

Taxon: Hibiscus cannabinus**Family:** Malvaceae

Common Name(s): bastard jute
bimli jute
Deccan hemp
Indian hemp
Java jute
Kenaf

Synonym(s): Abelmoschus congener Walp.
Furcaria cannabina Ulbr.
Hibiscus malangensis Baker f.

Assessor: No Assessor**Status:** Assessor Approved**End Date:** 25 Jul 2014**WRA Score:** 3.0**Designation:** EVALUATE**Rating:** Evaluate**Keywords:** Annual Herb, Naturalized, Weedy, Fiber Crop, Dehiscent Capsules

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	y
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?	y=1, n=-1	y
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	y
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)	y
303	Agricultural/forestry/horticultural weed		
304	Environmental weed		
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	n
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens		

Qsn #	Question	Answer Option	Answer
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
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	y
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	y=1, n=-1	y
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	1
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)		
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	y=1, n=-1	n
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	y=1, n=-1	n
801	Prolific seed production (>1000/m ²)		
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	n
803	Well controlled by herbicides	y=-1, n=1	y
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?	y
	Source(s)	Notes
	Wilson, F. D. 1978. Wild kenaf, <i>Hibiscus cannabinus</i> L. (Malvaceae), and related species in Kenya and Tanzania. <i>Economic Botany</i> , 3 (2): 199-204	"Kenaf, <i>Hibiscus cannabinus</i> L., occurs as a wild and ruderal plant in Kenya and Tanzania. It is polymorphic, varying in height, growth habit, spininess, flower color, and size of floral parts, capsules, and seeds. It occupies several distinct environmental niches, from low-lying meadows close to swamps and streams to semi-arid grassland/thornbush plains. It is also found in various weedy situations, such as cultivated and fallow fields, and fence- and hedgerows. At least one ecotype appears to be specifically adapted as a weed of cultivated fields."
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	[Wild type may be more "weedy" than cultivars, but breeding is still being pursued to reduce weedy traits] " <i>Hibiscus cannabinus</i> is a common wild plant in most African countries south of the Sahara. It may have been domesticated as a fibre plant already 6000 years ago in Sudan." ... "Almost no research has been carried out to enhance the genetic potential. The existing landraces are mixtures of genotypes; the available diversity should be studied and selections made from the desirable types. Purple-flowered strains and the purple false roselle (<i>Hibiscus acetosella</i>) are resistant to the main disease of kenaf, root-knot nematodes; hence they are potential sources of desirable genes in breeding programmes. Breeding of fibre cultivars with high potential yields under suboptimal conditions is urgent as kenaf grown for fibre is being pushed increasingly towards marginal environments. Other breeding objectives are plants without prickly stems and bristly capsules to facilitate harvesting, and resistance to diseases, nematodes and pests."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	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 24 Jul 2014]	"widely naturalized elsewhere in tropics "

103	Does the species have weedy races?	y
	Source(s)	Notes
	Wilson, F. D. 1978. Wild kenaf, <i>Hibiscus cannabinus</i> L. (Malvaceae), and related species in Kenya and Tanzania. <i>Economic Botany</i> , 3 (2): 199-204	"It is also found in various weedy situations, such as cultivated and fallow fields, and fence- and hedgerows. At least one ecotype appears to be specifically adapted as a weed of cultivated fields." ... "A shorter (± 1 m) cream-flowered form (Type 3, Table II) grows along roadsides and as a well established weed in cultivated and fallow fields, west of Lake Victoria near Biharamulo, and south of the lake between Geita and Sengerema..."

Qsn #	Question	Answer
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
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	" <i>Hibiscus cannabinus</i> is a common wild plant in most African countries south of the Sahara."

202	Quality of climate match data	High
	Source(s)	Notes
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	"Kenaf is now widespread in the tropics and subtropics."

203	Broad climate suitability (environmental versatility)	y
	Source(s)	Notes
	Duke, J.A. 1983. Handbook of Energy Crops - <i>Hibiscus cannabinus</i> . http://www.hort.purdue.edu/newcrop/duke_energy/hibiscus_cannabinus.html . [Accessed 24 Jul 2014]	[Broad range of climates and elevation range] "Ranging from Warm Temperate Thorn to Moist through Tropical Very Dry to Wet Forest Life Zones, kenaf is reported to tolerate annual precipitation of 5.7 to 41.0 dm (mean of 29 cases = 14.8), annual temperature of 11.1 to 27.5°C (mean of 29 cases = 21.1), and pH of 4.3 to 8.2 (mean of 24 cases = 6.1) (Duke, 1978, 1979). Kenaf is often recommended for tropical and subtropical climates, from sea-level to 1000 m altitude, with no night temperatures below 18.3 C, and 500 to 600 cm rainfall over 4–5 months with wet and dry periods. It is less exacting in its requirements than jute. It thrives best with temperatures of 15–27°C during the growing season. The plant is frost sensitive and damaged by heavy rains with strong winds."
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	[In tropics, elevation range exceeds 1000 m, demonstrating environmental versatility] " It is grown from sea level up to an altitude of 2700 m but does not do well above 2500 m and does not tolerate frost. It does well at day temperatures between 16°C and 27°C with 500–625 mm rainfall distributed over a period of 4–5 months. Lower temperatures retard plant growth. "

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	"Kenaf is now widespread in the tropics and subtropics."

205	Does the species have a history of repeated introductions outside its natural range?	y
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Qsn #	Question	Answer
	Source(s)	Notes
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	"As a vegetable it is widely grown in Africa, where it is grown on a much smaller scale as a fibre crop. In the past it has been of some importance as a commercial fibre crop in Côte d'Ivoire, Burkina Faso, Togo, Benin, Niger, Kenya, Tanzania and Malawi. India has long been the largest producer of kenaf fibre."
	Imada, C.T., Staples, G.W. & Herbst, D.R. 2005. Annotated Checklist of Cultivated Plants of Hawai'i. http://www2.bishopmuseum.org/HBS/botany/cultivatedplants/ . [Accessed 24 Jul 2014]	" <i>Hibiscus cannabinus</i> Linnaeus Common Names: Kenaf, Deccan-hemp Locations: Waimea Arboretum & Botanical Garden"
	Duke, J.A. 1983. Handbook of Energy Crops - <i>Hibiscus cannabinus</i> . http://www.hort.purdue.edu/newcrop/duke_energy/hibiscus_cannabinus.html . [Accessed 24 Jul 2014]	"Probably native to Africa, East Indies, Asia, or Australia, now naturalized in Africa and Asia, generally cultivated in India, and introduced in India, Indochina, Taiwan, Indonesia, and North and South America. Its distribution is between 45°N and 30°S. "

301	Naturalized beyond native range	y
	Source(s)	Notes
	Liogier, A.H. & Martorell, L.F. 2000. Flora of Puerto Rico and adjacent islands: a systematic synopsis. Second Edition Revised. La Editorial, UPR, San Juan, Puerto Rico	"Grown in gardens in Puerto Rico, sometimes escaped..."
	Wunderlin, R.P. 1982. Guide to the Vascular Plants of Central Florida. University Press of Florida, Gainesville, FL	"Native to tropical Africa. Escaped from cultivation."
	Romeiras, M. M., Catarino, L., Torrão, M. M., & Duarte, M. C. 2011. Diversity and origin of medicinal exotic flora in Cape Verde Islands. <i>Plant Ecology and Evolution</i> , 144(2): 214-225	"Table 1 – Checklist of the exotic naturalized medicinal plants of Cape Verde Islands." ... [<i>Hibiscus cannabinus</i> naturalized in M, Maio; T, Santiago]
	Small, J. K. 1910. Additions to the Flora of Peninsular Florida. II. Naturalized Species. <i>Bulletin of the Torrey Botanical Club</i> 37(10): 513-518	"The ambaree or brown Indian hemp is naturalized in both pinelands and about hammocks in southern Florida. Specimens were collected near Miami in the fall of 1903 by the writer and Mr. J. J. Carter."

302	Garden/amenity/disturbance weed	y
	Source(s)	Notes
	Wilson, F. D. 1978. Wild kenaf, <i>Hibiscus cannabinus</i> L. (Malvaceae), and related species in Kenya and Tanzania. <i>Economic Botany</i> , 3 (2): 199-204	"It is also found in various weedy situations, such as cultivated and fallow fields, and fence- and hedgerows. At least one ecotype appears to be specifically adapted as a weed of cultivated fields." ... "A shorter (± 1 m) cream-flowered form (Type 3, Table II) grows along roadsides and as a well established weed in cultivated and fallow fields, west of Lake Victoria near Biharamulo, and south of the lake between Geita and Sengerema (FDW 75-54, -58)."
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	"Kenaf grows naturally in grassland and as a weed in fields and wasteland." ... "In some regions it is semicultivated as a protected weed for use as a vegetable."

303	Agricultural/forestry/horticultural weed	

Qsn #	Question	Answer
	Source(s)	Notes
	Ngome, A. F., Becker, M., Mtei, M. K., & Mussnug, F. 2012. Management options and soil types differentially affect weeds in maize fields of Kakamega, Western Kenya. <i>Journal of Agricultural Science and Technology</i> 2: 104-114	"Abstract: Maize production in Kenya is constrained by weed infestation and nutrient deficiencies. Field studies were conducted during the 2008/2009 cropping seasons to investigate weeds in maize fields on three dominant soil types in Western Kenya. Weeds were inventoried and their composition was compared using Jaccard's index. The economic importance of weed species (potential to reduce yields and the difficulty to control them by manual weeding) was assessed through participatory surveys.. " ... "Table 2 Weed composition and coverage in maize fields of Western Kenya. +: observed less than 1%, -: not observed" [<i>Hibiscus cannabinus</i> listed among weeds, but impacts on yield unknown]
	Randall, R.P. 2012. <i>A Global Compendium of Weeds</i> . 2nd Edition. Department of Agriculture and Food, Western Australia	Listed as a weed of agriculture, but impacts on crop yields unknown

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

305	Congeneric weed	y
	Source(s)	Notes
	Chachalis, D., Korres, N., & Khah, E. M. 2008. Factors affecting seed germination and emergence of Venice mallow (<i>Hibiscus trionum</i>). <i>Weed Science</i> , 56(4): 509-515	"Venice mallow is considered an emerging weed problem in many regions in the world in crops such as cotton (<i>Gossypium hirsutum</i> L.; Prostko et al. 1998), soybean [<i>Glycine max</i> (L.) Merr.], and corn (<i>Zea mays</i> L.; Westra et al. 1990)." ... "The species was on the list of weed shifts due to the widespread use of herbicide-tolerant crops (Knezevic and Cassman 2003). In Australia, the species is also known as bladder ketmia and has been referred to as a serious emerging weed problem."
	Hussey, B.M.J., Keighery, G. J., Dodd, J., Lloyd, S.G. & Cousens, R.D. 2007. <i>Western Weeds. A Guide to the Weeds of Western Australia</i> . The Weed Society of Western Australia, Victoria Park, WA	[<i>Hibiscus trionum</i>] ... "Found as a weed of disturbed and cultivated land in parts of the Kimberley, the Pilbara, and the southwest from Moora to Donnybrook."

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

Qsn #	Question	Answer
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	[Prickly stems on wild accessions, but no evidence of true spines, thorns or burrs] "Annual herb, up to 2 m tall in the wild, up to 5 m in cultivars; taproot well developed, with lateral roots spreading horizontally to 1 m and adventitious roots on lowest stem section; stem erect, slender, cylindrical, prickly on wild accessions. Leaves alternate, simple; stipules filiform, 5–8 mm long, pubescent; petiole 3–30 cm long; blade 1–19 cm × 0.1–20 cm, very shallowly to very deeply palmately 3–7-lobed in lower part of plant, often unlobed in upper part or even bractlike near the apex, base cuneate to cordate, apex acuminate, margins serrate or dentate, upper surface glabrous but with a prominent, 3 mm long nectary at the base of the midrib, lower surface hairy along the veins."
	Wilson, F. D. 1978. Wild kenaf, <i>Hibiscus cannabinus</i> L (Malvaceae), and related species in Kenya and Tanzania. <i>Economic Botany</i> , 3 (2): 199-204	[Wild strains have spiny stems & vegetative parts] "Many of the wild East African strains however, share two characteristics that suggest that they have not been cultivated, or at least not domesticated for food or fiber. These characteristics are: (1) spiny vegetative parts, making the plants difficult to handle; ..."

402	Allelopathic	
	Source(s)	Notes
	de Albuquerque, M. B., dos Santos, R. C., Lima, L. M., de Albuquerque Melo Filho, P., Nogueira, R. J. M. C., da Câmara, C. A. G., & de Rezende Ramos, A. 2010. Allelopathy, an alternative tool to improve cropping systems. A review. <i>Agronomy for Sustainable Development</i> 31: 379–395	[Possibly. Allelopathic under laboratory conditions] "Kenaf (<i>Hibiscus cannabinus</i> L.)" ... "Russo et al. (1997) tested its potential use for allelopathic purposes using frost-killed kenaf that was chipped and either immediately frozen (weathered 0 months) or weathered in mats in the soil for two or four months." ... "According to the authors, extracts from kenaf weathered up to four months reduced germination in pigweed by 50 to 70%, especially at the highest concentration."
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	[Suggests that plants are not allelopathic] "Kenaf may be grown alone or intercropped with other plants. In some regions it is semicultivated as a protected weed for use as a vegetable."

403	Parasitic	n
	Source(s)	Notes
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	"Annual herb, up to 2 m tall in the wild, up to 5 m in cultivars." [No evidence. Malvaceae]

Qsn #	Question	Answer
404	Unpalatable to grazing animals	n
	Source(s)	Notes
	Webber III, C.L., Bhardwaj, H.L. and Bledsoe, V.K. 2002. Kenaf Production: Fiber, Feed, and Seed. Pp. 327-339 in J. Janick and A. Whipkey (eds.). Trends in new crops and new uses. ASHS Press, Alexandria, VA	"Although kenaf is usually considered a fiber crop, the entire kenaf plant, stalk (core and bark), and leaves, can be used as a livestock feed."
	Quattrocchi, U.. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"leaves and flowers eaten, fodder plant..."

405	Toxic to animals	n
	Source(s)	Notes
	Quattrocchi, U.. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"leaves and flowers eaten, fodder plant..."

406	Host for recognized pests and pathogens	
	Source(s)	Notes
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	[Possibly] "Diseases and pests of vegetable kenaf are the same as reported for the fibre crop, and most of them are also similar to these of cotton and okra. The main diseases are: foot, stem and collar rot and wilting caused by <i>Phytophthora</i> ; <i>Sclerotium rolfsii</i> causing collar rot; powdery mildew caused by <i>Leveillula taurica</i> ; <i>Coniella musaiaensis</i> causing leaf spot; <i>Selenosporella</i> species causing root rot and wilting; <i>Rhizoctonia solani</i> causing stem rot and lodging; <i>Pythium deliense</i> causing root rot; <i>Phomopsis</i> species causing stem spot; <i>Verticillium dahliae</i> causing wilting; <i>Fusarium oxysporum</i> causing wilting and necrosis; tobacco necrosis virus (TNV); and hibiscus latent ringspot virus (HLRSV), which is seed transmitted. The cotton flea beetle <i>Podagrica puncticollis</i> is a notable pest, most serious in the seedling stage. <i>Oxycareus</i> spp. and <i>Dysdercus supersticiosus</i> are seed infesting bugs. Kenaf is especially susceptible to root-knot nematodes (<i>Meloidogyne</i> spp.) that may reduce growth and yield especially on light-textured soils. Nematodes also predispose affected plants to pathogenic soil fungi. In order to control nematodes, crop rotation is recommended especially with amaranth or a cereal crop, and liberal application of organic fertilizer. Chemical spraying for control of pests and diseases is rarely applied."

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes

Qsn #	Question	Answer
	<p>Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands</p>	<p>[No evidence] "The shoots or young leaves, and sometimes the flowers and young fruits, are used as a vegetable. In Uganda a local delicacy is made from the seeds. These are roasted, ground and pounded, and the flour and skin are separated in water. The flour is rejected but the floating skin parts are used for the preparation of a paste, mixed with boiled pigeon peas. Children chew the bark for its sweetness.</p> <p>The stem is a source of fibre used in the manufacture of twine, rope and coarse textiles for sacking and cloth for packaging; special fibre cultivars exist. The production of kenaf fibre in Africa is rather uncommon, but locally important, e.g. in northern Nigeria, Niger and Sudan, where it is used for cordage, twines, fishlines and nets. Dried scraped ribbons are used for twine and cordage for sleeping mats. Ribbons and whole stems are a raw material for the pulp and paper industry. Seeds from the fibre crop are used for oil extraction, the rest being used as feed. The oil is suitable as a lubricant and for illumination, for manufacture of soap, linoleum and in paints and varnishes.</p> <p>In local medicine in Kenya, pounded roots are administered to spider bites, and leaves are used to treat stomach disorders. In West Africa, powdered leaves are applied to sores and boils, and a leaf infusion is administered for treating cough. In India, juice from the flowers is taken against biliousness, while the seed are considered stomachic and aphrodisiac. Whole young plants are an excellent fodder for cattle. The stem core (xylem) is used in combination with peat moss (<i>Sphagnum</i>) and fertilizers as a growth medium for plants. Kenaf plants accumulate minerals such as selenium and boron and can be used as a bioremedial tool for removing these metals from contaminated soil. In West Africa the plants are used as boundary markers."</p>
	<p>Webber III, C.L., Bhardwaj, H.L. and Bledsoe, V.K. 2002. Kenaf Production: Fiber, Feed, and Seed. Pp. 327-339 in J. Janick and A. Whipkey (eds.). Trends in new crops and new uses. ASHS Press, Alexandria, VA</p>	<p>[Seed capsules are a skin irritant] "The seed capsules are covered with many small, fine, loosely held, hairy structures that are very irritating when in contact with human skin."</p>
	<p>Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL</p>	<p>No evidence</p>

408	Creates a fire hazard in natural ecosystems	
	Source(s)	Notes
	<p>Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands</p>	<p>[No information found on the fire ecology of this species] "Annual herb, up to 2 m tall in the wild" ..."Kenaf grows naturally in grassland and as a weed in fields and wasteland."</p>

409	Is a shade tolerant plant at some stage of its life cycle	n
	Source(s)	Notes
	<p>Plants for a Future. 2014. <i>Hibiscus cannabinus</i>. http://www.pfaf.org/user/Plant.aspx?LatinName=Hibiscus+cannabinus. [Accessed 25 Jul 2014]</p>	<p>"Prefers a well-drained humus rich fertile soil in full sun[200]."</p>

Qsn #	Question	Answer
	Webber III, C.L., Bhardwaj, H.L. and Bledsoe, V.K. 2002. Kenaf Production: Fiber, Feed, and Seed. Pp. 327-339 in J. Janick and A. Whipkey (eds.). Trends in new crops and new uses. ASHS Press, Alexandria, VA	[Weeds may suppress growth, probably through competition for light, water & nutrients] "Though kenaf grows quickly and competes well with weeds, initial weed control is often required. Researchers have reported that kenaf is a good competitor with weeds once the plants are of sufficient size to shade the ground (Orsenigo 1964; Burnside and Williams 1968), yet weeds can significantly reduce kenaf yields. Weed control, therefore, becomes an important consideration in obtaining optimum kenaf yields."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	"It does best on well-drained, neutral sandy loams, rich in humus. It does not tolerate waterlogging."
	Duke, J.A. 1983. Handbook of Energy Crops - <i>Hibiscus cannabinus</i> . http://www.hort.purdue.edu/newcrop/duke_energy/hibiscus_cannabinus.html . [Accessed 24 Jul 2014]	"Kenaf is adaptable to a variety of soils, best being a deep, friable, well-drained, sandy loam with humus; light sandy soils are not recommended. A pH of neutral to slightly acid is suggested (C.S.I.R., 1948–1976)."
	University of Kentucky Cooperative Extension Service. 2014. Kenaf. Revised 2014. http://www.uky.edu/Ag/CCD/introsheets/kenafintro.pdf . [Accessed 25 Jul 2014]	"Kenaf is well adapted to a wide range of soil types; however, best yields occur on well-drained fertile sites."

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	"Annual herb, up to 2 m tall in the wild, up to 5 m in cultivars."

412	Forms dense thickets	n
	Source(s)	Notes
	University of Kentucky Cooperative Extension Service. 2014. Kenaf. Revised 2014. http://www.uky.edu/Ag/CCD/introsheets/kenafintro.pdf . [Accessed 25 Jul 2014]	[Cultivated in dense stands] "This crop is grown in dense stands to limit branching and promote the development of long fibers in the main stem."
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	[No evidence of thicket formation] "Kenaf grows naturally in grassland and as a weed in fields and wasteland."
	Abdullahi, A. E. 2004. Weed survey in cotton (<i>Gossypium hirsutum</i> L.) and sunflower (<i>Helianthus annuus</i> L.) fields in the Pandamatenga plains of northeastern Botswana. South African Journal of Plant and Soil, 21(1): 21-24	[Not in this study] "Table 1 Weeds growing in cotton and sunflower fields at Pandamatenga commercial farms, northeastern Botswana 1998" [<i>Hibiscus cannabinus</i> recorded at a density of 0.4 plants/m ²]

Qsn #	Question	Answer
501	Aquatic	n
	Source(s)	Notes
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	"Kenaf grows naturally in grassland and as a weed in fields and wasteland."

502	Grass	n
	Source(s)	Notes
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	"Annual herb, up to 2 m tall in the wild..." [Malvaceae]

503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	"Annual herb, up to 2 m tall in the wild"

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	"Annual herb, up to 2 m tall in the wild, up to 5 m in cultivars; taproot well developed, with lateral roots spreading horizontally to 1 m and adventitious roots on lowest stem section; stem erect, slender, cylindrical, prickly on wild accessions."
	University of Kentucky Cooperative Extension Service. 2014. Kenaf. Revised 2014. http://www.uky.edu/Ag/CCD/introsheets/kenafintro.pdf . [Accessed 25 Jul 2014]	"Kenaf (<i>Hibiscus cannabinus</i>) is a warm-season annual row crop in the same plant family as okra and cotton (Malvaceae). Kenaf plants are capable of growing to a height of 20 feet under favorable conditions; however, heights generally average 8 to 14 feet in a growing season of 4 to 5 months."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	[A common plant in the wild & in cultivation] " <i>Hibiscus cannabinus</i> is a common wild plant in most African countries south of the Sahara. It may have been domesticated as a fibre plant already 6000 years ago in Sudan. Kenaf is now widespread in the tropics and subtropics. As a vegetable it is widely grown in Africa, where it is grown on a much smaller scale as a fibre crop."

602	Produces viable seed	y
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Qsn #	Question	Answer
	Source(s)	Notes
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	"Kenaf is usually propagated from seed but may also be propagated through cuttings. Seed yield is 1–28 g/plant; the 1000-seed weight 25–27 g, in wild forms only 9–12 g."

603	Hybridizes naturally	
	Source(s)	Notes
	Menzel, M. Y., & Wilson, F. D. 1961. Chromosomes and crossing behavior of <i>Hibiscus cannabinus</i> , <i>H. acetosella</i> , and <i>H. radiatus</i> . American Journal of Botany 48(8): 651-657	"Reciprocal crosses of <i>H. cannabinus</i> and <i>H. acetosella</i> - The hybrids were morphologically intermediate between the parents, with red-tinged foliage, 5-lobed leaves, obscurely forked bracts and light-lavender flowers."
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	[Possibly. Artificial hybridization possible] "Interspecific hybridization has been attempted with variable success between <i>Hibiscus cannabinus</i> and other species within the same section, such as <i>Hibiscus sabdariffa</i> L., <i>Hibiscus radiatus</i> Cav., <i>Hibiscus diversifolius</i> Jacq. and <i>Hibiscus acetosella</i> Welw. ex Hiern."

604	Self-compatible or apomictic	y
	Source(s)	Notes
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	"Kenaf is mainly an out-breeding plant, but up to 30% self-pollination occurs. Flowers open before daybreak and begin to close about midday. The flower structure promotes cross pollination. The pistil is functional when the flower opens, while the stamens are not dehiscing until shortly after sunrise. While the pistil is still functional, the stigmatic lobes hang down, almost touching the unopened anthers. Later in the day, the stigmatic lobes become turgid and soon stand above the anthers, which lose their pollen."

605	Requires specialist pollinators	n
	Source(s)	Notes
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	"Cross-pollination is mainly effected by insects such as bees."

Qsn #	Question	Answer
606	Reproduction by vegetative fragmentation	n
	Source(s)	Notes
	Duke, J.A. 1983. Handbook of Energy Crops - Hibiscus cannabinus. http://www.hort.purdue.edu/newcrop/duke_energy/hibiscus_cannabinus.html . [Accessed 24 Jul 2014]	"Propagation is by seed. Seed retain viability for about 8 months under ordinary storage conditions."
	Bukenya-Ziraba, R., 2004. Hibiscus cannabinus L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	[No evidence of vegetative spread] "Annual herb, up to 2 m tall in the wild, up to 5 m in cultivars" ... "Kenaf is usually propagated from seed but may also be propagated through cuttings."

607	Minimum generative time (years)	1
	Source(s)	Notes
	Bukenya-Ziraba, R., 2004. Hibiscus cannabinus L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	[Annual. Capable of reaching maturity in one growing season] "Annual herb, up to 2 m tall in the wild, up to 5 m in cultivars; taproot well developed, with lateral roots spreading horizontally to 1 m and adventitious roots on lowest stem section; stem erect, slender, cylindrical, prickly on wild accessions. " ... "In general kenaf is an obligate short-day plant. Flowering is influenced by the time of planting; long days and high temperatures prolong the vegetative growth phase, an advantage for vegetable and fibre crops. Most cultivars remain vegetative until the photoperiod falls below 12.5 hours. In Ghana, day-neutral early maturing varieties exist that take 45–56 days from sowing to flowering."
	Dave's Garden. 2014. PlantFiles: Kenaf, Brown Indian Hemp - Hibiscus cannabinus. http://davesgarden.com/guides/pf/go/60020/ . [Accessed 25 Jul 2014]	[Comment from grower] "LOVE this hibiscus! The only drawback is it goes where it wants, in one season, from seed, my hibiscus has gotten 5 feet tall and 10 fet long by 5 feet wide! HUGE plant. It bloomed for me in April and May, then it stopped blooming in the summer heat, and started back up as the night temps dropped in the 50's."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	
	Source(s)	Notes
	Bukenya-Ziraba, R., 2004. Hibiscus cannabinus L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	[Fruit & seeds lack means of external attachment, but as a crop weed, it may be dispersed inadvertently with soil movement related to cultivation] "Fruit an ovoid, shortly beaked capsule 12–20 mm × 11–15 mm, densely appressed pubescent, 2–25(–35)-seeded. Seeds reniform to triangular with acute angles, 3–4 mm × 2–3 mm, grey to brown-black with pale yellowish spots, hilum brown." ... "Kenaf grows naturally in grassland and as a weed in fields and wasteland."

702	Propagules dispersed intentionally by people	y
	Source(s)	Notes

Qsn #	Question	Answer
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	"Kenaf is now widespread in the tropics and subtropics. As a vegetable it is widely grown in Africa, where it is grown on a much smaller scale as a fibre crop. In the past it has been of some importance as a commercial fibre crop in Côte d'Ivoire, Burkina Faso, Togo, Benin, Niger, Kenya, Tanzania and Malawi. India has long been the largest producer of kenaf fibre."

703	Propagules likely to disperse as a produce contaminant	
	Source(s)	Notes
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	[Grows as a weed & as a cultivated crop. Could possibly become a contaminant of other produce, although direct evidence is currently lacking] "Fruit an ovoid, shortly beaked capsule 12–20 mm × 11–15 mm, densely appressed pubescent, 2–25(–35)-seeded. Seeds reniform to triangular with acute angles, 3–4 mm × 2–3 mm, grey to brown-black with pale yellowish spots, hilum brown." ... "Kenaf grows naturally in grassland and as a weed in fields and wasteland."

704	Propagules adapted to wind dispersal	n
	Source(s)	Notes
	Ajibade, G. A., & Folorunsho, A. E. 2013. Phenological Studies of Two Varieties of <i>Hibiscus cannabinus</i> Linn in Ile-Ife, South West, Nigeria. <i>Journal of Biology, Agriculture and Healthcare</i> , 3(8): 49-56	[Dehiscent capsules. Dispersal may be aided by wind, but not specifically adapted for wind dispersal] "Seed dispersal in both varieties was by explosive mechanism and the undispersed seeds were observed germinating on the plant of both varieties."
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	[Seeds dehisce and are mainly dispersed by gravity. Wind may aid in short distance dispersal] "Seeds ripen in about 5 weeks after anthesis. In wild and vegetable types the fruit wall bursts and the seeds are spread on the ground, whilst in fibre types the fruits are indehiscent."

705	Propagules water dispersed	n
	Source(s)	Notes
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	[No adaptations for water dispersal, & habitat does not suggest movement by water] "Fruit an ovoid, shortly beaked capsule 12–20 mm × 11–15 mm, densely appressed pubescent, 2–25(–35)-seeded. Seeds reniform to triangular with acute angles, 3–4 mm × 2–3 mm, grey to brown-black with pale yellowish spots, hilum brown." ... "Kenaf grows naturally in grassland and as a weed in fields and wasteland."

706	Propagules bird dispersed	n
	Source(s)	Notes
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	"Fruit an ovoid, shortly beaked capsule 12–20 mm × 11–15 mm, densely appressed pubescent, 2–25(–35)-seeded. Seeds reniform to triangular with acute angles, 3–4 mm × 2–3 mm, grey to brown-black with pale yellowish spots, hilum brown. Seedling with epigeal germination."

Qsn #	Question	Answer
707	Propagules dispersed by other animals (externally)	n
	Source(s)	Notes
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	[No adaptations for external dispersal] "Fruit an ovoid, shortly beaked capsule 12–20 mm × 11–15 mm, densely appressed pubescent, 2–25(–35)-seeded. Seeds reniform to triangular with acute angles, 3–4 mm × 2–3 mm, grey to brown-black with pale yellowish spots, hilum brown."

708	Propagules survive passage through the gut	n
	Source(s)	Notes
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	[No adaptations for frugivory, & unlikely to be internally dispersed] "Fruit an ovoid, shortly beaked capsule 12–20 mm × 11–15 mm, densely appressed pubescent, 20–25(–35)-seeded. Seeds reniform to triangular with acute angles, 3–4 mm × 2–3 mm, grey to brown-black with pale yellowish spots, hilum brown."

801	Prolific seed production (>1000/m ²)	
	Source(s)	Notes
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	"Fruit an ovoid, shortly beaked capsule 12–20 mm × 11–15 mm, densely appressed pubescent, 20–25(–35)-seeded."
	Webber III, C.L., Bhardwaj, H.L. and Bledsoe, V.K. 2002. Kenaf Production: Fiber, Feed, and Seed. Pp. 327-339 in J. Janick and A. Whipkey (eds.). Trends in new crops and new uses. ASHS Press, Alexandria, VA	[Uncertain. Seed estimates come from cultivation] "Each capsule contains 5 segments with a total of 20 to 26 seeds/ capsule (Dempsey 1975). The slate-black, wedge-shaped kenaf seeds are approximately 6 mm long and 4 mm wide, with 35,000 to 40,000 seeds/kg (Fig. 4)."

802	Evidence that a persistent propagule bank is formed (>1 yr)	n
	Source(s)	Notes
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	[Ordinary conditions would approximate field conditions] "Under ordinary storage conditions at ambient temperatures and humidity, seeds remain viable for about 8 months. The optimum temperature for seed germination is about 35°C. "

803	Well controlled by herbicides	y
	Source(s)	Notes
	Kamble, S. I. 2008. Effect of spray application of glyphosate on morphological characters of <i>Hibiscus cannabinus</i> Linn. Biosciences, Biotechnology Research Asia 5(2): 823-828	"In present study, the herbicidal activities of glyphosate on <i>Hibiscus cannabinus</i> Linn. have been studied. The morphological responses might produce some light on the manner by which this compound affected on plants. The plants were sprayed with aqueous solution of different concentrations of herbicide from 100 to 5000 ppm. Glyphosate was efficient in killing the weed. The lethal dose of glyphosate was 1200 ppm."

Qsn #	Question	Answer
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	Notes
	Bukenya-Ziraba, R., 2004. <i>Hibiscus cannabinus</i> L. In: Grubben, G.J.H. & Denton, O.A. (Editors). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Netherlands	[Can be repeatedly cut for multiple harvests] "When ratoon cropping is practised, the second harvest is at the 6-week stage, 2–3 weeks after the thinning round. Cutting is done at a height of 6–8 cm, leaving 3 leaves and buds for regrowth. Up to 4–5 harvests may be carried out at 2–3-week ratooning intervals. "

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

- Elevation range exceeds 1000 m, demonstrating environmental versatility
- Grows in temperate & tropical climates
- Widely naturalized
- A weed in fields and wasteland (impacts on crop yields not specified)
- Other Hibiscus species have become invasive
- Wild types have spiny vegetative parts
- Potentially allelopathic
- Hairy seed capsules may be a skin irritant
- Tolerates many soil types
- Self-compatible
- Able to reach maturity in one growing season
- Seeds dispersed by dehiscent capsules & intentionally by people
- Tolerates repeated cutting & harvesting (resprouting ability)

Low Risk Traits

- Certain cultivated types may be less weedy
- A valuable fiber crop
- Palatable to grazing animals (used as fodder for livestock)
- Does not tolerate dense shade
- Not reported to spread vegetatively
- Not known to be dispersed by wind, water or birds
- Seeds should not form a seed bank that will persist beyond 1 year
- Glyphosate provides effective control

Second Screening Results for Her or Low Stature Shrubby Life Form

(A) Reported as a weed of cultivated lands?> Yes. At least one ecotype appears to be specifically adapted as a weed of cultivated fields

(B) Unpalatable to grazers?> No

Outcome = Evaluate

