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Annual, Italian and short rotation ryegrass varieties 2010

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The annual and Italian ryegrasses (*Lolium multiflorum*) play an important role in providing winter forage in areas where temperate perennial ryegrasses (*Lolium perenne*) fail to persist. Poor persistence of perennial ryegrass occurs on the NSW Slopes and Tablelands due to low rainfall and soil acidity. On the far north coast of NSW and in the irrigation areas of southern NSW, perennial ryegrass is unable to persist because of high summer temperatures and competition from tropical grasses.

Annual and Italian ryegrasses are often preferred to winter cereals as a winter forage because of their higher forage quality and greater tolerance of acid soils, waterlogging and repeat grazing to 5 cm stubble residue. They are also easier to establish and can be sown with a legume such as Persian or white clover.

Ongoing breeding and development produces a constant release of new varieties to the seed market. In general, breeders aim to produce varieties that:

- consistently produce a high total yield
- have high winter growth and
- have good rust resistance.

Field trials show that some varieties have a wide adaptability while others perform better in certain environments or conditions. Local yield information tested over several years is the best indication of performance in selecting the most appropriate variety.

Long-term results have shown relatively small improvements in new varieties of the same plant type for total yield or quality. However there has been progress in improving rust resistance.

Currently, there are more than 60 varieties marketed in Australia (Table 2). There are important differences in the seasonal growth pattern, susceptibility to rust, and persistence that can affect the choice of variety for a particular field or farm. No single variety suits all situations. Many farmers choose to sow mixtures or sow several different varieties in different paddocks to provide an even feed supply over the winter–spring period.

Plant type

The **annual ryegrass** varieties commonly known as Westerwolds ryegrasses (e.g. Tetila) produce seed heads on most tillers by mid to late October. At this time vegetative growth ceases and after seeds are formed the mature plants die. Natural regeneration occurs from seed. Forage quality declines as the proportion of stem increases, and as the mature plants die off.

Some farmers specifically manage to achieve natural regeneration from seed by removing stock at early heading to allow seed set. They then graze summer grasses hard in autumn to encourage seedling establishment. Re-establishment by this method can be variable so re-sowing each autumn is a more common practice.

In contrast, when the **Italian ryegrass** varieties (e.g. Concord) enter heading, only a proportion of tillers produce seed heads and vegetative growth continues until late November or December and even into the next autumn if conditions allow. Thus forage quality can be maintained for longer, but at lower levels than prior to heading. Cool conditions

and moisture from either rain or irrigation are required for this late season growth or the plants will die off like annuals.

In sub-tropical environments the persistence of Italian varieties into the second year is unreliable and most stands are re-sown each year. At lower latitudes with lower summer temperatures, second year growth is a common feature of the Italian ryegrasses.

The **'short rotation' ryegrasses** are hybrids between Italian and perennial ryegrasses (*Lolium x boucheanum*). Similar to perennial ryegrass, these short rotation varieties tend to have slower winter growth but can have later maturity with spring–summer growth after heading. In cooler tablelands environments they can persist for 2 to 4 years, but in the coastal subtropics they rarely survive the first summer. The proportion of Italian or perennial ryegrass genes varies within these ryegrasses. Those with more perennial ryegrass exhibit those traits to a greater extent. They are often sown in perennial ryegrass mixtures rather than as annual forage species.

A further variation is 'Festuolium', a hybrid between (*L. multiflorum)* and meadow fescue (*Festuca pratensis*) or tall fescue (*F. arundinacea*). These varieties aim to introduce rust resistance, summer vigour and better persistence from fescue to the ryegrass species. Perun is the only variety available in 2010.

The term 'annual ryegrass' is also used to refer to the species *Lolium rigidum*. This species is a common component of annual pastures in the southern wheat belt of Australia. It is less productive than L. *multiflorum* due to its earlier maturity, but is better adapted to self-regenerating annual pastures in rainfall environments receiving less than 600 mm/yr.

Varietal maturity

Within each ryegrass group, annual, Italian and short rotation, there is a range of maturities. A 10%–20% increase in spring production can be achieved by using later maturing varieties compared to early varieties since vegetative growth is extended into late November–December (Table 5). This allows for an extra one or two grazings.

Maturity or flowering date of each variety depends on its response to day length and cold requirements. Those varieties with a high cold requirement flower later because they take longer to accumulate their cold requirement over winter.

In general, the annual ryegrasses tend to mature earlier whereas the Italian ryegrasses are mid to late season maturing.

Actual heading date also varies with latitude and altitude and between years but in general terms season length or heading dates are defined as:

- early – heading dates within 4 days of Tetila.
- mid – heading dates 4 to 10 days later than Tetila
- late – heading dates over 10 days later than Tetila.

The choice of early or later maturity and exploiting the late vegetative growth of the Italians and short rotation types will depend on several factors.

- The potential of the paddock to produce forage from late spring to early summer. For coastal and low rainfall environments this will mean either access to irrigation or well drained soils with greater than 1 m depth and in the order of 100–150 mm/month rainfall for October to December. This will vary with locality and individual advice should be sought.
- The alternative uses of the field or irrigation water. Although late maturing lines produce more dry matter in spring, early maturity can be desirable to enable summer forage options to be sown in mid to late spring or allow tropical grasses or companion clovers to develop good spring growth. The tropical forages can provide higher dry matter production, similar forage quality and so greater water use efficiency as daily maximum temperatures rise above 30°C.
- The use of long season ryegrass can weaken underlying tropical grass. For example, when ryegrass is sown in early March and late maturity varieties extend into December, the underlying kikuyu stands can thin out, allowing competition from summer weeds.
- Using different varieties with a range of heading dates can help to manage spring pasture quality and silage harvests.

Winter growth

Several varieties consistently produce higher growth rates during winter, providing valuable forage when growth is normally slow. Early sowing is essential to allow varieties to express their potential in this trait.

Varietal evaluation conducted by Agri-Science Queensland in southern Queensland over 22 years prior to 2006 found that Aristocrat ll, Barberia, Warrior, Crusader, Status, Passerel Plus and Hulk consistently produced 5%–10% more winter growth than the mean of all varieties tested. Winter Star and T Rex also had high winter growth under favourable conditions.

In trials conducted by I&I NSW from 1999 to 2007 on the NSW coast only Caversham, Charger,

Diplex, Tabu and Mariner showed winter yields consistently 2%–5% higher than Concord (Table 4).

Rust susceptibility

Crown rust (*Puccinia coronata*), also referred to as leaf rust, commonly develops in September to late October on the north coast of New South Wales. Severe rust infection has potential to reduce leaf yield in these months by as much as 80%. In the case of mild to moderate infections, palatability and silage quality can be reduced even though yield is not unduly affected.

Rust is more likely to be seen in:

- warm, wet winter and spring conditions
- fields showing signs of nutrient deficiency, especially low nitrogen.
- dense more mature crops which may have been locked up to make silage.

Although research confirms there has been an improvement in rust resistance in the past 20 years, the ability of the rust pathogen to change means that recently released varieties can succumb to rust infection within a few years of release. Australian rust races may affect varieties classed as resistant in other countries. Selection for resistance will be an ongoing challenge.

In Queensland a number of varieties show long-standing resistance to rust, e.g. Midmar, Aristocrat and Aristocrat II. Table 3 shows rust ratings based on Taree trial data. It should be noted that all varieties exhibit some level of rust infection and that severity varies from year to year. On the NSW north coast it is advisable to avoid sowing varieties with rust ratings of 4 and over.

Varietal purity through seed certification can be an important factor in ensuring durability of rust resistance.

Ploidy

Ryegrass may be diploid (two sets of chromosomes per cell nucleus) or tetraploid (four sets of chromosomes). Ploidy can make a large difference to the seed size and plant stature (cell size, leaf size and tiller number).

Tetraploid varieties have a larger seed size than diploids resulting in greater seedling vigour, a faster establishment and higher initial grazing yields. However where establishment conditions are favourable, higher seed numbers in diploids and higher tiller numbers per plant can compensate for smaller plant size to produce similar initial grazing yields.

Tetraploid varieties have higher water soluble carbohydrate (sugar) levels and lower dry matter content. Lower dry matter content of tetraploid varieties has been implicated in lower autumn/winter milk yield where dry matter production was similar. Higher sugar content can have a minor effect on ease of silage making and animal nutrition. Tetraploids can take a little longer to wilt than diploids when making silage. Diploid varieties tend to have highest yield in evaluations in southern Queensland, but in general dry matter production is similar between types.

Sowing rates

Sowing rate depends on the growth potential of the field, sowing method, seedbed conditions and whether ryegrass is sown alone or in a mixture (Table 1). Where nitrogen fertility is low, addition of clovers is advisable.

In pure swards a seedling population of 500 plants/m^2 for tetraploids and 600 plants/m^2 for diploids is ideal for high first grazing yield. Seedling populations as low as 300 plants/m^2 can tiller to produce high yielding stands in later grazings.

High sowing rates can increase first harvest yield but have little effect on subsequent grazings as rapid tillering compensates for low plant numbers. Field observations show that sowing rates over 40 kg/ha do not produce higher seedling numbers or yield as there is a degree of self regulation in the stand.

Due to larger seed size the sowing rate of tetraploid varieties is normally 20%–40% higher than diploids to produce the target seedling population.

Table 1. Sowing rates (kg/ha).

kg/ha	Tetraploid	Diploid
High fertility dairy pasture	30–40	20–30
Medium fertility beef/sheep	15–25	10–20
Mixed with clover	5–15	5–10

Feed quality

Lolium multiflorum ryegrasses are among the highest quality of temperate grass species. Forage quality can reach 18%–22% crude protein, 11–12 MJ ME/kg DM in mid winter with NDF 35%–45% and ADF less than 25% until heading occurs in spring. As seed heads develop, forage quality declines to 10–10.5 MJ ME/kg DM and NDF

exceeds 45% and remains in that order during late spring and early summer.

Although tetraploid varieties exhibit higher water soluble carbohydrates and lower dry matter content, to date there is little difference in energy or protein content between varieties when tested repeatedly throughout the growing season and compared to varieties of similar maturity.

South African research has demonstrated higher total non-structural carbohydrate content and dry matter content in research lines but this material has yet to be marketed commercially in Australia.

Animal health issues

Annual and Italian (*Lolium multiflorum*) ryegrass varieties do not contain the endophytes that are associated with perennial ryegrass staggers. There are endophyte associations with *L. multiflorum* but they are not known to affect to animal health.

The high perennial content hybrids can have endophytes that are associated with staggers. More recent varieties are currently marketed with selected endophytes that reduce the threat of staggers.

Annual ryegrass toxicity, which can be a problem with annual (Wimmera) ryegrass (*Lolium rigidum*) found in southern Australia, has not been found in (*L. multiflorum*).

Annual and Italian (*Lolium multiflorum*) ryegrasses can develop nitrate toxicity if over-fertilised with nitrogen or grazed within 7–14 days of application.

Breeding ryegrass varieties

In Australia, ryegrasses are bred entirely by private companies. Many companies actively develop and test new lines over many years in Australian conditions, providing a sound basis for selection. Others market varieties directly imported from breeding programs in Europe, USA or New Zealand. Some of these varieties are promising elite material derived from the breeding programs of major international seed companies, others are older varieties that are priced accordingly as a cheap source of seed.

Many new varieties have Plant Breeders Rights (PBR) which restricts the sale of any seed produced by farmers. Under PBR each variety is signified as distinct, uniform and stable for several traits. It does not indicate yield or agronomic performance. PBR also provides funding for further breeding and innovation and so has a long-term benefit for the industry.

Seed quality

A high standard of varietal purity, germination and freedom from weeds are only assured where seed is produced under a certification scheme. Research has found that seed produced from rust-infected crops can weigh 50% less and has lower vigour. Hence, seed certified crops offer insurance of better seedling vigour.

Seed dressings

Several companies offer seed dressed with a combination of insecticide, fungicide, nutrients and growth factors. The relative benefits of these products may affect the choice of variety.

Caution is needed to observe withholding periods associated with using seed dressing. For example imidacloprid, an insecticide, requires six weeks between sowing and grazing. This may delay grazing or prevent use on early sowings that are ready for grazing within four to five weeks of sowing. Furthermore, seed dressings are species specific in activity and, in general, result in low application rates of insecticide per hectare that do not protect against heavy insect pressure.

Seed cost

Seed cost varies from $1.50 to $6.10/kg depending on variety and treatments. This can result in a variation in sowing cost of $40 to $180/ha.

Tetila is the main variety sown in NSW (30%–40%) as the seed cost is low. This is justified in low income industries and on soils that do not support good growth into November.

The higher seed costs of the newer varieties with better yield and rust tolerance can be justified in high income industries, e.g. dairying, and where conditions such as soil fertility and irrigation enable the potential for higher yield or longer growing season. Paying a higher seed price for the newer varieties can also represent an investment in research and development of better lines in the future.

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Tables

Tables 2–4 follow on pages 6–8.

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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 your office of the Department of Environment, Climate Change and Water for further details.

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Table 2. Ryegrass varieties currently marketed in Eastern Australia

		Distributor	Ploidy	Maturity
Annual				
Fantastic	PBR	Upper Murray Seeds	D	E
Betta Tetila		Park Seeds	T	E
Drummer	PBR	Seedmark	T	E
SF Catapult	TM	Seed Force	T	E
Double Crop	PBR	Vic Seeds	D	E
Grassmax	TM	Seedmark	D	E
Griffin	PBR	Heritageseeds	D	E
New Tetila		Vic Seeds	T	E
Rocket		Seed Distributors	T	E
SF Flyer	TM	Seed Force	D	E
SF Sprinter	TM	Seed Force	T	E
Sungrazer T	PBR	Wrightson Seeds	T	E
Tetila	Public		T	E
Tetila Gold		Upper Murray Seeds	T	E
Tetrone	TM	Seed Distributors	T	M
Abundant	PBR	Seed Distributors	T	M
Andy		Cropmark	T	M
Aristocrat II	PBR	Valley Seeds	D	M
Ceres Missile	PBR	PGG Seeds	D	M
Ceres Pronto	PBR	PGG Seeds	D	M
Grasslands Tama	Public		T	M
Noble	PBR	Valley Seeds	D	M
Prowgrow	PBR	Valley Seeds	D	M
Robust	PBR	Seedmark	T	M
Surrey II	PBR	Seed Distributors	D	M
T-Rex	PBR	Heritageseeds	T	M
Winter Star ll	PBR	Wrightson Seeds	T	M
SF Adrenalin	TM	Seed Force	T	M
SF Sultan	TM	Seed Force	D	M
Atomic	PBR	Upper Murray Seeds	T	M
Jivet	PBR	Seed Distributors	T	L
SF Speedyl	TM	Seed Force	T	L
Zoom	PBR	Cropmark	T	L

Italian				
Dargo	PBR	Vic Seeds	D	E
Caversham	PBR	Wrightson Seeds	D	M
Charger	PBR	Seedmark	D	M
Eclipse	PBR	Valley Seeds	D	M
Icon	PBR	Seed Distributors	D	M
Awesome	PBR	Upper Murray Seeds	D	L
Ceres Crusader	PBR	PGG Seeds	D	L
Concord	PBR	Wrightson Seeds	D	L
Conquest	PBR	Wrightson Seeds	D	L
Diplex		Seed Distributors	D	L
Feast ll	PBR	Wrightson Seeds	T	L
Grasslands Warrior	PBR	PGG Seeds	D	L
Grasslands Status	PBR	PGG Seeds	D	L
Hulk	PBR	Heritageseeds	D	L
Jeanne	PBR	Seed Distributors	T	L
Nourish	PBR	Wrightson Seeds	T	L
Marbella	PBR	PGG Seeds	D	L
SF Accelerate	TM	Seed Force	D	L
SF Emmerson	TM	Seed Force	T	L
SF Indulgence DipQ	TM	Seed Force	D	L
Sonik	PBR	Cropmark	D	L
Italian type hybrids				
Maverick Gold II	PBR	Wrightson Seeds	D	L
SF Momentum	TM	Seedforce	D	L
Denver	PBR	Michel Belair	T	L
Magnum	TM	Seed Distributors	T	M
Ceres Galaxy	PBR	PGG Seeds	T	M
Turbo	PBR	Valley Seeds	D	M
Perun	PBR	Seed Distributors	T	M
Perennial type hybrids				
Barberia	PBR	Heritageseeds	D	E
Revolution	PBR	Cropmark	D	M
Grasslands Supreme Plus AR1	PBR	PGG Seeds	D	M
Ceres Horizon		PGG Seeds	T	M
Banquet ll ENDO5	PBR	Wrightson Seeds	D	M
Impact Plus AR1	PBR	Heritageseeds	D	L

PBR = Plant Breeders Rights; TM = Trade Mark.
D = diploid; T = tetraploid; E = early; M = Medium; L = Late

Table 3. Rust rating from I&I NSW trials on the Mid North Coast from 1999–2007

Rust rating	Annual	Italian	Hybrid Italian
1 to 2	Tetrone, T Rex	SF Emerson, Caversham, Eclipse, Hulk, Crusader, Diplex, Feast ll, Marbella, Eclipse, Warrior, Grasslands Status, Charger, Dargo, Mariner	Maverick Gold ll, Grasslands Supreme,
2 to 3	SF Sprinter, Pronto Aristocrat ll	Sonic, SF Accelerate, Concord, Tabu, Aristocrat ll	Magnum
3 to 4	SF Flyer, Tetila, Winter Star ll	SF Adrenalin	
4 to 5	Missile, Andy	Robust, Growmore Plus	

Rust rating is based on visual observations of trials conducted on the Mid North Coast from 1999 to 2007. Severity of infection varies from year to year. Infection is rated on the proportion of leaf material affected by rust: 1 = very light, 2 = light, 3 = moderate, 4 = heavy, 5 = very heavy.

Table 4. Winter growth compared to Concord from I&I NSW coastal variety trials 1999 to 2007

Winter growth %	Annual	Italian	Hybrid Italian
Less than 95%	Aristocrat ll, Tetila, T Rex, Pronto, Winter Star	Marbella, Warrior, Grasslands Status, Hulk, Robust, Sonic	Grasslands Supreme, Magnum, Maverick Gold
95 to 99%		Crusader, Eclipse, Feast ll	
100 to 105%	Missile	Concord, Caversham, Charger, Dargo, Mariner, Tabu	
Greater than 105%		Diplex	

Winter yield is based on relative vegetative growth before 1st September compared to Concord in cutting trials conducted by I&I NSW from 1999 to 2007. Older varieties have appeared in over 50 trials compared to **newer varieties appearing at least seven trials.**

Table 5. Spring growth compared to Concord from I&I NSW coastal variety trials 1999 to 2007

Spring Growth %	Annual	Italian	Hybrid Italian
Less than 95%	Tetila, Aristocrat ll, Tetrone	Diplex, Eclipse, Dargo, Robust	
95 to 99	T Rex, Pronto	Eclipse, Feast ll, Hulk, Sonic, Grasslands Status	Magnum, Grasslands Supreme
100 to 105	Missile	Concord, Charger, Crusader, Caversham, Mariner, Warrior, Tabu	Maverick Gold
Greater than 105%		Marbella	

Spring yield is based on vegetative growth after 1 September compared to Concord in cutting trials conducted by I&I NSW from 1999 to 2007 where at least seven trials are available. In many cases this represents only one harvest for early varieties, and 2–3 harvests for later varieties. Hence, early varieties are expected to produce less in spring. These trials were conducted primarily on the NSW coast, different yield patterns may occur in other environments.