

Panicum maximum



Scientific name

Panicum maximum Jacq.

Synonyms

Megathyrsus maximus (Jacq.) B.K. Simon & S.W.L. Jacobs
Urochloa maxima (Jacq.) R.D. Webster
Panicum hirsutissimum Steud.
Panicum maximum Jacq. var. *hirsutissimum* (Steud.) Oliv.
Megathyrsus maximus var. *coloratus* (C.T. White) B.K. Simon & S.W.L. Jacobs
Panicum maximum var. *coloratum* C.T. White
Megathyrsus maximus var. *pubiglumis* (K. Schum.) B.K. Simon & S.W.L. Jacobs
Panicum maximum Jacq. var. *pubiglume* K. Schum.
Panicum maximum Jacq. var. *trichoglume* Robyns
Urochloa maxima var. *trichoglumis* (Robyns) R.D. Webster

Family/tribe

Family: *Poaceae* (alt. *Gramineae*) subfamily: *Panicoideae* tribe: *Paniceae*.

Common names

General:

Guinea grass, Tanganyika grass , buffalograss (English speaking countries); hhash el gîna (Arab countries); pasto guinea, mijo de guinea (Argentina); capim guinea, capim-colonião, capim de Angola, capim de feixe, erva da Guine' (Brazil); ratatana, giniopilli (Ceylon); da shu, yang cao (China); talapi, tinikarati (Cook Islands); suur hirss (Estonia); capime guiné, fataque, herbe de guinée, panic élevé (French speaking countries); guineagrass (German speaking countries), giiniigaas, gini ghaus gini hullu (India); rumput banggala, rumput gajah, suket londo (Indonesia); erba di guinea (Italian speaking countries); ginea kibi (Japan); rebha luh-buluhan, rumput benggala, rumput sarang sesak (Malaysia), gini ghans (Nepalese); zaina, pasto guinea (Peru); gramalote (Puerto Rico); gewone buffelsgras (South Africa); ya-kinni (Thailand); saafa (Tonga), güyana otu (Turkey); vao kini (Samoa); hierba de india (Venezuela); co kê to (Vietnam).

Short types:

Panic, green panic, (Australia), slender guinea grass (Kenya); castilla (Peru).

Morphological description

An extremely variable species, loosely to densely tufted, shortly rhizomatous, erect or geniculately ascending, rooting at the lower nodes. Leaf blades linear to narrowly lanceolate. Panicle open, oblong or pyramidal, with secondary branches well developed and flexuous. Spikelets oblong, blunt or acute , rounded on the back.

Because of the morphological and agronomic variability, the species will be treated here as 2 broad types:

Tall/medium (TM) type - tussock , mostly >1.5 m in flower.

Short (S) type - tussock , mostly <1.5 m in flower.

TM types: robust perennials (sometimes annuals or short-lived perennials), 1.5-3.5 m tall, with stems to about 10 mm diameter. Leaves glabrous to hairy, 40-100 cm long, 1-3.5 (rarely -5) cm wide, tapering to fine point. Panicle , 12-45 (-60) cm long, and 12-25 (-30) cm wide, spikelets 2.5-3 (-5) mm long; 700,000-2 million seeds/kg.

S types: lower growing perennials, of less robust appearance than the TM types, usually 0.5-1.5 (occasionally -1.8) m tall and with stems to about 5 mm diameter. Leaves glabrous to hairy, to 1.4 cm wide. Panicle 18-20 cm long and 15-18 cm wide, spikelets 2.5-3.5 mm long; 1.5 million seeds/kg.

Distribution

Native to:

Africa: Angola, Benin, Botswana, Cameroon, Cote D'Ivoire, Democratic Republic of Congo (Zaire), Eritrea, Ethiopia, Ghana, Kenya, Lesotho, Liberia, Malawi, Mozambique, Namibia, Nigeria, Senegal, Sierra Leone, Somalia, South Africa, Sudan, Swaziland, Tanzania, Uganda, Zambia, Zimbabwe.

Indian Ocean: Madagascar, Mauritius.

Asia: Yemen.

Widely naturalised in the tropics. Grows naturally in open grasslands, usually under or near trees and shrubs, and along riverbanks.

Uses/applications

Long term pasture if fertility maintained. Ideal for cut-and-carry, although bristly types may cause discomfort to forage collector. Suited to agroforestry due to shade tolerance. Reasonably palatable when mature, providing good roughage for use in conjunction with urea molasses licks. Has been used successfully for making silage and hay .

Ecology

Soil requirements

P. maximum grows in most soil types providing they are well-drained, moist and fertile, although some varieties are tolerant of lower fertility and poorer drainage. Tolerance of low soil pH and high Al⁺⁺⁺ saturation is also variable. 'Vencedor' and 'Centenário' were bred for these tolerances; other varieties require liming on acid ultisols and oxisols for best results. The species is generally intolerant of waterlogging or salinity.

Moisture

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TM varieties are mostly grown in areas with annual rainfall above 1,000 mm, while S varieties are planted in areas with 800 mm or less. Drought tolerance varies among cultivars, although generally they do not tolerate dry periods longer than 4 or 5 months. Tolerant of short term flooding by moving water.

Temperature

Occurs from sea level to >2,000 m. Temperature response varies with genotype. S varieties are generally less affected by cooler temperatures than are many of the TM varieties, producing good early season growth. TM varieties generally produce most growth in the middle of the warm season, and although this varies somewhat with accession /cultivar, this type is not recommended for the subtropics or high altitude tropics.

Light

Grows well in full sunlight but has been recorded as growing better at 30% shade, although yields are reduced by half at 50% shade. Some varieties recognised for ability to grow in shaded conditions, e.g. 'Embu', 'Petrie'.

Reproductive development

Flowering triggers apparently vary with provenance or cultivar, some producing a single flush of flowering ('Mombaça', 'Tanzania', 'Tobiatã') while others ('Centauro', 'Vencedor') may produce 2-3 flushes. 'Makueni' and 'Riversdale' are indeterminate , while 'Hamil' and 'Colonião' are short day plants. 'Petrie' and 'Gatton' are largely insensitive to daylength, and flower from early summer to late autumn in the subtropics.

Defoliation

Susceptible to frequent low cutting. For long-term maintenance of stand, TM varieties should not be cut or grazed below about 30 cm, and should be cut or grazed at about 4-weekly intervals to obtain best balance between quality and quantity. S varieties can be grazed lower, but still are better under a rotational regime.

Fire

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Fire does not cause long-term damage.

Agronomy

Guidelines for the establishment and management of sown pastures.

Establishment

Germination should be tested, since seed of some genotypes may not reach maximum germination until up to 18 months after harvest, while others may take only a few months. Dormancy can be overcome by removal of glumes from fresh seed. Seed can be drilled or broadcast at 2-3 kg/ha, and being a small seed, should be planted at no more than 1 cm deep. Rolling after sowing improves germination and establishment. *P. maximum* can also be established from rooted tillers (or cuttings with thick stemmed varieties) planted on the contour every 0.5-0.6 m in rows 1.25-1.5 m apart, or as close as 40 cm in a triangular pattern if a faster cover is required.

Fertiliser

Establishment fertiliser is necessary on infertile soils, using 20-40 kg/ha P, and about 50 kg/ha N if limited cultivation prior to planting. Maintenance fertiliser is needed for pure grass swards especially in cut-and-carry systems. Inadequate N will lead to weakening of the stand and invasion by less desirable species. Maintenance dressings of 200-400 kg/ha/yr N are required to promote healthy, productive stands on less fertile soils. Soils with a pH <5 require addition of lime to raise pH to 5.5-6.

Compatibility (with other species)

Combines well with twining legumes under light grazing. As these legumes are generally less tolerant of grazing than the grass, the legume component declines and weeds increase under heavier grazing. *P. maximum* should not be planted with less palatable grasses. This leads to selection and decline of the *P. maximum*. It can be grown successfully under open forest or plantation due to shade tolerance.

Companion species

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Grasses: *Chloris gayana*.

Legumes: *Centrosema pubescens*, *Pueraria phaseoloides*, *Macroptilium atropurpureum*, *Neonotonia wightii*, *Stylosanthes guianensis*, *S. capitata*, *S. macrocephala*, *Leucaena leucocephala*.

S varieties, which are often grown on less acid soils in lower rainfall subtropical environments, may be grown with *Clitoria ternatea*, *Desmanthus leptophyllus*, *D. virgatus*, and *Medicago sativa*.

Pests and diseases

Ergot (*Claviceps* spp.), and other fungal diseases, *Conidiosporymyces ayresii*, *Fusarium roseum*, and *Tilletia* sp., can reduce seed yields when conditions are favourable to the pathogen. Seed production has also been adversely affected by a smut (*Ustilago* sp.) in Colombia and bunt in the Rift Valley of Kenya. A leaf spot caused by *Cercospora fusimaculosus* has been recorded in Puerto Rico.

Spittlebug (English), cigarrinha (Brazil), chicharrita (Argentina), salivazo (Colombia) (*Notozulia entreriana*, *Deois flavopicta*, *D. incompleta*, *Mahanarva* spp., *Aeneolamia reducta*, *A. selecta* (*Homoptera*, *Cercopidae*) affects some cultivars in tropical America. 'Colonião', 'Tobiatã', 'Vencedor' and 'Gatton' are very susceptible to spittlebug attack.

Ability to spread

As guinea grass is reasonably palatable, spread is minimal or slow under grazed conditions. It is a very effective coloniser in ungrazed areas, particularly where some form of soil disturbance has occurred.

Weed potential

P. maximum spreads along water courses and ungrazed roadsides, and has been listed as a weed in many countries. It is a major weed in sugar-cane fields, due to its ability to grow under shaded conditions.

Feeding value

Feeding value

Nutritive value

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IVDMD from 64% (2 week regrowth) to 50% (8 week regrowth). Crude protein from 6-25% depending on age and N supply. Seasonally, CP values in 12 week old regrowth commonly range from 5-10%, P levels from 0.15-0.18%, Ca from 0.6-0.8% and Na from 0.07-0.12%.

Palatability/acceptability

P. maximum is well eaten by all classes of grazing livestock, with particularly high intakes of young leafy growth. It is also used for feeding fish in Vietnam.

Toxicity

In South Africa, it is suspected of causing "dikoor" in sheep, a photosensitisation disease, perhaps linked to smut infection. The plant is also said to cause fatal colic if eaten too wet or in excess. 'Petrie' has been implicated in hyperparathyroidism ('big head') in horses, and occasionally nephrosis or hypocalcaemia in ruminants, due to oxalate accumulation.

Production potential

Dry matter

Commonly (10-) 20-30 (-60) t/ha DM, depending on variety and growing conditions (particularly if high levels of N applied).

Animal production

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Can achieve up to 0.8 kg/hd/day LWG and up to 1,200 kg/ha/yr LWG (commonly 300-500 kg/ha/yr LWG) depending primarily on stocking rate and N fertiliser rate.

Genetics/breeding

$2n = 18, 32, 36, 48$. A facultative apomict in which both apospory and pseudogamy occur. The amount of sexual reproduction generally varies from 1-5 percent depending on the variety, although sexual lines have been identified.

Seed production

Best in environments with longer day lengths and distinct dry seasons. Seed ripens unevenly, and is shed as it matures. Highest seed yield (19 percent recovery) obtained when the panicle has shed 40-60 percent of its spikelets, which occurs about 12-14 days from panicle emergence. Direct heading is less efficient in terms of seed recovery than mowing, windrowing and sweating. Yields of 50-100 kg pure seed yield are common from machine harvest, and around 200 kg/ha from ground sweeping, although higher yields have been recorded.

Herbicide effects

Atrazine can be used for weed control in *P. maximum* at 4 L/ha. 'Gatton' can tolerate over 4.5 kg/ha AI of atrazine, whereas common weeds such as *Nicandra physaloides*, *Raphanus raphanistrum*, *Argemone ochroleuca*, *Ageratum conyzoides*, *Sida cordifolia* and *Eleusine indica* are killed at 0.9 kg/ha AI.

Broadleaf weeds can be controlled using a pre-emergent spray (no wetting agent required) of 2,4-D sodium salt at 4.5 kg/ha of an 840 g/kg AI product using a minimum of 340 L/ha of water. *P. maximum* is susceptible to glyphosate and readily controlled by drizzle applications. Young plants are susceptible to selective grass -killers, and to diuron at 2.5 kg/ha of an 800 g/kg AI. Mature plants can also be killed using 2,2-DPA at 2.3 kg of a 740 g/kg AI product plus paraquat at 85 ml of a 200 g/litre AI product plus wetting agent at 250 ml per 200 litres of water, spraying to point of runoff.

Strengths

- Very leafy.
- High quality feed.
- High production potential .
- Readily eaten by all stock.
- Suited to grazing and cutting.
- Drought tolerant.

- Early season growth in some lines.

Limitations

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- Requires fertile soils.
- Intolerant of waterlogging .
- Intolerant of heavy grazing.
- Becomes stemmy if not cut or grazed frequently.

Other comments

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Internet links

- <http://www.fao.org/ag/AGP/AGPC/doc/Gbase/data/pf000278.htm>
- <http://www.issg.org/database/species/ecology.asp?si=398&fr=1&sts>
- <http://www.boidecorte.com.br/scripts/informativo/pastagens/gramineas.asp>
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<http://www.seedtest.org/upload/cms/user/Abstract/80.pdf>

http://www.hort.purdue.edu/newcrop/duke_energy/Panicum_maximum.html

<http://www.issg.org/database/species/ecology.asp?si=398&fr=1&sts=>

Feeding value

<http://www.fao.org/ag/aga/agap/frg/AFRIS/Data/118.HTM>

http://www.ctahr.hawaii.edu/ctahr2001/InfoCenter/Forages/grasses/03bNatsukaze_guinea.html

Cultivars

Cultivars	Country/date released	Details
TM types		
'Aries'	Brazil (Matsuda, 2003)	Hybrid between LSC2 ('Centaurus') as the seed parent and 'Aruana' (creeping type). 1.2-1.5 m tall. More tolerant of poor drainage and very low grazing (horses and sheep). Rapid regrowth after cutting/ grazing. Can produce >1 t/ha/yr seed in 3 harvests.
'Atlas'	Brazil (Matsuda, 2003)	Hybrid. Sexual types from 'Tobiatã' crossed with K-68 from Ivory Coast. 1.5-2 m tall. Tolerant of high Al saturation, giving deeper root system and greater drought tolerance. Seed yields up to 600 kg/ha from a single harvest.
'Centenário'	Brazil (1986)	Hybrid. Perennial to 2 m tall. Drought tolerant. Tolerant of high Al saturation. Resistant to spittlebug.
'Centaurus'	Brazil (1988)	IAC* apomictic hybrid between Zimbabwean 'Katerere' and the sexual line 40 (derived from PI 277944). 1.2 m tall, narrow, medium length, dark green leaves and a bluish stem, which, like the leaves, sheaths and ligules, is glabrous; good frost tolerance, moderate fertility soils.
'Colonião' (BRA-004723, BRA-003824, BRA-003841)	Brazil	The oldest accession of <i>P. maximum</i> in Brazil, brought with the slaves in the sixteenth century. Perennial 2.0-2.5 (-3.0) m tall; glaucous stems to >1 cm diameter. Leaves grey-green, 80-90 cm long, 2.5-3 cm wide; leaf sheath glabrous, except for few short hairs near collar. Panicle 20-50 cm long, 15-30 cm wide. Drought tolerant. Susceptible to spittlebug.
'Hamil' (BRA-004731, ORSTOM G76)	Australia (1956)	A giant form, 2.0-3.0 (-4) m tall, rooting freely from stem nodes in contact with moist soil; more robust and coarser in appearance than common types, comparable to 'Colonião' type but with dense, stiff hairs on the basal leaf-sheath. Leaf blades are softly hairy, and upright. Drought tolerant. Well accepted by cattle, even when mature. Late flowering, commencing flowering early to mid-April at 26°S. Seed set is poor but is rather higher than in most other varieties. Seeds about 2.3-2.5 mm long, ellipsoidal, straw-coloured, ±1,600,000 per kg.
'IPR 86 Milênio' (ORSTOM K249, BRA-006998)	Paraná, Brazil (1999)	From Nairobi, Kenya, large tussocks to 1.65 m tall, leaves long, to 3.5 cm wide, with dense coarse short hairs on leaf blades and sheath. For well-fertilised, production intensive systems.
'IZ 1' (Acc. No 80)	Brazil	A selection and purification to achieve the botanic "typus" of 'Colonião'; leaves: broad, dark green to blue, with a white wax on the upper surface.
'Likoni' (K 5829, ORSTOM G26, BRA-004375)	Kenya/Uganda (1952)	Similar to 'Hamil' in plant height and leaf width, but with glabrous leaf sheath. Recommended for the high-rainfall areas (1,000-1,270 mm) on the Kenya coastal strip. Also used in Cuba.
'Makueni'	Kenya (early 1960s)	From Makueni, Kenya (1° 47'S, 37° 37'E, 1,200 m asl, rainfall 910 mm). More robust than common types, but

	1989, Australia (1973)	rainfall 970 mm). More robust than common types, but less robust and finer stemmed than giant cultivars, 'Hamil' and 'Colonião'; grows to 1.8-2.4 m in height and with occasional short stolons. Leaves to 80-100 cm long, 18-22 mm wide, less erect than in 'Hamil', 'Colonião' and common. Distinguished from these varieties by virtue of dense hairiness of leaf blade, sheath, exposed stem and spikelet. Inflorescence about the same size as that of 'Colonião', larger than common guinea and smaller than in 'Hamil'; outer glumes of the spikelet covered in short dense hairs while those of other varieties are glabrous; spikelets 3.0-3.5 mm long. Annual dry matter yields are similar to those of other cultivars but higher (up to 25% of its total yield) in the cool season, compared with 20% for common and 15% for 'Colonião' and 'Hamil'.
'Mombaça' (IRD/ORSTOM K190A, BRA-006645, CIAT 6962)	Brazil (1993)	From near Korogwe, Tanzania (5.20°S 38.50°E, 290 m asl, rainfall 1,050 mm). Large tussocks to 1.65 m, stems tinged with purple. Leaves long, to 3 cm wide, with short hairs on the upper surface; leaf sheaths glabrous. Hand harvested clean seed yield ca 140 kg/ha (av.7yrs). High resistance to spittlebug. Good drought and cold tolerance. Dry matter yield 28% more than that of 'Tanzania-1'. Liveweight gains of 770 kg/ha/yr compared with 600, and 590 kg/ha/yr from 'Tanzania-1' and 'Tobiatã'.
'Mutale'	South Africa	Origin northern Transvaal.
'Natsukaze'	Japan (1985)	Hybrid (tetraploid $2n = 32$) from Kyushu National Agricultural Experiment Station, Kumamoto, Japan. Erect, leafy, annual/short-lived perennial to about 2 m tall; 85% apomictic. Selected for early growth vigour and high dry matter yield. High resistance to root knot nematodes (<i>Meloidogyne</i> spp.).
'Natsuyataka'	Japan (1988)	Hybrid (tetraploid $2n = 32$; apomict) from Kyushu National Agricultural Experiment Station, Kumamoto, Japan. Semi-erect, tufted perennial to ca 2 m, rooting freely from stem nodes when in contact with or in close proximity to moist soil. Leaf sheaths largely glabrous. Similar in appearance to 'Gatton'. Selected for persistence and high dry matter yields. Good regrowth after cutting. Adapted to well-drained fertile or moderately fertile soils in humid subtropical and tropical environments. Best on acid soils (pH 4.8-6.7). Early growth is slower than in 'Natsukaze' but equal to that of 'Gatton' and 'Petrie'.
'N(t)chisi'	Kenya, Malawi, Zambia	Giant type, stems hairless, panicle distinctive dark brown colour. Used in Zambia and Malawi, often propagated vegetatively. Recommended for cut-and-carry systems.
'Reyan No.9'	China	No information available.
'Riversdale'	Australia (1975)	Tall, erect, tufted perennial with a few short creeping rhizomes. Selected from 'Common' to remove 'coarse guinea' contaminant. Leaves held more erect than those of 'Makueni'. Leaves about the same length as those of 'Hamil' (70-80 cm in mature plants) but shorter than those of 'Makueni' and 'Colonião'; 15-18 mm wide compared with those of 'Makueni' (18-22 mm), 'Hamil' (24-26 mm) and 'Colonião' (25-30 mm); blades softly hairy on the adaxial surface and sheath moderately hairy. Best in frost-free areas receiving >1,300 mm annual rainfall. Less tolerant of poor drainage than 'Hamil' and with dry matter yields comparable to those of other cultivars, although yielding less in winter and more in summer than

		although yielding less in winter, and more in summer than 'Makueni'.
'Si Muang' (ORSTOM T58)	Thailand	See 'Tanzânia-1'. Commonly called "purple guinea". Readily established from rooted cuttings or seed.
'Tanzânia-1' (ORSTOM T[SH1]58, BRA-007218, CIAT 16031, CPATU 132)	Brazil (1990)	From near Korogwe, Tanzania (5.15°S, 38.48°E, 300 m asl, rainfall 1,050 mm). Perennial, 1-1.5 (>2) m tall, very leafy, purplish seedheads, moderate to high spittlebug resistance. Suitable for cut-and-carry or light grazing. Broader adaptation than many <i>P. maximum</i> TM types. Best adapted to areas with short or no dry season (but can survive long dry season). Moderate drought and cold tolerance. Leaf production 80% higher, seed production 30-40% higher, and live weight gain /ha/year, 37%, higher than common guinea. Liveweight gain 720 g/hd/day during the wet and 240 g in the dry season; annual gains of 250 kg yearlings on 'Tanzânia', 'Tobiatã' and 'Colonião' of 520, 450 and 420 g/hd/day have been recorded.
'TD 58' (ORSTOM T58)	Thailand	See 'Si Muang'
'Tobiatã' (ORSTOM K187B, BRA-001511, CIAT 6299, ILCA 7160, CNPGC 132/78, CPATU 130) (K 187 = CPI 89251 = CIAT 6960)	Brazil (1982)	From near Mombo, Tanzania. A broad-leafed (to ca 5 cm), erect perennial to >2 m tall. Leaves pendulous. Stiff hairs on the leaf sheath may cause skin irritation in cut-and-carry system. Good drought tolerance, moderate cold tolerance. Reports of spittlebug resistance vary from high to very low. Early flowering (commencing early February at 26°S).
'Umtali' (G 438)	Zimbabwe	More persistent under summer grazing and flowers later than 'Sabi'. Could be suitable in tobacco rotations because not a host of <i>Meloidogyne</i> .
'Vencedor' (CIAT 26900, BRA008826)	Brazil (1990)	Hybrid resulting from crosses made in Colombia between the best 8 <i>Panicum maximum</i> introductions and sexual 'Tift 49'. Initial selections were made from plants grown on an oxisol with pH 4.7 and Al and Ca saturation of 85.5% and 8.6% respectively. Tussock to 1.6 m tall, and leaves to 1.9 cm wide, with no waxiness or pilosity. Adapted to medium to high fertility soils, growing well in soils of pH <5. Produces around >20 t/ha dry matter (CP 8-14% IVDMD 64%), and 150-200 kg/ha seed. Has good cold tolerance (temperatures down to 8°C). Very shade tolerant, being one of the highest yielding tropical grasses at 55-80% light transmission.
S type		
'Gatton' (CPI 6563, ORSTOM G62, BRA-004642)	Australia (1964)	Institutional collection from Zimbabwe, introduced as "brown buffel grass". Culms to about 1.5 m, almost glabrous, more robust than 'Petrie' with broader and longer leaves. Inflorescence 18-20 cm long, 15-18 cm wide at the lowest primary branch, lower branches are usually whorled; spikelets 2.6-2.9 mm long; 1.4 million seeds/kg. Adapted to subtropical and tropical areas receiving between 760-1,000 mm of rain annually (similar to 'Petrie'). Has a longer growing season and appears also to utilise soil nitrogen better than 'Petrie'. Seed yields about 100 kg/ha.
'Petrie'	Australia (1966)	Origin unknown. Formerly <i>P. maximum</i> var. <i>trichoglume</i> , often referred to as "green panic". Tifted

	(1966)	often referred to as "green panic". Erect, summer-growing perennial, mostly to 1 (occasionally to 1.8) m tall. Usually paler green and more conspicuously hairy than 'Gatton' and 'Sabi'. Spikelets 2.5-3.5 mm long, glumes covered with fine hairs; 1.5 million seeds (2.4 million caryopses)/kg. Adapted to areas with rainfall from 650-1,750 mm/yr (not as well suited to high rainfall as many taller varieties). More susceptible to frost than <i>Chloris gayana</i> . Has moderate to good drought tolerance, and responds quickly to rain. Best growth is made during early spring, better than <i>Cenchrus ciliaris</i> or <i>Chloris gayana</i> . Very shade tolerant. It will grow satisfactorily on soils from pH 5-8, but best on those with an acid or neutral reaction. Flowers from early summer to late autumn. Seed does not ripen evenly and shatters badly; has a long period of dormancy, not reaching maximum viability until about 18 months after harvest. Does not tolerate heavy grazing.
'Natsukomaki'	Japan	Hybrid from Kyushu National Agricultural Experiment Station, Kumamoto, Japan. Low growing, fine stemmed, small leafed variety selected for treading resistance, drying rate and flexibility of culms for hay.
'PUK P8'	South Africa	From Bethlehem, Free State, South Africa (28.2°S, 1,700 m asl, rainfall 800mm, temperature falls to -13°C for 10-14 days/year). Selected by the Potchefstroom University. Morphologically similar to, but more productive than 'Gatton'. Observed to withstand winter without any cold injury under natural conditions.
'Sabi' (CPI 28275) (K5881)	Zimbabwe	Less erect than 'Petrie', to 1.5 m, and with narrower, glabrous bluish green leaves and smaller spikelets. More tolerant of waterlogging than other varieties. Moderately drought tolerant. Good seed producer.

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Promising accessions

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Promising accessions	Country	Details
CIAT 668, 673, 690, 696.	Colombia	High dry season yields in highly acid, Al-rich soil, low in available P.
CIAT 6799, 6944, 16019, 16042	Colombia (Carimagua)	Well adapted to acid soils (pH 4.8) with high Al ⁺⁺⁺ saturation (90%).
CIAT 6171, 6172, 6177, 6506, 6629, 6798, 6799, 16021, 16024, 16065	Colombia (Carimagua)	High resistance to spittlebug (<i>Aeneolamia reducta</i>).
CIAT 36000	Colombia	Best selection for low fertility, acid savannah soils for intensive beef and dairy.
CPAC-3017, 3024, 3003, 3013, 3012, 3059, 3016, 3067, 3025 and 3050	Brazil (Ariquemes)	Best adapted to environment of 36 <i>P. maximum</i> tested.
CIAT 673	Vietnam	Broad-leafed variety used in cut-and-carry dairy systems around Ho Chi Minh City.

Comparison of Brazilian cultivars

	Colonião	Tanzânia	Mombaça	Tobiatã	Centenário	Vencedor
Acid soil tolerance	Low	Medium	Low	Low	High	Medium

Tolerance of low fertility	Low	Low	Low	Low	Medium	Medium
Response to fertiliser	High	High	High	High	Medium	Medium
Forage quality	High	High	High	High	High	High
Spittlebug resistance	Low	Medium/high	Medium	Low	-	Low
Ease of management	Low	High	Low	Low	Medium	Medium
Tolerance of cold and dry	High	-	-	-	-	-
Silage production	-	Good	Very good	-	-	-
Tolerance of intensive grazing	-	High	High	-	-	-
Height at stock entry (cm)	90-100	70-75	90-100	100-110	-	-
Height at stock exit (cm)	30-40	25-30	30-40	35-45	-	-
Seeds/kg						



cv. Tanzania (in seed) and cv. Mombaça.

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Panicum maximum cv. Colonião (tall form).

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Hand harvesting of seed in Thailand.

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Charolais cattle grazing *Panicum maximum* and *Neonotonia wightii* in New Caledonia.

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