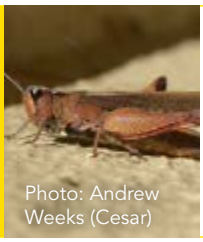
H = Hay
S = Silage
G = Grazing
C = Cut and Carry

Disease and pest resistance key:

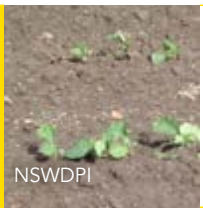
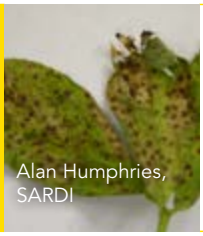
LR = Low Resistance
S = Susceptible
MR = Moderately Resistant
R = Resistant
HR = Highly Resistant

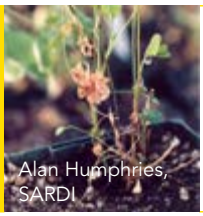
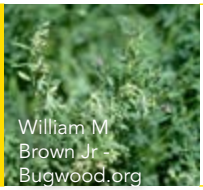
Common lucerne pests

			Description	Damage	Control
Aphids	**Bluegreen aphid (BGA)** *Acyrthosiphon kondoi*	Photo: Andrew Weeks (Cesar)	Primary pest of lucerne and other legume crops. Adults and wingless forms are dull blue-green to 3mm long. Long legs and antennae compared to other aphids. Colonies are active and multiply in autumn, winter, spring and in summer in cooler zones.	Initially attack buds, upper stems and new shoots, causing yellowing, stunted growth and leaf drop. Curling of leaves is typical indication. Particularly damaging in dry-stressed crops. May also be a vector for some virus diseases.	Sow less susceptible varieties such as the SARDI range. Use seed treated with correct systemic insecticide, monitoring, and an integrated spray program. Selective options for aphids are readily available and should be used to protect beneficial/ parasitic insect populations. Rotational grazing or harvesting may significantly reduce aphid damage.
	Spotted alfalfa aphid (SAA) *Therioaphis trifolii*	Photo: Andrew Weeks (Cesar)	Widespread pest of pasture legumes. Aphids are up to 2mm long, yellow to pale green. Up to 6 rows of dark spots on upper abdomen. Mostly active spring to autumn.	Cause whitening of leaf veins, wilting and leaf-fall, usually starting near the crown of the plant and migrating upwards. May cause plant/stand death. May also be a vector for some virus diseases.	
Beetles	**Blackheaded cockchafers** *Acrossidus spp.*	Photo: Andrew Weeks (Cesar)	Black-brown shiny scarab 10–12mm in length. Adults emerge to fly in mid-late summer, laying eggs in short, (often) weaker pastures. Eggs hatch early autumn. Larvae fairly wriggly, off-white, slender body from 3–15mm. Shiny black head.	Most severe in mid-late autumn in existing or newly direct drilled pastures. Burrowing undermines roots, and grubs will surface feed on all useful pasture plants including grasses, lucerne and clovers. Burrows found near soil piles.	Cultivation, fallow or break crops may assist. Phalaris and cocksfoot more resilient than other pasture species. Readily controlled with insecticide sprays.
	Wireworm and false wireworm *Elateridae spp and Gonocephalum spp.*	 Photo: Andrew Weeks (Cesar)	Wireworm: Dark-grey-brown-black oblong. Also known as click beetle. False wireworm: Adult similar colours but oval shape. Cream-yellow-golden larvae. Distinctly segmented body.	Eggs laid on or just below surface. Eat germinating seeds and roots of young seedlings. Usually in upper 5cm of soil. Adults may chew and ringbark seedling stems. Often a pest of weedy or trashy sites, especially low/no till situations.	Reduce crop trash. Cultivation and fallowing. Knock-down insecticides. Suitable seed coating insecticide.
Moths	**Heliothis** *Helicoverpa spp.*	Photo: Andrew Weeks (Cesar)	Adults brown with a light pattern to 25mm. Wings held flat. Caterpillar larvae from 1.5mm to 50mm. Light brown with dark heads, developing stripes as they age.	Eggs single or in small clusters. 1mm diameter, white, domed become orange-brown prior to hatching. Will chew large holes in leaves. Also feed on many other crops.	Cultivation and knock-down insecticide before sowing. Monitoring of crops through life-span. Chemical control.
	Corbie grubs *Oncopera spp.*		Brown-grey moths to 30mm long, 40mm wingspan. Eggs <1mm laid in long grass and trash, initially cream turning black over time. Larvae from 3mm to 60mm long, grey-purple with shiny head. Soil tunnels with clean entrance (no spoil).	Caterpillars from 30mm or so will surface feed at night to denude pastures of perennial grasses, especially from late autumn-early spring. Weakened root system and crown feeding will lead to pulling and bare patches in paddocks.	Keep pastures short or well grazed through late spring and summer. Chemical control is effective with timely application, usually mid-autumn.
	Greasy, pink, brown (True) cutworms *Agrotis spp.*		Often one of 3-4 species, including Bogong moth. Adults grey-brown from 36 to 45mm wingspan. Larvae up to 50mm long, grey to dark grey, often pinkish, plump, found just at or below soil surface, often curled up.	Eggs laid in moist, loose soil. Young larvae may chew foliage, larger caterpillars cut stems of seedlings at ground level. Mostly feed at night. Also feed on other crops including establishing pasture. May be found virtually year-round.	Cultivation and knock-down insecticide before sowing. Monitoring of early crops stages. Chemical control.

			Description	Damage	Control
Weevils	**Sitona weevil** *Sitona discoideus*	 Photo: Andrew Weeks (Cesar)	Small grey-tan weevil to 3mm long. Grubs to 3mm, chubby pale and legless, often feed on or burrow into legume nodules. Adults disperse by flying.	Larvae feed on roots of lucerne and other pasture legumes and flat-weeds. Grasses rarely affected by grubs, but adults will feed on most pasture species including grasses, leaving a scalloped leaf edge. Young tillers in no-till very susceptible.	Cultivation and fallow. Chemical control may be an option if needed in heavy infestations.
	Whitefringed weevil *Naupactus leucoloma*	 Photo: Andrew Weeks (Cesar)	Adults grey-tan with dark striations, large weevil to 12mm long. Larvae to 12mm, fat, cream with pale indistinct head region with distinct chewing mouth parts.	Most often a pest of established lucerne, especially 2–3 year old stand out of no-till establishment when damage may appear as wilting and plant loss in summer. Avoid close cropping with other hosts e.g. potatoes, peas, etc.	Farm hygiene, crop rotations and cultivation. Cereal break crop. Soil fumigation may be an option. Sprays ineffective.
Others	**Red-legged earthmite (RLEM) & blue oat mite (BOM)** *Halotydeus destructor, Penthaleus spp.*	BOM Photo: Cesar  RLEM Photo: Cesar		Especially problematic in emerging and seedling lucerne. Mites will suck the nutrients from swelled seeds and young plants. If plants are older, a typical whitening/silvering of part or all of the leaflets is evident.	Use seed treated with correct systemic insecticide, monitoring, and an integrated spray program.
	Lucerne flea *Sminthurus viridis*	Photo: Cesar	Wingless, yellow-green insect from 1–3mm in size. Pale yellow eggs laid in spring and autumn or in moist summer areas in clusters at soil level. Adults have a leaping action and often called 'springtails'.	Spring and autumn, summer pastures also affected. Clover, grass and lucerne leaves initially speckled then windowed out. Severe infestations may strip leave back to veins and petioles.	Monitoring of pastures or crops. Close grazing to admit summer heat/ sunlight into canopy. Chemical control.
	Wingless grasshopper *Phaulacridium vittatum*	 Photo: Andrew Weeks (Cesar)	Grey-brown adults to around 18–20mm. Occasionally develop wings to fly short distances. Eggs laid in autumn to 20mm under soil surface, hatching early summer. Juveniles from 4–5mm pinkish, to brown 8–10mm, size increasing with maturity.	Summer and autumn pest. Prefer to feed on broad-leaved species, especially clovers and broad-leaved weeds and often found on overgrazed sites. May do severe damage in dry years on green summer pastures.	Improve pasture growth ensuring grasses are well maintained. Chemical control.
	Slugs and snails *(many species)*	Photo: D Hobern, Atlas of Living Australia	Slugs may be black-grey to yellow-brown, from 1mm to 35–50mm. Eggs often cluster in soil and trash 1–1.5mm soft, white-transluscent. Snails of various sorts including garden snails and conical (pointed).	Newly hatched, very small slugs may feed within drill-rows and not emerge to take surface baits. Damage may occur to all parts of plants at any stage. Seedlings especially vulnerable. Older leaves typically have oblong windows rasped out.	Sow seed with an approved slug bait in problem situations. Monitor and re-apply if needed. Cultivation will assist initially. Harrowing or rolling may be beneficial.

Common lucerne diseases

			Cause	Symptoms & damage	Control options
Seedling	**Damping-off** *Pythium spp., Rhizoctonia solani, Fusarium spp., Phytophthora spp.*	 NSWDPI	Fungal complex affecting emerging seedlings. Very common in most soils under continually wet conditions. Spores spead by water, wind, soil etc. Exacerbated by over-watering and sowing seed too heavily.	Seedlings may either fail to emerge or, shortly after emergence, wilt and fall over with characteristic wasting of stem, often with dark lesions. May severely reduce viability of a new stand.	Use of seed treated with appropriate fungicide or AgriCote. Sow in conditions that promote rapid establishment (good seed-bed, warmer rather than cooler).
Leaf and stem	**Alfalfa mosaic virus (AMV)**	Alan Humphries, SARDI	Virus hosted by lucerne, perennial clovers, french beans and peas. Spread by aphids. Infected seed is most likely initial cause of stand infection.	Continuum from minimal to severe stunting of growth, pale mottling of leaves. Some strains under heavy infection may lead to stand death.	Sow seed known to be free of AMV. Control of vectors (aphids) especially in spring before numbers build up.
Leaf and stem	**Common leaf spot** *Pseudopeziza medicaginis* **Pepper spot** *Leptoshphaer-ulina trifolii*	 Alan Humphries, SARDI	Fungii hosted by lucerne, clovers and medics. Spread by crop debris and wind, rain etc. Development of diseases usually seen in cool-moist weather over mid-late winter, or occasionally on new re-growth after hay cutting.	Circular brown-black spots to 3mm over upper leaf surface. Leaves curl, yellow, brown and fall off. May also affect leaf petioles. Severe infections although rare, may reduce yield and feed quality.	Fungicide options may be available. Rotational grazing, removing whole crop and good crop hygiene is usually all that is required.
Leaf and stem	**Rust** *Uromyces striatus*	Agro Slide Bank	Commonly occurring fungal leaf disease, spread by wind and rain splash etc. Outbreaks favoured by warm, moist conditions. Spores or mycelium on plants and litter potential source of re-infection.	Red-brown pustules on the leaves and upper stems. Heavy outbreaks cause leaf fall, lower stock-feed value and reduced yield.	Complete grazing and regular harvesting to reduce canopy and local humidity.
Leaf and stem	**Downy mildew** *Peronospora trifoliorum*	NSWDPI	Widespread and occasionally important fungal disease hosted by lucerne and perennial clovers. Fungus develops under damp conditions and may carry-over in infected plant crowns. Dispersed by wind etc.	Autumn sown, slowly establishing seedlings the most readily affected. Lightening and curling of leaflets. Underside may be slight purple to grey. Affected young stems/shoots may wilt and die. Often first cut of the season is the most affected.	Complete grazing and regular harvesting to reduce canopy and local humidity.

			Cause	Symptoms & damage	Control options
Root and crown diseases	**Phytophthora (root rot)** *Phytophthora medicaginis*	Alan Humphries, SARDI	Fungal disease hosted by lucerne and medics, and also chickpeas and carrots. Initially may reduce establishment by damping off. Usually the greatest cause of stand death in heavier/wet soil conditions in southern Australia.	Yellowing, dwarfing and die-back/ thinning of stands, often in large patches. Stubby or very reduced root system. Roots with dark lesions on the surface or within. Severely reduced viable stand-life.	Paddock selection/ improved irrigation/ drainage management. Good crop rotations. Use of resistant cultivars.
	Bacterial wilt *Pseudopeziza medicaginis*	NSWDPI	Bacterial disease common in older varieties. May be spread by seed, hay, farm machinery etc.	Symptoms start to develop in stands from 2–3 years old as stunted and yellow, possibly with scorched leaf margins. Roots will be progressively affected by dark discolouration and plants eventually die.	Use resistant varieties. Farm hygiene. Seed from a reliable source.
	Anthracnose *Colletotrichum trifolii*	 Alan Humphries, SARDI	Fungal infection spread by plant debris, rain or too tight crop rotations. Warm, moist conditions favour disease. Typically appears in crops after 1–3 years in intensive lucerne production areas where susceptible cultivars are used.	Wilted stems on individual plants or in patches, with characteristic 'hook' of upper stem. Pale brown-grey lesions with dark spots and dark borders at base of stems.	Use of resistant cultivars. Long cropping breaks. Reduced canopy humidity (mowing/ grazing) if warm-humid conditions persist.
	Rhizoctonia (canker / stem-blight) *Rhizoctonia solani*	Alan Humphries, SARDI	Fungus hosted by most pasture species, cereals and oilseeds. Infections start from small black sclerotia on dead plant material. Sclerotia germinate under moist, warm conditions and infest a host.	Stand may slowly thin over a number of years to become unviable. Seen as a dark canker or girdling of stems at or just below soil-line. Exacerbated by moist conditions and mechanical damage.	Use low-crown varieties that may reduce impact of grazing or machinery. Reduce canopy cover, and thus humidity under warm-wet conditions.
	Verticillium wilt *Verticillium albo-atrum*	 William M Brown Jr - Bugwood.org	Fungal wilt disease hosted by wide variety of plants including potatoes, tomatoes, maple trees, brassicas and some nuts and fruits. No reliable cases reported in lucerne in Australia. Significant quarantine issue.	Wilting is usually the end-stage of the disease as the plant dies. Earlier disease progress may include leaf yellowing, plant stunting or internal stem staining.	Most modern varieties are bred to be resistant. Quarantine screening of imported material. Farm hygiene.
	Sclerotinia (crown and stem rot) *Sclerotinia trifoliorum*	Nigel Cattlin-Alamy	Fungal disease hosted by most pasture legumes. Dormant phase as black sclerotes. Cool, damp conditions in lush, dense crops are ideal for infection. Spread by wind, rain, plant litter etc.	Crowns and base of stems initially affected, causing wilting and death of plants. White mould on affected plant parts. Black sclerotes from within the stems and crown. Individual plants or whole stand may be affected.	Use seed from a reliable source, free of scerotes. Good cropping breaks between susceptible crops. Canopy management to reduce local humidity.

Lucerne decsion suite

Lucerne preparation checklist

Question?	Yes	No – Action required
Lucerne not grown on site for at least 2 years	✓	Crop for at least 2 years with alternative species.
Drainage OK. (casual water lays < 1 day)	✓	Improve drainage or select alternative site.
pH ($CaCl_2$) > 5.7	✓	Increase pH through liming or select alternative site.
Exchangeable Al^{3+} < 5%	✓	Decrease aluminium at depth through liming over a number of years or select alternative site.
Weed burden previously reduced	✓	Crop for 1–2 years with cereals or other grain crops, paying attention to weed control.
Irrigation available	Spring sow	Autumn or early spring sow.
Winter active variety (dormancy rating >6)	Autumn or spring sow	Spring sowing recommended in winter cold areas, for winter dormant varieties.

Variety to fit the job

Longevity increases →

Plan for:		3–4+ years	5–8+ years	8–10+ years
Dedicated hay production	**First choice**	SARDI 10 ⊖ Lucerne	SARDI 7 ⊖ Lucerne	SARDI-Grazer Lucerne
Dual purpose hay and grazing	**First choice**	SARDI 10 ⊖ Lucerne	SARDI 7 ⊖ Lucerne	SARDI-Grazer Lucerne
Grazing/extensive pasture	**First choice**	SARDI 10 ⊖ Lucerne	SARDI-Grazer Lucerne	SARDI-Grazer Lucerne
	Good alternative		SARDI 7 ⊖ Lucerne	

Hay quality increases →

DM yield per annum increases ←

Grazing tolerance increases →

Sowing rate kg/ha increases ↑

Lucerne sowing rates

Annual rainfall	Marginal dryland (350 mm–450 mm)	Dryland (450 mm–600 mm)	Favourable dryland (600 mm–800 mm)	High rainfall/irrigated (800 mm+/ irrigated)
kg/ha	4–6	6–8	10–12	15–25

It is strongly recommended that prior to sowing, a pre-plant, pre-emergent herbicide be considered. Herbicides such as trifluralin and pendimethalin are commonly used with good success. Consult an agronomist and check label instructions before proceeding. Low-till/no-till systems can be used to good effect, but paddock preparation, weed burden and herbicide spray systems need to be considered and prepared for prior to sowing.

Lucerne stand thinning out?

Sometimes after a number of years, lucerne plant numbers in a paddock may reduce to lower than desirable levels, but the lucerne stand may still be the best option for a while yet. It can be a very useful strategy to oversow the stand with a suitable companion species. If a full lucerne stand is required on that site, then it is better to terminate the existing lucerne, crop for a few years, address reasons for decline, and then re-sow.

Oversowing options for winter dominant rainfall zones

Desired outcome		350 mm–450 mm	450 mm–600 mm	600 mm–800 mm	800 mm+ / irrigated
		Oversow in autumn with a one-year species, terminate crop in following summer			
Keep lucerne for 1 more year	→	Express Forage oat 20 – 60 kg/ha	Vortex Annual ryegrass 10 – 15 kg/ha	Fuze Annual ryegrass 10 – 15 kg/ha	Hogan Annual ryegrass 15 – 20 kg/ha
		Oversow with a biennial species. Consider chicory for stands with many grass-weeds			
Keep lucerne for 2 more years	→	Hulk Italian ryegrass 8 – 12 kg/ha	Tempo Italian ryegrass ↔ 10 – 15 kg/ha	Commander Chicory ↔ 4 – 8 kg/ha	Arise Italian ryegrass 15 – 20 kg/ha
		Over-sow with a long-rotation grass			
Keep lucerne for 3–4 more years*	→	Bareno Grazing brome 6 – 10 kg/ha	Barberia Hybrid ryegrass 10 – 12 kg/ha	Shogun Hybrid ryegrass 12 – 15 kg/ha	Shogun or Samurye ** Hybrid ryegrass 15 – 20 kg/ha
		Over-sow in autumn with a one-year species, terminate crop in following summer			
Keep lucerne indefinitely*	→	Horizon Phalaris 2 – 3 kg/ha	Holdfast GT Phalaris 3 – 5 kg/ha	Maxsyn Perennial ryegrass 10 – 15 kg/ha	4front Perennial ryegrass 15 – 20 kg/ha
Full lucerne stand required	→	**Terminate current stand. Crop for 2 years minimum to utilise nitrogen fixation from the lucerne. Address reasons for decline such as weed burden, fertility, pH, drainage, cultivar disease susceptibilty, prior to re-sowing lucerne.**			

* In low-medium rainfall areas, an alternative to oversowing with grass is to consider introducing 6–8 kg/ha of one or two sub-clovers that suit the environment. Antas should be considered as a very good option for 3–4 years, Mintaro, Campeda and Monti for a longer time-frame.

** Samurye NEA12 hybrid ryegrass is only recommended for dairy and beef cattle.

↔ = interchangeable

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