

Taxon: Cymbopogon martini	Family: Poaceae
Common Name(s): ginger grass motia grass Palmarosa rosha grass sofia grass	Synonym(s): Andropogon martini Roxb.

Assessor: No Assessor	Status: Assessor Approved	End Date: 1 Jul 2014
WRA Score: 5.0	Designation: L	Rating: Low Risk

Keywords: Naturalized, Aromatic Grass, Clumping, Essential Oil, Seed Propagated

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	y
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	y
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	n=0, y = 1*multiplier (see Appendix 2)	y
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	y
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		

Qsn #	Question	Answer Option	Answer
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	y
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		
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	y
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	y=1, n=-1	n
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	n
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	2
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		
704	Propagules adapted to wind dispersal		
705	Propagules water dispersed	y=1, n=-1	n
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		
801	Prolific seed production (>1000/m ²)		
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
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2006. Flora of China. Vol. 22 (Poaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[No evidence] "This grass is native to India, but is cultivated elsewhere in the tropics for its oils. Two forms can be distinguished in the field, each with a different oil content, but the habit differences are not evident in herbarium material. The cultivar 'Motia' yields palmerosa oil and 'Sofia' yields ginger-grass oil."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. 2014. Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. 2014. 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
	Clayton, W.D., Vorontsova, M.S., Harman, K.T. and Williamson, H. 2006 onwards. GrassBase - The Online World Grass Flora. http://www.kew.org/data/grasses-db.html . [Accessed 23 Jun 2014]	"DISTRIBUTION Africa: western Indian ocean. Asia-temperate: China. Asia-tropical: India, Indo China, and Malesia. Australasia: Australia"

202	Quality of climate match data	High
	Source(s)	Notes
	Clayton, W.D., Vorontsova, M.S., Harman, K.T. and Williamson, H. 2006 onwards. GrassBase - The Online World Grass Flora. http://www.kew.org/data/grasses-db.html . [Accessed]	

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

Qsn #	Question	Answer
	de Guzman, C.C & Reglos, R.A., 1999. <i>Cymbopogon martini</i> (Roxb.) J.F. Watson[Internet] Record from Proseabase. L.P.A. Oyen and Nguyen Xuan Dung (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia. http://www.proseanet.org . [Accessed 23 Jun 2014]	" <i>Cymbopogon martini</i> occurs naturally and in cultivation in India from 12—32°N and is also grown commercially from about 5°S in Java and the Seychelles to 20°S in Madagascar. It is cultivated from 150—800(—1200) m altitude. Although under natural conditions it is often found on hillsides with an annual rainfall below 600 mm, it requires about 750 mm annual rainfall for a reasonable single harvest. If it is to be harvested several times per year, it requires at least 1500 mm annual rainfall and supplementary irrigation during periods of drought. <i>Cymbopogon martini</i> prefers warm and sunny conditions with average daily temperatures of 20—25°C; temperatures of 25—30°C for extended periods can significantly reduce yields and suppress flowering. Frost causes damage at all growth stages and at higher elevations aboveground plant parts may die back during the cool season. Even slight frost at harvesting can be devastating and may reduce yields by half."

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	Clayton, W.D., Vorontsova, M.S., Harman, K.T. and Williamson, H. 2006 onwards. GrassBase - The Online World Grass Flora. http://www.kew.org/data/grasses-db.html . [Accessed 23 Jun 2014]	"DISTRIBUTION Africa: western Indian ocean. Asia-temperate: China. Asia-tropical: India, Indo China, and Malesia. Australasia: Australia"

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	de Guzman, C.C & Reglos, R.A., 1999. <i>Cymbopogon martini</i> (Roxb.) J.F. Watson[Internet] Record from Proseabase. L.P.A. Oyen and Nguyen Xuan Dung (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia. http://www.proseanet.org . [Accessed 23 Jun 2014]	" <i>Cymbopogon martini</i> originates from the Indian subcontinent where wild stands have been exploited since antiquity and still produce an important portion of the essential oil. At the beginning of the 20th Century palmarosa grass was also taken into cultivation in India. In the 1930s palmarosa grass was introduced to Java where it yielded promising quantities of high quality oil. Production in Java grew steadily. It declined sharply during the Second World War, but was resumed on a smaller scale in the 1990s. In addition to India and Java, it is now also grown commercially in Brazil, Guatemala, Honduras, Madagascar and on a smaller scale in other African countries. In most of South-East Asia it is only grown occasionally. Var. <i>sofia</i> is sometimes cultivated in India."

301	Naturalized beyond native range	y
	Source(s)	Notes
	Queensland Government. 2014. <i>Cymbopogon martini</i> , WetlandInfo, Department of Environment and Heritage Protection, Queensland. http://wetlandinfo.ehp.qld.gov.au/wetlands/ecology/components/spcies/?cymbopogon-martini . [Accessed 23 Jun 2014]	"Endemicity: Introduced (International) - naturalised from overseas"

Qsn #	Question	Answer
	USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/ . [Accessed 23 Jun 2014]	"Naturalized: ASIA-TEMPERATE China: China [s.]"
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2006. Flora of China. Vol. 22 (Poaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[Reported as naturalized] "Grassy slopes; ca. 1000 m. Sichuan, Yunnan [native to India]."

302	Garden/amenity/disturbance weed	n
	Source(s)	Notes
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

303	Agricultural/forestry/horticultural weed	n
	Source(s)	Notes
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

304	Environmental weed	n
	Source(s)	Notes
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

305	Congeneric weed	y
	Source(s)	Notes
	U.S. Fish and Wildlife Service. 2011. Species Assessment Form for <i>Ranunculus hawaiiensis</i> . http://ecos.fws.gov/docs/candidate/assessments/2012/r1/Q38H_PO .pdf . [Accessed]	" <i>Ranunculus hawaiiensis</i> is threatened by introduced pasture grasses that degrade and destroy habitat and outcompete native plants (HBMP 2008)." ... "Nonnative plants which pose the greatest threats to <i>R. hawaiiensis</i> on the island of Maui are: <i>P. clandestinum</i> , <i>H. lanatus</i> , and <i>Cymbopogon refractus</i> (barbwire grass) (A. Medeiros, in litt. 1995)."
	USDA Natural Resources Conservation Service. 2014. Hawaii State-listed Noxious Weeds. http://plants.usda.gov/java/noxious?rptType=State&statefips=15 . [Accessed 24 Jun 2014]	<i>Cymbopogon refractus</i> is listed as a Hawaii State noxious weed

401	Produces spines, thorns or burrs	n
	Source(s)	Notes

Qsn #	Question	Answer
	Clayton, W.D., Vorontsova, M.S., Harman, K.T. and Williamson, H. 2006 onwards. GrassBase - The Online World Grass Flora. http://www.kew.org/data/grasses-db.html . [Accessed 23 Jun 2014]	[No evidence] "Perennial; caespitose. Rootstock evident. Culms erect; 150–300 cm long. Culm-nodes flush with internodes, or swollen. Ligule an eciliate membrane; 1.5–4 mm long. Leaf-blade base cordate, or amplexicaul. Leaf-blades linear, or lanceolate; 25–50 cm long; 10–30 mm wide; glaucous; aromatic. Leaf-blade margins scabrous. Leaf-blade apex attenuate; filiform. "

402	Allelopathic	
	Source(s)	Notes
	Suwitchayanon, P., Pukclai, P., & Kato-Noguchi, H. 2013. Allelopathic activity of <i>Cymbopogon nardus</i> (Poaceae): A preliminary study. <i>Journal of Plant Studies</i> , 2(2): 1-6	[Unknown. Allelopathic properties in other <i>Cymbopogon</i> species] "The results suggest that <i>C. nardus</i> may have allelopathic compounds and may be a candidate for isolation and identification of allelopathic compounds to develop an alternative weed management option."

403	Parasitic	n
	Source(s)	Notes
	Clayton, W.D., Vorontsova, M.S., Harman, K.T. and Williamson, H. 2006 onwards. GrassBase - The Online World Grass Flora. http://www.kew.org/data/grasses-db.html . [Accessed 23 Jun 2014]	Poaceae

404	Unpalatable to grazing animals	y
	Source(s)	Notes
	de Guzman, C.C & Reglos, R.A., 1999. <i>Cymbopogon martini</i> (Roxb.) J.F. Watson [Internet] Record from Proseabase. L.P.A. Oyen and Nguyen Xuan Dung (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia. http://www.proseanet.org . [Accessed 23 Jun 2014]	"However, the Indian Forest Department recommends planting it in forest plantations as a cash crop, since it is unpalatable to livestock and discourages grazing in young plantations."
	Quattrocchi, U. 2006. CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	[Probably not preferred due to oils, but not entirely unpalatable] "usually unpalatable to livestock, sometimes eaten by cattle"

405	Toxic to animals	n
	Source(s)	Notes
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence

406	Host for recognized pests and pathogens	
	Source(s)	Notes

Qsn #	Question	Answer
	de Guzman, C.C & Reglos, R.A., 1999. <i>Cymbopogon martini</i> (Roxb.) J.F. Watson[Internet] Record from Proseabase. L.P.A. Oyen and Nguyen Xuan Dung (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia. http://www.proseanet.org . [Accessed 23 Jun 2014]	"Diseases and pests A blight caused by <i>Ellisiella caudata</i> (<i>Curvularia andropogonis</i>) may cause severe damage in <i>Cymbopogon martini</i> during the rainy season throughout India. It causes greyish-brown spots on the leaves that coalesce to form large lesions. <i>Colletotrichum caudatum</i> leaf spot may also affect the crop. Serious pests are not known for <i>Cymbopogon martini</i> ."

407	Causes allergies or is otherwise toxic to humans	
	Source(s)	Notes
	de Guzman, C.C & Reglos, R.A., 1999. <i>Cymbopogon martini</i> (Roxb.) J.F. Watson[Internet] Record from Proseabase. L.P.A. Oyen and Nguyen Xuan Dung (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia. http://www.proseanet.org . [Accessed 23 Jun 2014]	[No evidence, but caution is advised when using medicinal plants] "Uses Two different oils are obtained from <i>Cymbopogon martini</i> , preferably from the flowering tops: var. <i>martini</i> yields palmarosa oil, confusingly also named East Indian geranium oil, while gingergrass oil is obtained from var. <i>sofia</i> . Palmarosa oil is applied in perfumes for soaps and cosmetics and for flavouring tobacco and liqueurs. It is also an important source of natural geraniol, which is an excellent extender in many floral, rose-like perfume compounds and a starting material for the production of aroma chemicals, notably geranyl esters that have a lasting rose-like aroma. Palmarosa oil is an active component of mosquito repellents. Gingergrass oil was once a popular perfumery material for rose compounds, particularly in soaps, but lost its popularity due to frequent adulteration. It is now mainly applied in the soap and detergent industry in India.] <i>Cymbopogon martini</i> is also grown extensively to control erosion on erodible hillsides and to stabilize edges of terraces and gullies. In traditional medicine <i>Cymbopogon martini</i> and its oils are used to treat rheumatism, hair loss, arthritis, lumbago and spasms."
	Dave's Garden. 2014. PlantFiles: Indian Geranium, Palmarosa - <i>Cymbopogon martini</i> . http://davesgarden.com/guides/pf/go/84642/ . [Accessed 24 Jun 2014]	[Possibly] "Danger: Handling plant may cause skin irritation or allergic reaction"
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence for <i>C. martini</i> . <i>C. citratus</i> & <i>C. nardus</i> oils reported to cause dermatitis

408	Creates a fire hazard in natural ecosystems	
	Source(s)	Notes
	WRA Specialist. 2014. Personal Communication	Unknown. Oils may increase flammability of grass

Qsn #	Question	Answer
409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	Notes
	Quattrocchi, U. 2006. CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"prefers warm and sunny conditions"
	Nair, P.K.R. 1980. Agroforestry Species a Crop Sheets Manual. International Council for Research in Agroforestry (ICRAF), Nairobi, Kenya	[Presumably yes. Can be grown under dense tree canopies] "Both varieties can be used in agroforestry practices in their they are adapted to marginal areas and poor soils and habitats: they can be grown under dense canopies of trees and used for soil conservation work."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	n
	Source(s)	Notes
	Quattrocchi, U. 2006. CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"does not tolerate acid soils or waterlogging, prefers warm and sunny conditions, fertile well drained soils"
	de Guzman, C.C & Reglos, R.A., 1999. <i>Cymbopogon martini</i> (Roxb.) J.F. Watson [Internet] Record from Proseabase. L.P.A. Oyen and Nguyen Xuan Dung (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia. http://www.proseanet.org . [Accessed]	"In its natural habitat <i>Cymbopogon martini</i> grows on poor, often slightly alkaline soils (pH 7.5–8.5) of sandy-loamy to loamy texture. Soils rich in organic matter and nitrogen are reported to yield high quality oil. In Orissa, India it is found on slightly saline soils. In cultivation, fertile well-drained soils of pH 6–7 are considered optimum. On alkaline soils (pH 8.5 or higher) growth and yields are reduced, but oil quality is not affected. Palmarosa grass does not tolerate acid soils or waterlogging."

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2006. Flora of China. Vol. 22 (Poaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Perennial from a short woody rootstock. Culms tufted, up to 3 m tall, lower nodes often swollen, mealy."

412	Forms dense thickets	
	Source(s)	Notes
	Nair, P.K.R. 1980. Agroforestry Species a Crop Sheets Manual. International Council for Research in Agroforestry (ICRAF), Nairobi, Kenya	[Unknown if dense growth excludes other vegetation] "grows densely and abundantly at lower altitudes "

501	Aquatic	n
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2006. Flora of China. Vol. 22 (Poaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Grassy slopes; ca. 1000 m." [Terrestrial]

502	Grass	y
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Qsn #	Question	Answer
	Source(s)	Notes
	Clayton, W.D., Vorontsova, M.S., Harman, K.T. and Williamson, H. 2006 onwards. GrassBase - The Online World Grass Flora. http://www.kew.org/data/grasses-db.html . [Accessed]	Poaceae

503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	Clayton, W.D., Vorontsova, M.S., Harman, K.T. and Williamson, H. 2006 onwards. GrassBase - The Online World Grass Flora. http://www.kew.org/data/grasses-db.html . [Accessed 23 Jun 2014]	"Perennial; caespitose. Rootstock evident. Culms erect; 150–300 cm long. Culm-nodes flush with internodes, or swollen. Ligule an eciliate membrane; 1.5–4 mm long. Leaf-blade base cordate, or amplexicaul. Leaf-blades linear, or lanceolate; 25–50 cm long; 10–30 mm wide; glaucous; aromatic. Leaf-blade margins scabrous. Leaf-blade apex attenuate; filiform."

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2006. Flora of China. Vol. 22 (Poaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Perennial from a short woody rootstock. Culms tufted, up to 3 m tall, lower nodes often swollen, mealy. Leaf sheaths glabrous; leaf blades lanceolate, usually glaucous below, dark green above, up to 50 × 2–3 cm, glabrous, base cordate, often amplexicaul, apex filiform; ligule 2–4 mm."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Quattrocchi, U. 2006. CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	No evidence

602	Produces viable seed	y
	Source(s)	Notes
	de Guzman, C.C & Reglos, R.A., 1999. <i>Cymbopogon martini</i> (Roxb.) J.F. Watson[Internet] Record from Proseabase. L.P.A. Oyen and Nguyen Xuan Dung (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia. http://www.proseanet.org . [Accessed 23 Jun 2014]	" <i>Cymbopogon martini</i> is generally propagated by seed. Propagation by offshoots and cuttings is also possible, but there are indications that seedlings yield more herbage and oil."

Qsn #	Question	Answer
603	Hybridizes naturally	
	Source(s)	Notes
	Tropical Species Database. 2014. <i>Cymbopogon martini</i> . http://tropical.theferns.info/viewtropical.php?id=Cymbopogon+martini . [Accessed 24 Jun 2014]	[Unknown if interspecific hybridization occurs] "There are two forms of this species and these hybridize spontaneously in the wild wherever their habitats overlap."
604	Self-compatible or apomictic	n
	Source(s)	Notes
	de Guzman, C.C & Reglos, R.A., 1999. <i>Cymbopogon martini</i> (Roxb.) J.F. Watson [Internet] Record from Proseabase. L.P.A. Oyen and Nguyen Xuan Dung (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia. http://www.proseanet.org . [Accessed 23 Jun 2014]	" <i>Cymbopogon martini</i> is strongly cross-pollinated and wild stands are highly variable."
	Brown, W. V., & Emery, W. H. 1958. Apomixis in the Gramineae: Panicoideae. <i>American Journal of Botany</i> , 45 (4): 253-263	"Table 1. The species of grasses examined embryologically for embryo sac type and apomixis. Embryo sac types listed as 4-nucleate are formed by apospory or diplospory. All species are perennial except those having an A preceding the number of accessions" [<i>Cymbopogon martini</i> - Embryo sac type = normal. Presumably not apomictic. Self-compatibility not addressed in this study]
605	Requires specialist pollinators	n
	Source(s)	Notes
	Zomlefer, W.B. 1994. <i>Guide to Flowering Plant Families</i> . The University of North Carolina Press, Chapel Hill & London	"The reduced flowers are anemophilous..." [Poaceae]
606	Reproduction by vegetative fragmentation	n
	Source(s)	Notes
	de Guzman, C.C & Reglos, R.A., 1999. <i>Cymbopogon martini</i> (Roxb.) J.F. Watson [Internet] Record from Proseabase. L.P.A. Oyen and Nguyen Xuan Dung (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia. http://www.proseanet.org . [Accessed 23 Jun 2014]	[No evidence] " <i>Cymbopogon martini</i> is generally propagated by seed. Propagation by offshoots and cuttings is also possible, but there are indications that seedlings yield more herbage and oil."
607	Minimum generative time (years)	2
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2006. <i>Flora of China</i> . Vol. 22 (Poaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Perennial from a short woody rootstock." [Based on biology of related species and perennial growth habit]
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n

Qsn #	Question	Answer
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2006. Flora of China. Vol. 22 (Poaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[Possibly, but no evidence, and seeds have no obvious means of external attachment] "Spathate panicle narrow, dense, erect, 20–30 cm; spatheoles green becoming reddish, 2– 4 cm; racemes 1.5–2 cm; rachis internodes and pedicels ciliate on margins, back sometimes pubescent; pedicel of homogamous pair swollen, barrel-shaped, shiny, fused to internode at base. Sessile spikelet oblong, 3.5–4.5 mm; lower glume flat, deeply grooved below middle (appearing as a line or keel on inside), keels winged above middle, veinless or 2-veined between keels; upper lemma 2-lobed; awn 1.4–1.8 cm. Pedicelled spikelet 3.5–4 mm."

702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2006. Flora of China. Vol. 22 (Poaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"This grass is native to India, but is cultivated elsewhere in the tropics for its oils."

703	Propagules likely to disperse as a produce contaminant	
	Source(s)	Notes
	de Guzman, C.C & Reglos, R.A., 1999. <i>Cymbopogon martini</i> (Roxb.) J.F. Watson[Internet] Record from Proseabase. L.P.A. Oyen and Nguyen Xuan Dung (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia. http://www.proseanet.org . [Accessed]	[Unknown. Possibly if grown in the vicinity of other commercial crops] " <i>Cymbopogon martini</i> is generally propagated by seed." ... "Seed is sown in nursery beds; 2.5 kg of clean seed is used for 100 m2 nursery, providing enough seedlings for a field of 1 ha. The tiny seeds are often mixed with fine sand to obtain even distribution, and the mixture is then beaten to detach the glumes and improve germination."

704	Propagules adapted to wind dispersal	
	Source(s)	Notes
	de Guzman, C.C & Reglos, R.A., 1999. <i>Cymbopogon martini</i> (Roxb.) J.F. Watson[Internet] Record from Proseabase. L.P.A. Oyen and Nguyen Xuan Dung (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia. http://www.proseanet.org . [Accessed]	[Dispersal possibly aided by wind, but no obvious adaptations to wind dispersal] "Fruit a cylindrical to subglobose caryopsis, with basal hilum; the fruiting panicle often turns bright red at maturity."

705	Propagules water dispersed	n
	Source(s)	Notes
	de Guzman, C.C & Reglos, R.A., 1999. <i>Cymbopogon martini</i> (Roxb.) J.F. Watson[Internet] Record from Proseabase. L.P.A. Oyen and Nguyen Xuan Dung (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia. http://www.proseanet.org . [Accessed]	"under natural conditions it is often found on hillsides with an annual rainfall below 600 mm" Although water may move seeds, plants generally occur in drier, non-riparian areas]

706	Propagules bird dispersed	n
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Qsn #	Question	Answer
	Source(s)	Notes
	de Guzman, C.C & Reglos, R.A., 1999. <i>Cymbopogon martini</i> (Roxb.) J.F. Watson[Internet] Record from Proseabase. L.P.A. Oyen and Nguyen Xuan Dung (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia. http://www.proseanet.org . [Accessed 24 Jun 2014]	[No evidence, and not fleshy-fruited] "Fruit a cylindrical to subglobose caryopsis, with basal hilum; the fruiting panicle often turns bright red at maturity."

707	Propagules dispersed by other animals (externally)	n
	Source(s)	Notes
	de Guzman, C.C & Reglos, R.A., 1999. <i>Cymbopogon martini</i> (Roxb.) J.F. Watson[Internet] Record from Proseabase. L.P.A. Oyen and Nguyen Xuan Dung (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia. http://www.proseanet.org . [Accessed 24 Jun 2014]	[No evidence, and no apparent means of external attachment] "Fruit a cylindrical to subglobose caryopsis, with basal hilum; the fruiting panicle often turns bright red at maturity."

708	Propagules survive passage through the gut	
	Source(s)	Notes
	de Guzman, C.C & Reglos, R.A., 1999. <i>Cymbopogon martini</i> (Roxb.) J.F. Watson[Internet] Record from Proseabase. L.P.A. Oyen and Nguyen Xuan Dung (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia. http://www.proseanet.org . [Accessed 24 Jun 2014]	[Unknown, but seeds unlikely to be consumed due to lack of palatability of grass] "the Indian Forest Department recommends planting it in forest plantations as a cash crop, since it is unpalatable to livestock and discourages grazing in young plantations."

801	Prolific seed production (>1000/m ²)	
	Source(s)	Notes
	de Guzman, C.C & Reglos, R.A., 1999. <i>Cymbopogon martini</i> (Roxb.) J.F. Watson[Internet] Record from Proseabase. L.P.A. Oyen and Nguyen Xuan Dung (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia. http://www.proseanet.org . [Accessed 24 Jun 2014]	[Unknown] " <i>Cymbopogon martini</i> is generally propagated by seed."

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	Notes
	Royal Botanic Gardens Kew. 2008. Seed Information Database (SID). Version 7.1. http://data.kew.org/sid/ . [Accessed 24 Jun 2014]	Unknown. Several related <i>Cymbopogon</i> species have orthodox seeds

803	Well controlled by herbicides	
	Source(s)	Notes

Qsn #	Question	Answer
	BioNET-EAFRINE. 2011. <i>Cymbopogon nardus</i> (Blue Citronella Grass). http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Cymbopogon_nardus_%28Blue_Citronella_Grass%29.htm . [Accessed]	[Unknown. Other <i>Cymbopogon</i> species effectively controlled by herbicides] "Spot spraying with a suitable herbicide reduces <i>C. nardus</i> without negatively impacting indigenous species and indigenous species respond positively to <i>C. nardus</i> reduction (Ssegawa 2007)."

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	Notes
	Tropical Species Database. 2014. <i>Cymbopogon martini</i> . http://tropical.theferns.info/viewtropical.php?id=Cymbopogon+martini . [Accessed 24 Jun 2014]	[Tolerates low cutting] "The height of cutting is generally 20 cm above the ground. Cutting high leaves a substantial stubble, so reducing the cost of harvesting and distillation, but cutting low stimulates regrowth of the crop"

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	WRA Specialist. 2014. Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits

- Thrives in tropical climates (increases probability that it could establish in Hawaiian Islands)
- Reported to be naturalized in China and Queensland, Australia
- Other *Cymbopogon* species have become invasive
- Unpalatable to grazing animals
- Skin contact may cause dermatitis in susceptible individuals
- Shade tolerant (can grow under dense tree canopies & possibly spread into intact forests)
- Seeds may be dispersed intentionally by people, or passively by wind or gravity
- Tolerates and can regrow after being cut back
- Limited and missing ecological information makes accurate risk predication difficult

Low Risk Traits

- Despite reports of naturalization, no negative impacts have been reported to date
- Unarmed (no spines, thorns or burrs)
- Source of essential oil for soaps & perfumes
- Plants require cross-pollination
- Not reported to spread vegetatively

Second Screening Results for Herbs

(A) Reported as a weed of cultivated lands? No
Outcome = Accept (Low Risk)