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Tropical kudzu (Pueraria phaseoloides)

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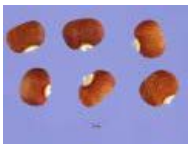
Click on the "Nutritional aspects" tab for recommendations for ruminants, pigs, poultry, rabbits, horses, fish and crustaceans





Common names

Tropical kudzu, puero (Australia) [English]; kudzu tropical, puero [French]; kudzú, kudzú tropical [Spanish]

Species

Pueraria phaseoloides (Roxb.) Benth. [Fabaceae]

Synonyms

Pueraria phaseoloides (Roxb.) Benth. var. *phaseoloides*, *Dolichos phaseoloides* Roxb.; *Pueraria phaseoloides* (Roxb.) Benth. var. *javanica* (Benth.) Baker, *Neustanthus javanicus* Benth., *Pueraria javanica* (Benth.) Benth, *Neustanthus sericans* Miq., *Pachyrhizus mollis* Hassk.

Taxonomic information

The tropical kuzu (*Pueraria phaseoloides* (Roxb.) Benth.) emcompasses only 2 varieties recognised by GRIN:

- *Pueraria phaseoloides* (Roxb.) Benth. var. *phaseoloides*,
- *Pueraria phaseoloides* (Roxb.) Benth. var. *javanica* (Benth.) Baker

The main differences between the 2 varieties are in the calyx shape and the general habit. Plants of the javanica variety are reported to be more robust (Cook et al., 2005)

Feed categories

- Legume forages
- drilling plants

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Description

Tropical kudzu (*Pueraria phaseoloides* (Roxb.) Benth.) is a vigorous, dense-growing vine cultivated in tropical countries as cover crop, green manure and fodder for livestock.

Morphological description

Tropical kudzu is a vigorous twining and climbing perennial legume. It is deeply rooted (down to 2 m depth) and its hairy, slender stems may be 6-10 m long (sometimes up to 15 m) x 0.6 cm in diameter. The stems may root from the nodes and then develop many branches (FAO, 2015; Cook et al., 2005; Halim, 1997). Tropical kudzu forms swards of tangled branches that may reach 60-75 cm in height. The young shoots are densely covered with brown hairs. The leaves are alternate, trifoliolate, borne on 3-11 cm long, hairy petioles. The leaflets are thin, dark green on their upper surface, pale green on the lower one, pubescent. The apical leaflet is triangular to ovate, cuneate at its base, shallowly lobed, 2-20 cm long x 2-16 cm broad. The lateral leaflets are oblique, rounded-obtuse at their base, 6-7 cm long x 6-7 cm broad. The inflorescence is an axillary raceme, 15-30 cm in length, bearing small, scattered, mauve to deep-purple flowers. Once pollinated, the flowers turn into pods (fruits). The fruits are linear, cylindrical, straight or slightly curved pods. The pods are 4-11 cm long and 3-5 mm in diameter. They contain 10 to 25 black, oblong, 3 mm long seeds. The pods are thinly hairy. Green when young, they turn black when maturing. The pods easily split open after sun-drying (FAO, 2015; Cook et al., 2005; Acevedo-Rodriguez, 2005; Halim, 1997).

use

Tropical kudzu is mainly used as a cover crop and green manure and as a pasture for livestock. It is one of the most used cover crops in the plantations of rubber, oil palm and coconut of the humid Asian Tropics. It is often used in sisal (*Agave sisalana*) plantations in Africa (Halim, 1997). In South America, it is planted as a cover crop in citrus, mango, and macadamia plantations (Fernandez Mayer, 2013). Its ability to smother weeds is a valuable trait. Its pioneering habit is useful for establishment on slopes (Halim, 1997). Tropical kudzu cultivated in coconut basins provides valuable green manure which enriches microbiological activity of the coconut rhizosphere (Thomas et al., 1984). The roots are reported to be edible and its fibrous roots are used to make ropes (Halim, 1997). Tropical kudzu is a valuable forage for livestock. It is highly palatable to livestock and can be grazed or cut for hay or silage making (Cook et al., 2005).

Distribution

Tropical kudzu is thought to be native of East and Southeast Asia. It has been introduced for cultivation in most tropics and is now naturalized and widespread in all humid tropics. Tropical kudzu is naturally found on river banks, roadsides, fallow fields and secondary forest (Halim, 1997). It grows from 0° to 17° in both hemispheres and from sea level to an altitude of up to 1000-1500 m (Cook et al., 2005). It can grow where annual rainfall is ranging from 850 mm to 2000 mm but it does better above 1500 mm rainfall and where day/night temperatures are 32°C/24°C. Biomass production decreases by 35% when the day/night temperatures fall to 26°C/15°C (Halim, 1997). Tropical kudzu is tolerant of dry conditions and seed production is promoted by a short dry season. Tropical kudzu can withstand short periods of waterlogging and flooding conditions. It is referred to be one of the most resistant nodulating legumes for the humid tropics (Halim, 1997). Tropical kudzu is very shade-tolerant and is preferred in many tropical tree plantations (FAO, 2015; Cook et al., 2005; Fernandez Mayer, 2013; Halim, 1997). Tropical kudzu can grow on a wide range of soils from sandy loams to clays but does not well on tight heavy clays (Cook et al., 2005). It is tolerant of acidic conditions (pH ranging from 3.5 to 5.5-6 are well suited) and does not suffer from aluminium toxicity. It does not well in saline soils (Halim, 1997). Over pH = 6, tropical kudzu may show some Fe deficiency. It does better in soils with medium-high fertility status and responds positively to K, P, Mg and S fertiliser applications (Cook et al., 2005; Halim, 1997).

drilling management

Tropical kudzu can be cultivated alone or in association with several erect grasses such as Para grass (*Brachiaria mutica*), bread grass (*Brachiaria brizantha*), cori grass (*Brachiaria miliiformis*), Congo grass (*Brachiaria ruziziensis*), Gamba grass (*Andropogon gayanus*), molasses grass (*Melinis minutiflora*), Guinea grass (*Megathyrsus maximus*) and elephant grass (*Pennisetum purpureum*). However, it does not as well with signal grass (*Brachiaria decumbens*) and pangola grass (*Digitaria eriantha*) (FAO, 2015; Cook et al., 2005). In oil palm plantations, tropical kudzu gave the highest yield in association with Guinea grass or Congograss (Ezenwa et al., 1996). When it is intended to be used in association with grasses, tropical kudzu should be oversown in the pre-existing grass pasture. It has a positive effect on grass growth and remains productive when the grass suffers from drought (Telford et al., 1947)

Tropical kudzu is mainly propagated by seeds. It seeds should be scarified before being broadcasted or drilled onto a well-prepared, weed-free seedbed. For pasture purpose, a good seeding rate is 0.5-1 kg seeds/ha. In places where tropical kudzu is new, the seeds should be inoculated with an appropriate strain of *Bradyrhizobium* (Halim, 1997). When seeds are not available, vegetative propagation can be done by planting rooted stolons at 1-2 m distance. Tropical kudzu should be planted at the beginning of the rainy season. Under irrigation, a valuable stand can be obtained in less than 6 months (Telford et al., 1947). The first months of establishment are somewhat difficult and require weeding. After that, the tropical kudzu becomes more agressive and effectively smothers weeds (Halim, 1997). Tropical kudzu grows 12 months a year (Telford et al., 1947)

Yield

Tropical kudzu may be grazed or cut for cut-and-carry or to make hay or silage. Dry matter yields are very variable, ranging from a 3-6 t/ha to over 20 /ha, depending on the cultivation method (alone or in association; under trees in plantation or a sole crop in stand) (Ezenwa et al., 1996; Magat et al., 1976). In Nigeria, yields of tropical kudzu in mixture with guinea grass were under 5.9 tons DM/ha under oil palm trees (Ezenwa et al., 1996).

Pasture

As tropical kudzu is sensitive to defoliation and very palatable to livestock (Skerman et al., 1990), it should not be heavily grazed, particularly when grown on poorly drained soils. Continuous or rotational lenient grazing is recommended. Tropical kudzu was reported to be poorly persistent after two years grazing when it was sown in poorly drained, compact soils (Halim, 1997). A stocking rate of 2-6 local cattle on a mixed sward of tropical kudzu/grass significantly reduced tropical kudzu ratio in only one year (Halim, 1997). Though not very resistant to high stocking rates when grazed, it could be successfully used in Acre, Brazil, where it helped establishing new pastures for cattle production (Valentim et al., 2005). It was recommended not to cut below 25 cm high for better rooting and drought resistance in a tropical kudzu/molasses grass mixture (Halim, 1997).

Hay and silage

Tropical kudzu can be dried and into hay. It could yield 4 t of hay in Colombia (Skerman et al., 1990). It was shown that the optimal cutting interval for hay quality was 60 days (Hiep et al., 2008a). It was also possible to make silage from a mixture of tropical kudzu and elephant grass or from a mixture of tropical kudzu and *Pennisetum purpurescans* (Skerman et al., 1990).

Environmental impact

Invasiveness

Because of its vigorous fast-growing habit, tropical kudzu was listed as one of the most aggressive weeds invading moist habitats in tropical and subtropical regions in the USA and in Australia (Randall, 2012; USDA, 2012). It is declared a noxious weed in the USA and an invasive plant in Costa Rica, Ecuador, Puerto Rico and the Pacific Islands (Hawaii, French polynesia, Niue and New Caledonia) (CABI, 2013). Tropical kudzu is a pioneering species that smothers neighbour plants under a solid blanket of leaves. It can break branches and uproot entire trees and shrubs (CABI, 2013).

N-fixing legume, soil improver and soil erosion controller

Tropical kudzu is an N-fixing legume. It could fix 100 to 300 kg N/ ha (Jørgensen, 2013; Neyra, 1992). In tree plantations, tropical kudzu has two main roles: it returns N to the soil and provides leaf-litter (organic matter) to the neighbouring trees (Tajuddin et al, 1990; Soong et al, 1976 cited by CABI, 2013).

datasheet citation

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Nutritional attributes

Tropical kudzu, like most legume forages, is rich in protein (about 20% DM, ranging from 13 to 25%). However, its fibre content is also very high (crude fibre 26-40%), which tends to be detrimental for animal feeding.

ruminants

Tropical kudzu is a valuable source of forage for sheep and cattle. It is palatable and provides good amount of DM and crude protein in tropical grasslands.

Dairy cows

Tropical kudzu could feed 2 cows/ha during the dry season and 4 cows/ha during the rainy season in Puerto Rico (Telford et al., 1947). In Brazil, an association of signal grass and tropical kudzu (10% of forage) supplemented with sorghum grain could sustain 8.1 kg milk/day *vs* 5.4 kg when signal grass and tropical kudzu were offered without sorghum grain (Monteiro et al., 2012).

Beef cattle

This legume has been predominantly used for growing animals. It seems to be poorly accepted by cattle under shade. It is very sensitive to overgrazing (Reynolds, 1995). The standard mixture of legumes currently used as cover crops for rubber and oil palm plantations in Southeast Asia includes *Centrosema pubescens*, *Pueraria phaseoloides*, *Calopogonium muconoides* and *Calopogonium caerulium*. Of these, only *C. pubescens* is palatable. *P. phaseoloides* is only partially consumed (Sánchez, 1995).

Sheep

When offered with various species at pasture under tree cover, tropical kudzu is less preferred (5 among a 1-6 scale) than grasses (Asiedu et al., 1978). However, compared to other mixed species grazed, the same weight gain (about 58 g/d) was observed although DM intake was lower and the DM digestibility comparable (Asiedu et al., 1978).

Table 1. Cattle and sheep feeding trials with tropical kudzu

Animal	Breed	Experiment	Level of kudzu offered	Main results	Country	Reference
Dairy cow	Dual purpose cross bred (400kg, 60DIM)	Grazing *Brachiaria decumbens* + tropical Kudzu (10%)	free grazing	Milk yield ranged from 5.4 to 8.1 kg (assuming 2.5 kg suckled by calf)	Brazil	Rueda et al., 2003
Steer	Crossbred (120 kg)	*Brachiaria decumbens* (Bd), B. *brizantha* (Bb) or *Axonopus scoparius* (A) associated or not with Desmodium *ovalifolium* (D) or Kudzu (K) and grazed for 240 d	free grazing	DMI is higher when Kudzu is associated with *Brachiaria* compared to *Desmodium* or *Brachiaria* alone. The highest DWG was obtained with Bd or Bb associated with K (277-358 g/d) compared to others (122-182 g/d)	Bolivia	Siles et al., 1995
	Nelore (254 kg)	*Brachiaria* (B) associated or not with *Desmodium* (BD) sp or Kudzu (BK) and grazed for 315 d at 3 stocking rates (2, 3, 4 head/ha)	free grazing various stocking rates	Higher stocking rate tends to decrease DWG with kudzu but DWG (415, 421 and 432 g/d) was not different in the three pastures B, BD and BK repectively. No differences in DMI (73-105 g/kg $P^{0.75}$)	Brazil	Pereira et al., 1992
	Crossbred (289-349 kg)	Grazing gramineous pasture plus (or not) a 30 or 60 min daily access to a small area of tropical Kudzu	limited grazing	Daily DMI increased with kudzu access but weed contamination in main pasture reduced this effect. DWG was higher when 60 or 30 min K access compared to no access: 836, 687 and 576 g/d respectively	Mexico	Perez et al., 2001
	N'dama	Guinea grass supplemented with various levels of tropical Kudzu	0 to 45%	Guinea grass DMI increased with increasing levels of kudzu. The highest weight gain was observed with the highest kudzu level (119 g/d)	Nigeria	O. et al., 2005
	Zebu 180kg)	Tropical Kudzu or *Andropogon-Stylosanthes* offered as supplement to native pasture grazed at two stocking rates (0.25 or 0.5 steer/ha)	limited grazing	Lower DWG observed when native pasture was supplemented with kudzu (about 310 g/d) compared to *Andrpogon-Stylosanthes* (440g/d) whatever the stocking rate	Colombia	Lascano et al., 1990
Heifer	Red-Sindhi (150-180kg)	Kudzu silage or hay supplemented to Guinea grass	ad libitum	Silage kudzu supplement tended to decrease Guinea grass intake (1.75 kg DM/100kg BW) and kudzu hay decreased Guinea grass intake (1.63 kg DM/100kg BW) compared to Guinea grass fed alone (2.05 DM/100kg BW). The DMI of hay was higher than silage (0.65 vs 0.33 DM/100kg BW). Supplementing Guinea grass with hay or silage did not change the diet DM digestibility	Vietnam	Hiep et al., 2008a

Sheep	Santa Ines (28kg)	Increasing levels of tropical kudzu mixed with *Brachiaria humidicola* (Bh)	25 to 100%	Total DMI and DMD increased with increasing levels of kudzu from 0.369 to 0.459 g/d and from 38.4 to 63.5% respectively.	Brazil	Monteiro et al., 2012

DMI: dry matter intake; DMD: dry matter digestibility; BW: body weight; DWG: daily weight gain

Pigs

The scientific literature on the use of tropical kudzu for pigs is scarce and inconclusive. Early trials in South America did not give satisfactory results, since the plants did not withstand the growing and rooting habits of the pigs (Chicco, 1969). In Southestern Nigeria, tropical kudzu was among the plants rated as "preferred" by smallholder pig farmers (Obua et al., 2012). Tropical kudzu has been tested for the feeding of gestating sows in Colombia (Sabogal Ospina et al., 1988). It was reported that tropical kudzu hay has been fed to pigs with good results (Göhl, 1982). However, in Congo (DRC), a comparison of 4 legume hays (*Vigna unguiculata*, *Psophocarpus scandens*, *Pueraria phaseoloides* and *Stylosanthes guianensis*) fed to growing pigs concluded that tropical kudzu hay should be avoided in pigs as it combines the lowest voluntary feed intake with the lowest nutrient digestibility (Kambashi et al., 2014).

Poultry

Tropical kudzu leaves are rich in fibre and hence not particularly adapted to poultry feeding. When tropical kudzu leaf meal was added to broiler diets, growth performance decreased significantly and feed conversion was degraded (Nworgu et al., 2013). This depressive effect was higher in young animals and with increasing levels of kudzu. In the same experiment, other leaf meals such as centro had less negative effects. Similarly, in slow growing chickens, feed intake and growth performance were depressed when 5 to 10% tropical kudzu leaf meal was included (Zambrano et al., 2015). When fed as green forage in supplement of a complete diet, tropical kudzu had a slight negative effect on growth and feed efficiency (Etela et al., 2007).

Rabbits

In a comparative study of the palatability of 23 forages, tested with growing rabbits and breeding does, tropical kudzu was in the middle range for palatability, close to *Paspalum vaginatum*, *Elaeis guineensis* and *Pennisetum purpureum*; but much less palatable than *Tridax procumbens* or *Ipomea batatas* vines (Adehan et al., 1994). This medium palatability has been confirmed in a study on the potential use of kudzu leaves by growing rabbits (Hiep et al., 2008b). In spite of this, tropical kudzu is widely used in small familial rabbitries, for example in Haiti (Kentor, 1990) and in Benin (Lebas, 2007). Generally, it is included in the list of green forages commonly used or usable for rabbit feeding in tropical Africa (Owen, 1981; Onifade et al., 1999; Mailafia et al., 2010) or in Southeast Asia (Wahab, 2001).

According to a digestibility trial conducted with *Pueraria phaseoloides* used as only feed, a digestible energy content of 7.2 MJ/kg DM was proposed for green tropical kudzu with a nitrogen digestibility coefficient of 63% (Raharjo et al., 1986). When sun-dried tropical kudzu was included at 0%, 20% and 40% in pelleted diets by substitution of the basal diet, the nutritive value was only 3.8 MJ DE/kg DM and N digestibility was 24% (Akoutey et al., 2012b) probably due to late maturity and to of bad harvest and/or drying conditions: the kudzu used in the study contained 15-17% ash, twice the average value. However, in a fattening test made with kudzu hay incorporated at 0, 20 or 40% in balanced diets, growth rate and feed efficiency were better than in the control diet with 20% kudzu hay, but they were significantly reduced with 40% of kudzu hay in the diet (Akoutey et al., 2012a). Reduced growth rate was also observed with 40% of kudzu hay (31.6 g/d) compared to 40% alfalfa hay (39.7 g/d) or 40% *Arachis glabrata* hay (39.7 g/d) (Gomez de Varela et al., 1983).

As a conclusion, fresh *Pueraria phaseoloides* forage can be used without restriction in rabbit feeding as source of fibre and protein. However, tropical kudzu protein cover only ~65% and ~75% of the requirements for sulfur-containing amino acids and lysine respectively, and only 80% and 50% of calcium and phosphorus requirements (Lebas, 2013). The precise nutritive value of tropical kudzu hay has not been established yet, but this dry forage could certainly be used as a good source of fibre.

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Tables of chemical composition and nutritional value

- Tropical kudzu (Pueraria phaseoloides), aerial part, fresh
- Tropical kudzu (Pueraria phaseoloides), aerial part, dry

Avg: average or predicted value; SD: standard deviation; Min: minimum value; Max: maximum value; Nb: number of values (samples) used

Tropical kudzu (Pueraria phaseoloides), aerial part, fresh

Main analysis	Unit	Avg	SD	me	Max	Nb
Dry matter	% as fed	19.0	4.0	14.0	32.7	33
Crude protein	% DM	19.3	3.3	13.1	25.8	48
Crude fibre	% DM	33.0	3.9	26.7	40.2	42
NDF	% DM	49.4		46.3	51.9	2 *
ADF	% DM	38.2	5.1	28.4	38.5	3 *
Lignin	% DM	7.1	1.6	5.4	8.5	3
Ether extract	% DM	2.2	0.7	1.0	3.9	38
Ash	% DM	8.7	1.7	5.3	11.3	46
Gross energy	MJ/kg DM	18.9				*

Minerals	Unit	Avg	SD	me	Max	Nb
Calcium	g/kg DM	9.6	2.2	5.4	14.5	42
Phosphorus	g/kg DM	2.7	0.7	1.5	4.0	41
Potassium	g/kg DM	23.6	7.2	10.2	36.5	39
Sodium	g/kg DM	0.1	0.1	0.1	0.2	3
Magnesium	g/kg DM	3.0	0.5	2.1	4.1	38
Manganese	mg/kg DM	98		43	153	2
Zinc	mg/kg DM	40		39	42	2
Copper	mg/kg DM	12		12	13	2
Iron	mg/kg DM	206				1

Amino acids	Unit	Avg	SD	me	Max	Nb
Arginine	% protein	4.1		4.0	4.3	2
Cystine	% protein	1.1				1
wistaria	% protein	4.4				1
Histidine	% protein	1.8		1.7	1.9	2
Isoleucine	% protein	3.9		3.5	4.4	2
Leucine	% protein	6.4		5.8	7.0	2
Lysine	% protein	3.3		3.2	3.3	2
Methionine	% protein	1.8				1
Phenylalanine	% protein	4.5		4.4	4.6	2
Threonine	% protein	4.4		4.3	4.4	2
Tryptophan	% protein	1.2				1
Tyrosine	% protein	3.4				1
Valine	% protein	4.6		4.3	4.9	2

Ruminant nutritive values	Unit	Avg	SD	me	Max	Nb
OM digestibility, ruminants	%	62.2				*
OM digestibility, ruminants (gas production)	%	75				1
Energy digestibility, ruminants	%	59.4				*
OF ruminants	MJ/kg DM	11.2				*
ME ruminants	MJ/kg DM	8.8				*

ME ruminants (gas production)	MJ/kg DM	9.4	7.9	11.0	2
Nitrogen digestibility, ruminants	%	80.0			1

The asterisk * indicates that the average value was obtained by an equation.

References

Abaunza et al., 1991 ; Babayemi 2007 ; Butterworth 1963 ; CIRAD 1991 ; Devendra et al., 1970 ; Evitayani et al., 2004 ; Gaulier, 1968 ; Kambashi et al, 2014. ; Rivera Brenes, 1947 ; Telford et al., 1947

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Tropical kudzu (Pueraria phaseoloides), aerial part, dry

Main analysis	Unit	Avg	SD	me	Max	Nb
Dry matter	% as fed	89.4				1
Crude protein	% DM	20.6		18.0	23.2	2
Crude fibre	% DM	41.3				1
NDF	% DM	46.3				1
ADF	% DM	28.4				1
Lignin	% DM	5.4				1
Ether extract	% DM	4.3				1
Ash	% DM	8.1		6.0	10.1	2
Gross energy	MJ/kg DM	19.8				*

Ruminant nutritive values	Unit	Avg	SD	me	Max	Nb
OM digestibility, Ruminant	%	54.5				*
Energy digestibility, ruminants	%	52.4				*
OF ruminants	MJ/kg DM	10.4				*
ME ruminants	MJ/kg DM	8.1				*
ME ruminants (gas production)	MJ/kg DM	7.9				1

The asterisk * indicates that the average value was obtained by an equation.

References

Dijkstra et al., 1962 ; Evitayani et al., 2004

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