

Family: *Fabaceae*

Taxon: *Canavalia ensiformis*

Synonym: *Canavalia ensiformis* var. *truncata* Ricker
Dolichos ensiformis L. (basionym)

Common Name: giant stock-bean
gotani-bean
horsebean
jack-bean
seaside bean
sword-bean
wonder-bean

Questionnaire : current 20090513
Status: Assessor Approved

Assessor: Patti Clifford
Data Entry Person: Patti Clifford

Designation: L(Hawai'i)

WRA Score 6

101	Is the species highly domesticated?	y=-3, n=0	y
102	Has the species become naturalized where grown?	y=1, n=-1	y
103	Does the species have weedy races?	y=1, n=-1	
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)	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	y=1, n=0	y
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	y
406	Host for recognized pests and pathogens	y=1, n=0	
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	y
408	Creates a fire hazard in natural ecosystems	y=1, n=0	n

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	y
411	Climbing or smothering growth habit	y=1, n=0	y
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	y
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	y=1, n=-1	y
604	Self-compatible or apomictic	y=1, n=-1	
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)	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	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	
801	Prolific seed production (>1000/m2)	y=1, n=-1	n
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	
803	Well controlled by herbicides	y=-1, n=1	
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	y=-1, n=1	

Designation: L(Hawai'i)

WRA Score **6**

Supporting Data:

101	1969. Sauer, J./Kaplan, L.. Canavalia beans in American prehistory. <i>American Antiquity</i> . 34: 417-424.	[Is the species highly domesticated? Yes "The naturally pantropical genus <i>Canavalia</i> is the source of four domesticated species, of which <i>C. plagiosperma</i> and <i>C. ensiformis</i> evidently evolved under aboriginal New World cultivation. Their exact origins are uncertain because the archaeological record is concentrated in dry regions where they arrived as irrigated crops. The earliest secure record of <i>C. ensiformis</i> is from about A.D. 900 in Oaxaca, but charred seeds from about 300 B.C. in Yucatan probably belong to this species."
101	2007. Pickersgill, B.. Domestication of plants in the Americas: insights from Mendelian and molecular genetics. <i>Annals of Botany</i> . 100: 925-940. http://aob.oxfordjournals.org.eres.library.manoa.hawaii.edu/content/100/5/925.full.pdf+html	[Is the species highly domesticated? Yes] <i>Canavalia ensiformis</i> was domesticated in the MesoAmerican area of the Americas. [reduced dispersal abilities]
102	1999. Wiersema, J.H./León, B.. <i>World Economic Plants: A Standard Reference</i> . CRC Press, Boca Raton, FL	[Has the species become naturalized where grown? Yes] Cultivated and naturalized worldwide, origin from a cultivar of American Indians.
103	2011. WRA Specialist. Personal Communication.	[Does the species have weedy races?] NA [the taxon is not a subspecies, cultivar or registered variety of a domesticated species]
201	1969. Sauer, J./Kaplan, L.. Canavalia beans in American prehistory. <i>American Antiquity</i> . 34: 417-424.	[Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"? 1] " Before their aboriginal distributions were documented, both <i>C. ensiformis</i> and <i>C. plagiosperma</i> had become widely dispersed among non-Indian peoples as minor food, forage, and cover crops. The first recognizable reference to <i>C. ensiformis</i> was by Sir Hans Sloane (1696: 68; 1707: 177). He found this item in Jamaica at Santiago de la Vega (Spanish Town) and in several planters' gardens elsewhere, grown for food and feed under the name of horse-bean. The first known report of <i>C. ensiformis</i> on the mainland dates from about 1800, when Sesse and Moquinio found it at some unspecified place in Mexico (unpublished drawing in Conservatoire et Jardin Botaniques, Geneve). It has occasionally been encountered since as a minor garden plant at widely scattered places in the southwestern United States, Mexico, Central America, and tropical South America. Unfortunately, all the archaeological specimens except the charred Maya beans are from arid and semiarid regions where <i>Canavalia</i> must have been introduced as a cultivated crop grown under irrigation. Transitional stages from wild to fully domesticated forms have not been recovered, and the geographical origins of the cultigens are obscure"
201	1998. Piperno, D.R./Pearsall, D.M.. The origins of agriculture in the lowland tropics. Emerald Group Publishing, http://books.google.com/books?id=0l4idYSg1c0C&pg=PA132&dq=canavalia+ensiformis&hl=en&ei=iPL3TdWtOoecsQPus6zeDA&sa=X&oi=book_result&ct=result&	[Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"? 1] <i>Canavalia ensiformis</i> is considered native to Central America and the Caribbean.
201	2004. Grubben, G.J.H.. <i>Vegetables</i> . Volume 2 of Plant resources of tropical Africa. PROTA, Wageningen, Netherlands	[Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"? 2] <i>Canavalia ensiformis</i> is considered a native of the new world and is only known in cultivation.
202	1998. Piperno, D.R./Pearsall, D.M.. The origins of agriculture in the lowland tropics. Emerald Group Publishing, http://books.google.com/books?id=0l4idYSg1c0C&pg=PA132&dq=canavalia+ensiformis&hl=en&ei=iPL3TdWtOoecsQPus6zeDA&sa=X&oi=book_result&ct=result&	[Quality of climate match data? 2] <i>Canavalia ensiformis</i> is considered native to Central America and the Caribbean.
202	2004. Grubben, G.J.H.. <i>Vegetables</i> . Volume 2 of Plant resources of tropical Africa. PROTA, Wageningen, Netherlands	[Quality of climate match data? 2] <i>Canavalia ensiformis</i> is considered a native of the new world and is only known in cultivation

203	1998. Piperno, D.R./Pearsall, D.M.. The origins of agriculture in the lowland tropics. Emerald Group Publishing, http://books.google.com/books?id=014idYSg1c0C&pg=PA132&dq=canavalia+ensiformis&hl=en&ei=iPL3TdWtOoecsQPus6zeDA&sa=X&oi=book_result&ct=result&	[Broad climate suitability (environmental versatility)? Yes] Can be grown up to an elevation of 1800m. Thrives under a variety of rainfall regimes, and are reported to grow well under from 700 to 4200 mm of rain.
203	2011. Educational Concerns for Hunger Organization (ECHO). ECHO's seed bank vegetable legumes <i>Canavalia ensiformis</i> . ECHO, http://www.echonet.org/content/SeedBank/549	[Broad climate suitability (environmental versatility)? Yes] Grows up to 1800m.
204	1998. Piperno, D.R./Pearsall, D.M.. The origins of agriculture in the lowland tropics. Emerald Group Publishing, http://books.google.com/books?id=014idYSg1c0C&pg=PA132&dq=canavalia+ensiformis&hl=en&ei=iPL3TdWtOoecsQPus6zeDA&sa=X&oi=book_result&ct=result&	[Native or naturalized in regions with tropical or subtropical climates? Yes] <i>Canavalia ensiformis</i> is considered native to Central America and the Carribean.
204	1999. Wiersema, J.H./León, B.. World Economic Plants: A Standard Reference. CRC Press, Boca Raton, FL	[Native or naturalized in regions with tropical or subtropical climates? Yes] Cultivated and naturalized worldwide, origin from a cultivar of American Indians.
205	1968. Purseglove, J.W.. Tropical crops dicotyledons 1. John Wiley and Sons Inc., New York	[Does the species have a history of repeated introductions outside its natural range? Yes] <i>Canavalia ensiformis</i> is a native of Central America and the West Indies and has now been widely introduced around the tropics.
205	1999. Wiersema, J.H./León, B.. World Economic Plants: A Standard Reference. CRC Press, Boca Raton, FL	[Does the species have a history of repeated introductions outside its natural range? Yes] Cultivated and naturalized worldwide, origin from a cultivar of American Indians.
301	1999. Wiersema, J.H./León, B.. World Economic Plants: A Standard Reference. CRC Press, Boca Raton, FL	[Naturalized beyond native range? Yes] Cultivated and naturalized worldwide, origin from a cultivar of American Indians.
302	2007. Randall, R.. Global Compendium of Weeds - <i>Canavalia ensiformis</i> [online database]. http://www.hear.org/gcw/species/canavalia_ensiformis/	[Garden/amenity/disturbance weed? No] No evidence.
303	2007. Randall, R.. Global Compendium of Weeds - <i>Canavalia ensiformis</i> [online database]. http://www.hear.org/gcw/species/canavalia_ensiformis/	[Agricultural/forestry/horticultural weed? No] No evidence.
304	2007. Randall, R.. Global Compendium of Weeds - <i>Canavalia ensiformis</i> [online database]. http://www.hear.org/gcw/species/canavalia_ensiformis/	[Environmental weed? No] No evidence.
305	1997. Waterhouse, D.F.. The major invertebrate pests and weeds of agriculture and plantation forestry in the Southern and Western Pacific. The Australian Centre for International Agricultural Research (ACIAR), Canberra http://aciarc.gov.au/files/node/2295/	[Congeneric weed? Yes] <i>Canavalia rosea</i> is considered to be a major weed of sandy and rocky beaches in the Southern and Western Pacific.
401	2011. Food and Agriculture Organization of the United Nations. <i>Canavalia ensiformis</i> (L.) DC.. Food and Agriculture Organization of the United Nations, http://www.fao.org/ag/AGP/AGPC/doc/Gbase/DATA/PF000012.HTM	[Produces spines, thorns or burrs? No] "Vigorous herbaceous annual climber or woody shrub; three leaflets, ovate or ovate-elliptic, acutely acuminate at the apex, broadly cuneate at the base, up to 20 cm long, 10 cm broad, smooth, with six to seven pairs of lateral nerves."
402	2002. Silva, G.S./Souza, I.M.R./Cutrim, F.A.. Effect of soil amendment with powdered seeds of pig bean on <i>Meloidogyne incognita</i> in tomato. <i>Fitopatologia Brasileira</i> . 27: 412-413.	[Allelopathic? Yes] "A greenhouse experiment was carried out to study the effect of powdered seeds of pig bean (<i>Canavalia ensiformis</i>) incorporated into the soil, for the control of <i>Meloidogyne incognita</i> race 1 in tomato (<i>Lycopersicon esculentum</i>) plants. Autoclaved soil was amended with 2.5, 5.0, 7.5 and 10.0 g of powdered seeds/kg of soil. Soil without amendment served as control. For comparison, the nematicide Carbofuran was included as an additional treatment. Nematode was controlled at rates above 5.0 g. Gall and egg mass indexes were reduced by 48% and 64%, respectively, with the application of 10 g of powdered seeds/kg of soil." [not a plant taxon, however <i>C. ensiformis</i> suppresses nematode reproduction]

402	2007. Lawson, I.Y.D./Dzomeku, K.I./Drisah, J.Y.. Time of planting mucuna and canavalia in an intercrop system with maize.. Journal of Agronomy. 6: 534-540. http://www.scialert.net/fulltext/?doi=ja.2007.534.540&org=11	[Allelopathic? Yes] "Field experiment was conducted to investigate the effects of two cover crops, Mucuna pruriens var. cocchinchinensis and Canavalia ensiformis, on weed interference and yield of maize (Zea mays var Okomas) in an intercropping system at different planting dates. The cover crops were intercropped 0, 2, 4 and 6 Weeks After Planting Maize (WAPM). The intercrop components were sown at 80x40 cm and arranged in a 1:1 spatial arrangement. Non-intercropped maize plots served as sole maize or control. Results showed that Mucuna had better spreading ability than Canavalia. The highest cover spread for Mucuna and Canavalia was observed when they were intercropped at 4 and 2 WAPM, respectively. Results also showed that the two cover crops exhibited (more than 56%) weed suppression when intercropped at 4 WAPM. The highest weed suppression for Mucuna and Canavalia were recorded when they were planted at 4 and 0 WAPM, respectively."
402	2008. Kintomo, A.A./Akintoye, H.A./Alasiri, K.O.. Role of legume fallow in intensified vegetable-based systems. Communications in Soil Science and Plant Analysis. 39: 1261-1268.	[Allelopathic? Yes] This experiment tested legume cover crops ability to suppress weed growth and supply nitrogen fixation to intensified vegetable based systems in Nigeria. Canavalia ensiformis reduced weed biomass by more than 50% and accumulated greater than 30 kg N ha ² 1.
403	2011. Food and Agriculture Organization of the United Nations. Canavalia ensiformis (L.) DC.. Food and Agriculture Organization of the United Nations, http://www.fao.org/ag/AGP/AGPC/doc/Gbase/DATA/PF000012.HTM	[Parasitic? No] Fabaceae.
404	1999. Wiersema, J.H./León, B.. World Economic Plants: A Standard Reference. CRC Press, Boca Raton, FL	[Unpalatable to grazing animals? No] Animal fodder and forage.
404	2011. Food and Agriculture Organization of the United Nations. Canavalia ensiformis (L.) DC.. Food and Agriculture Organization of the United Nations, http://www.fao.org/ag/AGP/AGPC/doc/Gbase/DATA/PF000012.HTM	[Unpalatable to grazing animals? No] Cultivated extensively for fodder.
405	1999. Wiersema, J.H./León, B.. World Economic Plants: A Standard Reference. CRC Press, Boca Raton, FL	[Toxic to animals? Yes] Toxic to mammals.
405	2011. Educational Concerns for Hunger Organization (ECHO). ECHO's seed bank vegetable legumes Canavalia ensiformis. ECHO, http://www.echonet.org/content/SeedBank/549	[Toxic to animals?] Very young pods are edible; mature beans are highly toxic, but heat treatment eliminates the toxic effects.
405	2011. Food and Agriculture Organization of the United Nations. Canavalia ensiformis (L.) DC.. Food and Agriculture Organization of the United Nations, http://www.fao.org/ag/AGP/AGPC/doc/Gbase/DATA/PF000012.HTM	[Toxic to animals? Yes] In Hawaii, half-ripe seeds and sorghum are fed. Forage has low palatability (Otero, 1952), but Krauss (1911) said that cattle acquire a taste for it. Forage yields of 18 to 23 tonnes/ha have been reached in Hawaii (Takahashi and Ripperton, 1949) . In Brazil and Cuba, silage has been made successfully from the plant. Addison (1957, 1958) advocated feeding the whole pod and seed to cattle. In a trial, cottonseed cake fed at 0.7 kg./head/day for 115 days gave a live weight gain of 51 kg.; C. ensiformis meal at 1.1 kg./head/day a gain of almost 51 kg. and urea at 84 g/head/day a gain of 25 kg. This was additional to a basic ration of 7 kg. grass silage and 3.6 kg. maize stover per head per day. Addison (1958) found that the meal was unpalatable but cattle would eat it if 18 litres of molasses were added to each tonne of C. ensiformis meal. Affleck (1961) and Shone (1961) have reported toxicity in cattle grazing C. ensiformis aftermath and consuming too much seed meal. The beans contain a basic amino acid, canavanine, which can be hydrolyzed to urea and catalyzed by an enzyme contained in an extract from pigs' liver. The seed is an important source of urease. Animals affected by eating too much of the plant or meal reach a temperature of 30°C, have a clear nasal discharge, and exhibit lameness and prostration. Mucus membranes become muddy in appearance and clear urine is passed more frequently than usual. It has been shown that 28 g of seed per 0.73 kg. body weight are lethal to cattle and either the meal should not comprise more than 30 percent of the ration or it should be heat-treated to destroy the enzyme before feeding."

406	2011. Food and Agriculture Organization of the United Nations. <i>Canavalia ensiformis</i> (L.) DC.. Food and Agriculture Organization of the United Nations, http://www.fao.org/ag/AGP/AGPC/doc/Gbase/DATA/PF000012.HTM	Host for recognized pests and pathogens?] Immune to most pests.
407	1998. Udeibie, A.B.I./Carlini, C.R.. Questions and answers to edibility problem of the <i>Canavalia ensiformis</i> seeds - a review. <i>Animal Feed Science and Technology</i> . 74: 95-106.	[Causes allergies or is otherwise toxic to humans? Yes] "The seed of <i>Canavalia ensiformis</i> (jackbean), a highly productive large-seeded tropical legume, contains about 300g crude protein and 600g carbohydrates kg ⁻¹ dry matter. It, however, contains toxic and antinutritional factors which limit its use as human food or animal feed."
407	1999. Oliveira, A.E.A./Sales, M.P./Machado, O.L.T./Fernandes, K.V.S./Xavier-Filho, J.. The toxicity of Jack bean (<i>Canavalia ensiformis</i>) cotyledon and seed coat proteins to the cowpea weevil (<i>Callosobruchus maculatus</i>). <i>zEntomologia Experimentalis Et Applic</i>	[Causes allergies or is otherwise toxic to humans? Yes] " The seeds of <i>Canavalia ensiformis</i> are endowed with a multiplicity of proteins and other compounds which are toxic to several organisms including man, other mammals and invertebrates."
407	2011. Educational Concerns for Hunger Organization (ECHO). ECHO's seed bank vegetable legumes <i>Canavalia ensiformis</i> . ECHO, http://www.echonet.org/content/SeedBank/549	[Causes allergies or is otherwise toxic to humans? Yes] Very young pods are edible; mature beans are highly toxic, but heat treatment eliminates the toxic effects.
408	2011. WRA Specialist. Personal Communication.	[Creates a fire hazard in natural ecosystems? No] No evidence of <i>Canavalia ensiformis</i> creating a fire hazard.
409	1968. Purselove, J.W.. Tropical crops dicotyledons 1. John Wiley and Sons Inc., New York	[Is a shade tolerant plant at some stage of its life cycle? Yes] Shade tolerant.
409	1998. Piperno, D.R./Pearsall, D.M.. The origins of agriculture in the lowland tropics. Emerald Group Publishing, http://books.google.com/books?id=0l4idYSg1c0C&pg=PA132&dq=canavalia+ensiformis&hl=en&ei=iPL3TdWtOoecsQPus6zeDA&sa=X&oi=book_result&ct=result&	[Is a shade tolerant plant at some stage of its life cycle? Yes] Plants will tolerate shade.
410	1998. Piperno, D.R./Pearsall, D.M.. The origins of agriculture in the lowland tropics. Emerald Group Publishing, http://books.google.com/books?id=0l4idYSg1c0C&pg=PA132&dq=canavalia+ensiformis&hl=en&ei=iPL3TdWtOoecsQPus6zeDA&sa=X&oi=book_result&ct=result&	[Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)? Yes] Tolerates a wide variety of soil textures and fertility, including depleted lowland soils, and are less affected by waterlogging and salinity than other pulses.
410	2011. Educational Concerns for Hunger Organization (ECHO). ECHO's seed bank vegetable legumes <i>Canavalia ensiformis</i> . ECHO, http://www.echonet.org/content/SeedBank/549	[Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)? Yes] Soil pH; 4.3-8.0; <i>Canavalia ensiformis</i> "will grow on impoverished tropical soils where other pulses will not grow. It has been a useful species in tropical soil reclamation efforts because of its deeply penetrating root system (affording high drought tolerance), its nitrogen fixation capabilities (providing for soil nutrient improvement) and its tolerance of a wide range of soil acidity and salinity conditions."
411	2011. Food and Agriculture Organization of the United Nations. <i>Canavalia ensiformis</i> (L.) DC.. Food and Agriculture Organization of the United Nations, http://www.fao.org/ag/AGP/AGPC/doc/Gbase/DATA/PF000012.HTM	[Climbing or smothering growth habit? Yes] Vigorous herbaceous climber or woody shrub.
412	2011. WRA Specialist. Personal Communication.	[Forms dense thickets? No] No evidence of thicket formation.
501	2011. Food and Agriculture Organization of the United Nations. <i>Canavalia ensiformis</i> (L.) DC.. Food and Agriculture Organization of the United Nations, http://www.fao.org/ag/AGP/AGPC/doc/Gbase/DATA/PF000012.HTM	[Aquatic? No] Terrestrial, herbaceous climber or woody shrub.

502	2011. Food and Agriculture Organization of the United Nations. <i>Canavalia ensiformis</i> (L.) DC.. Food and Agriculture Organization of the United Nations, http://www.fao.org/ag/AGP/AGPC/doc/Gbase/DATA/PF000012.HTM	[Grass? No] Fabaceae.
503	2008. Kintomo, A.A./Akintoye, H.A./Alasiri, K.O.. Role of legume fallow in intensified vegetable-based systems. <i>Communications in Soil Science and Plant Analysis</i> . 39: 1261-1268.	[Nitrogen producing woody plant? Yes] This experiment tested legume cover crops ability to suppress weed growth and supply nitrogen fixation to intensified vegetable based systems in Nigeria. <i>Canavalia ensiformis</i> reduced weed biomass by more than 50% and accumulated greater than 30 kg N ha ²¹ .
504	2011. Food and Agriculture Organization of the United Nations. <i>Canavalia ensiformis</i> (L.) DC.. Food and Agriculture Organization of the United Nations, http://www.fao.org/ag/AGP/AGPC/doc/Gbase/DATA/PF000012.HTM	[Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)? No] "Vigorous herbaceous annual climber or woody shrub; three leaflets, ovate or ovate-elliptic, acutely acuminate at the apex, broadly cuneate at the base, up to 20 cm long, 10 cm broad, smooth, with six to seven pairs of lateral nerves. Flowers rose, mauve or white with red base, about 2.5 cm long; few, on stout axis. Pod variable, sword-shaped, elongate, 30 cm or more long, with two longitudinal ribs near the upper suture; seeds narrowly ellipsoid, white, smooth. Each seed has a brown hilum extending around one quarter of it."
601	1964. Sauer, J.. Revision of <i>Canavalia</i> . <i>Brittonia</i> . 16: 106-181.	[Evidence of substantial reproductive failure in native habitat? No] All available collections of <i>Canavalia ensiformis</i> with habitat data are either from cultivation or apparently feral escapes in artificial habitats.
601	2004. Grubben, G.J.H.. <i>Vegetables</i> . Volume 2 of Plant resources of tropical Africa. PROTA, Wageningen, Netherlands	[Evidence of substantial reproductive failure in native habitat? No] <i>Canavalia ensiformis</i> is considered a native of the new world and is only known in cultivation.
602	2011. Daves Garden. PlantFiles: Jack bean <i>Canavalia ensiformis</i> . Dave's Garden, http://davesgarden.com/guides/pf/go/60529/	[Produces viable seed? Yes] Propagate from seed.
603	1996. Emebiri, L.C.. Evaluation of jackbean (<i>Canavalia ensiformis</i>) lines derived from natural crossing with swordbean (<i>Canavalia gladiata</i>). <i>Biological Agriculture and Horticulture</i> . 12: 319-325.	[Hybridizes naturally? Yes] "Jackbean (<i>Canavalia ensiformis</i> (L.) DC.), is considered one of the few pulses that grow really well on the highly leached, nutrient-depleted lowland tropical soils. Natural pollination with its close relative, the swordbean (<i>Canavalia gladiata</i> (Jacq.)), offers exploitable opportunities for gene introgression and varietal improvement without the necessities of artificial pollination. This paper reports the growth, biomass yield, nodulation and seed quality of advanced generation lines derived from the natural crossing of jackbean with swordbean. Crop growth rate (CGR) was significantly higher in three selections from the hybrid population than in the jackbean parent, with superiority ratings of 122.7% to 320.5% over the jackbean parent. Superiority in net assimilation rate (NAR) of 53.9% to 215.4%, and in forage yield of 46.5% to 183.6% was also evident in the three selections. However, the leaf weight ratio (LWR), as well as nodule number and nodule biomass were significantly inferior in the three selections, when compared to the jackbean parent. Seed size remained unaffected in one of the selections (JS 103), but was reduced by 5.6-22.2% in the other two selections. Seed coat fraction was increased by gene introgression from the swordbean, with selections such as JS 102 exhibiting a 50.4% increase.'
603	2004. Grubben, G.J.H.. <i>Vegetables</i> . Volume 2 of Plant resources of tropical Africa. PROTA, Wageningen, Netherlands	[Hybridizes naturally? Yes] " <i>Canavalia ensiformis</i> , <i>Canavalia gladiata</i> , and <i>Canavalia africana</i> are considered by some as a single species and they cross freely and their uses and chemical composition are similar. Also, an analysis based on DNA data designed to distinguish legume species failed to find differences between <i>C. ensiformis</i> and <i>C. gladiata</i> ."
604	1968. Purseglove, J.W.. <i>Tropical crops dicotyledons 1</i> . John Wiley and Sons Inc., New York	[Self-compatible or apomictic?] Bagged flowers set pods and seeds.
604	1993. Fee, J.B.. <i>Insect pollination of crops</i> . Academic Press, http://www.internationalpollinatorsinitiative.org/free/FreeChapter35.pdf	[Self-compatible or apomictic?] "Anther dehiscence of <i>Canavalia ensiformis</i> (L.) DC, Jack or horse bean, (Fig. 35.4) occurs prior to anthesis. Usually the stigma is located between the circle of 10 anthers and according to Purseglove (1968) bagged flowers set seed. However, in Java, shorter styles sometimes occur and self-pollination may not be so readily achieved (Sastrapradja et al, 1975, 1979). Only about 5% of flowers set on each of the five cultivated species of <i>Canavalia</i> in Java: <i>C. ensiformis</i> , <i>C. gladiata</i> , <i>C. maritima</i> , <i>C. microcarpa</i> and <i>C. virosa</i> . Furthermore, setting was not concentrated on the lower inflorescences which would be expected if pollination were adequate."
605	1968. Purseglove, J.W.. <i>Tropical crops dicotyledons 1</i> . John Wiley and Sons Inc., New York	[Requires specialist pollinators? No] "Under natural conditions the flowers are visited by bees and 20 per cent or more cross-pollinations occurs."

606	1968. Purseglove, J.W.. Tropical crops dicotyledons 1. John Wiley and Sons Inc., New York	[Reproduction by vegetative fragmentation? No] Propagate by seed.
606	2011. Daves Garden. PlantFiles: Jack bean <i>Canavalia ensiformis</i> . Dave's Garden, http://davesgarden.com/guides/pf/go/60529/	[Reproduction by vegetative fragmentation? No] Propagate by seed.
607	2011. Food and Agriculture Organization of the United Nations. <i>Canavalia ensiformis</i> (L.) DC.. Food and Agriculture Organization of the United Nations, http://www.fao.org/ag/AGP/AGPC/doc/Gbase/DATA/PF000012.HTM	[Minimum generative time (years)? 1] Hardy drought resistant annual. Grows slowly at first, flowers three months after planting, at which stage it is ploughed in for green manure for sugar cane in Mauritius.
701	1968. Purseglove, J.W.. Tropical crops dicotyledons 1. John Wiley and Sons Inc., New York	[Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)? No] "Pods stout, straw-colored when ripe, pendant, 20-30 x2-2.5 cm, ribbed near the upper suture; 8-20 seeded; usually only the 2-3 lowest fls of each inflorescence produce seeds." [unlikely, large pod]
702	2011. Educational Concerns for Hunger Organization (ECHO). ECHO's seed bank vegetable legumes <i>Canavalia ensiformis</i> . ECHO, http://www.echonet.org/content/SeedBank/549	[Propagules dispersed intentionally by people? Yes] <i>Canavalia ensiformis</i> is used for soil reclamation in the tropics. It is also used as a green manure and as fodder.
702	2011. Food and Agriculture Organization of the United Nations. <i>Canavalia ensiformis</i> (L.) DC.. Food and Agriculture Organization of the United Nations, http://www.fao.org/ag/AGP/AGPC/doc/Gbase/DATA/PF000012.HTM	[Propagules dispersed intentionally by people? Yes] Cultivated extensively for fodder and green manure.
703	2011. WRA Specialist. Personal Communication.	[Propagules likely to disperse as a produce contaminant? No] No evidence of contamination.
704	1968. Purseglove, J.W.. Tropical crops dicotyledons 1. John Wiley and Sons Inc., New York	[Propagules adapted to wind dispersal? No] Pods stout, straw-colored when ripe, pendant, 20-30 x2-2.5 cm, ribbed near the upper suture; 8-20 seeded; usually only the 2-3 lowest fls of each inflorescence produce seeds." [no adaptation for wind dispersal]
705	1964. Sauer, J.. Revision of <i>Canavalia</i> . <i>Brittonia</i> . 16: 106-181.	[Propagules water dispersed? No] "Seeds to 21 X 15 X 10 mm, oblong, moderately compressed, ivory or white with an inconspicuous brown mark near hilum, not buoyant or im-permeable; hilum ea 9 mm long."
706	1968. Purseglove, J.W.. Tropical crops dicotyledons 1. John Wiley and Sons Inc., New York	[Propagules bird dispersed? No] "Pods stout, straw-colored when ripe, pendant, 20-30 x2-2.5 cm, ribbed near the upper suture; 8-20 seeded; usually only the 2-3 lowest fls of each inflorescence produce seeds."
707	1968. Purseglove, J.W.. Tropical crops dicotyledons 1. John Wiley and Sons Inc., New York	[Propagules dispersed by other animals (externally)? No] "Pods stout, straw-colored when ripe, pendant, 20-30 x2-2.5 cm, ribbed near the upper suture; 8-20 seeded; usually only the 2-3 lowest fls of each inflorescence produce seeds." [no means of external attachment]
708	2011. WRA Specialist. Personal Communication.	[Propagules survive passage through the gut?] Unknown.
801	1968. Purseglove, J.W.. Tropical crops dicotyledons 1. John Wiley and Sons Inc., New York	[Prolific seed production (>1000/m2)? No] "Pods stout, straw-colored when ripe, pendant, 20-30 x2-2.5 cm, ribbed near the upper suture; 8-20 seeded; usually only the 2-3 lowest fls of each inflorescence produce seeds."
802	2011. WRA Specialist. Personal Communication.	[Evidence that a persistent propagule bank is formed (>1 yr)?] Unknown.
803	2011. WRA Specialist. Personal Communication.	[Well controlled by herbicides?] Unknown.
804	2011. WRA Specialist. Personal Communication.	Tolerates, or benefits from, mutilation, cultivation, or fire?] Unknown.
805	2011. WRA Specialist. Personal Communication.	[Effective natural enemies present locally (e.g. introduced biocontrol agents)?] Unknown.