

Taxon: *Markhamia zanzibarica* (Bojer ex DC.) K. Schum.

Family: Bignoniaceae

Common Name(s): bell bean tree
maroon bell bean

Synonym(s): *Markhamia stenocarpa* (Seem.) K.
Müenteria stenocarpa Seem.
Spathodea zanzibarica Bojer ex DC.

Assessor: Chuck Chimera

Status: Assessor Approved

End Date: 29 Oct 2019

WRA Score: -4.0

Designation: L

Rating: Low Risk

Keywords: Tropical Tree, Unarmed, Fodder Tree, Wind-Dispersed, Coppices

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
203	Broad climate suitability (environmental versatility)	y=1, n=0	n
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	y
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	n
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	n
302	Garden/amenity/disturbance weed	n=0, y = 1*multiplier (see Appendix 2)	n
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	n
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	n
305	Congeneric weed		
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	n
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n
408	Creates a fire hazard in natural ecosystems		
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	n

Qsn #	Question	Answer Option	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	n
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	n
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally		
604	Self-compatible or apomictic		
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	n
607	Minimum generative time (years)		
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	n
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant	y=1, n=-1	n
704	Propagules adapted to wind dispersal	y=1, n=-1	n
705	Propagules water dispersed		
706	Propagules bird dispersed	y=1, n=-1	n
707	Propagules dispersed by other animals (externally)	y=1, n=-1	n
708	Propagules survive passage through the gut	y=1, n=-1	n
801	Prolific seed production (>1000/m2)		
802	Evidence that a persistent propagule bank is formed (>1 yr)		
803	Well controlled by herbicides		
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	y
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

Supporting Data:

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	Mbambezeli, G. (2007). <i>Markhamia zanzibarica</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/markhamia-zanzibarica . [Accessed 28 Oct 2019]	[No evidence] "This is a tropical tree occurring at medium to low altitude from Tanzania and Malawi, south to the Kruger National Park in South Africa, and westward to Botswana, Namibia and the Caprivi Strip. It is found in bushveld, in riverine fringes, and often on rocky ridges and on hill slopes. It is commonly found growing among rocks on the dry northern slopes of the Soutpansberg."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2019). Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2019). Personal Communication	NA

201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	High
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2019). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 27 Oct 2019]	"Native Africa NORTHEAST TROPICAL AFRICA: Somalia (s.) EAST TROPICAL AFRICA: Kenya (e.), Tanzania (e.) WEST-CENTRAL TROPICAL AFRICA: Democratic Republic of the Congo SOUTH TROPICAL AFRICA: Angola, Malawi, Mozambique (n.e.), Zambia, Zimbabwe SOUTHERN AFRICA: Botswana"

202	Quality of climate match data	High
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2019). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 27 Oct 2019]	

203	Broad climate suitability (environmental versatility)	n
	Source(s)	Notes

Qsn #	Question	Answer
	Dave's Garden. (2019). <i>Markhamia</i> Species, Bell Bean Tree, Maroon Bell-Bean - <i>Markhamia zanzibarica</i> . https://davesgarden.com/guides/pf/go/164737/ . [Accessed 28 Oct 2019]	"Hardiness: USDA Zone 9b: to -3.8 °C (25 °F) USDA Zone 10a: to -1.1 °C (30 °F) USDA Zone 10b: to 1.7 °C (35 °F) USDA Zone 11: above 4.5 °C (40 °F)"
	Mbambezeli, G. (2007). <i>Markhamia zanzibarica</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/markhamia-zanzibarica . [Accessed 28 Oct 2019]	[Medium to low elevation tropical tree] "This is a tropical tree occurring at medium to low altitude from Tanzania and Malawi, south to the Kruger National Park in South Africa, and westward to Botswana, Namibia and the Caprivi Strip. It is found in bushveld, in riverine fringes, and often on rocky ridges and on hill slopes. It is commonly found growing among rocks on the dry northern slopes of the Soutpansberg."

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2019). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 27 Oct 2019]	"Native Africa NORTHEAST TROPICAL AFRICA: Somalia (s.) EAST TROPICAL AFRICA: Kenya (e.), Tanzania (e.) WEST-CENTRAL TROPICAL AFRICA: Democratic Republic of the Congo SOUTH TROPICAL AFRICA: Angola, Malawi, Mozambique (n.e.), Zambia, Zimbabwe SOUTHERN AFRICA: Botswana"

205	Does the species have a history of repeated introductions outside its natural range?	n
	Source(s)	Notes
	Staples, G.W. & Herbst, D.R. 2005. <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i> . Bishop Museum Press, Honolulu, HI	"It is native to eastern Africa, and plants grown in Hawai'i appear to be the only record of cultivation outside its native range."
	Dave's Garden. (2019). <i>Markhamia</i> Species, Bell Bean Tree, Maroon Bell-Bean - <i>Markhamia zanzibarica</i> . https://davesgarden.com/guides/pf/go/164737/ . [Accessed 28 Oct 2019]	"This plant has been said to grow in the following regions: El Sobrante, California San Marcos, California"

Qsn #	Question	Answer
301	Naturalized beyond native range	n
	Source(s)	Notes
	Staples, G.W. & Herbst, D.R. 2005. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	[No evidence] "It is native to eastern Africa, and plants grown in Hawai'i appear to be the only record of cultivation outside its native range."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence
	Wagner, W.L., Herbst, D.R. & Lorence, D.H. (2019). Flora of the Hawaiian Islands. Smithsonian Institution, Washington, D.C. http://botany.si.edu/ . [Accessed 28 Oct 2019]	No evidence to date

302	Garden/amenity/disturbance weed	n
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

303	Agricultural/forestry/horticultural weed	n
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

304	Environmental weed	n
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

305	Congeneric weed	
	Source(s)	Notes
	Balsinhas, A. A. (1983). The weeds of abandoned cotton fields in Mozambique. <i>Bothalia</i> , 14(3/4), 971-975	[<i>Markhamia obtusifolia</i> categorized as a woody "weed" of fallow or abandoned cotton fields. Impacts result if fields need to be cleared of vegetation prior to replanting. Ecologically behaves as a pioneer, successional species. Not reported to invade actively cultivated fields] "The weed flora of fields consists mainly of annual or herbaceous perennial plants. Manual weed control before the cotton is picked, eliminates most shrubby weeds. These become a problem in fallow fields only three or four years after cultivation has ceased. The more important shrubby species are: <i>Acacia polyacantha</i> subsp. <i>campylacantha</i> *, <i>Cassia petersiana</i> , <i>Commiphora edulis</i> , <i>Cryptolepis obtusa</i> *, <i>Markhamia obtusifolia</i> *, <i>Monotes africanus</i> * and <i>Tabernaemontana elegans</i> ."

401	Produces spines, thorns or burrs	n
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Qsn #	Question	Answer
	Source(s)	Notes
	Schmidt, E., Lötter, M. & McClelland, W. 2002. Trees and shrubs of Mpumalanga and Kruger National Park. Jacana Media, Johannesburg, South Africa	[No evidence] "Small, slender tree to 6 m; in bushveld on deep sands or on rocky outcrops. Main stem: single- or multi-stemmed: branches very brittle, bark grey-brown to grey, smooth, but flaking irregularly in large specimens. Leaves: pinnately compound, with 2-3 pairs of leaflets and a terminal leaflet. leaves borne in opposite pairs; leaflets oval, obovate or almost circular (40-140 x 25-60 mm), terminal pair of leaflets distinctly bigger than basal pair; margin entire or scalloped; dull to glossy fresh green above, slightly paler below; softly hairy when young, losing hairs above when older; petiole 40-90 mm long."

402	Allelopathic	
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	[Unknown. <i>Markhamia lutea</i> potentially allelopathic] "M. lutea is fast growing, not nitrogen fixing, has a large tap root and exhibits some negative effects on crops when used in agroforestry systems." ... "Although M. lutea is a popular agroforestry species, it has a negative net effect when planted with crops (such as bananas, beans and maize) especially those nearest to the tree (Yamoah et al., 1989; Aluma et al., 1992; Peden et al., 1993). This is mainly due to root competition which rapidly reduces subsoil nitrate levels and its dense crown (Okorio et al., 1994; Akyeampong et al., 1995; Jama et al., 1998). To reduce the effects of competition, trees may be planted far apart; dense shade and fibrous roots can be reduced by pruning and crops around trees may be heavily manured. Its negative effects on crops does not reduce the popularity of this species with farmers."

403	Parasitic	n
	Source(s)	Notes
	Schmidt, E., Lötter, M. & McClelland, W. 2002. Trees and shrubs of Mpumalanga and Kruger National Park. Jacana Media, Johannesburg, South Africa	"Small, slender tree to 6 m" [Bignoniaceae. No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	Notes
	Schmidt, E., Lötter, M. & McClelland, W. 2002. Trees and shrubs of Mpumalanga and Kruger National Park. Jacana Media, Johannesburg, South Africa	"Leaves browsed by elephants."
	Komwihangilo, D. M., Lekule, F. P., & Kajembe, G. C. (2008). Integrating local and formal scientific knowledge for efficient utilisation of livestock feeds in mixed production systems in Tanzania. In Land and Water Management in Southern Africa: Towards Sustainable Agriculture. Africa Institute of South Africa,	"Table 2: Farmers' knowledge on the utilisation of trees and shrubs in central Tanzania" [<i>Markhamia zanzibarica</i> - Leaves reported to be consumed by cattle and goats]

Qsn #	Question	Answer
405	Toxic to animals	n
	Source(s)	Notes
	Schmidt, E., Lötter, M. & McClelland, W. 2002. Trees and shrubs of Mpumalanga and Kruger National Park. Jacana Media, Johannesburg, South Africa	[No evidence] "Leaves browsed by elephants."
	Komwihangilo, D. M., Lekule, F. P., & Kajembe, G. C. (2008). Integrating local and formal scientific knowledge for efficient utilisation of livestock feeds in mixed production systems in Tanzania. In Land and Water Management in Southern Africa: Towards Sustainable Agriculture. Africa Institute of South Africa,	[No evidence] "Table 2: Farmers' knowledge on the utilisation of trees and shrubs in central Tanzania" [Markham/a zanzibarica - Leaves reported to be consumed by cattle and goats]
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	No evidence

406	Host for recognized pests and pathogens	
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	[Unknown. Few pests reported on related <i>M. lutea</i>] "There have been no major pests reported on <i>M. lutea</i> . Although the timber is known to be termite resistant, there have been unconfirmed reports of damage by <i>Cryptotermes</i> spp. (Campbell, 1974). Young shoots may also be attacked by borers, resulting in crooked stems (Katende et al., 1995)."

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes
	Mbambezeli, G. (2007). <i>Markhamia zanzibarica</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/markhamia-zanzibarica . [Accessed 28 Oct 2019]	[No evidence] "The wood is fairly hard and durable, pale brown to yellowish, finely grained and produces a smooth finish. It is used in buildings for roof timbers and to make tool handles. It is well suited for the manufacture of ornaments. Branches are usually too small to be of value. The roots are used in traditional medicine to treat backache."
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	No evidence

Qsn #	Question	Answer
408	Creates a fire hazard in natural ecosystems	
	Source(s)	Notes
	Mbambezeli, G. (2007). <i>Markhamia zanzibarica</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/markhamia-zanzibarica . [Accessed 28 Oct 2019]	[Unknown. No information on fire ecology of this species, and nothing to indicate that increased fire risk or fire frequency occurs within the distribution of this species] "This is a tropical tree occurring at medium to low altitude from Tanzania and Malawi, south to the Kruger National Park in South Africa, and westward to Botswana, Namibia and the Caprivi Strip. It is found in bushveld, in riverine fringes, and often on rocky ridges and on hill slopes. It is commonly found growing among rocks on the dry northern slopes of the Soutpansberg."

409	Is a shade tolerant plant at some stage of its life cycle	n
	Source(s)	Notes
	Mbambezeli, G. (2007). <i>Markhamia zanzibarica</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/markhamia-zanzibarica . [Accessed 28 Oct 2019]	"Aspect: Full Sun"
	Dave's Garden. (2019). <i>Markhamia</i> Species, Bell Bean Tree, Maroon Bell-Bean - <i>Markhamia zanzibarica</i> . https://davesgarden.com/guides/pf/go/164737/ . [Accessed 28 Oct 2019]	"Sun Exposure: Full Sun"

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	n
	Source(s)	Notes
	Mbambezeli, G. (2007). <i>Markhamia zanzibarica</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/markhamia-zanzibarica . [Accessed 28 Oct 2019]	"Soil type: Sandy, Loam PH: Neutral"

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Schmidt, E., Lötter, M. & McClelland, W. 2002. Trees and shrubs of Mpumalanga and Kruger National Park. Jacana Media, Johannesburg, South Africa	"Small, slender tree to 6 m"

412	Forms dense thickets	n
	Source(s)	Notes
	Schmidt, E., Lötter, M. & McClelland, W. 2002. Trees and shrubs of Mpumalanga and Kruger National Park. Jacana Media, Johannesburg, South Africa	"in bushveld on deep sands or on rocky outcrops." [No evidence]
	Van Wyk, B. & Van Wyk, P. 1997. Field Guide to Trees of Southern Africa. Struik Publishers, Cape Town, South Africa	[No evidence] "Small lender tree with crooked branches; occurring in bushveld. usually on rocky hillsides and in riverine fringes."

Qsn #	Question	Answer
	Mbambezeli, G. (2007). <i>Markhamia zanzibarica</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/markhamia-zanzibarica . [Accessed]	[No evidence] "This is a tropical tree occurring at medium to low altitude from Tanzania and Malawi, south to the Kruger National Park in South Africa, and westward to Botswana, Namibia and the Caprivi Strip. It is found in bushveld, in riverine fringes, and often on rocky ridges and on hill slopes. It is commonly found growing among rocks on the dry northern slopes of the Soutpansberg."
501	Aquatic	n
	Source(s)	Notes
	Schmidt, E., Lötter, M. & McClelland, W. 2002. Trees and shrubs of Mpumalanga and Kruger National Park. Jacana Media, Johannesburg, South Africa	[Terrestrial] "Small, slender tree to 6 m; in bushveld on deep sands or on rocky outcrops."
502	Grass	n
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2019). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 27 Oct 2019]	Family: Bignoniaceae
503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2019). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 27 Oct 2019]	Family: Bignoniaceae
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Schmidt, E., Lötter, M. & McClelland, W. 2002. Trees and shrubs of Mpumalanga and Kruger National Park. Jacana Media, Johannesburg, South Africa	"Small, slender tree to 6 m; in bushveld on deep sands or on rocky outcrops."
601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Mbambezeli, G. (2007). <i>Markhamia zanzibarica</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/markhamia-zanzibarica . [Accessed 28 Oct 2019]	"Conservation Status - <i>Markhamia zanzibarica</i> is not threatened."
602	Produces viable seed	y

Qsn #	Question	Answer
	Source(s)	Notes
	Mbambezeli, G. (2007). <i>Markhamia zanzibarica</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/markhamia-zanzibarica . [Accessed 28 Oct 2019]	" <i>Markhamia zanzibarica</i> is easily propagated from seed and truncheons. Sow seeds in spring or summer in a sandy mixture. Cover the seeds lightly with sand and keep moist and warm. Seeds will take three weeks to germinate. Seedlings should be transplanted into pots or bags when they are large enough to handle."

603	Hybridizes naturally	
	Source(s)	Notes
	WRA Specialist. (2019). Personal Communication	Unknown. No evidence found

604	Self-compatible or apomictic	
	Source(s)	Notes
	Kubitzki, K. & Kadereit, J.W. (eds.). (2004). The families and genera of vascular plants: Volume VII. Flowering plants, Dicotyledons. Lamiales (except Acanthaceae including Avicenniaceae). Springer-Verlag, Berlin, Heidelberg, New York	[Unknown for <i>Markhamia</i>] "Pollination and Reproductive Systems. Bignoniaceae show very diverse pollination syndromes, but only few detailed studies are available (e.g. Weber and Vogel 1986; Zyhra 1988; James and Knox 1993; Gussmann and Gottsberger 1996)."
	JSTOR Global Plants. (1905). Entry for <i>Markhamia zanzibarica</i> K. Schum. ex Engl. [family BIGNONIACEAE]. Flora of Tropical Africa, Vol IV, Part 2, page 516, (1905) Author: (By T. A. Sprague). plants.jstor.org	[Unknown] "Corolla-tube funnel-shaped, 11–12 lin. long, yellowish with purple spots; basal cylindric portion 3–4 1/2 lin. long, 1–1 1/4 lin. in diam.; lobes brownish-purple, 4–5 lin. long. Stamens inserted 4–5 lin. above the base of the corolla-tube; anther-lobes 1 lin. long, acute at the base. Disc annular, 2/3 lin. high. Ovary 2–2 1/3 lin. long, densely lepidote."

605	Requires specialist pollinators	n
	Source(s)	Notes
	Mbambezeli, G. (2007). <i>Markhamia zanzibarica</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/markhamia-zanzibarica . [Accessed 29 Oct 2019]	"The flowers are visited by ants."
	Johannsmeier, M.F. (2016). Beeplants of South Africa. Sources of nectar, pollen, honeydew and propolis for honeybees. Strelitzia 37. South African National Biodiversity Institute, Pretoria	[Visited by bees, which presumably act as pollinators] " <i>Markhamia zanzibarica</i> ... Beeplant Value = N2?, P?" [PI? notation means that pollen is collected by honeybees, but that the pollen ranking is questionable, though probably low. N2 = nectar - minor to medium source]

Qsn #	Question	Answer
606	Reproduction by vegetative fragmentation	n
	Source(s)	Notes
	Mbambezeli, G. (2007). <i>Markhamia zanzibarica</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/markhamia-zanzibarica . [Accessed 29 Oct 2019]	" <i>Markhamia zanzibarica</i> is easily propagated from seed and truncheons. Sow seeds in spring or summer in a sandy mixture. Cover the seeds lightly with sand and keep moist and warm. Seeds will take three weeks to germinate. Seedlings should be transplanted into pots or bags when they are large enough to handle. Take truncheon cuttings in late winter. Cut a medium-sized branch from the mother plant and plant directly into the soil or a pot/bag." [Propagates from truncheons, but no evidence this occurs naturally]

607	Minimum generative time (years)	
	Source(s)	Notes
	Tropical Plants Database, Ken Fern. (2019). <i>Markhamia zanzibarica</i> . http://tropical.theferns.info/viewtropical.php?id=Markhamia+zanzibarica . [Accessed 29 Oct 2019]	"Growth Rate: Slow" [Unknown, but as a tree, probably 3+ years]

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	Source(s)	Notes
	Mbambezeli, G. (2007). <i>Markhamia zanzibarica</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/markhamia-zanzibarica . [Accessed 29 Oct 2019]	"The fruits are slender, bean-like capsules, 300-500 mm long and spirally twisted, and dangle from the tree in late summer (January to May). Dark brown when mature, they split open lengthwise to release many flat, winged seeds." ... "The papery, winged seeds are dispersed by wind." [No evidence. No means of external attachment]

702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	Staples, G.W. & Herbst, D.R. 2005. <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i> . Bishop Museum Press, Honolulu, HI	"It is native to eastern Africa, and plants grown in Hawai'i appear to be the only record of cultivation outside its native range."
	Dave's Garden. (2019). <i>Markhamia Species, Bell Bean Tree, Maroon Bell-Bean - Markhamia zanzibarica</i> . https://davesgarden.com/guides/pf/go/164737/ . [Accessed 28 Oct 2019]	"This plant has been said to grow in the following regions: El Sobrante, California San Marcos, California"

703	Propagules likely to disperse as a produce contaminant	n
	Source(s)	Notes
	Mbambezeli, G. (2007). <i>Markhamia zanzibarica</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/markhamia-zanzibarica . [Accessed 29 Oct 2019]	"The fruits are slender, bean-like capsules, 300-500 mm long and spirally twisted, and dangle from the tree in late summer (January to May). Dark brown when mature, they split open lengthwise to release many flat, winged seeds." ... "The papery, winged seeds are dispersed by wind." [No evidence]

Qsn #	Question	Answer
704	Propagules adapted to wind dispersal	n
	Source(s)	Notes
	Mbambezeli, G. (2007). <i>Markhamia zanzibarica</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/markhamia-zanzibarica . [Accessed 29 Oct 2019]	"The fruits are slender, bean-like capsules, 300-500 mm long and spirally twisted, and dangle from the tree in late summer (January to May). Dark brown when mature, they split open lengthwise to release many flat, winged seeds." ... "The papery, winged seeds are dispersed by wind."

705	Propagules water dispersed	
	Source(s)	Notes
	Van Wyk, B. & Van Wyk, P. 1997. Field Guide to Trees of Southern Africa. Struik Publishers, Cape Town, South Africa	"occurring in bushveld. usually on rocky hillsides, and in riverine fringes." [Wind-dispersed, but occurrence in riverine habitats suggests water may result in movement of seeds]

706	Propagules bird dispersed	n
	Source(s)	Notes
	Mbambezeli, G. (2007). <i>Markhamia zanzibarica</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/markhamia-zanzibarica . [Accessed 29 Oct 2019]	"The papery, winged seeds are dispersed by wind."

707	Propagules dispersed by other animals (externally)	n
	Source(s)	Notes
	Mbambezeli, G. (2007). <i>Markhamia zanzibarica</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/markhamia-zanzibarica . [Accessed 29 Oct 2019]	"The papery, winged seeds are dispersed by wind." [No evidence. No means of external attachment]

708	Propagules survive passage through the gut	n
	Source(s)	Notes
	Mbambezeli, G. (2007). <i>Markhamia zanzibarica</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/markhamia-zanzibarica . [Accessed 29 Oct 2019]	"The papery, winged seeds are dispersed by wind. The leaves are eaten by elephants." [No evidence that seeds are consumed]

801	Prolific seed production (>1000/m ²)	
	Source(s)	Notes
	Mbambezeli, G. (2007). <i>Markhamia zanzibarica</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/markhamia-zanzibarica . [Accessed 29 Oct 2019]	"The fruits are slender, bean-like capsules, 300-500 mm long and spirally twisted, and dangle from the tree in late summer (January to May). Dark brown when mature, they split open lengthwise to release many flat, winged seeds." [Seed densities unknown]

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	Notes

Qsn #	Question	Answer
	Royal Botanic Gardens Kew. (2019) Seed Information Database (SID). Version 7.1. Available from: http://data.kew.org/sid/ . [Accessed]	"Storage Behaviour: Orthodox Storage Conditions: Long-term storage under IPGRI preferred conditions at RBG Kew, WP. Oldest collection 2 years" [Unknown under field conditions]

803	Well controlled by herbicides	
	Source(s)	Notes
	WRA Specialist. (2019). Personal Communication	Unknown. No information found on herbicide efficacy or chemical control of this species

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	Notes
	Tropical Plants Database, Ken Fern. (2019). <i>Markhamia zanzibarica</i> . http://tropical.theferns.info/viewtropical.php?id=Markhamia+zanzibarica . [Accessed 29 Oct 2019]	"Plants grow back quickly after being cut, so should coppice well"
	Joseph, G. S., Seymour, C. L., Cumming, G. S., Mahlangu, Z., & Cumming, D. H. (2013). Escaping the flames: large termitaria as refugia from fire in miombo woodland. <i>Landscape Ecology</i> , 28(8), 1505-1516	[Some leaves burnt with no resprouting observed] "Table 3 Mean fire damage ratings and resprouting indices (with standard deviation) for those species that occurred in more than 80 % of mound or matrix plots. Matrix trees undergo greater fire damage, and resprout with more vigour" [<i>Markhamia zanzibarica</i> - Mean fire damage = 1.7 ± 1.5; Mean resprout = 0.0 ± 0.0]

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	Staples, G.W. & Herbst, D.R. 2005. <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i> . Bishop Museum Press, Honolulu, HI	[Unknown] "It is native to eastern Africa, and plants grown in Hawai'i appear to be the only record of cultivation outside its native range."

Summary of Risk Traits:

High Risk / Undesirable Traits

- Grows and could potentially spread in tropical climates
- Reproduces by seeds
- Seeds dispersed by wind, possibly water, and intentionally by people
- Able to coppice and resprout after cutting
- Gaps in biological and ecological information may reduce accuracy of risk prediction

Low Risk Traits

- No reports of invasiveness or naturalization, but no evidence of widespread introduction outside native range
- Unarmed (no spines, thorns, or burrs)
- Provides fodder for livestock
- Non-toxic
- Grows in full sun (and spread into dense, shaded forest may be prevented)
- Not reported to spread vegetatively