

## Pasture species and cultivars used in New Zealand – a list

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### Abstract

In recent years, the number of pasture species and cultivars commercially available to farmers in New Zealand has increased significantly. Reasons for this include increased commercial activity in the development and supply of proprietary cultivars, and more specialisation in New Zealand's pastoral agriculture. In particular, pasture cultivars are increasingly marketed as proprietary products with associated technical support. This year there are 109 certified cultivars available, belonging to 23 grass, legume and herb species.

As a result, farmers are now able to develop improved pasture feed supply, but they are somewhat confused about pasture species and cultivars, and this frustrates their aims to produce high quality animal products from productive pastures. Accordingly, the herbage seeds industry needs to work from a clear reference list, to avoid any confusion when supplying farmers and overseas clients with their seed requirements. Our list of pasture species, types and cultivars available within New Zealand aims to be that reference.

**Keywords:** birdsfoot trefoil, brome grass, caucasian clover, chicory, clover, cocksfoot, cultivars, herbs, lotus, lucerne, pasture, phalaris, plantain, prairie grass, red clover, ryegrass, seeds, species, strawberry clover, sub clover, tall fescue, timothy, types, white clover, Yorkshire fog

### History of pasture cultivar development

During the past century, New Zealand has developed pasture species and cultivars that work well on the farm. Since European settlers imported exotic pasture seeds, mainly from Europe, new and effective types have been developed in particular regions. Early examples of such types include Hawke's Bay perennial ryegrass, Akaroa cocksfoot and Southland timothy. These types, developed through particular farming practices, performed well on New Zealand farms and were also exported.

During the post-war boom, New Zealand farmers demanded better pastures to meet feed demands for primary production, and plant breeders, then exclusively

government employees, bred the well-known Grasslands range of pasture species and cultivars, which were grown under MAF certification and used in all New Zealand farming regions. They also formed the basis of an increasing seed export industry, now supplying more than 40 countries and earning over \$40 million annually (Rolston *et al.* 1990).

Private breeding began with the development of Ellett perennial ryegrass (released in the late 1970s), and was soon undertaken by several seed companies, who also became the marketing agents for Grasslands proprietary cultivars when Plant Variety Rights legislation was established in New Zealand.

Since the 1930s, farmers have used almost exclusively only two pasture species – perennial ryegrass and white clover. These plants perform well in most situations, especially when they are liberally fertilised, and withstand a wide range of farm management skills. However, it became obvious to pasture scientists during the 1960s that other pasture species offered potential, and plant breeders began improving alternative grasses, legumes and grazing herbs. These were released as named cultivars during the 1970s and 1980s and have greatly extended the range of pasture seeds available to the farmer.

The introduction of Plant Variety Rights legislation in 1973 further encouraged the development of improved cultivars, especially ryegrasses. Many new cultivars and several new pasture species have been introduced in recent years. In addition, the understanding of endophyte effects on ryegrass, the development of non-chemical farming systems and several extreme weather events and pest invasions, have exposed the limitations of traditional species.

It is little wonder that farmers, seed retailers and other interested people have increasingly sought advice on pasture renovation decisions. As proprietary marketing of pasture species and cultivars has rapidly expanded in the past decade, the flow of technical information to support sales has greatly increased. In turn, this has led to further confusion in the farmer's mind – what to believe, what to mix, and what to sow.

### Pasture seeds mixtures

The question of how diverse to make a seed mixture will depend to a certain extent on what a farmer wants

to use the pasture for, and the particular situation – the paddock’s ecological conditions, especially its soil type and fertility level, and the grazing pressure likely to be applied.

Under moist, fertile, intensely grazed conditions it is likely that one or two species will dominate, usually perennial ryegrass and white clover, so the mixture can be kept simple. Complex pasture seeds mixtures are of greater value on less fertile soils or pastures prone to moderate drought, than in highly fertile pastures (Campbell 1990). These may include two or three compatible grasses mixed with two or more white clover cultivars, some larger-leaved than others, and possibly red clover and herbs, such as chicory (Charlton & Belgrave 1992). The use of complex mixtures can extend seasonal growth, help minimise weed invasion, enhance production, and provide a more varied livestock diet where required.

### Why this list?

In publishing the appended *List of Available Species and Cultivars*, we aim to give interested parties an objective guide to cultivar types.

We have compiled a list of the species that are commercially available as certified seed, and have outlined the characteristics, value and use of each species. The main types within each species are described, with the cultivars listed within each type

category. Some minor cultivars may not be included when there is insufficient information to classify them into a type. The list will be amended in future years, as new information becomes available.

We propose that the New Zealand Grassland Association publishes this list updated annually or as deemed necessary. The authorship will evolve over time, but should include personnel with objective views – the draft will be refereed in any case.

It is the prime intention that this will be a neutral descriptive list – not a “recommended list”. The description will improve as objective information becomes available, and to accommodate any useful suggestions received.

We have listed the breeder and marketing agent. Most commercially available cultivars have been bred in New Zealand, but where the cultivars have been bred overseas, and especially in Northern Europe, they may be more winter dormant and less suited to our conditions than those bred locally.

We feel that the *New Zealand Grassland Association’s Annual Proceedings* is a neutral medium for such a list, which is in demand throughout the pastoral farming industry. The list should further stimulate discussion and comment from members at conferences and on other occasions.

We welcome comments and suggestions to improve its content so that it remains a useful working reference for pastoral farming personnel.

## LIST OF PASTURE SPECIES AND CULTIVARS USED IN NEW ZEALAND

### 1. GRASSES

#### **PERENNIAL RYEGRASS** (*Lolium perenne* L.)

This is the most widely used temperate grass in New Zealand as it grows well in a wide range of fertile situations, is easy to establish and manage, and usually forms a compatible mixture with white clover and several other pasture species.

Perennial ryegrass requires moist fertile conditions and is able to withstand treading and hard grazing. However, it performs poorly during hot dry conditions, when many deeper-rooted grasses may maintain production. It is also prone to infection by crown and stem rust disease, which lowers its production and feed quality, especially during slow growth periods in humid summers.

#### **Endophyte in ryegrass**

Perennial ryegrass may contain a “live-in” fungus, endophyte, which produces three major known toxins within the ryegrass plant, especially near the shoot base and seedheads:

- *Peramine* deters attack and feeding by Argentine stem weevil and some other pests, and greatly enhances ryegrass persistence throughout much of New Zealand, except cool moist regions such as Southland, the West Coast and inland South Island areas.
- *Lolitrems* B causes ryegrass staggers in grazing animals. Levels vary throughout the year, but usually reach danger levels around late December in dryland regions, and can remain so until late autumn.
- *Ergovaline* causes heat stress and blood circulation problems. Levels also vary considerably during the year, becoming highest during summer. Ergovaline can affect livestock when levels are as low as 0.5 ppm, though they peak at around 2 ppm.

These endophyte toxins are present in fresh pasture, and are known to survive in pasture conserved as hay. Farmers relying on perennial ryegrass pastures for feed have the following options with regard to endophyte:

- Use endophyte-free pasture species where applicable. If sowing endophyte-free perennial ryegrass pastures, budget for frequent resowing – every 1–5 years, depending on the district.
- Dilute the endophyte effect by adding some toxin-free species such as cocksfoot, brome grasses, timothy or phalaris, legumes such as white clover and red clover, and grazing herbs (chicory or plantain).
- Grow paddocks to span the summer-early autumn danger period, which contain endophyte-free special-purpose species – tall fescue, lucerne, brassica crops and chicory mixtures.
- There is variation in endophyte toxicity between strains of endophyte in ryegrass cultivars. Cultivars with a less toxic endophyte may enhance animal performance (Bluett *et al.* 1997) and, in the future, cultivars may be available with endophyte strains that produce the pest-resisting toxin, peramine, but no lolitrems B or ergovaline, the toxins causing animal disorders. These types have been inoculated into several ryegrass cultivars and are currently being animal-tested before commercial release. However, care will be needed with new sowings to ensure that the soil is free of ryegrass seed containing wild endophyte. Improved ryegrass palatability, because of the less toxic endophyte content, may possibly make these pastures more prone to damage from overgrazing.

Perennial ryegrass is normally used in all New Zealand livestock farming systems. However, low-endophyte types are used more for deer and horse pastures, as these animals are more sensitive to ryegrass staggers, and in the southern South Island where Argentine stem weevil is not a significant pasture pest.

The usual sowing rate in a mixture for diploid ryegrasses is 20–25 kg/ha, which may be reduced if other grasses are added to the mix. The larger seeded tetraploids require 25–30 kg/ha.

#### **Cultivar types**

Perennial ryegrass cultivars are usually classified into types according to flowering time. Seedhead emergence is associated with the spring growth flush, and early-heading cultivars are more productive in August–September

than later-heading types. However, a decline in feed quality is associated with this seedhead development, hence later flowering types will retain their leafiness and pasture quality longer.

Cultivars also vary according to their chromosome number – there are diploid and tetraploid types. Perennial and annual ryegrasses occur naturally only as diploid plants, with a standard set of 14 chromosomes in each cell. Pasture plant breeders have doubled the chromosome number to form tetraploid types, which are larger plants with bigger cells, more water content and larger seed. They differ from diploids in some major features and are generally preferred more than diploids by grazing animals (van Bogaert 1975).

In pastures of similar digestibility levels, tetraploid ryegrass cultivars have often, but not always, been shown to increase animal intake by up to 3–4%, with a similar improvement in animal production. Using tetraploids can also improve stocking rate by up to 8%, provided the tetraploid cultivars perform similarly to diploids agronomically (Hageman *et al.* 1993; Vipond *et al.* 1993). However, tetraploid ryegrasses require high soil fertility levels, adequate moisture and lax grazing management for best results.

### Perennial ryegrass types and cultivars

Cultivar	Breeder/marketing agent	Endophyte status
<b>Very early flowering, diploid</b>		
Meridian	NZ Agriseeds	HE/LE*
<b>Early flowering, diploid (the standard type used historically throughout New Zealand)</b>		
Aires HD	Wrightson	HE/LE
Banks	Wrightson	HE/LE
Bronsyn	NZ Agriseeds	HE/LE
Ceres Kingston	PGG	HE/LE
Ceres Marathon	PGG	HE/LE
Dobson	NZ Agriseeds	HE/LE
Ellett	NZ Agriseeds	HE/LE
Embassy	Wrightson	HE/LE
Grasslands Nui	AgResearch/Public	HE/LE
· Grasslands SuperNui**	AgResearch/Agricom	HE
· Grasslands ZeroNui**	AgResearch/Public	LE
Grasslands Pacific	AgResearch/Wrightson	HE/LE
Grasslands Ruanui	AgResearch/Public	LE
Grasslands Samson	AgResearch/Agricom	HE/LE
Vedette NZ Agriseeds		HE/LE
Yatsyn 1	NZ Agriseeds	HE/LE
<b>Early flowering, tetraploid</b>		
Nevis	NZ Agriseeds	HE/LE
<b>Late flowering, tetraploid</b>		
Quartet	Wrightson	HE/LE

\* HE = seed with high endophyte (over 70% at harvest). LE = seed with low endophyte (under 5% at harvest). (Endophyte status of cultivars provided by seed companies but this may vary between years and with seed storage.)

\*\* Different brands of *Grasslands Nui*, marketed with either high or low endophyte content.

### HYBRID RYEGRASS (*Lolium × boucheanum* Kunth syn. *L. hybridum* Hausskn.)

Hybrid ryegrasses are bred from perennial ryegrass and Italian ryegrass to combine the best features of both parent species.

They range from types that resemble Italian ryegrass more (traditionally known as short-rotation ryegrasses), with high yields of larger-leaved forage, persisting from 1–4 years, to types almost as persistent as perennial ryegrass (traditionally called long-rotation ryegrass). Some cultivars may contain the same endophyte as described for perennial ryegrass.

Hybrid ryegrasses are frequently added to perennial pasture seed mixtures to provide increased winter production during the first few years and to boost animal performance in cooler regions (Ryan & Widdup 1997). They can be sown as the sole grass component into cultivated seedbeds at 20–30 kg/ha or added to perennial pasture mixtures at 5 kg/ha.

Hybrid ryegrasses are commonly sown in late summer/autumn to provide increased winter/early spring production.

### Perennial-type hybrids (traditionally called long-rotation ryegrass)

The perennial-type hybrids usually contain more perennial than Italian ryegrass in their breeding and show improved winter growth over that of perennial ryegrass, at the cost of reduced persistence. Winter yields are typically 50–70% of Italian ryegrasses and their persistence averages 3–5 years. However, this varies from 1–2 years in dry conditions to more than 10 years in moist, pest-free situations, especially when rotationally-grazed. The original cultivar of this type was Grasslands Ariki.

### Perennial-type hybrid ryegrass types

Cultivar	Breeder/marketing agent	Endophyte status
<b>Early flowering, diploid</b>		
Grasslands Marsden	AgResearch/Marsden Growers	LE
Grasslands Supreme <sup>Plus</sup>	AgResearch/Agricom	HE/LE
<b>Mid-season flowering, diploid</b>		
Grasslands Impact	AgResearch/NZ Agriseeds	HE/LE
<b>Early flowering, tetraploid</b>		
Ceres Horizon	PGG	HE
Grasslands Greenstone	AgResearch/Agricom	LE/ <i>Endosafe</i> *

\* *Endosafe*<sup>TM</sup> is an endophyte strain producing peramine, but no lolitrem B. Its ergovaline level usually remains below danger level in this cultivar when kept topped and leafy (L.R. Fletcher, pers. comm.).

### Italian-type hybrids (traditionally called short-rotation ryegrass)

The Italian-type hybrids usually contain more Italian ryegrass than perennial ryegrass in their genetic make-up and can grow almost as much as Italian ryegrasses during winter, but with enhanced persistence.

Typically, their winter yield is 70–90% of Italian ryegrasses and their persistence averages 2–3 years, though this varies from 1 year in dry conditions to more than 3 years in moist, pest-free situations. The original cultivar of this type was Grasslands Manawa, originally known as H1.

### Italian-type hybrid ryegrass types

Cultivar	Breeder/marketing agent	Endophyte status
<b>Diploid</b>		
Ceres Geyser	PGG	HE/LE
Grasslands Manawa	AgResearch/public	LE
Maverick Gold	Wrightson	HE/LE
<b>Tetraploid</b>		
Ceres Galaxy	PGG	LE

### ITALIAN RYEGRASS (*Lolium multiflorum* L.)

This species is an erect, large-leaved ryegrass that produces heavy yields of high quality forage for up to 3 years. Westerwolths (or Westerwolds) ryegrass is an annual type within the species, used between crops and for temporary cool-season feed. It is usually sown in autumn and persists until early summer. If sown in spring, this type will quickly develop seedheads.

This grass is commonly sown in high fertility areas during late summer/early autumn to provide extra winter and early spring production.

Italian ryegrass is usually sown into cultivated seedbeds at 20–30 kg/ha, but larger-seeded tetraploid types should be sown at higher rates, 30–35 kg/ha. Using heavier sowing rates and sowing earlier will boost production during the first few autumn grazings.

Annual types will generally persist only until flowering and seed set in early summer. Some biennial types may persist through moist summers to provide productive pasture in the second winter and spring. Endophyte-related livestock disorders are not problems in Italian ryegrass. Perennial ryegrass endophyte is not present in any Italian ryegrasses, but some may contain the annual ryegrass type, which provides resistance to Argentine stem weevil only during seedling emergence – this is not associated with any animal health problems (Latch *et al.* 1988).

Tetraploid types have been developed in the past 40 years. They are larger plants that perform best under high fertility, moist conditions and in longer rotations. Grazing animals tend to prefer tetraploid plants and this can increase feed intake, improving animal performance.

### Italian ryegrass types

Cultivar	Breeder/marketing agent
<b>Diploid</b>	
Ceres Crusader	PGG
Concord	Wrightson
Conker	Wrightson
Corvette	AgResearch/Wrightson
Cordura	Wrightson
Exalta	UK/Cropmark
Flanker	Agri-seeds
Marbella <sup>Sud</sup>	Wrightson/Agricom
<b>Tetraploid</b>	
Grasslands Moata	AgResearch/Public
Feast	Wrightson

### Annual ryegrass types (Westerwolths or Westerwolds)

Cultivar	Breeder/marketing agent
<b>Diploid</b>	
Ceres Progrow	PGG
<b>Tetraploid</b>	
Grasslands Tama	AgResearch/Public
Andy	France/Cropmark

### COCKSFOOT (*Dactylis glomerata* L.)

Cocksfoot is a productive, drought-tolerant grass that grows strongly during summer. However, it can become unacceptable to stock if not regularly grazed, becoming coarse and unpalatable. It is slower to establish than perennial ryegrass.

It is a valuable grass in drier situations of moderate fertility and is suited to light and free-draining soils.

Cocksfoot is endophyte-free, so can be safely grazed during summer. However, its forage quality is lower than that of perennial ryegrass and can be particularly poor when seedheads are present. Grazing control should aim to prevent excessive seedhead development. Under dry conditions cocksfoot may dominate white clover to such an extent that pastures become protein-deficient, unproductive and unpalatable (Moloney 1993).

Cocksfoot mixes well with perennial ryegrass and phalaris but the dense types can be too aggressive, especially when mixed with tall fescue. Recently introduced cultivars have good rust disease resistance and once established, cocksfoot is pest tolerant.

Sow cocksfoot at 1–2 kg/ha in mixtures with other grasses or 4–8 kg/ha as the sole grass with clover. Sowing into warmer soils (February–March) is recommended to hasten seedling establishment.

### Types

Cocksfoot cultivars vary in tiller density. Two types have been developed – the traditional coarse, erect types, and denser types that can withstand close, continuous grazing by sheep. One new cultivar, a cross between the two types, is semi-erect.

The dense types, originating from NW Spain, are classified as subspecies *izcoi* (Ortiz & Rodriguez-Oubina 1993), whereas traditional types are usually classified as subspecies *glomerata*, or hybrids between subspecies *glomerata* and *lusitanica*, the latter originating in Portugal. Cocksfoot cultivars are also classified according to flowering date.

### Cocksfoot types

Cultivar	Breeder/marketing agent	Flowering time
<b>Erect types</b>		
Grasslands Kara	AgResearch/PGG	Mid-season
Saborto	UK/Wrightson	Mid-season
<b>Semi-erect types</b>		
Grasslands Vision	AgResearch/Cropmark	Mid-season
<b>Dense types</b>		
Grasslands Tekapo	AgResearch/Wrightson	Early
Grasslands Wana	AgResearch/Cropmark	Late
Grasslands Excel	AgResearch/Cropmark	Late

### TALL FESCUE (*Festuca arundinacea* Sch.)

Tall fescue is a deep-rooted, perennial grass that is productive and drought tolerant, best suited to high fertility and heavy or wetter soils. It also withstands acid, alkaline soils and poor drainage. It requires high soil fertility levels and responds well to nitrogen (Milne *et al.* 1998). It is useful in dry conditions as a special-purpose summer pasture, growing well in all seasons, especially summer and autumn. It is becoming increasingly popular as an alternative to ryegrass-based mixtures in drier regions and where subtropical grass invasion is an increasing problem. Endophyte is not present in tall fescue seeds sold in New Zealand, but wild tall fescue usually contains an endophyte that can be toxic when grazed by livestock.

Grazing control in spring should be more frequent to prevent excessive seedhead development, as stemmy pastures grow poor quality feed. Seedheads are difficult to remove by grazing.

Tall fescue is usually sown as the sole grass component with clover, or with low rates of erect cocksfoot types or phalaris. It should never be sown in mixtures with ryegrass as ryegrass dominates and fescue soon disappears. Sow tall fescue at 15–30 kg/ha with clover. Insecticide treated seed will provide protection against the common pest, Argentine stem weevil. The seed establishes faster in warm soils, so tall fescue-based mixtures should be sown in February–March, or in September–October.

### Types

Cultivars vary in their flowering time, even more than perennial ryegrass. Early-flowering types grow well in August–September but their quality declines earlier than later-flowering types as seedheads develop. Cultivars also vary in establishment rate but, in comparison with ryegrass, all would be rated as slow.

In addition, cultivars vary in tiller density. Traditional types are larger and have more broad foliage than perennial ryegrass, while some are as fine-leaved as perennial ryegrass. Broad-leaved types suit rotational grazing, whereas the fine-leaved dense types can withstand close continuous sheep grazing.

One cultivar has an ability to spread by rhizomes, although this may take several years to be apparent in grazed pasture. Spread is greater in sandy or free-textured soils and when cultivars are under lax grazing management to allow vigorous growth through the summer–autumn (Stewart 1997). Two cultivars offer some winter growth activity.

## Tall fescue types

Cultivar	Breeder/marketing agent
<b>Very early-flowering, broad-leaved</b>	
AU Triumph	USA/Wrightson
Dovey	UK/NZ Agriseeds
Grasslands Fletcha	AgResearch/Agricom
<b>Early flowering, broad-leaved</b>	
Grasslands Advance	AgResearch/Agricom
Vulcan	Wrightson
Lunibelle	France/Cropmark
<b>Mid season flowering, fine-leaved, rhizomatous</b>	
Ceres Torpedo	PGG

## BROME GRASSES

- PRAIRIE GRASS** (*Bromus willdenowii* Kunth syn: *B. catharticus* Vahl., syn *B. unioloides* H.B.K)
 

Prairie grass is a large-leaved, large-tillered, short-lived, perennial grass from South America. It offers excellent winter/early spring growth and drought tolerance, and is commonly used as special-purpose pasture for quality winter and summer feed. Unlike most other grasses, its large-seeded panicle flowerhead is palatable to grazing stock. Prairie grass provides productive high quality pasture for 2–4 years.

It thrives only on fertile free-draining soils with a pH level above 5.5 and will not tolerate waterlogged conditions, pugging or soil acidity. Prairie grass is prone to attack by hessian fly in northern North Island regions, but is suitable for use in drier eastern regions of both North and South Islands.

Seeds are large and require fungicide dressing for protection against head smut disease. Prairie grass is usually sown at 25–30 kg/ha. De-awned seed is available for easier sowing.

### Prairie grass types

Cultivar	Breeder/marketing agent
Ceres Atom	PGG
Grasslands Matua	AgResearch/Rosevear

- GRAZING BROME** (*Bromus stamineus* Desv.)
 

Grazing brome is a perennial grass closely related to prairie grass, with good winter growth but finer-leaved and finer-tillered, giving it good tolerance to close grazing. Grazing brome is best suited to medium to light land where it produces a high quality persistent pasture with strong winter growth and drought tolerance.

It is suited to close grazing in dry East Coast regions, where it is useful as a special-purpose pasture for quality winter and summer feed. Its useful range includes the free-draining, less fertile soils along the east coast, and extending inland until low winter temperatures reduce its cool-season advantage.

Grazing brome requires close frequent grazing to perform well, and fails to persist on wet, heavy soils and when attacked by hessian fly in the northern North Island. Unlike prairie grass, however, grazing brome is resistant to head smut.

The sowing rate of grazing brome is usually 25–30 kg/ha. De-awned seed is available for easier sowing.

Cultivar	Breeder/marketing agent
Grasslands Gala	PGG-AgResearch/PGG



- **PASTURE BROME** (*Bromus valdivianus* Phil.)

Pasture brome is a medium tillered, perennial brome grass species that is more persistent than prairie grass under grazing. It provides strong spring–summer growth with drought tolerance but only moderate winter growth. It is persistent on fertile, free-draining soils. Like other brome species, it does not tolerate waterlogging or pugging, but it may tolerate higher rainfall conditions than other brome grasses. Unlike prairie grass, however, pasture brome is resistant to head smut.

It is suited to dry East Coast and inland regions, where it is useful as a special-purpose pasture for quality summer feed.

The sowing rate is 25–30 kg/ha. De-awned seed is available for easier sowing.

Cultivar	Breeder/marketing agent
Bareno	NZ Agriseeds

- **UPLAND BROME** (*Bromus sitchensis* Trin.)

Upland brome is a tall, erect, broad-leaved short-lived perennial brome grass, similar to prairie grass, but differing from it by having low winter growth and stronger summer production. It has the potential to provide large quantities of nutritional forage in flat to rolling dry upland areas with cold winters and warm summers.

Seeds are large and require fungicide dressing for protection against head smut disease. Upland brome is usually sown at 25–30 kg/ha. De-awned seed is available for easier sowing.

Cultivar	Breeder/marketing agent
Grasslands Hakari	AgResearch/Wrightson

- **SMOOTH BROME** (*Bromus inermis* Leyss.)

An erect-growing, perennial brome grass species with broad leaves and few tillers. Unlike the other bromes, smooth brome spreads by rhizomes to give a thick persistent pasture that tolerates severe grazing. This grass grows best in high country regions with cool winters and hot summers. Smooth brome is usually sown at 15–25 kg/ha – use fungicide-treated, de-awned seed.

Cultivar	Breeder/marketing agent
Grasslands Tiki	AgResearch/Wrightson

### **TIMOTHY** (*Phleum pratense* L.)

Timothy is a perennial grass that is late to start spring growth, is later-flowering than ryegrasses, and has low drought tolerance. Timothy provides a high quality pasture and is very palatable. It retains its quality even when in the seedhead stage and produces high quality summer hay.

Timothy is often added to pasture mixtures in moist southern or inland regions – it best suits moist heavy soils in the cool-temperate regions. It can be a valuable addition to pasture mixtures intended for lax grazing, but otherwise tends to be a minor component because of its high palatability and lower competitive ability. It has performed well in milk production trials (Johnson & Thomson 1996).

Timothy is sown at 6–8 kg/ha as a sole grass with clover, or at 1–3 kg/ha in mixtures.

It should also be noted that erect hay-type cultivars of Northern Hemisphere origin, particularly from cold winter climates such as Canada and Scandinavia, are often available in New Zealand. Research over 60 years has consistently shown that these are less productive and persistent under New Zealand grazed conditions than the original New Zealand bred cultivar, Grasslands Kahu (Corkill 1949; Gorman 1950a, 1950b; Caradus 1978, 1988; Maunsell & Scott 1996).

## Timothy types

Cultivar	Breeder/marketing agent
<b>Early-flowering (late compared with ryegrass)</b>	
Grasslands Charlton	AgResearch/Agricom
Ceres Viking	PGG
<b>Late-flowering (extremely late compared with ryegrass)</b>	
Grasslands Kahu	AgResearch/Public

## PHALARIS (*Phalaris aquatica* L.)

Phalaris is a hardy perennial grass that performs best in drier soils of moderate fertility. It withstands hard grazing and treading once established, has excellent pest resistance and is reputed to deter grass grub feeding, thereby helping to protect companion grasses and legumes. It grows best during autumn and early winter, so can be included in mixtures with ryegrass (spring growth) and cocksfoot (summer/winter growth), or with tall fescue and clovers.

**NB.** *Phalaris can cause staggers in grazing stock.* This is more severe on cobalt-deficient soils such as volcanic ash in the Central Plateau, and on recent alluvial silt and stony loams. Check the cobalt soil status in low and marginal areas before sowing phalaris. Phalaris dominant pastures may also occasionally cause sudden death in livestock. Care must be taken with the use of all cultivars, even those bred for lower toxicity.

Phalaris should always be sown in mixtures with other grasses – ryegrass or tall fescue, cocksfoot or brome grasses. It is recommended to include 1 kg/ha in pasture mixtures for dry regions. As with several other grasses, it germinates more rapidly in warmer soils so February–March, or September–October sowings are recommended.

Cultivar	Breeder/marketing agent
Grasslands Maru	AgResearch/Agricom

## YORKSHIRE FOG (*Holcus lanatus* L.)

A common perennial grass species in wet conditions and on infertile, acidic soils, or those with high aluminium levels. It is a dense, hairy grass that becomes dominant unless closely grazed.

Yorkshire fog is used for erosion control, roadside revegetation, and in forestry to revegetate logged areas. In pastures it must be managed to prevent a buildup of dead matter in the pasture base. The species contains flavanoids and tannins at a low level. Rust disease is less prevalent in commercial cultivars.

## Yorkshire fog types

Cultivar	Breeder/marketing agent
Massey Basyn	Massey University/Wrightson
Melita	NZ Agriseeds

## 2. LEGUMES

### WHITE CLOVER (*Trifolium repens* L.)

White clover is New Zealand's most important forage plant. It fixes nitrogen in pastures and provides high quality herbage. It is grown widely throughout New Zealand and performs well on moderate to highly fertile soils, but can be less satisfactory in dry situations.

White clover is a perennial legume that spreads by creeping stolons and naturally reseeds itself, especially when laxly grazed during summer. The original seedling crown and root is replaced within a few years by plants developed from rooted stolons. Plants with high stolon density tend to persist best.

White clover should be sown in most seed mixtures at 3–5 kg/ha. Two or three different types are often mixed together to maintain good clover content for grazing and nitrogen fixation.

### TYPES

White clover is classified according to leaf size and this feature is linked with several other important features. Large leaves are normally associated with upright plant growth, thicker stolons, larger roots and flowerheads, but with fewer stolons and a lower stolon density. Productivity is similar for each white clover type under its appropriate grazing management – lax infrequent grazing for large-leaved types and close frequent grazing for small-leaved types.

Large-leaved types, often called Ladino clover, grow taller and upright, and have thick stolons and robust roots. These types would be used in taller, rotationally grazed pastures, particularly those grown for dairying. Although productive in these pastures, large-leaved types have fewer stolons and hence a lower capacity to regenerate and persist. The stolons are also more prone to being removed by grazing, because of their large size. For this reason, mixing these types with medium-leaved types can increase persistence of the species, especially in closer-grazed pastures.

Medium-leaved types are intermediate in features. The original Grasslands Huia, typical of this type, has been used widely throughout New Zealand in general-purpose pastures. These types perform well under a range of grazing managements, except under close continuous grazing where they are surpassed by the small-leaved types, and under lax grazing, where large-leaved types are better (Caradus *et al.* 1995).

Small-leaved types are low-growing, with many small leaves and thin, multi-branched stolons. Their low-growing habit and high stolon density make it difficult for grazing animals to remove them and this gives them excellent tolerance to severe defoliation. They are best used under close, continuous grazing, particularly by sheep.

The seasonal growth pattern of white clover varies – some cultivars have been bred for increased cool-season growth in warmer regions. Disease and pest tolerance also differs among cultivars. Unlike some overseas cultivars, New Zealand cultivars usually contain high levels of cyanogenic glucoside compounds. These compounds may give greater tolerance to some pests in New Zealand and are not considered to be detrimental for grazing animals under normal circumstances.

### White clover types

#### Large-leaved

Cultivar	Breeder/marketing agent
Aran	Ireland/ NZ Agriseeds
Grasslands Challenge	AgResearch/Wrightson
Grasslands Kopu	AgResearch/Wrightson
Grasslands Pitau	AgResearch/Public
Grasslands Sustain	AgResearch/NZ Agriseeds
Le Bons	Wrightson

## Medium-leaved

Cultivar	Breeder/marketing agent
Grasslands Demand	AgResearch/Cropmark NZ
Grasslands Huia	AgResearch/Public
Grasslands Prestige	AgResearch/PGG
Grasslands Nusiral	AgResearch/Agricom

## Small-leaved

Cultivar	Breeder/marketing agent
Grasslands Tahora	AgResearch/Wrightson
Prop	AgResearch/NZ Agriseeds

### RED CLOVER (*Trifolium pratense* L.)

Red clover is a tap-rooted plant with dull, hairy foliage, usually bearing a distinct leaf mark. It is slower to flower than white clover. Red clover has large flowerheads comprising long florets that are pollinated by long-tongued bumblebees and, to a lesser extent, by honeybees.

Red clover usually persists 2–4 years in mixed pastures, although it may last up to 7 years under more favourable conditions. It is best suited to lax grazing or where a long summer grazing rotation is used. It does not tolerate hard, continuous grazing regimes.

Red clover is excellent for use in fertile pasture situations, even on drier soils, mixed with grasses, other legumes and grazing herbs. It conserves well as silage and hay. The species is highly preferred by deer, but is acceptable to all stock. Red clover is often included with white clover in pasture mixtures throughout New Zealand and performs well on soils that are moderately to highly fertile. It grows well during summer and is often included for hay pastures in moist regions. In drier regions, its deep rooting and summer growth provide superior production to white clover during dry summers and its herbage carries the lowest levels of the fungal spores causing facial eczema in livestock.

Red clover can contain up to 1% of oestrogenic compounds. Oestrogen levels can lower ewe fertility when red clover is grazed for flushing, but the recent cultivars contain much lower levels of formononetin, the oestrogen responsible for this problem. However, these compounds also improve red clover's tolerance to pests such as grass grub and black beetle (Sutherland *et al.* 1980). Cultivars with lower phyto-oestrogen levels are now available.

Red clover is usually sown in mixtures at 4 kg/ha, but tetraploid types must be sown at heavier rates because the seeds are larger. The species must be established well, as it does not reseed readily.

Cultivars are usually divided into early- and late-flowering types. Early types not only flower earlier but usually commence spring growth earlier. Cultivars can also be either diploid or tetraploid. Tetraploid types are often larger plants with larger leaves. Their larger floret size often makes pollination more difficult for bees and, as a consequence, seed yields are frequently lower.

A spreading type has recently become available. This has an ability, under lax grazing, to develop some daughter plants from the nodes of horizontal shoots. If enough daughter plants establish, they can effectively replace the parent crown when it dies, forming a self-perpetuating, persistent red clover component. Its spreading ability is much like that of white clover but is usually much less effective. Even when conditions for daughter plant establishment are not ideal, this type shows an enhanced persistence. Such types are usually prostrate rather than erect, and are of more value under grazing, rather than for hay.

## Red clover types

Cultivar	Breeder/marketing agent	Comment
<b>Early diploid types</b>		
Grasslands Colenso	AgResearch/PGG	medium oestrogen
Grasslands Hamua	AgResearch/public	higher oestrogen
<b>Early, spreading type</b>		
Astred	Australia/Wrightson	lower oestrogen
<b>Late diploid type</b>		
Grasslands Turoa	AgResearch/public	higher oestrogen
<b>Late tetraploid types</b>		
Grasslands G27	AgResearch/Agricom	lower oestrogen
Grasslands Pawera	AgResearch/public	higher oestrogen

## LUCERNE (Alfalfa) (*Medicago sativa* L.)

An erect growing, drought-tolerant, perennial legume commonly used in dryland pasture systems. Grown in pure stands, lucerne requires high fertiliser and often high pesticide rates to perform well. The species does not reseed itself easily and may persist from 4–8 years or more depending on the conditions.

Lucerne is commonly used in dry regions to provide high quality pasture and hay during summer. It is dormant in winter and farmers usually spray stands at this time to control weeds. Resistance to bacterial wilt, stem nematode and aphids is commonly required in New Zealand cultivars.

Recent cultivars have resistance and tolerance to a wider range of pests and diseases, helping overcome on-farm problems. Lucerne is sown at 10 kg/ha and establishment can be a problem in some regions. Inoculate seed before sowing.

## Lucerne types

Cultivar	Breeder/marketing agent
Grasslands Kaituna	AgResearch /Wrightson
Grasslands Otaio	AgResearch/Agricom
Pioneer 5454	USA/Genetic Technologies
Pioneer 5681	USA/Genetic Technologies
Wairau	AgResearch/Public
WL325HQ	USA/Wrightson

## SUBTERRANEAN CLOVER (Subclover) (*Trifolium subterraneum* L.)

An annual species with hairy, broad and heart-shaped trifoliate leaves, some with distinct leaf marks. It grows long, horizontal stems during winter and spring, which bear only three to six white florets in each flowerhead.

Named for its ability to bury the seed, its seedheads bend and are pushed into the soil surface after flowering, so the plant survives the summer as a seed. As an annual, the plant disappears from pastures during summer. The seeds germinate when rainfall resumes, but some can fail during subsequent dry spells (“false strike”).

Subclover is useful in dry east coast regions, particularly in situations too dry for white clover, where it can contribute up to 20% of the herbage during the cool season. However, it is important to minimise grazing during flowering to allow maximum seed set and to use cultivars with an appropriate flowering time to ensure it sets seed before the dry summer. Late-flowering cultivars are best suited to New Zealand (Smetham *et al.* 1994).

Subclover is usually sown in seeds mixtures at 6–10 kg/ha. All seed is imported from Australia.

Cultivars are classified according to flowering time, as follows:

### Subterranean clover types

Cultivar	Breeder/marketing agent
<b>Early to mid-season</b>	
Seaton Park	Australia/Public
<b>Mid-season</b>	
Woogenellup	Australia/Public
Trikkala	Australia/Public
<b>Mid-late season</b>	
Denmark	Australia/PGG
Mount Barker	Australia/Public
Goulburn	Australia/Agricom
Karadale	Australia/Public
Leura	Australia/Wrightson
<b>Late season</b>	
Tallarook	Australia/Public

### STRAWBERRY CLOVER (*Trifolium fragiferum*. L)

A prostrate, perennial legume that looks similar to white clover as it has prostrate, branched and creeping stolons. However, its small trifoliolate leaves are slender and quite pointed, and its small flowerheads are usually pink and resemble strawberry fruits.

Strawberry clover thrives on saline soils, usually close to the sea or river estuaries where it often replaces white clover. Its sowing rate is usually 3–6 kg/ha and its seedling vigour is less than that of white clover. It is recommended for use on soils that are too saline for white clover.

### Strawberry clover types

Cultivar	Breeder/marketing agent
Grasslands Onwards	AgResearch/Agricom
Grasslands Upwards	AgResearch/Wrightson

### LOTUS (or lotus major) (*L. pedunculatus* Cav. syn. *Lotus uliginosus* Schk. syn. *L. major* Scop.)

A perennial, five-leaved legume that thrives in wet acidic, infertile situations under lighter grazing pressure. Naturalised throughout this country and known locally as lotus major, this performs as a pioneer legume for pasture development where white clover fails to perform. It was used to entice livestock to graze in roughland, to crush scrub/bush and improve the grazing. Lotus is now widely used in agroforestry situations because it tolerates shade and needle litter better than clover.

Lotus spreads and persists by creeping rhizomes, and can climb through litter and up steep banks. It contains condensed tannins, so is non-bloating to animals. The tannins also prevent forage proteins in the rumen from degradation, enhancing amino-acid digestion which results in leaner meat and more wool.

The plant is also resistant to grass grub and porina caterpillar, making it valuable for extensive farming systems. Recent research indicates that condensed tannins also impart anthelmintic effects and reduce the incidence of daggy wool and flystrike in sheep.

Sowing rate for lotus is up to 5 kg/ha in New Zealand (much less in warmer Australian situations). It is very slow establishing in cold soils, though can be rapid when soil temperatures are over 15°C.

It is recommended for soils that are too wet, acidic, or low in phosphate for white clover.

Breeders have developed tetraploid types from the natural diploid material.

## Lotus types

Cultivar	Breeder/marketing agent
<b>Diploid</b>	
Grasslands Sunrise	AgResearch/Agriseeds
<b>Tetraploid</b>	
Grasslands Maku	AgResearch/Cropmark
Barsilvi	NZ Agriseeds

### BIRDSFOOT TREFOIL (*Lotus corniculatus* L.)

Birdsfoot trefoil is a shorter-lived perennial *Lotus* species, resembling lucerne in its use and management. Like lucerne, it has not naturalised in New Zealand, as its *Rhizobium* strain does not persist in New Zealand soils. However, it thrives in less fertile situations than does lucerne.

Birdsfoot trefoil is an erect-growing, five-leaved plant with paler green, succulent foliage. It resembles lotus, but is much more erect in growth habit and the standard types lack the creeping rhizomes characteristic of lotus. Its yellow florets mature to form a seedhead resembling a bird's foot, hence the common name.

Birdsfoot trefoil produces high quality forage containing condensed tannins, the effects of which are described in the *Lotus pedunculatus* section. Birdsfoot trefoil has strong tap-roots and tolerates drought, making it suitable as a special-purpose legume stand in drought-prone, infertile eastern regions. It needs much less fertiliser than lucerne.

It may be sown alone, or mixed with non-aggressive forage species, at 10 kg/ha and must be inoculated with its special *Rhizobium* strain. Establishment is slower than lucerne so the stand requires careful and lax grazing management during the first year and rotational grazing subsequently – avoid grazing it too closely. Regular herbicide sprays in winter will control weed invasion.

Cultivar	Breeder/marketing agent
Grasslands Goldie	AgResearch/Cropmark

### CAUCASIAN CLOVER (*Trifolium ambiguum* Bieb.)

Caucasian clover is a rhizomatous, perennial clover that is persistent once established. It is usually slow to establish and requires careful management during this period. Once fully established, caucasian clover offers strong spring–summer growth and pest tolerance, but is winter dormant.

Past work in the South Island high country, and more recent work at Winchmore and in the Bay of Plenty, has shown the potential of this species to greatly increase the legume content of a pasture compared with white clover. It therefore has the potential to improve animal productivity and nitrogen fixation under dryland conditions.

Caucasian clover spreads through the sward by a vigorous network of underground rhizomes. This protects the growing points from overgrazing, treading, and high soil surface temperatures.

It should be sown at 3–5 kg/ha, usually in spring. Seed is supplied coated and inoculated with the correct *Rhizobium* strain but it must be sown within the specified time after inoculation as high rhizobial numbers are important.

Cultivar	Breeder/marketing agent
Endura	Wrightson

### 3. GRAZING HERBS

#### CHICORY (*Cichorium intybus* L.)

Chicory is a moderately persistent, leafy herb with a deep tap-root, which gives excellent animal production in lambs, deer and cattle. It produces high yields of high quality feed, from spring through to autumn, but is usually dormant in winter. Its leaves resemble docks or dandelions but it is much more succulent, and is avidly grazed by all stock.

Chicory is suited to fertile free-draining soils and rotational grazing, where it lasts 3–5 years. It requires rotational grazing (or cutting) for best results. A tendency to bolt rapidly into flower during spring must be controlled by grazing to maintain quality, otherwise its tall stems become woody and unpalatable.

Its growth accelerates in spring, peaks over summer and early autumn and declines in winter. Its forage is digested more rapidly than normal forage and this helps account for high liveweight gains and better health from chicory pastures.

Chicory can be sown at 5 kg/ha in mixtures with legumes or as a component in standard grass/clover mixtures at 1–2 kg/ha.

Cultivar	Breeder/marketing agent
Grasslands Puna	AgResearch/Wrightson

#### PLANTAIN (*Plantago lanceolata* L.)

Plantain is a perennial herb that performs well in a range of pastures, particularly those that are less fertile and more open. The well-known weed plant has been developed into two vigorous and erect-growing cultivars. They are highly palatable to animals, establish rapidly, are drought and pest tolerant, and have a high mineral content. Grazing management should aim to minimise seedhead frequency as leafy plantain is of high quality but plants with seedheads have little feed value (Stewart 1996).

Plantain can be included in pasture mixtures on less fertile soils, and especially in dryland regions. In such situations, plantain content rarely exceeds 20% of the pasture. Plantain may be sown in mixtures with grass and clover at 1–2 kg/ha.

#### Plantain types

Cultivar	Breeder/marketing agent
Grasslands Lancelot	AgResearch/PGG
Ceres Tonic	Pyne Gould Guinness

### MARKETING AGENTS

#### AgResearch Grasslands

Private Bag 11008  
Palmerston North  
Phone (06) 356 8019  
Fax (06) 351 8032

#### Agricom New Zealand Ltd

PO Box 539  
Ashburton  
Phone (03) 308 8772  
Fax (03) 308 8762

#### Cropmark Seeds Ltd

PO Box 454  
Ashburton  
Phone (03) 308 2181  
Fax (03) 308 9680

#### New Zealand Agriseeds Ltd

Old West Coast Road  
R D 1  
Christchurch  
Phone (03) 318 8514  
Fax (03) 318 8549



**Pyne Gould Guinness Ltd**

PO Box 3100  
Christchurch  
Phone (03) 343 3999  
Fax (03) 348 1381

**H.L. Rosevear & Co Ltd**

PO Box 560  
Ashburton  
Phone (03) 308 9786  
Fax (03) 308 2097

**Genetic Technologies Ltd**

PO Box 105 303  
Auckland  
Phone (09) 307 0000  
Fax (09) 307 3300

**Wrightson Seeds Ltd**

PO Box 939  
Christchurch  
Phone (03) 349 5284  
Fax (03) 349 4076

**REFERENCES AND FURTHER READING**

We suggest that anyone seeking further information on these products can obtain technical support information from seed retailers and the marketing agents. In addition, the *Proceedings of the New Zealand Grassland Association* contains many papers that provide accurate information on features, suitability and performance of some species and cultivars. Many of the useful references, including those from the recent NZGA *Proceedings*, are listed as follows:

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