NSW GOVERNMENT Primary Industries

FACTSHEET

Pasture and winter forage crop sowing guide - Hawkesbury-Nepean, Hunter and Manning Valleys

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Information in this guide applies to high rainfall (above 750 mm) and irrigated pasture throughout the catchments of the Hastings, Manning, Karuah, Hunter and the Nepean-Hawkesbury rivers.

Highlights

- Improved perennial pastures offer better quality feed and quicker regrowth following rain thus enabling higher stocking rates and greater flexibility in marketing options for coastal beef producers.
- Leaving a minimum residue of 5cm pasture (1000 kg DM/ha) after grazing has shown better recovery and survival of pastures.
- Oversowing of annual ryegrass as a forage crop, complements summer growing pastures on high fertility soils by providing extra winter - spring grazing in favoured areas and under irrigation.

Key management issues

Establishing perennial pasture

- Choose a perennial grass pasture species suited to soil fertility. This provides a basis for a pasture that will provide good quality feed and offer competition against weeds and protection from soil erosion.
- The tropical species, kikuyu and setaria will perform best north of the Hawkesbury River.
- Temperate species ryegrass, phalaris and fescue will suit areas south of the Hawkesbury River and cooler plateau locations such as Comboyne.
- White clover is a valuable addition to all pastures to improve feed quality and provide a source of nitrogen.
- Use inoculated, lime pelleted seed for all legumes.
- Control of pre-existing pasture and weeds prior to sowing new perennial pastures is essential.
- Avoid cultivation on steep slopes to prevent erosion.
- Aim to sow all pasture species in this Primefact during March to mid May when rainfall and falling temperatures provide ideal conditions for seedling survival.
- Aim to sow tropical species in the warmer conditions of March – early April. Can sow in February if moisture conditions favourable.
- Only sow when soil is moist to 200 mm.
- Sowing depth for fine seeds should be no more than 10 mm.
- Rolling after sowing is highly recommended.
- Fertilise to match nutrient removal and deficiencies identified by soil tests.
- Delay grazing until plants are well established – at least 10 cm high and won't pull out.

Rotational grazing offers increased pasture utilisation where production levels justify additional time and fencing requirements.

Allow newly sown permanent pastures to seed in the first year by only lightly grazing if enough growth is available.

Annual species

- Annual ryegrass and white clover may be established by over seeding into heavily grazed, sprayed or mulched kikuyu, paspalum or setaria pasture.
- Sod seeding is the preferred method of sowing though broadcasting is also successful when rainfall is adequate.
- Use recommended sowing rates to ensure good plant population and early feed production.
- Nitrogen fertiliser will be required for optimum ryegrass production.

Species selection

This region presents a wide range of environments and livestock requirements. Selection of pastures is a process of determining realistic and achievable livestock goals by matching pasture species to soil type and local environment capabilities. In most cases the first objective for pasture establishment is to establish or encourage a perennial pasture that will:

- provide good quality forage
- persist for many years
- provide competition against weeds; and
- protect against erosion

This means making several choices.

Permanent temperate or tropical species

Temperate grasses and legumes provide higher quality forage (11 MJ ME/kg DM) than tropical grasses (7-10 MJ ME/kg DM). This translates to higher livestock production from temperate species. For example, milk production of 18-22 L per day from ryegrass compared to 15 L per day from kikuyu. Similarly, animal growth rates are 1 to 1.25 kg/day for ryegrass versus 0.90 kg/day from kikuyu. However, the subtropical climate north of the Hawkesbury River favours the lower quality, summer growing tropical species. Rainfall exceeds or is close to evaporation (Eto) from February to mid July (Figure 1).

This provides a vigorous growth period for tropical grasses and enables them to out-compete temperate species in the late summer and autumn. High summer temperatures and periods of spring–summer moisture stress also restrict the growth of temperate species. Therefore in the long term, tropical species persist and produce better in this area.

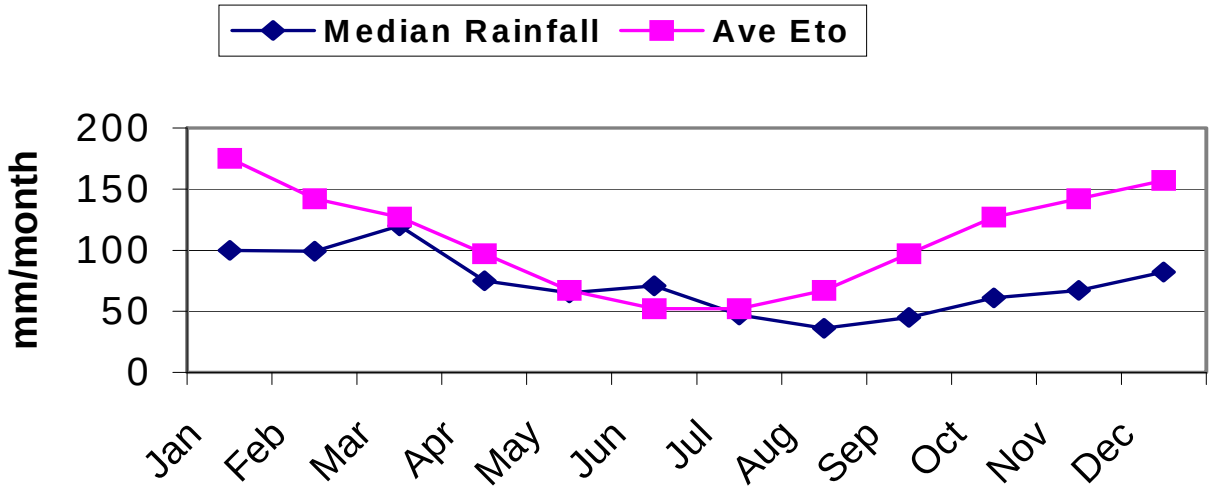
Irrigation can overcome the moisture deficit experienced in spring/summer but the higher summer temperatures limit the growth rate of temperate perennials and over time, weeds will dominate the pasture. Tropical species provide higher growth rates when irrigated in summer. However, where adequate irrigation is available and prior preparation has reduced the presence of summer weeds, temperate perennials can provide several years of productive autumn to spring growth before renovation is required.

South of the Hawkesbury River and inland from Gloucester and Maitland the temperate perennial species will persist so they are an acceptable choice for permanent pastures. This also applies for specific situations, such as irrigation in the Hunter and the cooler plateau environments of Comboyne or Elands.

Soil suitability

Both tropical and temperate species can be highly productive but require favourable soil conditions and high fertiliser rates to realise their potential.

Figure 1. Climate data for Taree



Soils, such as the alluvial flats and the red volcanic (ferrosol) soils that are deep and well-drained are ideal for these species. The more 'hardy', often less productive species perform and persist better in harsh soil conditions and require less fertiliser. Hardy species suit the shallow duplex (chromosols and kurosols) soils that have impervious clay subsoil.

Applying irrigation or fertiliser can make naturally poor soil conditions more suited to productive species. Each situation is specific to enterprise returns and management. Options for both high production and hardy pastures are listed in this publication. In some instances hardy native pastures are the best species to leave in a location.

Location

There is a decline in average rainfall (Fig 2) from the coastal strip to the mountain range in the west that affects the success of several species. Lotus for example requires over 1200 mm rainfall for persistence, except in damp gully areas.

Microclimates brought about by proximity to the sea or topography changes such as an elevated plateau or a nearby escarpment can also affect both rainfall and temperature. Local knowledge is needed to assess location capabilities.

Legume management

A major challenge when managing subtropical pastures is to achieve a consistent legume contribution. Poor legume growth reduces livestock feed intake and the nitrogen status of the pasture. This in turn reduces the production and protein content of the tropical summer grasses and consequently reduces animal production.

Low phosphorous and potassium, acid soils, nematodes and dry spring and summer conditions can contribute to clover decline. Grazing management of the grasses, and reseeding clover with proper fertilisation are keys to ensuring a good clover contribution.

Annual forages

Annual winter forages are highly productive in winter and spring when tropical grasses are dormant, due to the cooler conditions. They can provide an additional 70 to 100 days of high quality grazing and can be sown each year into tropical grass species such as kikuyu.

Production will be more reliable especially in spring if irrigation is available. In addition, forage ryegrasses and clovers can be used as a cover crop when sowing new perennial pastures.

Varieties

This publication does not cover varietal choice rather it lists varieties in common use as examples only. For more detail about varieties and the factors affecting your choice please refer to the DPI publication *Pasture Varieties used in NSW 2010-2011,* or consult your local agronomist, seed supplier or reseller.

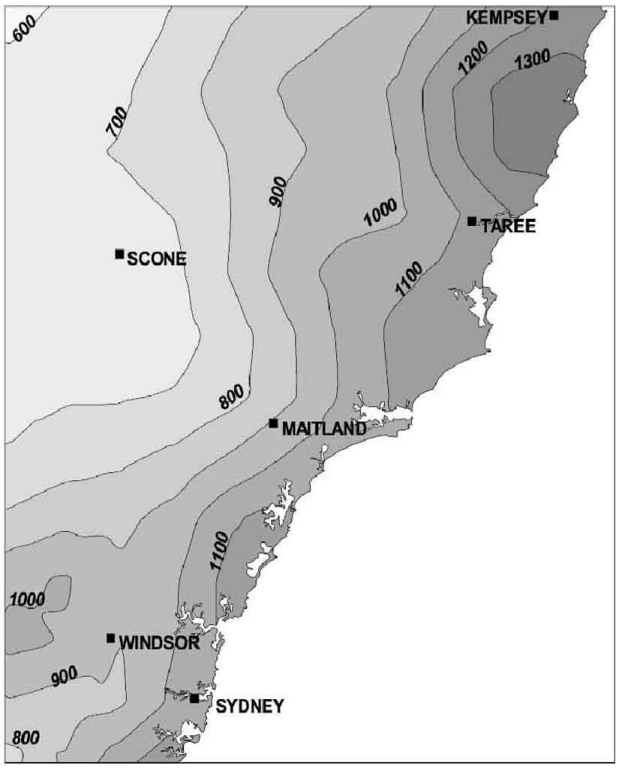


Figure 2. Indicative rainfall isohyets for the mid North Coast

Establishment success – the 3A way

Sowing improved pastures requires a commitment to higher inputs and improved management. Any growth in productivity due to introduced species will require increased fertiliser and higher stocking rates to achieve the new potential. Unproductive species will eventually dominate where adequate fertiliser application is not maintained. A major cost of pasture improvement is purchasing more stock to consume more forage. These factors need considering before commencing a pasture improvement program.

The 3A program is a list of eight key management practices that, when systematically adopted, will improve pasture establishment success. The 3A's are three most essential components of the program. The more of the eight keys achieved, the higher the success rate of pasture establishment. More detail on specifics of the program can be obtained through your local agronomist.

Sowing improved pastures - the 3A Way

The 3A Way is a sequence of eight key stages for establishing productive pastures. Seasonal conditions dramatically affect results and constant monitoring is required to determine how to manage the establishment phase. Times will vary for spring and autumn sowings as well as within regions.

❑ Assess, select and plan early

Assess existing pasture, weeds and soil fertility 12 months prior to sowing

- » Select correct species and variety to suit the soil, paddock and purpose
- » Budget check - assess costs & returns

❑ Year before weed/pest control

- » Control summer weeds prior to sowing - grow a forage crop eg. cowpeas
- » and/or spray or spray-graze broadleaf weeds in autumn and/or spring

Graze well through spring and summer and avoid cultivation where fireweed is a hazard

❑ Remove excess plant material before sowing

Graze well over summer to reduce plant height. Use pre-sowing, grazing, mulch or cultivation

- » Conventional sowings - summer fallow/weed control. Incorporate lime if needed
- » Direct drill and broadcast sowings - continue to "graze well"
- » If you can't heavily graze then slash or mulch in early March to expose some soil

❑ Targeted nutrition

Target fertiliser and lime applications to soil requirements by soil testing *prior* to sowing
Allow four weeks to six weeks before sowing to obtain results

- » Always use phosphorous at sowing – banding with the seed is more efficient
- » Nitrogen and potassium can be broadcast after sowing
- » Mixed fertiliser of nitrogen, phosphorous, sulphur are useful at sowing eg. DAP or Granulock®
- » Limit nitrogen with the sown seed to less than 30 N kg/ha

Lime is faster-acting if incorporated but can be broadcast 2-12 months prior to sowing

A Appropriate weed and pest control

Graze well to keep weeds and existing pasture small in summer/autumn before sowing

- » Assess weed and pest levels including wet areas for slugs and snails
- » Either use appropriate herbicides or insecticides at label rates
- » Or cultivate to achieve a firm, fine weed-free seedbed
- » Look for pests and weed seedlings at 10-14 days after sowing
- » Re-examine weekly. Treat early! NB: Fireweed during autumn and winter

A Adequate soil moisture

- » Sow from March to late May. Sow tropical species early in this period
- » Don't sow on the first rain in autumn if summer was dry. Allow 50mm total rain
- » Only spring sow where irrigation is available

Target: sow when there is a moist soil surface with moisture down to 200mm

(unless irrigation available)

A Accurate seed placement

Choose the most reliable method available. Sowing depth and coverage is critical

- » Direct drill - average furrow depth 25mm but furrow open with 5% of seed and fertiliser still visible. Tilth over the seed no more than 5mm
- » Cultivated seedbed - seed to 10mm deep, harrow or roll
- » Broadcast - when cool and moist can mulch or harrow and roll

❑ Grazing

Allow plants to reach 100mm to 200mm tall with roots well anchored

- » Graze heavily but quickly down to 25mm to 50mm - THEN SPELL until 100-200mm. Allow grasses and legumes to seed in the first summer.

High performance, temperate

AIM: To establish high quality, permanent, temperate pasture with year-round production, suitable for *high fertility* soils with full irrigation.

- Perennial ryegrass and white clover form the basis for a high quality pasture with some potential for summer growth. Red clover, chicory, plantain or lucerne are added to the mixture to provide summer growth.
- Requires favourable moisture conditions with high soil phosphorous and soil that isn't too acid, pH($CaCl_2$) > 5.
- Invasion of summer grasses and high summer temperatures are major threats to persistence.
- Most suited to south of the Hawskesbury River, irrigation in the Hunter or plateau locations such as Comboyne where cooler conditions reduce the summer grass threat.
- Irrigation is preferred for ryegrass persistence however hardy varieties with Kangaroo Valley background may persist on favoured dryland areas.
- Summer growth of perennial ryegrass is restricted by its sensitivity to moisture stress and temperatures > 30 °C.
- Expect to oversow (or direct drill) regularly to maintain ryegrass and clover.
- Prairie grass or fescues also offer high quality pastures in well drained, high pH soils.
- Only sow lucerne in suitable deep, well drained soil, pH($CaCl_2$) > 5 at depth.

Sowing Time

Late March to May is best. Early sowing preferred if moisture is available.

Topdressed fertiliser

Apply 45 kg/ha nitrogen (eg 100kg/ha urea) after 1st and 3rd grazing. Extra nitrogen can be applied if required. Use a soil test to help decide lime & potash (K) requirement. Add potassium (eg potash at 125–250 kg/ha) if required in several applications from sowing to spring.

Annual topdressing

Depends on productivity, soil type and past fertiliser use. Phosphorous (P), potassium (K) and sulphur (S) should be monitored for adequate levels through soil testing. Apply nitrogen when moisture conditions for growth are favourable. Annual application of 150–200 kg N/ha, 50 kg P/ha and 90–120 kg K/ha are commonly used in irrigated or favoured areas.

Top dressing phosphorous fertiliser is usually most effective in autumn and late August.

Potassium responses are likely from early spring application. Replace nutrients removed by grazing or silage.

What to sow	Seed rate kg/ha	Comments
Perennial ryegrass e.g. Bealey, Alto, Quartet, Samson, Avalon, Fitzroy, Meridian & others **Plus**	12–20	Kangaroo Valley & earlier seeding varieties may persist without irrigation. Animal safe endophytes may improve establishment and persistence of perennial ryegrass
White clover e.g. Haifa, Osceola, Will	2	A large-medium leaved variety
Useful additions: **Forage chicory** e.g. Puna, Grouse **Red Clover** e.g. Redquin, Hamua **Plantain** e.g. Tonic, Hercules **Lucerne** e.g. Genesis, Aurora	½-1 and/or 2-3	Red clover grows at higher temperatures than white clover Winter active varieties

Always sow legumes with lime pellet inoculated seed (check use by date of pre coated seed)

Legume	Inoculant
Lucerne	Use Group A
White, Red, Berseem , Strawberry Clover	Use Group B
Sub clover, Balansa or Arrowleaf	Use Group C
Lotus (Maku)	Use Group D

Fertiliser when sowing

Method	Nutrient requirement	Fertiliser
1. Direct drill	20 kg N plus 20 kg P & 20 kg S/ha	e.g. 150 kg/ha Granulock 15
2. Cultivated	**a. Sown in rows** 20 kg N & 20 kg P/ha	e.g. 100 kg/ha DAP
	b. Broadcast 20-40 kg N plus 20-40 kg P/ha	e.g. 100 to 250 kg/ha DAP
Acid soils (pH [$CaCl_2$] less than 5.0) can benefit from 2.5 t/ha lime incorporated when paddock is cultivated before sowing		

Grazing management

Graze this mixture for maximum production of high quality forage from autumn through to spring. Graze lightly during summer to encourage persistence. *Graze first* when ryegrass plants are well established and won't pull out: approximately 7 to 8 weeks after planting.

Graze in April to October: when ryegrass tillers have 3 leaves or earlier if pasture lodges. Avoid shading and death of lower leaves. Graze down to 5 cm then allow regrowth.

November to March grazing: Allow pasture to set seed, maintain high stubble – 8 to 10 cm so as not to expose bare earth. Graze when lucerne or red clover starts to flower. Puna chicory should be 30 cm high.

MOLYBDENUM (Mo) is essential for good legume growth. Acidic soils common in this region are often lacking in this trace element. Normal requirements are supplied by 250 kg/ha of Mo super or equivalent when sowing *or* by applying 100 g/ha of MOLYBDENUM TRIOXIDE directly to the legume seed when inoculating. Apply (Mo) super every four or five years to established pastures to maintain satisfactory molybdenum levels. Note applying excess Mo can interfere with copper (Cu) uptake.

Responses to molybdenum will vary depending on soil type and fertiliser history. Consult your agronomist for further details.

Hardy permanent temperate

AIM: To establish a hardy permanent, high quality, winter pasture in *medium fertility* soils.

- Phalaris and tall fescue are hardier than perennial ryegrass for dryland beef pastures in the southern and western part of the region.
- Medium to high fertility soil required.
- Persistence (especially phalaris) may be a problem on low fertility, acid soils.
- Summer grass invasion will threaten persistence particularly in warmer areas north of Newcastle.
- Sow phalaris in fertile, protected locations.
- Can oversow with ryegrass in second year. Kangaroo Valley types are usually the most persistent.
- Max P is a ‘safe’ endophyte it deters insects from damaging tall fescue. See Primefact 535 *Endophytes of perennial ryegrass and tall fescue* for further information.

What to sow	Seed Rate kg/ha	Comments
Phalaris e.g. Holdfast, Sirosa **and/or**	3–4	pH > 5, sensitive to acid soils
Tall fescue e.g. Dovey, Advance, **plus**	5-8	Requires heavy grazing to maintain feed quality
White clover e.g. Haifa, Trophy	1-2	May already be present
Lotus Maku or Strawberry Clover or	½ -1	Performs well in damp areas
Sub clover e.g. Goulburn, Seaton Park LF, Clare 2	5 -7	For areas with dry summer – upper Hunter
Alternate temperate grass species		
Cocksfoot	2-3	Only in cooler areas, tolerates lower fertility & lower pH than phalaris
Prairie Grass	10-20	Don’t overgraze. Management critical for persistence. Sensitive to acid soils, requires pH ($CaCl_2$) > 5
Perennial ryegrass (Kangaroo Valley types)		May be semi-permanent.

Note Maku lotus seed may be difficult to obtain

Sowing time

Late March to May is best. June planting is usually satisfactory but slow to establish.

Fertiliser

Follow perennial rye management in first year – see page 5. Maintenance rates are generally 20% lower since productivity is expected to be lower.

Grazing management

- *First year*: aim for establishment and seed set. Light rotational grazing may be possible in winter and early spring. Avoid grazing after early September to allow heading & seed set.
- *Established phalaris* should be grazed in rotation during autumn and winter to remove bulk but allow recovery after grazing. During spring, moderate set-stocking allows heading.

High performance tropical pastures

AIM: To establish a medium quality, permanent, summer growing pasture on medium to high fertility soil.

- Kikuyu grass forms the basis of a summer producing pasture. Winter production is derived from white clover and/or annual ryegrass sown each autumn.
- Suited to alluvial flats or better drained soil on slopes.
- Requires high phosphorous inputs to maintain production & persistence. (Colwell P >40 ppm).
- High seed cost means kikuyu grass requires a fine, cultivated seedbed with well-planned weed control.
- Establishment can be variable in the first year and so often requires a second summer to obtain full ground cover.
- Where kikuyu grass is present in a degraded pasture it can be rejuvenated by applying fertiliser and slashing to keep short.
- In small areas it can be planted by runners or sods.
- White clover persistence can be a problem due to vigorous kikuyu grass growth in the autumn. Nematodes can reduce clover persistence in the third year.
- Established kikuyu grass can be suppressed by heavy grazing, herbicide and/or mulching in early autumn then direct drill or broadcast with forage ryegrass for winter feed.
- Kikuyu grass poisoning sometimes affects cattle after a drought.
- Kikuyu grass can affect calcium uptake in horses and should not be used as a sole feed. Supplementation with calcium and phosphorous is required.

What to sow	Seed rate kg/ha	*Comments*
Kikuyu e.g. Whittet	2-5	Slow to establish
and		
White clover e.g. Haifa, Trophy, Osceola, Will	1-2	A large-medium leaved variety
Lotus e.g. Maku or Strawberry Clover	½ -1	Damp areas or high rainfall only

Sowing time

Late Feb to March is the best sowing time. Spring or early summer sowing should be under irrigation only. Conventional seedbed preferred.

Fertiliser

Follow perennial rye management for sowing on page 5.

Top-dress with nitrogen fertiliser 45 kg N/ha (e.g. 100 kg urea), before rain or irrigation in first summer/autumn to promote growth.

Lime application may benefit clover growth if pH <5 and aluminium is greater than 10 % of to soil CEC.

Grazing management

- *First year*: concentrate on kikuyu establishment, graze lightly or slash to encourage spread of kikuyu runners.
- *Established* pasture: maintain legumes and pasture quality by grazing when 18 to 20 cm high or when runners have 4 ½ leaves.
- Maintain quality by grazing kikuyu when it is young and leafy. Stem material has high fibre and low quality. Practices that help achieve good quality are:
  - » Rotational grazing with a back fence.
  - » Slash after grazing to remove old rank growth.
- If excess feed is available plan to make silage, usually in February-March. After grazing slash, top-dress with nitrogen and allow 3 to 5 weeks growth then harvest.
- Kikuyu must be grazed or mulched to 2.5 cm in March/April and kept short through autumn to allow light penetration for clover seedlings. Be aware that this management may also allow fireweed establishment
- Further reading Primefact 1068 *Milk production from kikuyu grass based pastures.*

Bulk poultry litter is a very effective fertiliser. Its use should be limited by soil phosphorus test levels. Grass pastures may need extra nitrogen. Legumes may need extra potassium.

NOTE: Poultry litter has variable quality. It can also wash into dams or rivers causing pollution. For further information see Primefact 534 – *Best practice guidelines for using poultry litter on pastures.* www.dpi.nsw.gov.au/agric (search for poultry litter).

Hardy tropical pasture

AIM: To have a hardy, medium quality, summer-growing, permanent pasture able to persist on *medium to low fertility* soil.

- Setaria forms the basis of a summer producing pasture that requires less fertiliser and tolerates poorer soils than kikuyu in the *northern areas*.
- Setaria establishment can be variable in the first year
- Lenient grazing is required to promote self seeding in the first year
- Setaria is not recommended south of the Hawkesbury River, where Rhodes grass and paspalum are preferred.
- Aerial sowing is possible but risky because of warm weather when these grasses are sown. Must control weeds.
- Can oversow with ryegrass or clovers in 2nd year.
- A light cover crop of cowpeas @ 10 kg/ha in spring or ryegrass @ 5 kg/ha in autumn may be used.
- These summer-growing grasses can affect calcium uptake in horses and should not be the sole feed. Supplementation with calcium and phosphorous can overcome these problems.

Sowing time

March -while soil temperatures are above 18°C at 9:00am. During summer if good moisture available.

Fertiliser

Follow perennial rye management for sowing, see page 5.

What to sow	Seed rate kg/ha	Comments
Setaria e.g. Narok, Solander **Plus**	2	Northern areas. Very tolerant of acid soils
White clover e.g. Haifa, Trophy	1-2	Use a large-medium leaved variety
Lotus or Strawberry Clover eg: Maku	½ -1	Damp or high rainfall areas only
Alternative tropical grass species that can be sown especially in southern areas.		
Common paspalum	2-6	Suits poorer drained soils
Rhodes Grass e.g. Callide	2-3	

- Topdress with nitrogen fertiliser 45 kg N/ha, before rain or irrigation in first summer/autumn to promote growth.
- Lime application may benefit clover growth if pH <5 and aluminium is greater than 10% of the soil CEC.

Grazing management

- *First year*: aim for establishment and seed set. Lightly graze in the first summer. Allow legumes to set seed each year.
- *Established pasture*: Allow seed set of grasses as required. Normally graze well in autumn to allow clover growth before winter.
- Heavy grazing of Rhodes Grass in autumn will reduce persistence.

Legumes for improving grass pastures

AIM: To oversow pasture legumes into an established perennial grass pasture (such as carpet grass, couch, kikuyu or some native pastures).

- White clover is currently considered the best legume to improve pasture feed quality for dryland coastal pastures. Clover can increase animal production by 30 to 60% compared to pure grass swards. Ideal animal production comes from a legume component of 30%, however a reasonable coastal target is 10%.
- Factors such as hot dry summers, high autumn growth of summer grasses, low soil phosphorous and potassium, nematodes and soil acidity contribute to the difficulty of maintaining clover growth in coastal pastures for more than 3-4 years. Therefore, white clover should be reseeded every 1-2 years or after poor clover years, by adding lime-pelleted, inoculated seed to phosphorus fertilizer and spreading immediately. Ryegrass may be added at 5 kg/ha dryland. Sub clover best in dry summer areas of the Hunter Valley.
- Before spreading, the paddock should be heavily grazed or mulched or both to suppress grass growth and remove excess dry grass.
- If trying to introduce perennial grasses so as to replace carpet grass, use a knockdown herbicide or cultivation before sowing.
- Steeper slopes can be aerially sown or broadcast where there is tractor access.
- Bloat problems may occur in spring.
- Lotus is adapted to wet areas of fields or in 1200 mm annual rainfall. Main growing season is

summer and autumn. Seed may be difficult to obtain.

What to sow	Seed rate kg/ha	Comments
White clover Dairy: e.g. Haifa, Kopu, Challenge, Waverley, Will, Osceola Beef: e.g. Mink, Sustain, Huia, Trophy, Haifa	1-2	Dairy types are more erect. Use large to medium leaved varieties
Lotus or Strawberry Clover e.g.: Maku	½ -1	Only in high rainfall or damp areas
Red clover e.g. Redquin, Astred, Colenso, Renegade, Sensation	2-3	Tend to be more summer active and less persistent than white clover
Sub clover e.g. Seaton Park LF, Clare 2, Goulburn, Riverina, Antas	5–8	Annual clover, must set seed in spring For areas with dry summer

Sowing time

April-May is preferred. April is possible if moisture is good. White and sub clover can be sown as late as June.

Fertiliser

- Use phosphorous and sulfur-based fertilisers at sowing if only legumes are sown e.g. 120 kg/ha GoldPhos or superphosphate equivalent.
- Use molybdenum additive to fertiliser when sowing into acid soils (pH($CaCl_2$) < 5.5).
- Annual topdressing with 20 kg P/ha eg as 250 kg/ha single superphosphate or equivalent.
- Phosphorous test should be above Colwell 30ppm for persistence.
- Soil test for potassium requirements. Apply in late winter if needed.
- Growth is reduced where pH($CaCl_2$) falls below 5 and aluminium is > 10% of CEC. Lime may be required.

Grazing management

- Each year heavily graze summer growing grasses in autumn (April–May) to help light penetrate to stolons and seedlings as they emerge. Some areas may require mulching or a silage cut if stock numbers are inadequate.
- Keep pasture short until clover dominates.
- Rotational grazing of white clover during seedset in spring can be an important method of spreading seed around the farm.
- Avoid over-grazing in December and January to protect stolon growth.

Annual Ryegrass

AIM: To have free seeding, high quality annual grass to fill winter feed gap in perennial summer grass pastures.

- Annual ryegrass, also called rigid ryegrass (*Lolium rigidum)* is early seeding and persistent when allowed to seed freely in spring.
- The perennial companion grass must be grazed short or slashed in autumn to allow the ryegrass to establish each year.
- Ryegrass requires high soil fertility, especially nitrogen to grow well.
- Annual ryegrass can be susceptible to leaf rust in spring. Herbicide resistance is a problem in some cropping areas and annual ryegrass toxicity is a problem in southern Australia.

What to sow	Seed rate kg/ha	Comments
Annual (Rigid) ryegrass e.g. Wimmera, Guard Safeguard	5-15	Annual ryegrass toxicity and herbicide resistance could be problems with Wimmera ryegrass. Resistant to annual ryegrass toxicity.

Lucerne

AIM: To have high quality, semi-permanent pasture suitable for rotational grazing or fodder conservation.

- Lucerne offers high quality pasture all- year-round with the option of making hay or silage.
- Persistence is greater in dry summer areas with irrigation e.g. Hunter Valley. On coastal areas high autumn rainfall leads to leaf diseases and waterlogging will cause plant loss in poorly drained soils.
- Well-drained soils are essential in all environments e.g. alluvial river flats.
- Not suited to acid soils. Lime where pH($CaCl_2$). <5. Check subsoil pH to 30cm.. Molybdenum is also required on these soils.
- Weed invasion by summer-growing grasses can occur over time.
- Bloat can be a problem.

- Can add white clover at 1 kg/ha to compensate for waterlogging losses of lucerne.
- Conventional weed free seedbed recommended for establishment.
- Use a variety with disease and insect resistance.
- Winter active varieties offer greater production for grazing in winter. Semi-dormant varieties give less winter grazing but tend to persist longer and are often chosen for hay where grazing is less important.
- Use herbicide to control annual weeds.
- Control aphids on all seedling lucerne.
- Use seed dressing for pythium root rot.
- Spray broadleaf weeds soon after emergence. See label for all herbicide details.
- See NSW I&I booklet *Weed control in pastures and lucerne* for further information.

Sowing time

August to October is best where irrigation is available and weeds can be controlled.

Late March–early April is acceptable if insects and weeds are controlled. Sow 10 -15 kg/ha.

Fertiliser

A soil test will help determine the need for lime and fertiliser. Use 20 kg/ha of P& S at sowing e.g. 140 kg/ha Goldphos.

As a guide 15-30 kg/ha P (e.g. 180-360 kg/ha superphosphate) and 60-120 kg/ha K (e.g. 125-250 kg/ha Muriate of Potash) is often needed every year.

What to sow	Seed rate kg/ha	Comments
Grazing e.g. Aurora, Genesis, SARDI Ten and L90 or Aquarius	10-15	Winter active varieties for winter grazing
Hay e.g. 54Q53, Venus, L56		Semi to winter dormant varieties
See Primefact 705 *Current lucerne varieties 2009* for full list of lucerne varieties.		

Grazing management

Avoid first grazing until plants are 30 to 40 cm high and well- rooted. Rotational grazing is essential for persistence. Cut for hay or silage when 10% is flowering or new shoots start to grow from crown.

Earlier grazing or cutting will provide higher feed value but stand-life and yield may be reduced.

LIME APPLICATION

When sowing species that are highly sensitive to acid soils and aluminium toxicity e.g. lucerne, apply lime 3 to 12 months prior to sowing to allow time for changes in pH to occur.

These changes will occur quicker if lime is incorporated. Broadcasting without incorporation is effective but takes longer. A break crop such as cowpeas can provide an opportunity to incorporate lime and to reduce summer weeds.

Many coastal soils are too acid to achieve economic responses to lime with beef production. In these cases choose acid tolerant species and where possible acid tolerant varieties. Check subsoil pH to 30 cm.

Annual winter forage crops

AIM: To produce large amounts of high quality winter forage for one growing season.

Forage Ryegrass

- Forage ryegrass provides the basis for high quality forage sown on an annual basis. Forage ryegrass tolerates wet conditions better than oats and will produce 40 to 60% higher winter growth than perennial ryegrass.
- Requires high rainfall or irrigation to ensure spring production.
- May be direct drilled or broadcast into perennial pastures for winter feed. Kikuyu may need suppressing, cultivation, grazing or mulching if sowing is before April. Suppression of kikuyu with herbicide can lead to complete death of kikuyu which is undesirable for summer production.
- High nitrogen inputs are required when sowing into existing summer grass pasture.
- May be mixed with forage clovers, such as Persian and/or companion herbs such as plantain or chicory.
- May be broadcast, direct drilled or conventionally sown.

Sowing time

March–April is best for early feed. Irrigation may be needed for February sowing. Sow mid-March onwards for dryland. Can be sown until end of June but greatest benefit comes from early sowing.

Fertiliser

As for perennial ryegrass at sowing, see page 5. Top-dress with nitrogen 30-60 kg N/ha (e.g. 60 to 125 kg urea/ha) after every 2nd grazing while conditions are favourable for growth. Lower rates for dryland, higher rates where irrigation meets moisture demand.

Potassium can be broadcast after sowing or with nitrogen mixes e.g. 50/50.

What to sow	Seed rate kg/ha	Comments
Early-mid e.g. Tetila*, T-rex* Winter star II*, SF Sprinter	15-30	Higher sowing rates for tetraploids*
Mid season diploids e.g. Caversham, SF Sultan	15-30	
Later season e.g. Concord, Hulk, Crusader, Maverick Gold, Feast II, SF Indulgence	15-30	May persist more than one year in favourable conditions
See Primefact 1002 *Annual, Italian and Short Rotation Ryegrass varieties 2010* for full list of varieties		

Grazing management

- Graze when each ryegrass tiller has three leaves or when 15-18 cm high to avoid yellowing and death of lower leaves. Do not graze below 5 cm as this delays regrowth. Strip graze using back fences for best utilization and recovery. Interval between grazings depends on leaf emergence, ranging from 40 days in winter to 14 days in spring.
- Lock up until first sign of emerging seed heads or lodging if making silage in spring.
- Note in good springs later season varieties may delay the summer regrowth of kikuyu

BUFFER ZONE BESIDE RIVERS AND CREEKS

Aim to maintain a permanent grass or tree zone beside all watercourses.

This zone will help 'catch' eroded soil, manure and fertiliser before it gets into the waterway thereby reducing nutrient waste and helping to improve water quality.

Early autumn feed

Winter Cereals

AIM: To produce quick feed in autumn of high quality winter forage for one growing season.

- Oats provide earlier feed in autumn than forage ryegrasses but will run to head earlier in the spring.
- Oats may be more productive than ryegrass in lower fertility paddocks and more tolerant of rough seedbed conditions.
- May be direct drilled.
- Can be mixed with ryegrass or forage clovers to extend the spring production later in the year. Halve the seed rate of oats to avoid smothering the forage ryegrass.
- Coolabah oats is sensitive to acid soils.
- Barley is an alternative to oats but is very susceptible to very wet or acid soils. Barley is preferred by horses.
- Winter wheats such as Currawong or EGA Wedgetail can provide grazing and grain options with a higher grain value. Animals grazing wheat may need sodium supplement.
- Dual purpose triticale such as Endeavour and Crackerjack are more tolerant of acid soils.
- For more detailed information see the: *2011 Winter Crop Variety Sowing Guide.*

What to sow	Seed rate kg/ha	Comments
Oats e.g. Taipan*, Warrego*, Nugene*, Volta*, Eurabbie, Coolabah, Saia, Bimbil, Graza 80, Many others	Small seed 60-80 Large seed 100-140	Sow late Feb to early May *better rust tolerance
Barley e.g. Yambla, Dictator	60-90	Sow March-April

Sowing time

Sowing time for oats is dependent on the variety used (see table above). Sowing before recommended times can lead to premature heading and reduced grazing time.

Seed size affects sowing rate of varieties i.e. large seed has higher seeding rate

Fertiliser

As for perennial ryegrass at sowing, see page 5. As for forage rye's after sowing.

Grazing Management

- Graze when plants won't pull out, approximately 20 to 30 cm high or 6 leaves. Avoid yellowing and death of lower leaves. Leave 10 cm plus stubble for better regrowth.
- Expect poor regrowth if first grazing is delayed until a large bulk has grown and seed heads are developing in stems.

Forage Brassicas

- Forage brassicas are an alternative to oats and other winter cereals for early sowing (before soil cools enough to sow forage ryegrass)
- Low seed rates required due to small seed.
- Needs high fertility soil and good weed control to grow well.
- Watch for insects, especially caterpillars on leaves.
- High feed quality but low fibre means best grazed in rotation with grass pasture.
- Very sensitive to waterlogging
- Can be oversown with ryegrass at first grazing
- See Primefact *Forage Brassica for Autumn/Winter Milk Production* and Agfact P2.1.13 *Forage brassicas – quality crops for livestock production* for further information

What to sow	Seed rate kg/ha	Comments
Leafy turnip (*B. campestris)* eg. Pasja, Hunter, SF Pacer, Appin	3-4 0.5-1 in mixtures	Sow late Feb to late March for early grazing
Forage Rape *(B. Napus)* eg. Goliath, Winfred	As Above	

Fertiliser

As for perennial ryegrass at sowing, page 5. As for forage ryegrass after sowing, page 11.

Grazing Management

- Animals that have not grazed brassicas previously may take several days to become accustomed and graze well.
- Do not overgraze, leave at least 10cm stubble for leafy turnip. Try to graze leaf but not stem for forage rape.
- First grazing generally 6-7 weeks for leafy turnip when plant has 8 mature leaves and is approximately 50cm high.
- Forage rape slower/more mature at first grazing. May be 10 weeks when change of leaf colour occurs.
- Monitor for animal health issues.

Forage clovers

AIM: To produce high quality forage from April to November–December.

- Persian, Balansa, Berseem and Arrowleaf clover are *annual* legumes, which provide high quality legume forage. Normally sown each year.
- 'Maral' Persian types and Berseem are later maturing so can produce later season feed, provided moisture is available in late November – December. Irrigation is preferred.
- Balansa and 'Nitro' Persian types will flower and set seed mid-spring. They may regenerate from seed and can be sown with sub clover.
- Require good soil phosphorus to produce and inoculation with species-specific bacteria is recommended.
- Balansa is moderately tolerant of acid soils.
- Persian, Berseem and Balansa tolerate some waterlogging.
- Arrowleaf needs good drainage.
- When mixed with oats or ryegrass do not top-dress at high rates with nitrogen fertiliser if maximum benefit is to be obtained from clovers. Nitrogen top dressing will improve ryegrass growth when cold, wet conditions stop clover growth.
- Can be grazed or conserved as hay or silage in spring.
- May be slow to start. Sow early for greatest amount of feed.
- Bloat can be a risk with some clovers.

What to sow	Seed rate kg/ha	Comments
Persian late types e.g. Maral, Laser, **Persian early types** Nitro Plus, Prolific	6-10	Late types offer longer growing season in spring. Sensitive to acid soils.
Balansa e.g. Paradana, Frontier, Bolta	2-4	
Berseem eg. Elite 11	10-15	
Arrowleaf eg: Arrowtas, Zulu II	6-10	

Sowing time

Late February to April provides highest autumn winter feed. February sowing is subject to hot conditions during emergence so irrigation back up is preferred.

Fertiliser

20-40 kg/ha phosphorus e.g. 250-500 kg/ha superphosphate or equivalent. Add molybdenum potassium, and lime where needed.

BACKFENCING

Controlled grazing of forage crops or improved pasture ensures maximum pasture production and quality.

Ryegrass will start to regrow 2 to 3 days after grazing. Any damage to the plant, such as regrazing or slashing after this time, will delay regrowth and future grazing by 1 to 2 weeks.

Backfence if it takes more than 3 days to graze a paddock.

Fertiliser

Adequate fertiliser must be used to achieve high yields. A 5 t/ha crop removes 22 kg phosphorus and 64 kg nitrogen. Sow with 100 kg/ha DAP (cultivated ground) or equivalent. Additional fertiliser may be top-dressed.

What to sow	Seed rate kg/ha	When to sow
Triticale e.g. Bogong	90-120 (irrigation) 60-90 (dryland)	Sow early May to mid June
Wheat e.g. Brennan Currawong	60-100 (irrigation) 40-60 (dryland)	Sow April to mid May
Barley e.g.Tulla (tolerates acid soils), Binalong, Mackay	60-90 (irrigation) 50-60 (dryland)	Sow May to end June Sow May to early July
Oats e.g. Eurabbie, Quoll, Yarran	90-120 (irrigation) 60-90 (dryland)	Sow March to end June

Winter cereals for grain or silage

AIM: To use cereals for feed grain production, with potential for high spring silage yield.

- Certain varieties of barley, wheat, triticale, cereal rye and oats can all be grown for grazing and grain/silage. These varieties are listed in the previous forage crop section of this guide.
- Grain/silage only varieties are also available. The varieties listed here have the highest *stockfeed* grain yield potential.
- For more detailed information see:
  - » 2011 Winter Crop Variety Sowing Guide
  - » 2011 Weed control in Winter Crops (from NSW DPI offices or website)

The viability of growing local stockfeed grain depends on grain prices in the traditional grain growing areas.

- Triticale is most tolerant of acid soils while barley is least tolerant. Varieties vary in tolerance to acid soils.

Sowing time

Sowing time is critical. All winter cereal varieties have specific sowing times. Sow too early and you risk premature heading and frost damage to seed heads. Sow too late and a dry spring will decrease yield. Grazing will delay heading but may affect regrowth.

For further information on pastures

This guide provides only a brief summary of information on suggested pasture species, varieties, sowing times, seed rates and a general guide to fertiliser rates. Consult your agronomist for more specific information. More detailed publications are available on the website or for sale.

Website address: www.dpi.nsw.gov.au/agric
Select *Field Crops and Pastures*, then select *Pastures*, then *Pasture Planner* for detailed information on each species mentioned. Browse the site for additional information.

Dairy link and dairy check

A series of handbooks and workshops for groups of dairy farmers covering:

- Establishing Pastures
- Managing Pastures
- Growing Heifers
- Realistic Rations

See www.dpi.nsw.gov.au

PROfarm

A wide range of short courses are now available under the Department of Primary Industries PROfarm program. Courses include:

Weekend short courses

- Introduction to pastures
- Soil and fertilisers
- Chainsaws
- Weeds
- Managing improved pastures
- Safe use of tractors
- Prograze Abridged
- Fencing
- Farm chemicals
- Cattlecare

For more details contact your local Department of Primary Industries office or phone 1800 025 520 or (02) 4939 8881 or www.tocal.nsw.edu.au/courses

Prograze

A series of workshops for beef producers covering:

- Pasture assessment;
- Livestock production from pastures;
- Cattle condition scoring;
- Cow breeding; and
- Pasture and grazing management & more!

Topfodder Silage

A 3 day course covering all aspects of fodder conservation with emphasis on silage. Includes:

- Principles of making silage
- Crop/pasture selection
- Making, storing, feeding silage
- Economics of fodder conservation

Landscan

Landscan will give you skills to:

- Understand soil test results
- Assess paddock potential
- Understand your landscape limitations
- Choose the right pastures for different landscapes
- Understand and manage soil fertility, acidity and salinity
- Match livestock requirements with landscape variability
- Prioritise inputs and management for production and sustainability

Feed Quality Service

Available from NSW DPI, Wagga Wagga. Contact our Customer Service Centre 1800 675 623 for further details.

Soil Testing Service

Available from NSW DPI or visit www.dpi.nsw.gov.au/aboutus/services/das/soils for further details.

For further information contact:

Neil Griffiths, District Agronomist, Tocal, Paterson
Phone: (02) 4939 8948

Peter Beale, District Agronomist, Taree Phone: (02) 6552 7299

Ashley Senn, District Agronomist, Richmond
Phone: (02) 4588 2111

Always read the label

Users of agricultural or veterinary chemical products must always read the label and any permit, before using the product, and strictly comply with the directions on the label and the conditions of any permit. Users are not absolved from compliance with the directions on the label or the conditions of the permit by reason of any statement made or not made in this publication.

Pasture improvement cautions

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

The *Native Vegetation Act 2003* restricts some pasture improvement practices where existing pasture contains native species. Inquire through the NSW Office of Environment and Heritage for further details.

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