How do I grow tedera?

The issue:	Livestock producers are faced with climate variability challenges and rising input costs while trying to maximise livestock productivity and profitability.
The impact:	Traditional or older pasture systems can limit production due to poor performance in dry periods or shorter production windows.
The opportunity:	Tedera is a resilient legume pasture that can fill feed gaps at a lower cost while offering livestock productivity gains.

What is tedera?

Tedera is a herbaceous, perennial, self-pollinating, drought-tolerant legume pasture for Mediterranean-type environments across southern Australia. A variety called Lanza® (T15-1218 (ⅆ)) has been developed in Australia and is now commercially available. It has been trialled extensively in WA but could be suited to similar environments in other states. Tedera grows year-round and growth is only limited by extreme drought conditions or low temperatures during winter.

Tedera is a pasture for livestock production offering:

- high drought tolerance with the ability to maintain green leaves through summer and autumn
- an adaptable deep root system for climate resilience
- an extended green pasture growing season, reducing reliance on supplementary feeding or lower quality feed such as crop stubbles
- the opportunity to rest other pastures in preparation for the autumn break
- the opportunity to increase profit through an extended season (modelling indicated incorporating tedera with annual pastures had a much larger impact on profitability than incorporating lucerne with annuals and could potentially increase mixed farm profit by more than 30%)
- hard seededness allowing slow breakdown over summer and autumn and reducing the risk of germination on false breaks
- phosphorus, potassium and sulphur efficiency as tedera tolerates lower levels of soil nutrition
- soil nitrogen fixation
- a safe, high quality food source.

Sheep grazing tedera trials.

Which environments does tedera suit?

Tedera suits:

- most temperature zones, except those with extensive frost
- dry climates and rainfall zones down to 350mm average annual rainfall
- acid soil conditions (a soil pH ($CaCl_2$) of ≥4.8 is ideal but it can tolerate lower) as it has some tolerance to aluminium (moderate tolerance compared with common perennial forages) and magnesium (the most tolerant of 11 common perennial forages when tested)
- areas prone to transient waterlogging (but this may affect its drought tolerance levels due to poorly developed root zones while waterlogged).

Where does tedera come from?

Bituminaria bituminosa C.H. Stirton (tedera) is widely distributed in all countries surrounding the Mediterranean Sea. It is a diverse species with many botanical varieties adapted to regions with 150–1,000mm of annual rainfall, from sea level to high altitude, and from regions with no frosts to cold mountain climates.

Tedera at flowering.

Why is tedera more drought tolerant than other species?

Tedera's drought tolerance is due to several inter-connected attributes which maximise water extraction from drying soils, minimise water loss from shoots and improve water use efficiency.

These attributes include:

- maintaining leaf water content and function under drought conditions
- water use efficiency (30% higher than lucerne)
- traits to reduce water loss which include modifying shoot and root characteristics to access soil moisture and reduce transpiration.

Researcher Dr Daniel Real (right) in a tedera trial with Dandaragan producer David Brown.

Will tedera suit my farm?

Factors to be considered:

- **Rainfall:** Lanza® tedera is suited to regions in the south-west of WA with an annual rainfall down to 350mm. Specific regions for tedera outside of WA are yet to be confirmed.
- **Temperature:** Tedera grows well relative to other species where temperatures are hot in summer and moderate in winter.
- **Soil type:** It can grow in a range of deep soils with little impediment for root penetration and with a range of pH levels and fertility.

The long-term productivity and survival of tedera swards through multiple dry summers is dependent on the plant's ability to establish a deep root system to access subsoil moisture. The most productive and persistent stands of tedera have been in deep sandy loams, deep loamy sands or deep duplex soils. These soils, classified as coloured sands and deep sandy duplex soils, cover more than 6.2 million hectares in WA.

What about soil fertility?

Tedera has lower soil nutritional needs than other pasture types, such as sub-clover and lucerne, for establishment and production. This means you can:

- reduce establishment and production costs
- avoid over-fertilising and reduce the risk of nutrient run-off
- reduce reliance on fertiliser
- use a low level of starter N, which is proven to be highly beneficial to tedera as with other legume pastures.

Existing fertility in previously cropped paddocks is likely to support optimal tedera production without the need for additional nutrient inputs.

Tedera has similar phosphorus requirements as sub-clover but is more efficient when using potassium (K) and sulphur (S).

The reduced requirements for P, K and S at tedera peak production represent an advantage over less efficient species as less fertiliser (and reduced input costs) is needed to maximise tedera biomass production.

Table 1. P, K and S nutrient concentrations in soils (mg/kg^{-1}) and shoots (%) at which Lanza® production reached and then dropped to 90% of peak biomass. Measurements outside these figures could indicate deficiency or toxicity.

	Lanza®			Lucerne		
	≥90%	**Peak**	**≤90%**	**≥90%**	**Peak**	**≤90%**
Colwell soil P (mg/kg^{-1})	3.0	7.6	19	10	22	46
Shoot P (%)	0.06	0.48	0.98	0.24	0.74	1.5
Colwell soil K (mg/kg^{-1})	3.0	12	50	6.0	27	120
Shoot K (%)	0.50	1.36	3.1	0.31	1.3	3.4
Soil S (mg/kg^{-1})	7.4	12*	No max	3.8	8.8	20**
Shoot S (%)	0.22	0.25*	No max	0.12	0.23	0.39**

* Peak productivity was not reached within the soil nutrient concentrations tested (no max) and therefore the peak productivity level is taken as the maximum productivity.

** These figures are extrapolated from beyond the range of tested soil S concentrations.

P (phosphorus), K (potassium), S (sulphur), mg (milligrams) and kg (kilograms).

It's best to test

While tedera can be productive with lower soil fertility, soil health should not be ignored altogether.

Producers should use soil or shoot testing to identify when further nutrients are required and seek professional advice on maintaining the optimum levels of soil nutrients.

P and K toxicity and deficiency, and S deficiency can be signalled by aspects of plant growth (generally in the roots and leaves) and any changes in plant appearance should be investigated.

High levels of K can have a detrimental effect on root nodulation, an important process for fixing atmospheric nitrogen.

How do I grow tedera?

Checklist for sowing

- ☑ Source high quality seed.
- ☑ If sowing in a new area, ensure seed is inoculated with the correct strain of rhizobia.
- ☑ Sow into a clean paddock (preferably a paddock coming out of a cropping rotation) with good weed control for several years prior.
- ☑ Carry out one or two herbicide knockdowns to minimise weed competition at establishment.
- ☑ If insect infestation is identified as a risk, apply an insecticide with one of the herbicide applications.
- ☑ Use standard seeding equipment to sow the pasture.
- ☑ Sow at 2cm deep at 10–15kg/ha at 22cm row spacings for highest productivity.
- ☑ Sow after the first rains of the season break to allow seedlings to develop a deep root system before the first summer.

Factors to consider for sowing

Seed quality and viability

Tedera seed is encased in a pod which the seed needs to germinate 'through' after sowing. Germination rates are generally lower than other pasture species, at around 50–70%. This is due to:

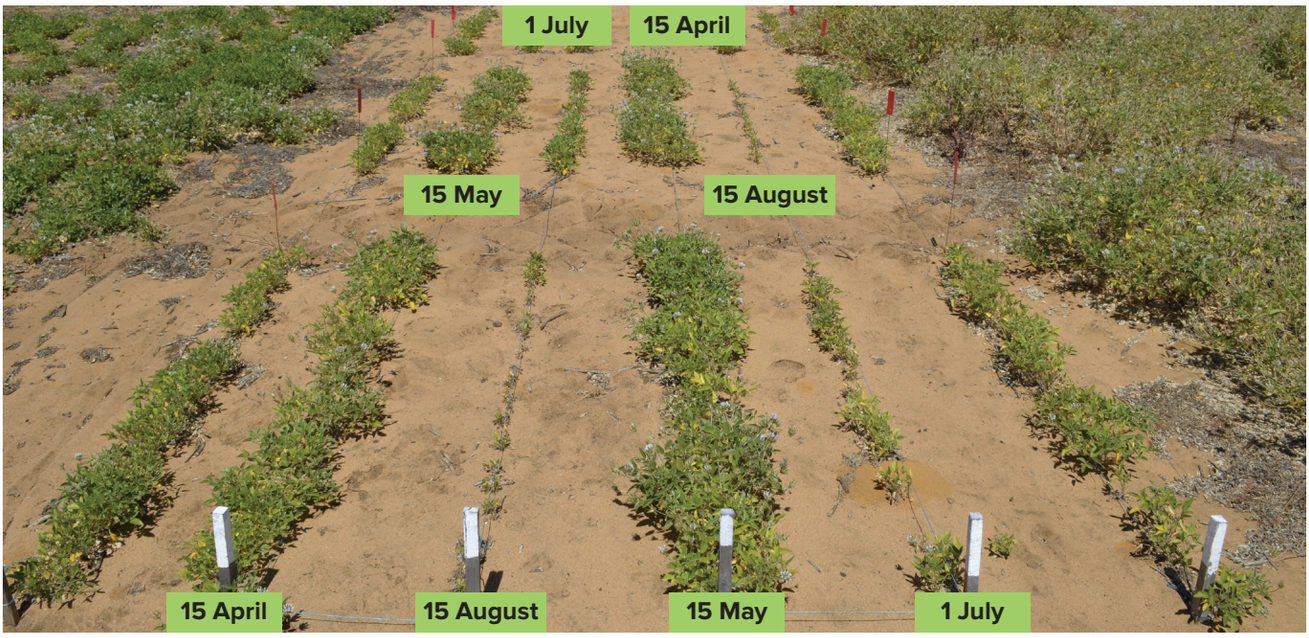
1. The pod being inseparable from the seed, meaning scarification is not uniform
2. Tedera's long flowering window which means seed maturity is over a long period and some immature seed will be harvested.

Seed inoculation

Tedera must be inoculated to biologically fix nitrogen. Treated seed should be sown as soon as possible, generally within 24 hours of inoculant application.

Special strain WSM 4083 is commercially available. WSM 4083 is suited to pH 4.8–8.5, salinity levels less than 300mM NaCl (millimolar sodium chloride). Trials are indicating inoculation provides protection for at least seven years but further work is underway to establish the full length of coverage.

Close-up of tedera nodules (top) and a nodulated seedling (bottom).



Time of sowing experiment demonstrating clear differences in plant size and vigour among sowing dates. Three experiments were established at Dandaragan (pictured on 10 December), Three Springs and Cunderdin (WA) with four sowing times: dry sowing before the break of season (15 April), early sowing just after the break of season (15 May), late sowing after cereal crop program was completed (1 July) and early spring sowing (15 August).

Sowing technique

Tedera sowing does not require any special equipment and the usual seeding machinery set-up is ideal.

Time of sowing

Sowing as early as possible after the first autumn/winter rains is recommended in areas with mild winters and low rainfall to strike a balance between allowing plants to germinate well while providing time for seedlings to develop a deep root system before the first summer. In regions with medium to high rainfall and cold winters, early spring planting is possible, provided there is good control of winter volunteer species.

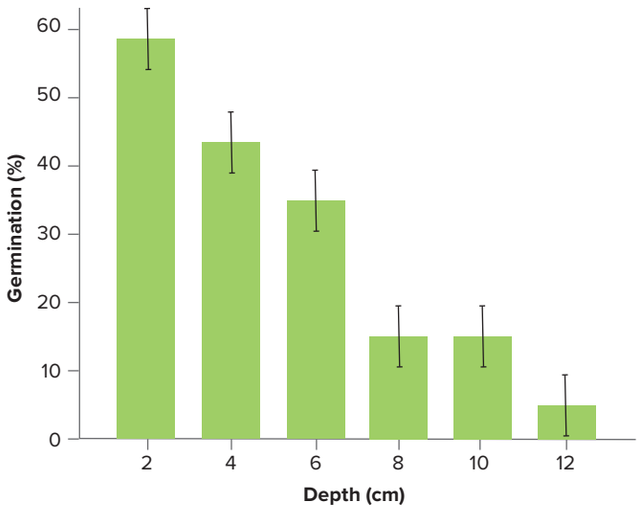
In paddocks with an expected high weed seed bank, sow after one or two herbicide knockdowns.

Sowing depth

A sowing depth of 2cm provides the most consistent and rapid emergence in a range of soil types. Results also confirmed sowing depth is less critical on sandy soils, and deeper sowing on light soils may provide some protection from lengthy dry spells following sowing.

Row spacing

Row spacing has little effect on biomass production. However, in drier times the highest production came from 22cm row spacings, leading to this being the recommended distance.



Emergence/germination percentage of tedera after 10 weeks when sown at 2, 4, 6, 8, 10 and 12cm depths.

Sowing rate

Climate is the biggest dictators of biomass production but in optimal years sowing rate was a factor. Trials sown at 15kg/ha of seed produced more biomass in an optimal year than those sown at 10kg/ha. However, in sub-optimal conditions biomass production was relatively consistent between rates. It is recommended producers determine the ideal sowing rate – either 10 or 15kg/ha – based on the price and/or availability of seed.

How do I manage tedera grazing?

Optimal management of grazing includes these strategies:

- During the establishment year, if tedera is sown early in March/April, graze it for the first time in November/December. If sown in August/September, with good growth over summer, it could be grazed for the first time in March/April.
- Graze frequently during dry periods and allow it to accumulate biomass during cooler, wetter seasons.
- Use it to fill the dry period feed gap.
- Rotationally or continuously graze from late summer, when it can be used to replace supplementary feeding.
- Consider it a tool to extend the grazing window into late autumn, allowing annual pastures to rest for seed set and early establishment.

Tedera can remain green during long, dry summers in WA (where research has been carried out to date) with minimum loss of leaves. Tedera will persist well under either continuous or rotational grazing over the long-term.

TOP TIP

Serving it up

Tedera is the solution when all other feed is depleting. There is no recommended grazing start point but if you put sheep on to tedera when, for example, it offers 1,000kg/ha of dry matter then sheep should be removed when that volume is halved (500kg/ha). Grazing to half the feed on offer is recommended in all scenarios including dry periods.

Livestock need no preparation for moving on to tedera pastures and after a few days happily graze it.

Here are two options to make optimal use of this out-of-season green feed:

1. **Using tedera to extend the growing season**

   Best practice is tactical grazing, when tedera pastures are used during two critical times of the year:

   Period 1 – Late autumn and early winter, providing an early start to the green feed season for animals and high quality feed when winter crops are sown and remaining stubble quality is poor (leached by early rains). This allows annual pasture paddocks to rest to improve establishment. Livestock can then be moved onto replenished annual pastures.

   Period 2 – Late spring, when it is grazed again to extend the green feed season, whilst allowing annual pasture to be rested to maximise seed set and seed bank. The late spring grazing also has the benefit of reducing green leaf area of tedera plants before the stressful summer period, improving sward health and longevity. Animals can then be moved on to stubbles or crop residue following harvest.

Grazing tedera during both periods one and two can extend green feed availability by about three months.

2. **Using tedera to reduce supplementary feeding**

   Tedera productivity is maximised by grazing frequently during the drier periods and holding off grazing over the cooler months to support biomass accumulation and to allow roots to grow stronger and deeper.

A defoliation experiment at Cunderdin in a one-year-old tedera stand in August, 2018. The experiment examined cutting the pasture to a height of five centimetres twice, four times or eight times a year.

What is the nutritional value of tedera?

Both leaves and stem material of tedera provide a valuable source of high quality and palatable feed, with good digestibility, protein and metabolisable energy.

Crude protein (CP) % appears to peak in spring and autumn, while dry matter digestibility (DMD) and metobolisable energy (ME) are highest in winter and summer.

Table 2. The concentration of CP, DMD and ME of the seven accessions of tedera in samples of edible leaf and stem.

	Season of grazing			
Attribute	**Winter**	**Spring**	**Summer**	**Autumn**
CP (%)	13.77	15.27	12.57	17.90
DMD (%)	72.76	69.58	74.09	70.20
ME (MJ/kg DM)	10.90	10.35	11.12	10.45

MJ – megajoules

TOP TIP

Is it safe to eat?

There are no reports in scientific literature or by producers of tedera causing any health problems in grazing animals. No toxicity for grazing animals has been reported for tedera. After a few days of initial familiarisation, tedera is grazed readily.

Bloat can be a problem for ruminants grazing highly digestible pastures with high protein content and no condensed tannins, commonly the case with many legume-based forages. Tedera has a lower protein content than lucerne, a species which can cause bloat. Tedera also produces polyphenolics (2%) and condensed tannins (0.5%) and there has been no case of bloating in Australian or international tedera research or by traditional users in the native environments.

Research is still underway into its impact on cattle. Researchers cannot give any advice on the bloat impact on cattle at this stage.

How do I control weeds in tedera?

Weed control is imperative for successful establishment and long-term productivity. Tedera seedlings do not compete well with winter weeds.

Research from eight herbicide experiments from 2017 to 2021 identified several broadleaf and grass-selective herbicides for pre and post-emergent application with tedera. Results were published in the scientific peer-reviewed journal *Agronomy* in 2022 (https://doi.org/10.3390/agronomy12051198).

Please note: These results should not be taken as recommendations, as off-label use of herbicides on tedera cannot be advised. Herbicides identified which were well tolerated by tedera will need to be granted a special permit by the APVMA or to be included in the herbicide label by the supplier. Once a permit is granted, their use will be recommended.

The most important herbicides identified for use on tedera were:

- propyzamide (mainly to control grasses) as a pre and/or post-emergent.
- flumetsulan (to control broadleaf weeds) as pre and/or post-emergent
- diquat and paraquat as desiccants on established tedera during winter for a clean-up of all weeds or at harvesting time
- diclofop-methyl, fluazifop-p butyl-ester and propaquizafop as post-emergent grass selectives.

Negotiations for permits with the APVMA (Australian Pesticides and Veterinary Medicines Authority) are underway. Applications for minor use permits are also underway.

Table 3. Herbicides identified for use in legume pastures or pasture including tedera

Product name (most common available) (registrant)	Active constituent (concentration)	Pasture description (weeds controlled)	Comments
Agrifop 375 (Sipcam)	Diclofop-methyl (375g/L)	Pasture (annual ryegrass, wild oats)	A post-emergent grass selective Group A herbicide with known resistance in annual ryegrass and wild oats.
Reglone® (Syngenta)	Diquat (200g/L)	Pasture (capeweed, erodium, barley grass, brome grass, silver grass, vernal grass)	A post-emergent broad-spectrum Group L herbicide registered for pasture renovation and establishment. Will burn all green plant tissue.
Fusilade® Forte 128 EC (Syngenta)	Fluazifop-p butyl-ester (128g/L)	Pasture (annual phalaris, annual ryegrass, barley grass, brome grass, volunteer cereals, wild oats)	A post-emergent grass-selective Group A herbicide with known resistance in annual ryegrass and wild oats.
Broadstrike® (Corteva)	Flumetsulam (800g/kg)	Pasture (various broadleaf weeds)	An early post-emergent broad-spectrum Group B herbicide.
Gramoxone® 360 Pro (Syngenta)	Paraquat (360g/L)	Pasture (annual grasses and broadleaf weeds)	A post-emergent broad-spectrum Group L herbicide registered for pasture establishment, pasture cleaning, spray-topping and the prevention of annual ryegrass toxicity. Will burn all green plant tissue.
Shogun® (ADAMA)	Propaquizafop (100g/L)	Legume pasture (annual ryegrass, barley grass, brome grass, volunteer cereals, wild oats)	A post-emergent grass-selective Group A herbicide with known resistance in annual ryegrass and wild oats.
Edge 900 WG (Imtrade)	Propyzamide (900g/kg)	Legume pasture (various annual grasses and broadleaf weeds)	A post-emergent broad-spectrum Group D herbicide which can be applied to seedling and established crops.

Note: For any product selected, check the label carefully to ensure that tedera is covered by the legume pastures/pasture legumes wording.

How do I manage pests and disease in tedera?

Research has established:

- tedera is quite tolerant to aphids and nematodes
- native budworm must be managed in seed crops
- redlegged earth mite (RLEM) do not seem to cause an economic impact
- *Phoma herbarum* (a fungal disease), phytoplasma and alfalfa mosaic virus (AMV) have been observed in tedera but their economic impact has not been measured.

Pests in tedera

Native budworm *(Helicoverpa punctigera)* should be controlled in tedera grown for seed. Two or three applications of alpha-cypermethrin at 20g of active ingredient/ha every three weeks, starting in early flowering, is effective to avoid seed damage. It is recommended to monitor the moth numbers with pheromone traps in seed crops and start treatment if moths are present. When you see damaged seed, it is already too late for an effective control.

The last two growth stages (fifth and sixth instar) will start to defoliate plants, but tedera outgrows the foliar damage.

RLEM will attack tedera but they won't kill it or have the impact they do on other annual legumes, like sub-clover. However, it is beneficial to control RLEM to avoid damage to cotyledons which will reduce vigour and growth.

Pratylenchus neglectus (the most common root lesion nematode (RLN)) is a typical migratory endoparasite which causes yield losses in the main broadacre crops grown in WA. In trials Lanza® tedera was resistent to RLN *P. neglectus,* offering similar resistance as lupins and serradella. This means it could offer break crop opportunities for growers managing *P. neglectus*.

Diseases in tedera

Phoma herbarum is a fungal plant pathogen which causes pale brown lesions on tedera leaves, 1.5–4mm in diameter, which develop a distinct dark brown margin. Occasional lesions also show a distinct chlorotic halo extending 1–1.5mm outside the boundary of the lesion. *P. herbarum* affects lucerne and soybean in WA. It is not known if *P. herbarum* has an economic impact on tedera production in the wheatbelt.

Phytoplasma are phloem-inhabiting bacterial organisms transported via leaf-sucking insects, such as leafhopper. Phytoplasma causing 'witches' broom'-type symptoms including stunted growth, with small leaves, shortened internodes and bushy growth was found in tedera seed multiplication nurseries at Medina, WA and was named 'Bituminaria witches'-broom phytoplasma' (BiWB). Usually, the most damage is seen in autumn at the end of the dry season when plants have been growing slowly for a long period. Once growing conditions improve, the unaffected parts of the plant can quickly outgrow the phytoplasma multiplying within the affected parts.

Tedera with parts of the plant showing phytoplasma (BiWB) symptoms and part of the plant growing normally.

There is no cure for phytoplasma but leafhoppers can be controlled with insecticides. Growers should look for phytoplasma and leafhoppers in neighbouring areas and apply insecticides accordingly. Phytoplasma is not transmitted by seed.

Alfalfa mosaic virus (AMV) can affect tedera. AMV caused calico (bright yellow mosaic) leaf symptoms on tedera plants growing in genetic evaluation plots. Lucerne buffer rows were likely sources for spread by aphids to healthy tedera plants.

While AMV is not a major issue, growers can only control the aphids which spread it (with insecticide) and not the virus itself.

How do I harvest tedera seed?

Key factors for harvesting success are:

- tedera flowers over several weeks, and seed ripens unevenly
- optimum harvest time is around six weeks after the peak of flowering
- harvest must be timed right, as ripe seed can drop
- tedera plants are green and leafy when seed ripens so swathing or chemical desiccation is required prior to harvesting with a header
- header harvesting can yield up to 300kg/ha clean seed
- pollinators are beneficial for high seed set.

Time of flowering and seed set

Tedera is an indeterminate flowering species with an average peak of flowering in October. The flowering period is spread over several weeks and the peak of mature seed production occurs approximately six weeks after the peak of flowering. Therefore, at a single point in time in late spring, tedera can have a mixture of mature and immature seeds, along with open flowers.

Defoliate before flowering

To reduce leaf biomass at flowering and provide a more favourable leaf to root ratio and water balance in late spring, seed crops can either be grazed or desiccated in early to mid-winter with herbicide.

Using herbicide will have the dual purpose of controlling annual weeds and reducing leaf area.

Both management options will delay flowering for two to three weeks, pushing full flowering later into spring or early summer when average temperatures are more often above 15°C and reducing the risk of frost at flowering time.

TOP TIP

More bees please

While tedera is a self-pollinated species capable of producing its own seed without pollinators, encouraging insect pollinators lifts seed production. WA trials comparing areas covered with insect-proof mesh to no restriction on honeybees found bees visiting the flowers led to 1,083kg/ha of seed production compared to 560kg/ha in experimental covered areas.

As flowering coincides with the timing for native budworm control it is suggested producers use honeybee-friendly insecticides or time sprays to avoid impacting foraging honeybees (after sunset or before sunrise).

What machine do I use?

A conventional grain harvester without any special modifications is sufficient and practical, with only adjustments to the settings as required.

Being a perennial plant, tedera remains green once seed is mature. Therefore, it needs to be desiccated with a chemical spray or cut and swathed and allowed to dry for a few days to be harvested when fully dry.

Desiccation has been the preferred method of harvesting tedera up to date, while cutting and swathing has not been tested at commercial scale yet.

Paraquat and diquat are effective desiccants in adult tedera plants, which can recover well after treatment.

Lanza® tedera harvesting from desiccated seed crop at Dandaragan.

More information

See the manual – *Tedera: A guide to growing and utilising this perennial pasture legume*

DPIRD: www.agric.wa.gov.au/pasture-species/lanza%C2%AE-tedera

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