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POSSIBILITIES



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SEPASAL is a database and enquiry service about useful "wild" and semi-domesticated plants of tropical and subtropical drylands, developed and maintained at the Royal Botanic Gardens, Kew. "Useful" includes plants which humans eat, use as medicine, feed to animals, make things from, use as fuel, and many other uses.

Since 2004, there has been a Namibian SEPASAL team, based at the National Botanical Research Institute of the Ministry of Agriculture which has been updating the information on Namibian species from Namibian and southern African literature and unpublished sources. By August 2007, over 700 Namibian species had been updated.

Work on updating species information, and adding new species to the database, is ongoing. It may be worth visiting the web site and querying the database to obtain the latest information for this species.

Internet SEPASAL

New query

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 *Display help*In names list include: synonyms vernacular names and display: All names per page*Your query found 1 taxon***Panicum maximum Jacq [2182]**

Family: POACEAE

Synonyms

Panicum tephrosanthum Schinz

Vernacular names

- (Mozambique) capim da guine [2259] [5480], erva da Guine [2259], tengou [5480]
 (South Africa) amaYakayaka [2259]
 (Zimbabwe) garangichi [1340]
 Acholi (Uganda) otok [6658]
 Afrikaans (Namibia) groot panicum [5083] [5115] [5116]
 Afrikaans (South Africa) Sabi panicum [2259], gewone buffelsgras [2259] [5117], soetgras [2259], blousaadgras [2259], blousaadsoetgras [2259], brown-top buffelgras [2259], brown-top buffelsgras [2259], buffelgras [2259], buffelsgras [2259], purple-top buffelgras [2259], purple-top buffelsgras [2259]
 Afrikaans (South Africa, Transvaal) Mutale-witbuffelgras [6201]
 Afrikaans (Southern Africa) blousaad soetgras [2182]
 Afrikaans (Zimbabwe) bush buffelgras [2259], bush buffelsgras [2259]
 Ateso (Uganda) edinyo [6658]
 Brasileiro (Mozambique) capim da Angola [2259]
 Changana (Mozambique) chihunze [2259]
 Chope (Mozambique) dipunde [2259]
 English Guinea grass [2506] [6658]
 English (Botswana) buffalo grass [5092]
 English (Namibia) Guinea grass [2259] [5111] [5115] [5116]
 English (South Africa) Guinea grass [2259] [5117], bush buffalo grass [2259], purple-top buffalo grass [2259], rainbow grass [2259], ubabe [2259], ubabe grass [2259]
 English (Southern Africa) Guinea grass [2182] [5664]
 English (Zimbabwe) Guinea grass [2259]
 German (Namibia) Grosses Hirsegras [2259] [5083] [5115] [5116]

Jul'hoan (Namibia)	goho [5083] [5111] [5115], glaunla'a [5083] [5115]
Lango (Uganda)	odunyo [6658]
Luganda (Uganda)	mukonzikonzi [6658]
Lugisu (Uganda)	nabititi [6658]
Lunyoro	orukonzi [6658]
Luo (Uganda)	odunyo [6658], otok [6658]
Lusoga (Uganda)	mukonde [6658], musekende [6658]
Manhica (Mozambique)	chibuze [2259]
Ndebele (Zimbabwe)	uHatshi [2259]
Ronga (Mozambique)	chiundze [2259]
Rumanyo (Namibia)	malianjashi [5115]
Sotho	mofantsoe [2259]
Sotho (South Africa)	bobonare [2259], lehola [2259]
Swazi (Mozambique)	lissuane [2259]
Tonga	chamuzenene [1374]
Tonga (Zimbabwe)	nsenkenene [2259]
Tswana	mfhafha [1340], mphaga [1340]
Zezeru (Zimbabwe)	chiTserere [2259], chiVavane [2259]
Zulu	amayakayaka [1340], olukulu [1340], ubabe [1340]
Zulu (South Africa)	ubabe [2259], ubabeolukulu [2259]

Partial distribution

Plant origin	Continent	Region	Botanical country
Native	Africa	East Tropical Africa	Kenya [2259] [6573], Tanzania [2259], Uganda [2259]
		South Tropical Africa	Angola [2259] [5126] [6189], Malawi [3] [2259] [6189], Mozambique [3] [2259] [5480], Zambia [3] [2259] [5481], Zimbabwe [3] [2259] [5125] [6189]
		Southern Africa	Botswana [3] [2182] [2259] [5104] [5186] [6189], Cape Province [2182] [2259] [5104] [6189], Caprivi Strip [2182], Lesotho [2259] [5550], Namibia [2182] [2259] [5104] [5115], Natal [2182] [2259] [5104] [6189], Orange Free State [2182] [2259] [5104], Swaziland [2259] [5104] [5452], Transvaal [2182] [2259] [5104] [6189] [6201]

		West-Central Tropical Africa	Zaire [2259]
Introduced	Asia-Tropical	Indian Subcontinent Malesia	Sri Lanka [1653] Malaya [1653], New Guinea [1653], Philippines [1653], Sarawak [1653]
	Australasia Pacific Southern America	Australia North-Central Pacific Brazil Caribbean Northern South America	Hawaii [1653] Puerto Rico [1653] Venezuela [1653]
Status Unknown	Africa	West-Central Tropical Africa Western Indian Ocean	Congo [6189] Madagascar [2182]

ISO countries: Brazil [[1653](#)] , India [[1653](#)] [[2259](#)] , Madagascar [[6573](#)] , United States [[1653](#)] , South Africa [[2182](#)] [[2259](#)] [[5104](#)] [[6189](#)] [[6573](#)]

Descriptors

Category	Descriptors and states
DESCRIPTION	Prostrate/Procumbent/Semi-erect [2182]; Tussock Forming/Tufted/Caespitose [3] [5116] [6573] [6658]; Annual [3] [2182]; Erect [2182] [6573]; Densely Tufted [2182] [2506]; Loosely Tufted [2182]; Rhizomatous [2182] [2506] [5116] [6189] [6573]; Perennial [3] [2182] [2506] [5104] [6573] [6658]; Plant Height <= 3 m [5664] [6658]
CLIMATE	Not Frost Tolerant [1653] [6201]; Tropical Summer Rains [2259]; Subtropical, Hot and Arid [5104]; Annual Rainfall 300-1500 mm [6189]
SOILS	Well Drained [1653] [6189]; Alluvial Soils [2259] [6189]; Sandy [5111] [6189]; Loamy Sands [5111]; Sandy Loams [1653]; Clayey [6189]
HABITAT	Forest [1653] [6573]; Shrubland/Bushland/Scrub [1653] [6573]; Grassland/Forb-Land [1653] [2259] [6658]; Wooded Grassland [2182] [5117] [6573]; Pioneer in Forest Gaps [1653]; Wooded Shrubland [2182] [5117]; Semi-Desert [2182] [5117]; Termitaria [2259]; Watercourses [2182] [2259] [6573]; Anthropogenic Landscapes [3]; Croplands [2182]; Altitude 20-2100 m a.s.l. [5104]
PHYSIOLOGY	C4 [6146]; Resistant to Non-Insect Pests [2259] [6189] [6201]; Shade Tolerant [3] [1653] [2182] [5116] [6189]; Susceptible to Non-Insect Pests [6658]
PRODUCTION AND VALUE	Wild Plants Utilised [2259] [5116]; Traded Within a Country [6201]; Major Crop/Forestry Species [1653] [2259]; Recommended for Cultivation [5117] [5664]
CONSTRAINTS	Agricultural Weed [5664] [6573]
SOURCES OF PLANTING MATERIAL	Other Seed Sources [5181]
FURTHER DATA SOURCES	Botanical Illustration [1653] [2182] [2259] [5116] [6088]; Additional References [5638] [5717]; Regional Distribution Map [2259] [5664]; Botanical Photograph [2182] [5117] [5664]; Databases [5123] [5341]; Habit Illustration/Photograph [1653] [5117] [5664]; Grid Map [2182] [5115] [5116] [5117] [5123] [5125]
SEPASAL DATASHEET STATUS	Taxon Recently Added from Literature [6040]

CHEMICAL ANALYSES Poisonous Compounds - aerial parts [[1340](#)] [[5320](#)]; Nutritional Analyses - aerial parts [[1653](#)]; Proteins - aerial parts [[1653](#)]

Uses

Major use	Use group	Specific uses
FOOD [1188] [2514] [2658]	Seeds	famine food [550] [1374] [2506]; cereals [1374]
ANIMAL FOOD	Fertile Plant Parts Aerial Parts	seeds, birds [1653] [5664]; seeds, primates [2514] unspecified aerial parts, mammals, grazing [1653] [2259] [5116] [5117] [5664] [6189]; unspecified aerial parts, mammals, hay/straw [1653] [2259] [5117] [5664] [6189]; unspecified aerial parts, mammals, fodder [1653] [2259] [5118] [6189]; unspecified aerial parts, game mammals, grazing [2259] [5117]; stems, primates [2514]; unspecified aerial parts, mammals, forage [6189]; unspecified aerial parts, mammals, forage, winter [6189]; unspecified aerial parts, mammals, silage [1653] [6189] [6201]; unspecified aerial parts, mammals, hay/straw, winter [6201]; fodder [6573]; grazing [6573] [6658]; hay/straw [6573] [6658]
MATERIALS	Fibres	stems, 'jewellery'/personal adornment [5111]; stems, drinking straws [5111]; unspecified aerial parts, fences [5118]; unspecified aerial parts, thatch [5118]
ENVIRONMENTAL USES	Revegetators	degraded land [6189]
	Indicators	rangelands [5117] [5664]
GENE SOURCES		drought resistance [1653] [6189] [6201]; disease resistance [2259]

Picture

None recorded

Notes

NOMENCLATURE/TAXONOMY

Varieties:

Var. *trichoglume* is widely grown under the common names Slender guinea, Green panic or Petri. Var. *pubiglume* refers to the varieties with hairy spikelets. Embu is another type found in Kenya and differs from all other varieties of *P. maximum* in having long creeping stem bases, many-noded stems and almost lanceolate leaves although its floral parts are typical for the species [[1653](#)].

Name derivation:

Panicum is an old Latin name for the common millet, *Setaria italica* Beauv. 'Maximum' is Latin for 'the greatest', alluding to the fact that the grass can be tall [[2259](#)].

Synonyms:

Panicum maximum var. *altissimum* Kuntze and *P. maximum* var. *trichoglume* Robyns [[3](#)].

DISTRIBUTION

Africa:

Tropical Africa and in Madagascar [[2182](#)].

Worldwide:

Native in tropical Africa, introduced to other tropical and subtropical countries: India, Sri Lanka, Australia, Malaya, New Guinea, Sarawak, the Philippines, Hawaii, the West Indies, Caribbean Islands, the northern parts of South America, Central America and the USA, Brazil and Puerto Rico [[1653](#)].

Namibia:

Northern half of the country [5116] .

Widely distributed in Kenya, throughout tropical and South Africa; Madagascar and found elsewhere in the tropics [6573] .

RARITY/CONSERVATION

Namibia:

Assessed as Lower Risk Least Concern in 1994 [5400] .

DESCRIPTION

Roots:

Stout rhizome [2506] .

Seed:

Seed is in the form of a spikelet with a single caryopsis and varies in size depending on variety [1653] .

Height:

0.7-2.5 m [2259] .

Height:

It displays much variation and some lines, especially those in the tropical parts, grow up to 2-3 m tall and have a reed-like appearance [5664] .

Height:

Up to 2 m [2182] .

Height:

Up to 2.5 m [5104] .

Inflorescences:

Usually much branched with secondary branches well developed and flexuous. Spikelets blunt or acute, rounded on the back, cartilaginous. The closed spikelet has many nerves clearly visible on the lemma of the lower floret. Lower floret usually male with the palea well developed. Female-fertile (upper) lemma pale and conspicuously transversely rugose [2182] .

Inflorescences:

Panicle 12-45(60) cm long, oblong or pyramidal, the lowest branches arranged in a whorl [3] .

Leaves:

Leaf laminae (6)12-40(100) cm long and (4)12-35 mm wide, acuminate [3] .

Lifeform:

Graminoid [5104] .

Height:

Growing up to 3 m (10 ft) [5664] [6658] .

Growth form:

Tufted [6573] [6658] .

Habit:

Erect or sometimes geniculately ascending culms [6573] .

IDENTIFICATION

Other species of *Panicum* that are typically large and robust include *P. coloratum* and its varieties and *P. deustum*, *P. subalbidum* and *P. infestum*. All differ from *P. maximum* in having the main panicle branches arranged singly or in pairs, not in whorls [2259] .

FOOD - SEEDS

Cereals:

Seeds are boiled as a cereal during February and possibly January [1374] .

Famine food:

In Zambia, Senga people collect the seed for food in time of scarcity [550] .

Famine food:

In an emergency the grain can be used as famine food [2506] .

Famine food:

Used as a famine food in middle Gwembe Valley, Zambia [1374] .

Grains are boiled [2658] .

Grains used by Gwembe Tonga of Zambia in February [1188] .

ANIMAL FOOD

It is leafy and palatable under good management [6658] .

ANIMAL FOOD - FERTILE PLANT PARTS

Seeds, primates:

Grain is eaten by baboons and chimpanzees in Africa [2514] .

Seeds, birds:

In southern Africa the spikelets are very popular amongst seed-eating birds such as finches and doves which mainly eat grasses with round seeds and probably play an important role in seed dispersal [5664] .

ANIMAL FOOD - AERIAL PARTS

Stems, primates:

Baboons eat the leaf/shoots, stem-meristem and the pith (Stolz 1977, Ransom 1981) [2514] .

Unspecified aerial parts, mammals, fodder:

In India the grass is almost invariably cut and fed green [1653] .

Unspecified aerial parts, mammals, forage, winter:

A good practice is to allow for annual rest in autumn, usually after 2 hay cuts have been taken, and to make use of this forage during winter when there is seasonal shortage of grazing. This aftermath is very useful, as the grass retains its feeding value even in frosted state [6189] .

Unspecified aerial parts, mammals, hay/straw, winter:

Recommended for standing hay during winter [6201] .

Unspecified aerial parts, mammals, grazing:

It is very palatable to all kinds of stock, at least at reasonably early stages of growth, a few weeks after the last cut or grazing. At the later stages of growth the leaves remain highly palatable, whereas the thick stems of robust varieties are left uneaten, but the herbage of finer varieties containing, at the more mature stages, numerous thin stems, is eaten less willingly [1653] .

Unspecified aerial parts, mammals, silage:

In northern Transvaal (South Africa) it is important to mix molasses or maize meal with the silage [6201] .

Unspecified aerial parts, mammals, silage:

When making silage the addition of a preservative or molasses is essential [6189] .

Unspecified aerial parts, game mammals, grazing:

Fed on extensively by white rhino, buffalo and zebra at Kyle Game Reserve [2259] .

Unspecified aerial parts, mammals, fodder:

Possibly the best and most important cultivated fodder grass of the tropical Americas and India. Widely cultivated in Africa for fodder [2259] .

Unspecified aerial parts, mammals, grazing:

One of the most palatable and most valuable climax grasses which are widespread over practically all of southern Africa [5116] .

Unspecified aerial parts, mammals, grazing:

One of the most valuable and palatable veld grasses in southern Africa. It is particularly palatable, delivers a high leaf production and usually occurs in abundance in good veld [2259] [5117] [5664] [6189] .

Unspecified aerial parts, mammals, hay/straw:

Due to the high palatability and leaf production, as well as the good seed production, it is a popular cultivated pasture and is especially used to make hay [5664] .

Unspecified aerial parts, mammals, hay/straw:

Selected cultivars such as 'Green panic' produce hay and standing hay of high quality in South Africa [5117] .

Unspecified aerial parts, mammals, hay/straw:

Widely cultivated in Africa for hay [2259] .

Grazing:

It is a valuable ley grass and mixes well with most legumes [6658] .

Hay:

Suitable for standing hay, though stemmy when old [6658] .

Fodder, grazing, hay:

A good palatable grass when young, and very valuable as fodder; when available used as a cultivated grass both for pasture and hay [6573] .

MATERIALS - FIBRES

Stems, drinking straws:

In Namibia the stalks are used by the Jul'hoansi people for making drinking straws [5111] .

Stems, jewellery:

In Namibia the hollow stalks are used by the Jul'hoansi people for making necklaces [5111] .

Unspecified aerial parts, fences:

In northern Namibia it is used for kraal fences [5118] .

Unspecified aerial parts, thatch:

In northern Namibia it is used for thatching [5118] .

ENVIRONMENTAL USES - REVEGETATORS

Degraded land:

In Bathurst (South Africa) it was found to be of primary value for revegetating denuded areas, especially on surfaces where bush-clearing had been carried out [6189] .

ENVIRONMENTAL USES - INDICATORS

Rangelands:

In southern Africa it is classified as a Decreaser i.e. grasses that are abundant in good veld, but that decrease in number when the veld is overgrazed or undergrazed [5117] [5664] .

NUTRITIONAL VALUE

Aerial parts, crude protein, crude fibre, P, NFE, EE, DM digestibility, TDN, crude protein digestibility, DCP, crude fibre digestibility, NFE:

Crude protein ranges from 4-20%, crude fibre ranges from 28-36%, P > 0.15%, NFE 40-50%, EE 0.6-2.8%, DM digestibility 40-62%, TDN 38-61%, crude protein digestibility 15-73%, DCP 0.6-71%, crude fibre digestibility 40-70% and NFE 26-67%. These figures show a variation in nutritive value of herbage, the variation depending mainly on the stage of growth at which the herbage was harvested [1653] .

TOXICITY/POISONOUS COMPOUNDS

Aerial parts, hydrocyanic acid:

In South Africa it was found to yield hydrocyanic acid under suitable conditions [1340] .

Aerial parts, paraphenylenediamine, sheep:

The ingestion of *P. maximum* causes 'Dikoor' (literally 'thick ear'), a disease of young sheep. It is probably caused by the chemical substance, paraphenylenediamine [1340] .

Aerial parts, sheep:

'Dikoor', a disease of young sheep caused by wilted *Panicum* pastures [5320] .

WEED PROBLEMS CAUSED

Southern Africa:

It is a persistent weed, mainly in sugarcane fields. It must preferably be controlled in the seedling stage, as it is exceptionally difficult to eradicate later when the tufts have reached maturity [5664] .

A weed of cultivation or disturbed ground [6573] .

CONSTRAINTS - MISCELLANEOUS

Although it is drought resistant, it will not tolerate long periods of continuous drought [6189] .
Does not tolerate prolonged waterlogging or flooding. Short-term flooding is tolerated only if the top parts of the grass are exposed to the air [1653] .
Flowering lasts for a considerable period of time, and this affects seed harvesting and yields. Seed damage by birds and poor seed formation are the two other important factors adversely affecting seed production [1653] .
In southern Africa it is sensitive to overgrazing [6189] .
It is very vulnerable and easily destroyed by overgrazing, and allowance should be made for autumn rest for plants to build up root reserves [6189] .
It seeds well but the heads ripen very unevenly, with the result that mechanical harvesting of the seed is ruled out [6189] .

RAINFALL

Malawi:

800 to 1200 m [6189] .

Namibia:

300-600 mm [6146] .

Southern Africa:

It grows best under a rainfall of 625 to 1500 mm per annum [6189] [6201] .

Tropical regions:

Can grow in areas with annual rainfall of 650-800 mm but most types perform better in more humid areas with over 1000 mm [1653] .

TEMPERATURE

Africa:

Grows in frost-free tropical climate [1653] .

ALTITUDE

Angola:

1700 m [6189] .

Botswana:

1000 m [6189] .

Congo:

1600 to 1800 m [6189] .

South Africa:

Eastern Cape from sea level to 1200 m, Highveld 1500 to 1700 m and Transvaal 800 to 1500 m [6189] .

TOPOGRAPHY/SITES

Southern Africa:

In cultivated areas and along riverbanks, but well adapted to a variety of conditions [2182] .

River banks [6573] .

DRAINAGE

Tropical regions:

Does not tolerate prolonged waterlogging or flooding. Short-term flooding is tolerated only if the top parts of the grass are exposed to the air [1653] .

SOILS

Southern Africa:

Grows on a variety of soils, even on very sandy soils (Alexandria and Bathurst in Rep. of South Africa), but it prefers a heavy, well drained clay or loamy soil. It does exceptionally well on alluvial soil [6189] .

Tropical regions:

Mainly well drained, lightly-textured soils. Preferably sandy loams or loams and does not tolerate heavy clays [1653] .

South Africa:

Not recommended for cultivation on shallow sandy soils [6201] .

South tropical Africa:

Stable or unstable soils in natural or unnatural situations [3] .

Adapted to more fertile soils [6658] .

VEGETATION

Africa:

It occurs at forest edges, in bush, as a pioneer grass covering the land cleared from forest and in grassland with scattered trees where it tends to grow in light shade, under trees [1653] .

Botswana:

Associated with *Acacia erioloba*, *Acacia nigrescens* and *Acacia tortilis* [5092] .

Namibia:

Occasional to dominant [5115] .

South tropical Africa:

In shady or open habitats [3] .

Southern Africa:

A subclimax to climax grass which occurs in abundance in good veld. P. maximum is a habitat-specific grass which often represents two or even all three succession stages [5664] .

Southern Africa:

Fynbos, Savanna and Nama-Karoo [2182] .

Not often a major constituent of natural grassland [6658] .

Open or wooded grassland, deciduous bushland, forest edges [6573] .

ENVIRONMENTAL FACTORS - MISCELLANEOUS

Africa:

Cv. Sabi from Zimbabwe and cv. Makueni from Kenya are drought resistant [1653] .

It can be utilised extensively. High stocking rates of 2 steers/ha, and sometimes even higher were reported from Puerto Rico, Venezuela and Brazil. In Australia and less humid tropics and subtropics stockings rates are in the order of 2-4 ha per head of cattle [1653] .

Southern Africa:

Although it is drought resistant, it will not tolerate long periods of continuous drought [6189] .

Southern Africa:

It is very vulnerable and easily destroyed by overgrazing, and allowance should be made for autumn rest for plants to build up root reserves [6189] .

South Africa:

A well developed root system contributes to withstand drought [6201] .

South Africa:

In northern Transvaal as standing hay a stock rate of 10 units of average size per 3 ha per month was obtained [6201] .

In shady damp places with fertile soil, especially under canopy of trees [2182] [2259] .

In southern Africa it is sensitive to overgrazing in summer [2259] [6189] .

POLLINATION

In the Philippines the flowering occurred early in the evening, with a peak at 6 pm to 10 pm, depending on the variety, and lasted for 80 minutes. It is an aposporous and pseudogamous facultative apomict with about 2-3% of sexual reproduction which can be affected by cross- or self-pollination and this rate is normally maintained in the progenies of sexual plants. Under pseudogamy, pollination is necessary for the formation of the endosperm. Pollen tubes can reach the ovule in less than 3 hours [1653] .

FLOWERING/FRUITING/SEED SET

Flowering, fruiting:

In the Philippines 25% of spikelets flowered 6 days after panicle emergence and 50% of spikelets shed 15 days later. Flowering occurred early in the evening, with a peak at 6 pm to 10 pm, depending on the variety, and it lasted for 80 minutes [1653] .

Fruiting:

In Colombia the spikelets mature about 32 days after anthesis [1653] .

Flowering, South Africa:

November to July [5117] .

Flowering, southern Africa:

November to July [2182] .

Flowering, southern Africa:

October to May [2259] .

Flowering, southern Africa:

September to March [5664] .

DISPERSAL

In southern Africa the spikelets are very popular amongst seed-eating birds such as finches and doves which mainly eat grasses with round seeds and probably play an important role in seed dispersal [5664] .

GERMINATION

Germination improves with storage and fresh seed should not be sown. Germination and emergence are slow and uneven and the seedlings need some protection from weeds [1653] .

Zimbabwe:

Freshly harvested seed germinated to 5%, the germination increased to 24% after storage for about a year and to 40% when seed was treated for 10 minutes with concentrated sulphuric acid. The soft glumes of the spikelet may inhibit germination but hard glumes (lemma and palea of fertile floret) should not be removed. The naked caryopses did not germinate. Germination can also be increased by soaking in KNO₂ solutions or by seed leaching in running water. Alternate wetting and drying at early stages of germination can increase seed germinability. So can alternating temperatures, e.g. from 10 to 40 degrees, during the germination [1653] .

Southern Africa:

Germinates very well [2259] [5116] .

VEGETATIVE GROWTH

It grows rapidly, luxuriantly and combines well with legumes [6573] .

CYTOLOGY

The majority of plants and populations are tetraploids, normally, allotetraploids, with $2n = 32$ although hexaploids ($2n = 48$) occur fairly frequently. Other ploidy levels were also reported i.e. triploids ($2n = 24$), pentaploids ($2n = 40$), octoploids ($2n = 64$), nonaploids ($2n = 72$) and also plants with irregular chromosome numbers ($2n = 31, 36, 37, 38$). There are also diploid forms ($2n = 16$) which differ from the higher ploidy types in being entirely sexual. Purely sexual diploid populations were found at Korogwe, Tanzania and another less clearly defined diploid centre in Dar es Salaam [1653] .

For the genus $x = 7, 9, 10$ (high polyploidy) [98] [5150] .

PHOTOSYNTHESIS

C4-PCK physiology with K-PS-PCK anatomy [6146] .

PHYSIOLOGICAL TOLERANCES

Resistant to drought [6658] .

NEMATODE PESTS

The Rhodesian (Zimbabwean) strain is resistant to root-knot nematode [2259] .

FUNGAL DISEASES

It is relative free from leaf diseases but cv. Gamelote is invariably affected by leafspot caused at a later stage of growth by *Cercospora fusimaculosus*. The spikelets are often subject to smut or *Fusarium* diseases and some varieties are much more susceptible to spikelet diseases than others. A bunt disease, probably caused by *Tilletia echinosperma*, has been observed in certain areas of Kenya [1653] .

OTHER PESTS/DISEASES

In the moister areas bird damage reduces the yield of seed [6658] .

CULTIVATION

Africa:

Cultivated in Angola, Botswana, Congo, Malawi, South Africa and Zimbabwe [6189] .

America, India, Africa:

Possibly the best and most important cultivated fodder grass of the tropical Americas and India. Widely cultivated in Africa for fodder [2259] .

Cultivars:

Panicum maximum is a very variable species, especially in East Africa, and numerous natural types exist. Two main groups, differing in their agronomic characteristics, can be distinguished: 1. Large or medium types suitable for both soilage and grazing. They can be economically established from tuft splits. Most of the known cultivars are: Coloniao (grown from Brazil and introduced to other countries), Boringuen and Broadleaf (both from Puerto Rico), Guinea (Venezuela), Hamil (Australia), Gatton (Australia), Semper verde (Brazil), Sigor and Nchisi (Kenya), King ranch (USA) 2. Small, low-growing types mainly suitable for grazing, which should be grown closer and can be established mainly from seed. Cv. Green panic or Slender guinea (var. *trichoglume*), cv. Petrie of Australia (widely distributed in cultivation), cv. Sabi (of Rhodesian/Zimbabwean) origin, cv. Makueni (originates from dry south-eastern parts of Kenya and cv. Embu (Kenya) [1653] .

Cultivated to a moderate extent in Africa and has been introduced to other tropical and subtropical countries; India, Sri Lanka, Australia, Malaya, New Guinea, Sarawak, the Philippines, Hawaii and some areas where it is grown on farms but mostly on an experimental scale. It was first introduced into India in 1793. The main areas of cultivation are, however, South and Central America, the West Indies and, to a lesser extent, the southeast of the USA. It was introduced to America, probably in the eighteenth century and certainly early in the nineteenth century from West Africa. It soon spread throughout the Caribbean Islands to the northern parts of South America, Central America and the USA and, independently, from southeast coastal Brazil inland. In America it is now grown on large scale and has also spread to natural and semi-natural vegetation where it has perfectly naturalised [1653] .

Kenya, Zimbabwe:

Var. Makueni and var. Sabi from Zimbabwe are good seed producers [1653] .

Southern Africa:

It combines well with various perennial legumes, including lucerne and subtropical species, especially when planted in alternate rows [6189] .

Southern Africa:

The best known strains cultivated in the member countries of the Sarcus region are, Lilongwe, Coast, Nanyuki and *P. maximum* var. *trichoglume* [6189] .

South Africa:

Selected cultivars such as 'Green panic' produce hay and standing hay of high quality [5117] .

Southern Africa:

Due to high palatability and leaf production, as well as good seed production, it is a popular cultivated pasture and is especially used to make hay [5664] .

SEED WEIGHT

In large spikelet varieties, 1 000 spikelets weigh 1.40 g (700 000/ kg) and 1 000 scarified seeds, i.e. those with removed soft glumes, weigh 0.85 g (1 200 000/ kg). Unprocessed seeds of small spikelet cv. Sabi weigh 0.75 g/1 000 or 1 350 000/kg [1653] .

SEED STORAGE

Newly reaped seed has a very low viability, and it is advisable to store fresh seed for 6 to 9 months before planting, to allow for after-ripening [6189] .

Seed longevity depends on storage conditions. In sealed containers and at a temperature of 10 degrees germinability can last for a long time but is lost much earlier when stored in bags at higher or altering temperatures [1653] .

PROPAGATION FROM SEED

Planting technique:

The seed may be drilled by means of special grass planting machinery, but as this is not always available, mixing the seed with sifted manure or fertiliser and planting through the fertiliser attachment of an ordinary maize planter can be relied on to give good results. Seeding rate: The normal rate is 4 to 12 kg per ha when broadcast and less if planted in rows of 1 m apart. Land preparation: On most soils a dressing of 200 lb of superphosphate (or equivalent) and 100-150 lb of ammonium sulphate (or equivalent) per acre, should be applied prior to establishment [6189] .

Seed supply:

Seed production is difficult and seed is in short supply. Small types, such as Slender Guinea, cv. Sabi and cv. Makueni, are better seeders than the majority of large types and are established from seed. Preparation of soil: The seed bed is prepared in the usual way although spreading uncleaned seed on the soil surface of arable land has been reported from South America as a frequent practice [1653] .

Depth of sowing:

Seed sowing to a depth of 1-2 cm can be recommended. Seeds of *P. maximum* can germinate at a greater depth than those of other tropical grasses with small seeds [1653] .

Fertilisers:

P is usually applied at sowing, the rates depending on the soil fertility, and N can be applied later [1653] .

Germination:

In Zimbabwe freshly harvested seed germinated to 5%, the germination increased to 24 % after storage for about a year and to 40% when seed was treated for 10 minutes with concentrated sulphuric acid. The soft glumes of the spikelet may inhibit germination but hard glumes (lemma and palea of fertile floret) should not be removed. The naked caryopses did not germinate. Germination can also be increased by soaking in KNO₂ solutions or by seed leaching in running water. Alternate wetting and drying at early stages of germination can increase seed germinability. So can alternating temperatures, e.g. from 10 to 40 degrees, during the germination [1653] .

Mulching:

Mulching with straw which retains moisture near the ground surface can improve the establishment. [1653] .

Preparation of soil:

The seed bed is prepared in the usual way although spreading uncleaned seed on the soil surface of arable land has been reported from South America as a frequent practice [1653] .

Seeding method:

In Hawaii sowing from air (in mixture with other grasses) at 2.4 kg/ ha into burnt bushland without soil tillage gave satisfactory germination and good early growth [1653] .

Seeding rate:

Seed is usually sown at a rate of 4 to 10 kg/ha, depending on seed quality which is often low although in the earlier years sowing rates up to 110 kg/ha was sometimes recommended. Seed with 100% purity and germination can be sown at 1-2 kg/ha [1653] .

Weeding:

The seedlings need some protection from weeds. It is recommended in Zimbabwe to let weed seedlings emerge, to destroy them and then plant *P. maximum*. Herbicides, including different forms of 2,4D can be used as a pre-sowing application. On weedy land an early cut, or grazing if the weeds are palatable, can be recommended [1653] .

Fertiliser:

The grass is phosphate sensitive. It is recommended to increase the phosphate content prior planting to at least 20 parts per million. A treatment of 5-10 kg phosphate/ha is important during the growing season. In areas where production is under irrigation 350 g N may be added 3-4 times per year [6201] .

Irrigation:

Irrigation of at least 20 mm per week water is required. In areas where it is intensively grazed it needs more water, at least 75 mm per week [6201] .

Seeding rate:

In northern Transvaal (South Africa) it is planted at a rate of 7-10 kg seed/ha [6201] .

Sowing time:

In warmer areas it is sown from October to April. In areas where weeds occur it is better to plant later during the season (March to April) [6201] .

PROPAGATION - VEGETATIVE

Can be established either by seed or vegetatively by tuft splits. Vegetative propagation can be applied in practice only to the large types, single plants of which occupy considerable space. The splits can be spaced about 2 m by 1.5-1 m and 5 000-10 000 splits are required to plant one hectare. When planted in wet weather or on irrigated land, the splits survive reasonably well and the grass can be first cut or grazed 3-4 months after planting [1653] .

Southern Africa:

As there is a general scarcity of seed, establishment is mostly done vegetatively by dividing the plants [6189] .

'CROP' MANAGEMENT

Annual rest:

A good practice is to allow for annual rest in autumn, usually after 2 hay cuts have been taken, and to make use of this forage during winter when there is seasonal shortage of grazing. This aftermath is very useful, as the grass retains its feeding value even in frosted state [6189] .

Fertiliser application:

Although the grass is easily damaged by severe over-grazing, fertilisers may be worked into the soil by disking them in. This process of scarification also serves to rejuvenate unproductive pastures and will do no harm, providing it is done judiciously [6189] .

Fertiliser:

Reacts well to N fertiliser. The responses are the highest at moderate rates of N, 100-250 kg/ha, decreasing gradually at further application to a maximum of about 600 kg/ha. N is often applied at 50 kg/ha after each cut or grazing in natural grasslands or at 100 kg after every second cut. Responses depend to a greater extent on the content of available P in the soil and very considerable increases in DM yields, sometimes even greater than from fertiliser N, were obtained on P-deficient, e.g. granitic soils [1653] .

Grazing/harvesting:

Cutting or grazing to 15-20 cm from the ground, or even higher, has usually no advantage over low cutting to about 5 cm. The general trend is that with frequent cutting or grazing the increase in cutting level increases the yields, whereas the reverse was observed for infrequent cutting. Rotational grazing with 3- to 9-week intervals between grazing during the growing season often increases the herbage and animals yields compared with continuous grazing and is usually recommended, but there are also reports that continuous grazing can yield as much, if not more, grass as rotational grazing [1653] .

Irrigation:

Sprinkler irrigation during the dry season increased herbage yields during the five dry months when unfertilised as well as fertilised with moderate amounts of NPK. [1653] .

Leys:

The grass is long-lived, produces an abundance of organic material, is not difficult to eradicate and may therefore be used as a ley crop. Fertiliser application: Although the grass is easily damaged by severe overgrazing, fertilisers may be worked into the soil by disking it in. This process of scarification also serves to rejuvenate unproductive pastures and will do no harm, providing it is done judiciously. Annual rest: A good practice is to allow for annual rest in autumn, usually after 2 hay cuts have been taken, and to make use of this forage during winter when there is a seasonal shortage of grazing. This aftermath is very useful, as the grass retains its feeding value even in a frosted state [6189] .

Mixtures:

Cultivation with mixtures improved yields considerably. Crude protein yields increase almost invariably with the presence of legumes in the sward. The increases can be as high as two to four fold. Animal production from P. maximum/legume mixtures is, as a rule, much higher than from the grass alone [1653] .

Fertiliser:

In southern Africa it responds well to fertiliser [2259] [5116] [5117] [5664] .

Leys:

The Zimbabwean strain, Sabi Panicum has been used in leys in tobacco rotations [2259] .

HARVESTING

Cutting or grazing to 15-20 cm from the ground, or even higher, usually has no advantage over low cutting to about 5 cm. The general trend is that with frequent cutting or grazing the increase in cutting level increases the yields, whereas the reverse was observed for infrequent cutting [1653] .

Flowering lasts for a considerable period of time, and this affects seed harvesting and yields [1653] .

Harvesting is done by hand, stripping the panicles of large varieties or cutting the herbage near the ground in smaller varieties, stooking it, and thrashing later by beating with sticks. To prevent excessive seed shedding and bird damage, the panicles can be tied together before harvesting or the stooks are piled together and covered with another, smaller stook placed upside-down. Seed requires post-harvest maturation which may take 6-18 months [1653] .

Southern Africa:

It seeds well but the heads ripen very unevenly, with the result that mechanical harvesting of the seed is ruled out [6189] .

South Africa:

In northern Transvaal the panicles are harvested by hand, transported in bags to a shed where it is spread on the floor and left for a few days to dry [6201] .

It seeds well but harvesting of the seed must be done at the correct stage [6658] .

STORAGE

Southern Africa:

The grass is coarse stemmed, dries slowly and it is therefore necessary to turn it frequently in the swath before stacking [6189] .

YIELDS

Kenya:

Slender Guinea produced 300 lb seed/ac. (about 335 kg/ha) in which the percentage of spikelets containing caryopsis might be as low as 1-5%. Var. Makueni gave 25 kg of pure germinating seed/ha [1653] .

Numerous and controversial data on P. maximum productivity can be found in the literature. The yields depend on the cultivar, soil fertility, fertilisers, rainfall and the management. In Columbia well fertilised and irrigated grass can produce 40-50 t/ha and in India a yield of 226 t fresh herbage/ha/year in 12 cuts were recorded for sewage irrigated grass. In Puerto Rico 46.72 t DM/ha were recorded for a crop given 900 kg N/ha and in other trials over 35 t/ha. Fairly high yields were obtained in Thailand, 20 t DM/ha/year in the first 2 years of growth when the grass was well fertilised with NPK and irrigated during the dry season. Lower yields were obtained in French Guiana, 14.4 t DM/ha, but more realistic yields range between 4 and 12 t DM/ha or between 15 and 50 t fresh herbage and can be lower [1653] .

Southern Africa:

20 to 30 tons of green material per acre may be expected from the grass [6189] .

Philippines:

Records of 48-51 kg/ha of seed with 5-7% of good, full seeds for three large cultivars and 99-156 kg for two selections from cv. Sabi were obtained [1653] .

Seeds, South Africa:

In northern Transvaal 130 ha planted with Panicum maximum produced 45 t of seeds. 30 Ton DM/ha were produced after the seed was harvested [6201] .

PRODUCTION

Numerous and controversial data on P. maximum productivity can be found in the literature. The yields depend on the cultivar, soil fertility, fertilisers, rainfall and the management. In Columbia well fertilised and irrigated grass can produce 40-50 t/ha and in India a yield of 226 t fresh herbage/ha/year in 12 cuts were recorded for sewage irrigated grass. In Puerto Rico 46.72 t DM/ha were recorded for a crop given 900 kg N/ha and in other trials over 35 t/ha. Fairly high yields were obtained in Thailand, 20 t DM/ha/year in the first 2 years of growth when the grass was well fertilised with NPK and irrigated during the dry season. Lower yields were obtained in French Guiana, 14.4 t DM/ha,

but more realistic yields range between 4 and 12 t DM/ha or between 15 and 50 t fresh herbage and can be lower [1653] .

On poorer soils it is less successful, production falling off rapidly after the first year, unless regularly fertilised [6658] .

TRADE

South Africa:

The production of seed in the Mutale area (northern Transvaal) is for the local market [6201] .

FIELD TRIALS

An increase of 38 kg DM (dry matter) production per kg of applied N was obtained in Queensland at 140 kg/ha, but reduced to 27.6 kg at 280 kg N/ha [1653] .

Australia:

Green Panic (var. trichoglume) survived 5-10 day flooding to 90-100% but none survived 20 days of flooding. Cutting the grass before flooding reduced the survival [1653] .

Australia, Kenya:

Trials with mixtures were carried out in Australia and Kenya [267] .

Brazil:

Sprinkler irrigation during the dry season increased herbage yields during the five dry and cool months from 6.7 to 8.0 t/ha, unfertilised, and from 9.1 to 10.9 t when fertilised with moderate amounts of NPK [1653] .

Extensive experimental work has been done, especially in Puerto Rico, where high herbage and animal production from *P. maximum* has been achieved [1653] .

Hawaii:

Sowing from air (in mixture with other grasses) at 2.4 kg/ha into burnt bushland without soil tillage gave satisfactory germination and good early growth [1653] .

In field trials in which the soil was periodically dried and moistened to a depth of 2-3 cm the best emergence was observed from 2.5-3 cm [1653] .

India:

Sewage water irrigation is practised in India and high yields up to over 100 t fresh material/ha are obtained [1653] .

South Africa:

In northern Transvaal 130 ha planted with *Panicum maximum* produced 45 t of seeds. It produces 30 t DM/ha after the seed is harvested [6201] .

Uganda:

The application of N increased its proportion in a sown mixture with *Hyparrhenia rufa* to 20-30% compared with an almost complete dominance of *H. rufa* in paddocks receiving no N [1653] .

RESEARCH NEEDS

Seed sowing gives good results but seed production is difficult and seed is in short supply. The breeding and propagating of varieties with higher seed production could help [1653] .

SEED SUPPLIERS

National Plant Genetic Resources Centre, National Botanical Research Institute, Private Bag 13184, Windhoek, Namibia [5181] .

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References

- [3] Flora Zambesiaca. 1960-. London: Crown Agents for Overseas Governments and Administrations. En. Edited by A.W. Exell et al.
- [98] Leistner, O.A., et al., eds. 1963-. *Flora of Southern Africa*. Pretoria, South Africa: Government Printer. En.
- [267] Bogdan, A.V. 1949. Observations on palatability of some leguminous plants of Kenya. *E. Afr. Agric. J.* 15(1): 38-41. En.
- [550] Burkill, H.M. 1994. *The useful plants of West Tropical Africa. Volume 2. Families E-I*. Kew, U.K.: Royal Botanic Gardens, Kew. xii, 636p. En. Supplement to Keay, R.W.J. and Hepper, F.N., eds. (1954-1972), *The Flora of West Tropical Africa*, 2nd ed.
- [1188] Grivetti, L.E. 1981. *Perspectives on dietary utilization of wild plants, nutritional status and agricultural development*. Fresno, California: International Geographical Union Commission of Rural Development (Symposium). 98p. En. 23-25 April 1981.
- [1340] Watt, J.M. and Breyer-Brandwijk, M.G. 1962. *The medicinal and poisonous plants of southern and eastern Africa*. Edinburgh and London: E. and S. Livingstone. ix, 1457p. En. 2nd ed.
- [1374] Scudder, T. 1962. *The ecology of the Gwembe Tonga: Kariba studies*. Manchester: Manchester University Press. 274p. En. Vol. 2.
- [1653] Bogdan, A.V. 1977. *Tropical pasture and fodder plants (grasses and legumes)*. London: Longman. xiii, 475p. En.
- [2182] Gibbs Russell, G.E., Watson, L., Koekemoer, M., Smook, L. et al. 1990. *Grasses of Southern Africa*. Pretoria, South Africa: National Botanic Gardens/Botanical Research Institute. 437p. Mem. Bot. Survey South Africa No. 58.
- [2259] Chippindall, L.K.A. and Crook, A.O. 1976. *Grasses of Southern Africa*. Salisbury, Rhodesia: M.O. Collins. 240 parts in loose leaf form.
- [2506] Tredgold, M.H. 1986. *Food plants of Zimbabwe: with old and new ways of preparation*. Gweru, Zimbabwe: Mambo Press. xii, 153p. En.
- [2514] Peters, C.R., O'Brien, E.M. and Drummond, R.B. 1992. *Edible wild plants of sub-Saharan Africa*. Kew, U.K.: Royal Botanic Gardens, Kew. 239p. En.
- [2658] Kunkel, G. 1984. *Plants for human consumption*. Koenigstein: Koeltz Scientific Books. xiv, 393p. En.
- [5083] Craven, P. and Kolberg, H. In prep. *Common names of Namibian plants*. Windhoek.
- [5092] Roodt, V. 1998. *Trees and shrubs of the Okavango Delta. Medicinal uses and nutritional value*. Gaborone: Shell Oil Botswana. 21(1): 67-73. The Shell field guide series: part I.
- [5104] Germishuizen, G. and Meyer, N.L., eds. 2003. *Plants of southern Africa: an annotated checklist*. Strelitzia 14. Pretoria: National Botanical Institute.
- [5111] Leger, S. 1997. *The hidden gifts of nature. A description of today's use of plants in west Bushmanland (Namibia)*. ed. German Development Service.
- [5115] Klaassen, E.S. and Craven, P. 2003. *Checklist of grasses in Namibia. SABONET Report No. 20*. Pretoria and Windhoek: Southern African Botanical Diversity Network.
- [5116] Müller M.A.N. 1984. *Grasses of South West Africa/Namibia*. Windhoek: Department of Agriculture and Nature Conservation.
- [5117] Van Oudtshoorn, F. 1992. *Guide to grasses of South Africa*. Arcadia, Pretoria: Briza Publications. 301p.
- [5118] Ostermeier-Noczil, B. 1997. *Smallholders of northern Namibia. Ethnobotanical case study of the traditional Mbukushu village "Kaké" in the Kavango/Caprivi-region*. Vienna: University of Vienna. Unpublished Diploma thesis.
- [5123] National Herbarium of Namibia. Undated. *Specimen Database (SPMNDB)*. Windhoek: National Botanical Research Institute of Namibia.
- [5125] Chapano, C. 2002. *A checklist of Zimbabwean grasses. SABONET Report No. 16*. Pretoria: Southern African Botanical Diversity Network.
- [5126] Costa, E., Martins, T. and Monteiro, F. 2004. *A checklist of Angola grasses - Checklist das Poaceae de Angola. SABONET Report No. 28*. Pretoria: Southern African Botanical Diversity Network.
- [5150] Leistner, O.A., ed. 2000. *Seed plants of southern Africa: families and genera. Strelitzia 10*. Pretoria: National Botanical Institute.
- [5181] National Plant Genetic Resources Centre. undated. Windhoek, Namibia: National Botanical Research Institute of Namibia.
- [5186] Kabelo, M. and Mafokate, D. 2004. *A checklist of Botswana grasses. SABONET Report No. 24*. Gaborone and Pretoria: Southern African Botanical Diversity Network.
- [5320] Van Wyk, B-E., van Heerden, F. and van Oudtshoorn, B. 2002. *Poisonous plants of South Africa*. Pretoria: Briza Publications.
- [5341] National Plant Genetic Resources Centre. undated. *Database*. Windhoek, Namibia: National Botanical Research Institute of Namibia. En.

- [5400] Craven, P. and Loots, S. 2002. Namibia. Pretoria, Southern African Botanical Diversity Network. Pp. 61-92.
- [5452] Braun, K.P., Dlamini, S.D.V., Mdladla, D.R., Methule, N.P. et al. 2004. *Swaziland flora checklist*. SABONET Report No. 27. Pretoria: Southern African Botanical Diversity Network.
- [5480] Da Silva, M.C., Izidine, S. and Amude, A.B. 2004. *A preliminary checklist of the vascular plants of Mozambique*. SABONET Report No. 30. Pretoria: Southern African Botanical Diversity Network. 183p.
- [5481] Phiri, P.S.M. 2005. *A checklist of Zambian vascular plants*. SABONET Report No. 32. Pretoria: Southern African Botanical Diversity Network. 167p.
- [5550] Kobisi, K. 2005. *Preliminary checklist of the plants of Lesotho*. SABONET Report No. 34. Pretoria and Roma: Southern African Botanical Diversity Network. 84p.
- [5638] Stoltz, L.P. 1977. *The population dynamics of Baboons *Papio ursinus* Kerr 1792, in the Transvaal*. Ph.D dissertation, University of Pretoria.
- [5664] Van Oudtshoorn, F. 2004. *Guide to grasses of Southern Africa*. Pretoria: Briza Publications. En. 288p.
- [5717] Ransom, T.W. 1981. *Beach troop of the Gombe*. Lewisburg: Bucknell University Press.
- [6040] SEPASAL Namibia. 2005/2006. *National Botanical Research Institute of Namibia*. Windhoek: Namibia.
- [6088] Meredith, D. 1955. *The grasses and pastures of South Africa*. Union of S. Africa: Central News Agency.
- [6146] 2006. <http://www.bgc-jena.mpg.de/bgc-processes/publdata.namibia.pdf>. 09/02/2006.
- [6189] Sarccus. 1961. *The cultivated grasses of southern Africa*. Pretoria: Government Printer. Final report of the grass inventory sub-committee.
- [6201] Cilliers, J. 1989. Venda kweek puik witbuffelgras. *Landbouweekblad*. 17 Februarie 1989. Pp. 34-37. Af.
- [6573] Kamal, M. Ibrahim and Kabuye, H.S. Christine. 1987. *An illustrated manual of Kenyan grasses*. Food and Agriculture Organization of the United Nations. En.
- [6658] Wendt, W.B., Stobbs, T.H., Tiley, G.E.D and Tucker, G.G. 1970. *Pasture Handbook; A practical guide for farmers, extension workers and students, to the establishment and management of sown pastures and fodder crops in Uganda*. Department of Agriculture, Ministry of Agriculture and Forestry, Entebbe. En.

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