

Tropical perennial grasses 4. Sowing rates



This brochure is the fourth in a series of guides released by the Future Farm Industries CRC (FFI CRC) to promote the use and management of tropical grass based pasture mixes in the summer-rain dominant region of New South Wales (see map).





'Seed' of most tropical perennial grasses is sold and sown 'in the floret' or as coated seed. In both cases, 'seed' may also consist of chaffy or inert plant material, empty florets and seeds of other species including weeds. Assess seed quality by obtaining a copy of a current certificate of seed analysis.

Aim to establish a minimum of 10 plants/m². This means sowing 170 germinable seeds per square metre, because seed and seedling losses can be high.

To achieve this plant density, cultivars with large seed size and therefore lower seed numbers per kilogram need to be sown at higher rates. Aim to buy seed with high purity and germination and low amounts of inert material and other seeds. Cultivars with low seed purity (often indicating high amounts of empty florets) or low germination have low values for the proportion of live seed (PLS) and need to be sown at higher rates to compensate for the low seed quality. Seed coatings greatly add to seed weight and sowing rate will need to be increased.

Buying seed

It is essential to establish tropical perennial grass stands with a good plant density so that there are sufficient plants to provide a productive pasture with high ground cover. To achieve this there are three major factors that need close attention:

- 1. pre-sowing weed control
- 2. seed quality
- 3. sowing time and depth.

Finally, you need to ensure that there are sufficient germinable seeds sown and this depends on the sowing rate. Don't be tempted to save on sowing costs by reducing sowing rates. If seeding rates are too low, moderate savings made on seed cost at establishment will incur large losses in the early years after establishment, since low density stands have low production, low ground cover and are prone to weed invasion.

Calculating sowing rates

Most tropical perennial grass seed is sown either 'in the floret' or as coated seed. Often seed 'in the floret' is as it was harvested and has not been processed to remove the fluffy or awned structures that surround the seed. It has also not been processed to remove other chaffy inert material and seeds of other species (including weeds). Also because of uneven ripening not all florets contain a seed. Similarly, coated seed is often not processed and so all material (stem and leaf material, other seeds and empty florets) is coated.





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Tropical perennial grasses - Sowing rates

Seed coating is undertaken commercially to assist the flow of light or fluffy seeds in seeding equipment. The actual size and weight of caryopses (seeds removed from the floret) of different tropical perennial grasses varies widely (see Table 1) as does their germination percentage. This variation makes it difficult to be prescriptive about sowing rate in terms of the weight of seeds (kg/ha) that need to be sown to achieve a good plant density.

As a general rule, the larger the seed the more vigorous the seedling, although Katambora Rhodes grass seedlings grow rapidly from a very small seed and Floren bluegrass seedlings tend to grow slowly from a moderately sized seed. For the cultivars listed in Table 1, Swann forest bluegrass and Katambora Rhodes grass have the smallest seeds and the buffel grasses* Gayndah, American and Biloela the largest seeds. However, it should be noted the data in Table 1 are for caryopses (i.e. seed removed from the floret). Since not all florets contain seeds and not all seeds are viable and can germinate, sowing rates need to be adjusted to account for these differences.

The best way to calculate sowing rate is to work back from the amount of seed that needs to be sown to establish a minimum plant density at establishment of 10 plants/m² (i.e. 100,000 plants/ha). Research in Queensland (W. Scattini, pers. comm.) indicates that 17 germinable seeds are required to establish one plant. Therefore, a minimum of 10 plants/m², requires 170 germinable seeds/m² to be sown (i.e. 1.7 million germinable seeds/ha).

Purity and Germination rates

Purity and germination, determined in a certificate of seed analysis, are used to calculate proportion of live seeds (PLS). It is a combination of the seed size (number and weight of seeds) and the PLS value for a seed sample that will determine the sowing rate required to achieve the minimum plant density. If all 'seeds' were caryopses and all were germinable then the purity and germination percentage would be 100% and the PLS would be 1. As this is highly unlikely to occur, sowing rates need to be adjusted upwards to compensate for lower purity and germination. Table 2 indicates the effects of declining seed purity and seed germination on the sowing rate of a range of tropical perennial grass cultivars.



Adjusting for germination and purity can mean the difference between a pasture with good seedling density (top right) or one with poor density (bottom left).

Cultivar	Seed weight (g)/100 seeds	Number of seeds/kg
Bambatsi panic	0.093	1,075,300
Premier digit grass	0.043	2,325,600
Petrie green panic	0.062	1,626,020
Gatton panic	0.068	1,470,600
Narok setaria	0.114	877,200
Inverell purple pigeon grass	0.104	961,500
American buffel grass	0.198	505,050
Gayndah buffel grass	0.285	350,900
Biloela buffel grass	0.187	534,800
Pioneer Rhodes grass	0.037	2,702,700
Callide Rhodes grass	0.033	3,030,300
Katambora Rhodes grass	0.024	4,166,700
Hatch creeping bluegrass	0.116	862,100
Floren bluegrass	0.090	1,111,100
Swann forest bluegrass	0.017	5,776,250

Table 1. Variation in caryopsis (seed removed from the floret) weight and number per kg for a range of tropical perennial grasses. Data provided by W Scattini and G Lodge.

* Some agricultural species, such as buffel grass, have weed risk potential. When choosing species and cultivars for agricultural systems, the agricultural benefits must be balanced with the risk to the environment. Introduced species need to be prevented from becoming weeds in agricultural or native environments. More information on weed risk is available at www.futurefarmonline.com.au/about/weedrisk.htm As shown in Table 2, the sowing rate for 'seed' that has 50% purity and 50% germination would need to be increased by four-fold $(0.5 \times 0.5 =$ 0.25 and 1/0.25 = 4). As the PLS value declines from 1 towards 0, the sowing rate of all cultivars in Table 2 increases markedly, particularly so for those with larger seeds that need to be sown at a higher rate to achieve the minimum plant density at establishment of 10 plants/m². This will also affect the cost of seed. For example, at a nominal cost of \$20/kg for Bambatsi panic seed, the cost of seed with a PLS of 0.49 (70% germination and 70% purity) would be \$64/ha (\$20 x 3.2). This cost would increase to \$126/ha for seed with a PLS of 0.25 (50% germination and 50% purity) and \$352/ha for seed with a PLS of 0.09 (30% germination and 30% purity).

The average PLS values for a range of commonly sown tropical perennial grasses were obtained from 168 certificates of seed analysis. As a guide, these data together with estimates of seed size, were used to calculate the required sowing rate to achieve a minimum plant density of 10 plants/m², and are shown in Table 3.

Table 3 again shows that there is a distinct cost advantage in sowing seeds with higher purity and germination. However, it needs to be emphasised that a plant density of 10 plants/m² is the minimum and higher sowing rates are desirable.

The same principles apply to the cost of sowing coated seed. All seed is sold by weight with prices quoted in dollars per kilogram (\$/kg) of seed. However, a 2:1 seed coating (2 kg of seed coating to 1 kg of 'seed' by weight) will additionally increase the sowing rate 3-fold; a 4:1 seed coating will increase sowing rate by 5-fold. Therefore, for the same seed quality (purity, germination and proportion of other seeds), it is usually more cost effective to buy seed in the floret and increase the sowing rate than it is to buy coated seed.

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Cultivor	Sowing rate (kg/ha)				
Cultivar	PLS=1.0	PLS=0.49	PLS=0.25	PLS=0.09	
Bambatsi panic	1.6	3.2	6.3	17.6	
Premier digit grass	0.7	1.5	2.9	8.1	
Petrie green panic	1.0	2.1	4.2	11.6	
Gatton panic	1.2	2.4	4.6	12.8	
Narok setaria	1.9	4.0	7.8	21.5	
Inverell purple pigeon grass	1.8	3.6	7.1	19.6	
American buffel grass	3.4	6.9	13.5	37.4	
Gayndah buffel grass	4.8	9.9	19.4	53.8	
Biloela buffel grass	3.2	6.5	12.7	36.3	
Pioneer Rhodes grass	0.6	1.3	2.5	7.0	
Callide Rhodes grass	0.6	1.1	2.2	6.2	
Katambora Rhodes grass	0.4	0.8	1.6	4.5	
Hatch creeping bluegrass	2.0	4.0	7.9	21.9	
Floren bluegrass	1.5	3.1	6.1	17.0	
Swann forest	0.3	0.6	1.2	3.3	

Table 2. Effect of the declining proportion of pure live seeds (PLS) on the sowing rate required to achieve a minimum plant density of 10 plants/m² at establishment. For a PLS of 1.0, seed purity and germination would both be 100%; for a PLS of 0.49, they would both be 70% (i.e. 0.7×0.7); for a PLS of 0.25, they would be 50%, and for a PLS of 0.09, they would be 30%.

Cultivar	PLS	Sowing rate kg/ha
Bambatsi panic	0.57	2.8
Premier digit grass	0.40	1.8
Inverell purple pigeon grass	0.24	7.2
Katambora Rhodes grass	0.52	0.8
Floren bluegrass	0.22	7.0
Swann forest bluegrass	0.31	1.0

Table 3. Average PLS (proportion of live seed) of some tropical grasses (based on certificates of seed analysis) and the sowing rates required to achieve 10 plants/ m^2 .

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