

APPENDIX I. National Seed Quality Standards for Certified Seeds

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

GRASSES

Species	Minimum Pure Seed % by mass	Minimum Germination % by count	Maximum Other Seeds % by mass
Bahia grass	60	60	2.00
Buffel grass	90	20	2.00
Cocksfoot	90	70	3.00 ¹
Creeping bluegrass	50	20	5.00
Guinea grass	40	25	0.70
Italian ryegrass	97	80	1.00
Kikyuyu	95	60	1.00
Lovegrass	97	70	0.50
Purple pigeon grass	80	40	3.00
Phalaris	97	65	1.00
Perennial veldt grass	65	40	1.00
Perennial ryegrass	97	75	1.00 ²
Rhodes grass (Diploid)	80	20	4.00
Rhodes grass (Tetraploid)	75	10	4.00
Setaria	60	20	1.20
Tall fescue	96	70	3.00 ³
Tall wheat grass	85	65	2.00

LEGUMES

Species	Minimum Pure Seed % by mass	Minimum Germination % by count	Maximum Other Seeds % by mass
Annual medics	98	70 ⁴	2.00 ⁵
Arrowleaf clover	98	60	1.00
Balansa clover	98	65	1.00
Berseem clover	98	80	1.00
Biserrula	98	70	0.50
Crimson clover	98	65	1.00
Joint vetch	95	50	2.00
Kenya white clover	97	50	1.00
Lucerne	98	60	0.50
Persian clover	98	65 ⁶	1.00
Red clover	97	60	0.50
Rose clover	98	70	1.00
Strawberry clover	98	60	1.00
Subterranean clover	98	70	0.50
Serradella	90	75 ⁷	1.00
White clover	97	60	2.00

¹ 3% maximum, of which no more than 1.00% shall be seeds other than Lolium species

² In a bad blind seed disease year standards may be adjusted multilaterally

³ 3% maximum, of which no more than 1.00% shall be seeds other than Lolium species

⁴ Germination % does not include hard seeds

⁵ 2.0% maximum, of which more than 0.5% shall be seeds other than burr medic

⁶ Cv – Kyambro – 50% germination

⁷ Minimum germination for certification – includes normal and hard seeds

APPENDIX II. Reading a Seed Certification Label

Cultivar

Cannot be assessed by seed analysis. Purchase Certified Seed or seed produced under a suitable Quality Assurance scheme to ensure seed is the correct cultivar.

Line Number

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

Pure Seeds

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

Abnormal Seedlings

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

Statement of Seed Analysis								
Certificate of Analysis Number: 1234556								
Issued without alteration or erasure								
Common Name: Subterranean Clover			Line Number: AUS/N66/1/742					
Cultivar: Junce			Other ID: East 42					
Species: Trifolium subterranean			Lab Number: 78910					
Number of Bags: 400			Issue Date: 15/05/2001					
Weight of Lot: 10,000 kg								
Purity - % weight			GERMINATION - % Number					
Pure Seeds	Inert Matter	Other Seeds	Number of Days of Test	Normal Seedlings Final Count	Hard Seed	Fresh Un-germinated seed	Abnormal Seedlings	Dead Seeds
99.1	0.6	0.3	10	66	10	0	16	8
Other Seeds in 250.0 grams								
Format:	Common name	Botanical name	Number					
	Red Clover	Trifolium pratense	54					
	Millet	Echinochloa spp.	2					
	Wireweed	Polygonum aviculare	1					
Inert Matter: Broken Seed, Dirt, Decoated Seed								
These analysis results relate only to the sample as received by the Laboratory Sample details as stated by the Applicant								
<i>J Smith</i> OFFICER IN CHARGE								

Inert Matter

Amount of non-seed material or broken seed particles. May include fungal material such as ergot and sclerotes.

Hard Seed

Seed that is dormant.

Other Seeds

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

Normal Seedlings

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

APPENDIX III. Average seed counts for major pasture species

Variety	'000/kg	Variety	'000 / kg
Temperate Grasses		Tropical Grasses	
Cocksfoot	1344	Bahia grass	1000
Perennial veldt grass	712	Bambatsi panic	1600
Phalaris	650	Buffel grass	600
Prairie grass	110	Floren bluegrass	2090
Puccinellia	5000	Gatton panic	1160
Ryegrass (perennial)	500–600	Green panic	1280
Ryegrass Italian	460	Kikuyu	410
Ryegrass hybrid (Diploid)	500–600	Paspalum	570–700
Ryegrass hybrid (Tetraploid)	200–300	Premier digit grass	1700–2500
Ryegrass annual	418	Purple pigeon	550
Tall fescue	404	Rhodes grass	2800
Tall wheat grass	190	Setaria	1300–1900
Timothy	250	Swann Forest Bluegrass	580
Temperate legumes		Tropical legumes	
Balansa clover	1400	Amarillo peanut	6–7
Barrel medic	235	Atro	79
Berseem clover	326	Axillaris	120
Crimson clover	250	Creeping vigna	75
Gland clover	1430	Greenleaf desmodium	750
Lotus	2062	Lotononis	3500
Lucerne	440–500	Kenya clover	700–1000
Murex medic	262	Wynn cassia	250
Persian clover	1456		
Red clover (Diploid)	528	Pasture herbs	
Red clover (Tetraploid)	295	Chicory	830
Rose clover	331	Plantain	500
Snail medic	390		
Strawberry clover	766		
Subterranean clover	117		
White clover	1572		
Woolly pod vetch	25		
Yellow serradella	196		

APPENDIX IV. Characteristics of commercially available lucerne varieties

The ratings below are provided by seed companies or breeders. This list is intended as a guide only. It does not represent results of comparative tests between these varieties, or represent recommendations by NSW DPI. (Compiled by Mary-Anne Lattimore – District Agronomist, NSW DPI Yanco)

Variety	Late aut. -winter growth#	Spotted Alfalfa aphid	Blue- green aphid	Phytophthora root rot	Anthracnose +	Stem nematode	Bacterial wilt
Winter dormant							
Prime ♂	3	R	MR	R	R	R	R
Pioneer brand 54Q53 ♂	4	R	MR	HR	HR	HR	HR
WL 342HQ-MF	4	R	R	HR	HR	R	HR
Semi winter dormant							
Kaituna ♂	5	R	HR	MR	R	HR	R
Hunter River*	5	S	S	S	S	S	S
Pioneer Brand L55 ♂	5	HR	R	HR	HR	MR	R
Pioneer Brand L56 ♂	5	HR	HR	HR	HR	HR	HR
Venus ♂	5	HR	R	MR	LR	~	~
Winter active							
Aurora*	6	HR	HR	R	MR	R	LR
Genesis ♂	6	HR	R	R	R	~	~
Hunterfield*	6	HR	LR	S	S	S	S
WL 414	6	HR	HR	HR	MR	R	R
Stamina GT6®	6	HR	R	R	HR	HR	~
SuperAurora ♂	6	HR	HR	HR	S	~	~
Flairdale ♂	7	R	HR	R	LR	R	~
Pioneer brand 57Q75 ♂	7	HR	R	HR	HR	R	MR
Quadrella ♂	7	R	R	MR	R	LR	S
SARDI SEVEN ♂	7	HR	HR	HR	HR	R	~
Trifecta*	7	R	HR	MR	R	LR	R
UQL-1 ♂	7	HR	HR	HR	HR	~	~
Highly winter-active varieties on next page							

Varieties are listed in order of increasing late autumn/winter growth – from 3 (very slow growth) through 6 (moderate growth) to 10 (very active growth). The dormancy groupings are not absolutely distinct; the range of dormancy is continuous.

♠ Protected by Plant Breeder's Rights ®, TM registered trade mark; ~ No data available.

* Public variety, not covered by licensing agreements or Plant Breeder's Rights

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

Pests/disease resistance

HR	Highly resistant
R	Resistant
MR	Moderately resistant
LR	Low resistance
S	Susceptible

The basis for ratings are the number of seedlings that survive pests and diseases in glass house tests. The reaction of established plants may differ (especially in the case of blue-green aphid). A variety rated as having resistance to a pest (e.g. Blue-green aphid) may still require control measures to avoid loss of yield. **Note that a high level of 'resistance' does not mean the variety is immune from the pest or disease, a proportion of plants may be susceptible.**

**Appendix IV. Characteristics of commercially available lucerne varieties
(continued)**

Variety	Late aut. -winter growth#	Spotted Alfalfa aphid	Blue- green aphid	Phytophthora root rot	Anthracnose +	Stem nematode	Bacterial wilt
Highly winter-active							
Aquarius ϕ	8	R	HR	HR	LR	R	MR
Eureka ϕ	8	HR	HR	R	R	R	~
Hallmark ϕ	8	HR	R	HR	HR	HR	~
Multi Foli-8 TM	8	HR	HR	HR	R	R	R
Pioneer brand L69 ϕ	8	HR	HR	R	HR	LR	LR
Super Siriver ϕ	8	R	HR	R	MR	~	~
WL 525HQ	8	HR	HR	HR	MR	R	MR
Cropper Nine [®]	9	R	HR	HR	MR	MR	~
CUF101*	9	R	HR	MR	S	S	S
Multileaf [®] Generation ϕ	9	HR	HR	HR	HR	MR	~
Pioneer brand L90 ϕ	9	R	HR	HR	HR	R	LR
Salado ϕ	9	R	HR	LR	LR	MR	~
Sceptre ϕ	9	R	HR	R	R	MR	~
Sequel*	9	R	R	MR	R	S	S
Sequel HR ϕ	9	R	R	R	HR	R	~
SuperSequel ϕ	9	HR	HR	R	LR	~	~
Silverado ϕ	9	HR	HR	HR	HR	MR	~
Siriver*	9	HR	MR	S	S	S	S
Siriver MkII	9	~	~	~	~	~	~
WL 612	9	HR	HR	HR	MR	HR	~
SARDI TEN ϕ	10	HR	HR	R	R	R	~

APPENDIX V. Characteristics of some sub clover varieties

List provided by Brian Dear – Principle Research Scientist, NSW DPI Wagga Wagga

Variety	Formo-nonetin level	Flowering starts	Flowering time index (days from sowing, mid May, to start of flowering)		Seed mature by	Min annual rainfall (mm)* for persistence in NSW		Hardseed-edness
			Perth	Wagga		South	North	
Nungarin	Very low	Early Aug	77	110	Late Sept	375	600	Very high
Izmir	Low	Early Aug	77	110	Late Sept	350	500	Very high
Dalkeith	Very low	Late Aug	97	120	Mid Oct	400	650	Very high
Urana	Low	Early Aug	110	123	Late Oct	400	600	High
Seaton Park LF	Low	Early Sept	112	125	Late Oct	475	700	Moderate
York	Very low	Early Sept	112	125	Late Oct	475	700	Very high
Trikkala	Low	Early Sept	112	122	Late Oct	525	750	Low
Riverina	Low	Mid Sept	116	128	Mid Nov	500	700	Moderate
Rosedale	Low	Mid Sept	114	120	Early Nov	500	650	Moderate
Gosse	Very low	Late Sept	126	136	Late Nov	650	800	Moderate
Napier	Low	Late Oct	155	160	Late Dec	750	900	Moderate
Junee	Very low	Mid Sept	128	138	Mid Nov	500	725	Moderate
Coolamon	Low	Mid Sept	133	140	Mid Nov	475	575	Moderate
Woogenellup	Low	Mid Sept	130	140	Mid Nov	525	750	Low
Clare	Low	Late Sept	136	142	Late Nov	650	675	Low
Goulburn	Very low	Late Sept	140	145	Late Nov	525	775	Moderate
Denmark	Very low	Early Oct	144	149	Late Nov	600	850	Low
Leura	Very low	Early Oct	151	156	Early Dec	750	900	Very low
Nuba	Low	Early Oct	146	152	Early Dec	700	900	Moderate

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

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

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

A number of livestock disorders are associated with pasture improvement, and their occurrence is common across many pasture species. These disorders are as follows:

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

Livestock health disorders that are of importance in relation to a particular pasture species are listed below. Fortunately, appropriate management can reduce the risk associated with most of these problems. Consult your veterinarian or livestock advisor for further advice, especially when planning pasture improvement projects.

ANNUAL LEGUMES

ARROWLEAF CLOVER (*Trifolium vesiculosum*): Can cause bloat in cattle.

BALANSA CLOVER (*Trifolium michelianum*): Bloat in cattle; urinary calculi (clover stones) incidence may increase in sheep; occasionally red gut in sheep.

BERSEEM CLOVER (*Trifolium alexandrinum*): Bloat in cattle; urinary calculi (clover stones) incidence may increase in sheep; occasionally red gut in sheep.

BISERRULA (*Biserrula pelecinus*): Photosensitisation in sheep has been observed in sheep grazing biserrula pastures in Western Australia.

BARREL MEDIC (*Medicago truncatula*): Photosensitisation in horses, occasionally red gut in sheep, frequently bloat in cattle.

BURR MEDIC (*Medicago polymorpha*): Ingestion of this plant has been associated with cases of photosensitisation in sheep, cattle and horses, as well as bloat in cattle. Phytoestrogens can have negative effects on the reproductive process and on the reproductive tract of grazing livestock.

CRIMSON CLOVER (*Trifolium incarnatum*): Bloat in cattle is possible, but seldom occurs.

GAMA MEDIC (*Medicago rugosum*): No known livestock effects, however bloat risk likely

GLAND CLOVER (*Trifolium glanduliferum*): No livestock disorders have been reported but, as with most legumes, could be expected to cause bloat in cattle. Cv. Prima contains low levels of coumarins which can be converted to dicoumarol in mouldy hay. Care should be taken not to feed mouldy hay to livestock. Pigs are extremely sensitive to dicoumarol.

HYBRID MEDIC: Can cause bloat in cattle.

MUREX MEDIC (*Medicago murex*): Photosensitisation in horses, occasionally red gut in sheep, frequently bloat in cattle.

SNAIL MEDIC (*Medicago scutellata*): Photosensitisation in horses, occasionally red gut in sheep, frequently bloat in cattle.

SPHERE MEDIC (*Medicago sphaeocarpus*): Can cause bloat in cattle.

STRAND MEDIC (*Medicago littoralis*): Photosensitisation in horses, occasionally red gut in sheep, frequently bloat in cattle.

PERSIAN CLOVER (*Trifolium resupinatum*): Photosensitisation sometimes; bloat in cattle; urinary calculi (clover stones) incidence may increase in sheep; red gut in sheep occasionally.

ROSE CLOVER (*Trifolium hirtum*): The ingestion of old flower heads may be associated with fibre ball (phytobezoar) development in the abomasum of cattle, and with wool contamination in sheep.

Bloat in cattle; urinary calculi (clover stones) incidence may increase in sheep; occasionally red gut in sheep.

SERRADELLA (*Ornithopus* spp): No problems reported.

SUBTERRANEAN CLOVER (*Trifolium subterraneum*): Infertility, sometimes due to oestrogenic compounds (mainly *T. subterraneum* var. Dwalganup); bloat in cattle; urinary calculi (clover stones) incidence may increase in sheep; red gut in sheep occasionally. Phytoestrogens can have negative effects on the reproductive process and on the reproductive tract of grazing livestock

WOOLLY POD VETCH (*Vicia villosa*): 'Ill thrift' syndrome in cattle, with dermatitis and diarrhoea (sometimes).

PERENNIAL LEGUMES

BIRDSFOOT TREFOIL (*Lotus corniculatus*) (see also Lotus): Is known to sometimes produce cyanogenic glucosides, but reports of cyanide poisoning associated with it are very rare. Its ingestion can occasionally be associated with cases of photosensitisation.

CAUCASIAN CLOVER (*Trifolium ambiguum*): Can cause bloat in cattle.

LOTUS (*Lotus uliginosus* Syn *L. pedunculatus*): Sometimes cyanogenic glycosides (*L. cruentus* syn. *coccineus*). Milk taint (*L. corniculatus* and *L. major* syn. *pedunculatus* syn. *uliginosus*).

Occasionally develops tannin levels high enough to reduce feed intake.

LUCERNE (*Medicago sativa*): Bloat in cattle. Photosensitisation in horses, occasionally red gut in sheep. Infertility in livestock due to oestrogenic compounds has been associated with ingestion of lucerne leaves stressed by leaf diseases or by insect attack. Can contain low levels of coumarins which can be converted to dicoumarol in mouldy hay. Care should be taken not to feed mouldy hay to livestock. Pigs are extremely sensitive to dicoumarol.

RED CLOVER (*Trifolium pratense*): Infertility sometimes due to oestrogenic compounds; bloat in cattle; urinary calculi (clover stones) incidence may increase in sheep; occasionally red gut in sheep.

STRAWBERRY CLOVER (*Trifolium fragiferum*): Infertility sometimes due to oestrogenic compounds; bloat in cattle; urinary calculi (clover stones) incidence may increase in sheep; occasionally red gut in sheep.

WHITE CLOVER (*Trifolium repens*): Bloat in cattle; urinary calculi (clover stones) incidence may increase in sheep; occasionally red gut in sheep. Phytoestrogens can have negative effects on the reproductive process and on the reproductive tract of grazing livestock

TEMPERATE GRASSES

BERMUDA COUCH GRASS (*Cynodon dactylon*): can be cyanogenic.

COCKSFOOT (*Dactylis glomerata*): No problems reported.

GRAZING BROME (*Bromus stamineus*): No problems reported.

KANGAROO GRASS (*Themeda triandra*): No problems reported.

PASTURE BROME (*Bromus valdivianus*): No problems reported.

PERENNIAL VELDT GRASS (*Ehrharta calycina*): No problems reported.

PHALARIS (*Phalaris aquatica*): Sometimes phalaris staggers; occasionally phalaris sudden death syndrome.

PRAIRIE GRASS (*Bromus willdenowii*): Awns may penetrate skin of sheep; possible wool contaminant.

PUCCINELLIA (*Puccinellia ciliata*): No problems reported.

RYEGRASS (*Lolium* spp): Ryegrass staggers, Summer endophyte hyperthermia-ill thrift, ergot of rye poisoning.

RYEGRASS – ANNUAL (*Lolium rigidum*): Annual ryegrass toxicity; ergot of rye poisoning.

TALL FESCUE (*Festuca arundinacea*): Summer endophyte hyperthermia-ill thrift, or winter lameness (peripheral gangrene), associated with ergot alkaloid production within the grass.

TALL WHEATGRASS (*Thinopyrum ponticum*): No problems reported.

TIMOTHY (*Phleum pratense*): No problems reported.

WALLABY GRASS (*Austrodanthonia* spp.): Can occasionally accumulate dangerous amounts of cyanogenic glycosides.

WEeping GRASS (*Microlaena stipoides*): No problems reported.

TROPICAL LEGUMES

ATRO (*Macroptilium atropurpureum*) = Siratro: No problems reported.

AXILLARIS (*Macrotyloma axillare*): No problems reported.

CREeping VIGNA (*Vigna parkeri*): Nitrate poisoning has occurred with a related species.

FORAGE PEANUT (*Arachis pintoi*): No problems reported.

GLYCINE (*Neonotonia wightii*): No problems reported.

GREENLEAF DESMODIUM (*Desmodium intortum*): No problems reported.

ROUNDLEAF CASSIA (*Chamaecrista rotundifolia*): Some cassia spp. (e.g. *C. obtusifolia* and *C. occidentalis*) have been associated with poisoning in ruminants and horses – both leaves and seeds were toxic, and muscle damage was the main effect. So far there have been no problems reported for *C. rotundifolia*.

TROPICAL GRASSES

BAHIA GRASS (*Paspalum notatum*): Not known if there is a risk of nervous ergotism ('staggers').

BAMBATSI PANIC (= Makarikari panic): (*Panicum coloratum* var. *makarikariense*) Liver disease with associated photosensitisation (sporadic outbreaks in ruminants).

BUFFEL GRASS (*Cenchrus ciliaris*): Frequently hyperparathyroidism ('big head') in horses, occasionally nephrosis or hypocalcaemia in ruminants, due to oxalates.

This genus can occasionally accumulate dangerously high levels of selenium when grown on some soil types

CREEPING BLUEGRASS (*Bothriochloa insculpta*): No problems reported.

DIGIT GRASS (*Digitaria eriantha* ssp *eriantha*): No problems reported.

BLUEGRASS (*Dicanthium aristatum*): No problems reported.

FOREST BLUEGRASS (*Bothriochloa bladhii* ssp *glabra*): No problems reported.

GATTON PANIC OR GREEN PANIC (*Panicum maximum*): Frequently hyperparathyroidism ('big head') in horses, occasionally nephrosis or hypocalcaemia in ruminants, due to oxalates.

INDIAN BLUEGRASS (*Bothriochloa pertusa*): No problems reported.

KIKUYU (*Pennisetum clandestinum*): Frequently hyperparathyroidism ('big head') in horses, occasionally nephrosis or hypocalcaemia in ruminants, due to oxalates. Very occasionally nitrate poisoning. Kikuyu poisoning is an unusual rumen disorder that can sporadically occur in cattle, especially where rapid Autumn growth follows a protracted dry period.

LOVEGRASS (*Eragrostis curvula*, type *Conferta*): No problems reported.

MITCHELL GRASS (*Astrela lappacea*): Can cause blindness and deaths in cattle on the rare occasions when the grass becomes infected with the fungal corals of *Corallocytostroma ornicopreoides*.

MOLASSES GRASS (*Melinis minutiflora*): No problems reported.

PASPALUM (*Paspalum dilatatum*): Nervous ergotism ('staggers').

PURPLE PIGEON GRASS (*Setaria incrassata*): Frequently hyperparathyroidism ('big head') in horses, occasionally nephrosis or hypocalcaemia in ruminants, due to oxalates.

RHODES GRASS (*Chloris gayana*): This genus can occasionally accumulate dangerously high levels of selenium on some soil types.

SETARIA (*Setaria sphacelata* var. *sericea*): Frequently hyperparathyroidism ('big head') in horses, occasionally nephrosis or hypocalcaemia in ruminants, due to oxalates.

PASTURE HERBS

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

PLANTAIN (*Plantago lanceolata*): No livestock disorders have been encountered.

APPENDIX VII. Points to consider when making up a pasture mixture

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

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

Enterprise:

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

Soils:

Soil type

Where there is a large variability in soil types in a paddock it is often worthwhile increasing the number of species or varieties as opposed to a simple mixture of one grass and one legume to cover the variability. Minor soil variations often will not warrant increasing the number of species in a mixture.

Soil pH

Differences in pH for example may be covered by including serradella in with an otherwise sub clover dominant mixture, or including cocksfoot in with phalaris etc. to cover areas of low pH in an otherwise neutral to slightly acid soil.

Drainage and salinity

Species tolerant to waterlogging and/or salinity, are often included in mixtures to provide coverage in parts of the paddock that are poorly drained. e.g. Yaninicum sub clovers like Riverina may be added to other subterranean clover varieties to allow for low lying areas, where it will thrive and other varieties may fail. Similarly, where salinity is a problem in parts of a paddock, tolerant species such as strawberry clover and tall fescue are added to a mixture depending on the level of salinity present.

Fertility

This is less of a reason to expand a pasture mixture, as fertility needs can usually be met by legume nitrogen and adding fertiliser. There may be instances where a high fertility demanding species such as phalaris may be added to a mixture otherwise reliant on cocksfoot to take advantage of high fertility areas in a paddock and vice versa. Similarly bambatsi panic, a species suited to high fertility clay soils, is often mixed with rhodes

grass (capable of growing on low fertility soils), to cover paddock variability in terms of soil type.

Aspect:

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

Plant characteristics:

There is a wide range of reasons for including or excluding species with differing plant characteristics in mixtures. This ranges from adding an annual component to an otherwise perennial mixture to improve persistence in western areas or vice versa in higher rainfall areas. Stoloniferous plants may be a useful addition to a mixture to increase stability and the likelihood of reliable ground cover thus reducing erosion risk and weed invasion.

Plant characteristics such as seedling vigour and competitiveness may be used in a mixture to ensure the botanical composition is suitable. In some situations species vigour can have deleterious effects such as when perennial ryegrass (with high seedling vigour) is sown with tall fescue – as a result fescue establishment is often poor especially from late autumn/ winter sowings. Resistance to disease or insect pests may also be a reason to add a variety to a mixture to improve the reliability of production and/or persistence from the pasture.

Livestock health:

Species are often included or excluded to reduce the risk of a particular livestock disorder. Bloat is often the reason why grasses are added to lucerne or high legume-content pastures to reduce the incidence of bloat. See Appendix VI for livestock disorders associated with species.

Grazing management considerations:

The optimum grazing management for species differs and may dictate what should be included in a mixture, especially where longevity of species is important. Whilst most species that we use are fairly forgiving of short-term mismanagement, most will benefit in the long term from tactical grazing at one stage or another (e.g. to enhance seed set, recruitment of seedlings, improve tillering etc.).

APPENDIX VIII. Further information

Pasture publications available from NSW DPI

Agfact No.	Title	Agfact No.	Title
P1.1.3	Grazing and spelling in the dry rangelands	P2.5.27	Perennial veldt grass
P2.1.7	Tagasaste (tree lucerne)	P2.5.31	Rhodes grass
P2.1.12	Pasture legumes for low rainfall environments	P2.5.34	Siratro
P2.2.4	Pasture establishment on native Country: central and southern Tablelands	P2.5.35	Panic grasses for pastures
P2.2.25	Lucerne for pasture and fodder	P2.5.36	Shaw creeping vigna – a Tablelands subtropical legume
P2.3.4	Summer fodder crops for the	P2.5.37	Curly Mitchell grass
P2.3.8	Irrigated pastures for northern inland NSW	P2.5.39	Wallaby grass – a domesticated native grass
P2.3.9	Endophytes of perennial ryegrass and tall fescue	P2.5.42	Gland clover
P2.4.3	Pastures for horses	P2.7.3	Preparing your paddock for better pasture hay
P2.5.1	Phalaris pastures	P2.5.1	Phalaris pastures
P2.5.3	Managing kikuyu for milk production	P2.7.7	Hay storing – round bales
P2.5.5	Cocksfoot – a versatile pasture grass	P2.AB.1	Diseases of lucerne
P2.5.9	Namoi woolly pod vetch	P2.AB.2	Diseases of clover
P2.5.11	Medic pastures	P2.AE.A	Scarab grubs in northern tableland pastures
P2.5.16	Subterranean clover in NSW – Identification and use	P2.AE.3	Underground grass-grubs
P2.5.18	Safari Kenya white clover	P2.AE.5	Black-headed pasture cockchafer
P2.5.19	Bargoo jointvetch	P2.AE.6	Field crickets
P2.5.21	Purple pigeon grass	P3.E.1	Band seeders for pasture establishment
P2.5.22	Persian clover		
P2.5.23	Serradella		
P2.5.24	Balansa clover		
P2.5.24	Murex medic – variety Zodiac		

NOTE: As well as Agfacts, a number of shorter Agnotes are available on specific pasture issues. Please note that Agfacts and Agnotes are being replaced progressively by a new information series called Primefacts. If you cannot find the Agfact or Agnote you are looking for please search our website for a Primefact of the same name or subject.

Other publications

Light soils – Managing Them Better – (Book)

Managing High Rainfall Native Pastures on a Whole-farm Basis (Booklet)

Weed Control in Lucerne and Pastures (Booklet)

Pastures Manual (Home Studies program)

PROGRAZE Manual

Prime Pastures Program

Pasture weed management kit

Topfodder silage guide

Haymaker

Available from NSW DPI web page

(www.dpi.nsw.gov.au) – (Select Field Crops then Pastures, then select Pastures species)

Pasture species and varieties

PASTURE PLANNER (what to sow, how, when and where)

Introduction to selecting and using pastures – Selecting pastures for your district

Temperate grass species

Cocksfoot	Puccinellia
Grazing brome	Short-term ryegrass
Pasture brome	Tall fescue
Perennial ryegrass	Tall wheatgrass
Phalaris	Timothy
Prairie grass	

Temperate legume species

Arrowleaf clover	Lucerne
Balansa clover	Persian clover
Barrel medic	Pink serradella
Berseem clover	Red clover
Birdsfoot trefoil	Rose clover
Biserrula	Slender serradella
Caucasian clover	Snail medic
Crimson clover	Sphere medic
Strand medic	Strawberry clover
Murex medic	Subterranean clover
Gland clover	White clover
Greater lotus	Woolly pod vetch
Hybrid disc medic	Yellow serradella

Tropical Grass Species

Bahia grass	Forest bluegrass
Bambatsi panic	Green panic
Bluegrass	Gatton panic
Buffel grass	Kikuyu
Consol lovegrass	Purple pigeon grass
Creeping bluegrass	Digit grass
Rhodes grass	Setaria

Tropical legume species

Atro	Green leaf desmodium
Axillaris	Kenya clover
Desmanthus	Lotononus
Forage peanut	Round-leafed cassia
Glycine	Shaw creeping vigna

Pasture species and varieties (cont.)

Amarillo peanut
Berseem clover
Biserrula – a new legume for acid soils
Burgundy bean
Chicory: a high performance forage
Cocksfoot – a versatile pasture grass
Consol Lovegrass
Curly Mitchell grass
Digit grass
Endophytes of perennial ryegrasses and tall fescue

Gland clover
Lucerne for pasture and fodder
Murex medic
Namoi woolly pod vetch
Native grasses
Panic pastures
Persian clover
Phalaris pastures
Purple pigeon grass
Rose clover
Serradella
Setaria for coastal pastures
Shaw creeping vigna – a subtropical legume
Subterranean Clover – Identification and use
Wallaby grass – a domesticated native grass

Forage crops

Cereals for grazing
Forage brassicas
Forage sorghums and millets
Spray irrigated maize for silage
Summer legume forage crops: Cowpea, Lablab, Soybeans

Pasture establishment

Eight steps to perennial pasture establishment
Inoculating and pelleting pasture legume seed
Successful establishment of tropical perennial grasses in North West NSW
Band seeders for pasture establishment

Pasture management

Endophytes of perennial ryegrasses and tall fescue
Best practice guidelines for using poultry litter on pastures
Grazing management of lucerne
Matching pasture production to livestock enterprises – estimates of pasture production
Managing pastures after drought
Pasture sustainability and management in drought
Pasture recovery after bushfires
Assessing pasture
Measuring herbage mass – the median quadrat technique
Pasture sustainability and management in drought
Managing kikuyu for milk production
Are my soils acid?
Pasture crop rotations
Pasture pays
Pasture PIC
Managing Coolatai grass
Grazing management for native pastures on the North West Slopes of NSW
Pasture management for weed control
Management of profitable and sustainable pastures