

Family: *Lamiaceae*

Taxon: *Salvia hispanica*

Synonym:

Common Name: chia
mexikansk chia-salvia

Questionnaire :	current 20090513	Assessor:	Patti Clifford	Designation: L
Status:	Assessor Approved	Data Entry Person:	Patti Clifford	WRA Score -1
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	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		y=1, n=0	
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		y=1, n=0	
407	Causes allergies or is otherwise toxic to humans		y=1, n=0	n
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	
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)		y=1, n=0	
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	y=1, n=-1	n
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)	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	y
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

WRA Score -1

Supporting Data:

101	2005. Cahill, J.P.. Human selection and domestication of chia (<i>Salvia hispanica</i> L.O. <i>Journal of Ethnobiology</i> . 25: 155-174.	[Is the species highly domesticated? Yes] "The group of full domesticates is defined by their closed calyxes, larger seeds, variability in calyx pubescence, and gigantism. Closed calyxes prevent seed dispersal and effectively prevent survival of fully domesticated varieties outside of human cultivation. This character meets the criterion for "full domestication" as described by Harlan (1975) or "agricultural domestication" as described by others. None of the herbarium specimens of wild populations or wild material sampled for this study exhibit any degree of closure of calyxes. To date, the trait has been observed only in the fully domesticated varieties of <i>Salvia hispanica</i> and has not been reported in wild populations or related species of <i>Salvia</i> . Like other qualitative traits in the species, closure of calyxes could have developed as the result of conscious human selection."
101	2011. Jamboonsri, W./Phillips, T.D./Geneve, R.L./Cahill, J.P./Hildebrand, D.F.. Extending the range of an ancient crop, <i>Salvia hispanica</i> L. - a new omega 3 source. <i>Genetic Resources and Crop Evolution</i> .	[Is the species highly domesticated? Yes] "While photoperiod insensitivity may be the most essential trait for expansion of dispersal, domestication syndrome traits also facilitate successful expansion beyond the Mesoamerican center of crop diversity. Chia is no exception exhibiting the results of human selection for, among other traits: yield components, vigor, plant architecture, uniform maturation, and nonshattering, the latter achieved by calyxes that remain closed at seed maturity effectively eliminating natural dispersal and confining domesticated varieties to human cultivation."
102	1989. Wood, J.R.I./Harley, R.M.. The genus <i>Salvia</i> (Labiatae) in Columbia. <i>Kew Bulletin</i> . 44: 211-278. http://www.jstor.org/stable/4110799	[Has the species become naturalized where grown? Yes] "Of the 42 species of <i>Salvia</i> found in Colombia three are relatively recent introductions which occur as escapes from cultivation in a few isolated localities (<i>S. hispanica</i> and <i>S. leucantha</i> from Mexico and <i>S. splendens</i> from Brazil). The remaining 39 species are all native."
102	1990. Estilai, A./Hashemi, A./Truman, K.. Chromosome number and meiotic behavior of cultivated chia, <i>Salvia hispanica</i> (Lamiaceae). <i>Hort Science</i> . 25: 1646-1647. http://hortsci.ashspublishings.org/content/25/12/1646.full.pdf	[Has the species become naturalized where grown?] According to Bailey (1976), <i>Salvia hispanica</i> is naturalized in the West Indies.
103	2011. WRA Specialist. Personal Communication.	[Does the species have weedy races? Unknown]
201	2012. USDA Agricultural Research Service. GRIN germplasm resources information network [online database]. http://www.ars-grin.gov/cgi-bin/npgs/html/index.pl	[Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"? 2 High] Native distributional range: Mexico [central and south]; Guatemala.
202	2012. USDA Agricultural Research Service. GRIN germplasm resources information network [online database]. http://www.ars-grin.gov/cgi-bin/npgs/html/index.pl	[Quality of climate match data? 2 High] Native distributional range: Mexico [central and south]; Guatemala.
203	2000. Kintzios, S.E.. <i>Sage: the genus Salvia</i> . CRC Press,	[Broad climate suitability (environmental versatility)?] Seeds of <i>Salvia hispanica</i> were germinated at 1500 m elevation, in Venezuela from a batch of Mexican origin.
203	2010. Mascia, P.N.. <i>Plant biotechnology for sustainable production of energy and co-products</i> . Springer,	[Broad climate suitability (environmental versatility)?] Chia is grown commercially in tropical and subtropical areas. It is cultivated in Argentina, Bolivia, Colombia, Mexico and Peru, where latitudes range from 20degrees 55 minutes N to 25 degrees 5 minutes S and it is very frost sensitive.
203	2011. Jamboonsri, W./Phillips, T.D./Geneve, R.L./Cahill, J.P./Hildebrand, D.F.. Extending the range of an ancient crop, <i>Salvia hispanica</i> L. - a new omega 3 source. <i>Genetic Resources and Crop Evolution</i> .	[Broad climate suitability (environmental versatility)? No] "Chia grows well in Kentucky and has low requirement for pesticides, fertilizer and irrigation. It produces flower buds in short days of October and is killed by frost before seeds set. Seed production cannot be attained in most areas of North America."
204	2012. USDA Agricultural Research Service. GRIN germplasm resources information network [online database]. http://www.ars-grin.gov/cgi-bin/npgs/html/index.pl	[Native or naturalized in regions with tropical or subtropical climates? Yes] Native distributional range: Mexico [central and south]; Guatemala.
205	2010. Mascia, P.N.. <i>Plant biotechnology for sustainable production of energy and co-products</i> . Springer,	[Does the species have a history of repeated introductions outside its natural range? Yes] Chia is grown commercially in tropical and subtropical areas. It is cultivated in Argentina, Bolivia, Colombia, Mexico and Peru, where latitudes range from 20degrees 55 minutes N to 25 degrees 5 minutes S and it is very frost sensitive.
205	2011. Small, E.. 34. Chia - not just a pet. <i>Biodiversity</i> . 12: 49-56.	[Does the species have a history of repeated introductions outside its natural range? Yes] Chia is grown commercially in Argentina, Australia, Ecuador, Guatemala, Bolivia and Mexico. [recent resurgence in interest of this species]

301	1989. Wood, J.R.I./Harley, R.M.. The genus <i>Salvia</i> (Labiatae) in Columbia. <i>Kew Bulletin</i> . 44: 211-278. http://www.jstor.org/stable/4110799	[Naturalized beyond native range? Yes] "Of the 42 species of <i>Salvia</i> found in Colombia three are relatively recent introductions which occur as escapes from cultivation in a few isolated localities (<i>S. hispanica</i> and <i>S. leucantha</i> from Mexico and <i>S. splendens</i> from Brazil). The remaining 39 species are all native."
301	1990. Estilai, A./Hashemi, A./Truman, K.. Chromosome number and meiotic behavior of cultivated chia, <i>Salvia hispanica</i> (Lamiaceae). <i>Hort Science</i> . 25: 1646-1647. http://hortsci.ashspublications.org/content/25/12/1646.full.pdf	[Naturalized beyond native range?] According to Bailey (1976), <i>Salvia hispanica</i> is naturalized in the West Indies.
302	2007. Randall, R.P.. Global Compendium of Weeds - Index [Online Database]. http://www.hear.org/gcw/	[Garden/amenity/disturbance weed? No] No evidence.
303	2011. WRA Specialist. Personal Communication.	[Agricultural/forestry/horticultural weed? No evidence]
304	2007. Randall, R.P.. Global Compendium of Weeds - Index [Online Database]. http://www.hear.org/gcw/	[Environmental weed? No] No evidence.
305	2011. Center for Invasive Plant Management. Invasive plant information - western states and provinces weed lists. http://www.weedcenter.org/inv_plant_info/state.html	[Congeneric weed? Yes] <i>Salvia aethiopsis</i> is classified as a noxious weed in several states in the United States.
401	2011. Preedy, V.R./Watson, R.R./Patel, V.B.. Nuts and seeds in health and disease prevention. Academic Press,	[Produces spines, thorns or burrs? No] An annual herb, normally about 1 m high, having branched quadrangular stems, and opposite leaves with a 40-mm petiole.
402	2005. Cahill, J.P.. Human selection and domestication of chia (<i>Salvia hispanica</i> L.O. <i>Journal of Ethnobiology</i> . 25: 155-174.	[Allelopathic?] "Numerous studies have implicated cultivation and agriculture as causative factors in the development of allelopathy (Einhellig 1996; Seigler 1996). The beneficial chemical and ecological characteristic of allelopathy has accompanied advanced full domestication. Preliminary experiments with aqueous root leachates of the morphologically advanced domesticates of <i>Salvia hispanica</i> applied to <i>Echinochloa</i> and <i>Amaranthus</i> seeds show statistically significant inhibition of germination of <i>Echinochloa</i> seeds, but not for wild or any of the other domesticated varieties tested (see Table 3). Further experimentation is needed, both in isolating chemical compounds involved and identifying common weeds associated with <i>Salvia hispanica</i> monocrop systems in Mexico."
403	2010. Nickrent, D.. The parasitic plant connection. Department of Plant Biology, Southern Illinois University, Carbondale http://www.parasiticplants.siu.edu/index.html	[Parasitic? No] Lamiaceae.
403	2011. Small, E.. 34. Chia - not just a pet. <i>Biodiversity</i> . 12: 49-56.	[Parasitic? No] Lamiaceae.
404	2011. Small, E.. 34. Chia - not just a pet. <i>Biodiversity</i> . 12: 49-56.	[Unpalatable to grazing animals? No] Chia has recently become popular with the realisation that it is an invaluable oilseed. Between 25 and 40% of the seeds is oil, which is useful for food, industrial applications, and cosmetic products. After the oil has been extracted from the seeds, the remaining oilcake is high in protein, and can be used to feed humans and livestock. Chia stems and foliage constitute an excellent livestock feed, but should be consumed prior to flowering, when protein content decreases significantly in the green parts.
405	2011. Small, E.. 34. Chia - not just a pet. <i>Biodiversity</i> . 12: 49-56.	[Toxic to animals?] Chia has recently become popular with the realisation that it is an invaluable oilseed. Between 25 and 40% of the seeds is oil, which is useful for food, industrial applications, and cosmetic products. After the oil has been extracted from the seeds, the remaining oilcake is high in protein, and can be used to feed humans and livestock.
406	2011. WRA Specialist. Personal Communication.	[Host for recognized pests and pathogens? Unknown]
407	2005. Cahill, J.P.. Human selection and domestication of chia (<i>Salvia hispanica</i> L.O. <i>Journal of Ethnobiology</i> . 25: 155-174.	[Causes allergies or is otherwise toxic to humans?] "Since dried calyx trichomes can induce sneezing, decreased calyx pubescence relieves the hand thresher from incessant irritation. The popular Mexican varieties chia poblana from Cuatepec, Puebla, and others grown in Sonora typify fully domesticated varieties with decreased density of calyx pubescence."

407	2011. Jamboonsri, W./Phillips, T.D./Geneve, R.L./Cahill, J.P./Hildebrand, D.F.. Extending the range of an ancient crop, <i>Salvia hispanica</i> L. - a new omega 3 source. <i>Genetic Resources and Crop Evolution</i> .	[Causes allergies or is otherwise toxic to humans?] Chia, <i>Salvia hispanica</i> L., has long been cultivated and domesticated. It was widely used in pre-Columbian Mesoamerica as a major commodity."
407	2011. Small, E.. 34. Chia - not just a pet. <i>Biodiversity</i> . 12: 49-56.	[Causes allergies or is otherwise toxic to humans? No] Chia has recently become popular with the realisation that it is an invaluable oilseed. Between 25 and 40% of the seeds is oil, which is useful for food, industrial applications, and cosmetic products. After the oil has been extracted from the seeds, the remaining oilcake is high in protein, and can be used to feed humans and livestock.
408	2011. WRA Specialist. Personal Communication.	[Creates a fire hazard in natural ecosystems? No] No evidence of fire promotion.
409	2011. WRA Specialist. Personal Communication.	[Is a shade tolerant plant at some stage of its life cycle? Unknown]
410	2011. WRA Specialist. Personal Communication.	[Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)? Unknown]
411	2011. Preedy, V.R./Watson, R.R./Patel, V.B.. Nuts and seeds in health and disease prevention. Academic Press,	[Climbing or smothering growth habit? No] Annual about 1 m tall.
412	2011. Preedy, V.R./Watson, R.R./Patel, V.B.. Nuts and seeds in health and disease prevention. Academic Press,	[Forms dense thickets? No] Annual about 1 m tall.
501	2011. Small, E.. 34. Chia - not just a pet. <i>Biodiversity</i> . 12: 49-56.	[Aquatic? No] Terrestrial, herbaceous annual.
502	2011. Small, E.. 34. Chia - not just a pet. <i>Biodiversity</i> . 12: 49-56.	[Grass? No] Lamiaceae.
503	2011. Small, E.. 34. Chia - not just a pet. <i>Biodiversity</i> . 12: 49-56.	[Nitrogen fixing woody plant? No] Annual.
504	2011. Small, E.. 34. Chia - not just a pet. <i>Biodiversity</i> . 12: 49-56.	[Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)? No] Fast growing annual herbs.
601	2011. Small, E.. 34. Chia - not just a pet. <i>Biodiversity</i> . 12: 49-56.	[Evidence of substantial reproductive failure in native habitat? No] "Wild populations of <i>S. hispanica</i> are uncommon today, and indeed may also have been so in ancient times. They are found growing in isolated populations in mountainous regions of Mexico and Central America, including the Sierra Madre Occidental, trans-volcanic belt of Mexico, the Sierra Madre del Sur, and the volcanic highland of Guatemala.
602	2000. Kintzios, S.E.. Sage: the genus <i>Salvia</i> . CRC Press,	[Produces viable seeds? Yes] Seeds of <i>Salvia hispanica</i> were germinated at 1500 m elevation, in Venezuela from a batch of Mexican origin.
602	2005. Cahill, J.P.. Human selection and domestication of chia (<i>Salvia hispanica</i> L.O. <i>Journal of Ethnobiology</i> . 25: 155-174.	[Produces viable seeds? Yes] "Informant Jesus de Latorre Guterrez of Acatic, Jalisco, described his method for mechanical planting of <i>Salvia hispanica</i> . He plows furrows approximately 8 cm apart. On the ridges between the furrows, the machinery punches holes about 2.5 cm in diameter, 5 cm deep, and 50 cm apart. He then drops several seeds in each hole which is left open. The mesic microenvironment in the holes facilitates germination and within a few days the seedlings emerge. With other planting techniques, hydrated seeds tend to dry out, inhibiting germination and increasing predation by birds and ants."
603	2003. Cahill, J.P.. <i>Ethnobotany of chia</i> . <i>Economic Botany</i> . 57: 604-618.	[Hybridizes naturally? No] "No evidence of interspecies hybridization has surfaced for <i>Salvia hispanica</i> and hybridization among <i>Calosphaea</i> species is reportedly rare."
604	2011. Small, E.. 34. Chia - not just a pet. <i>Biodiversity</i> . 12: 49-56.	[Self-compatible or apomictic? Yes] Self-pollinating.
605	2011. Small, E.. 34. Chia - not just a pet. <i>Biodiversity</i> . 12: 49-56.	[Requires specialist pollinators? No] Self-pollinating.
606	2011. WRA Specialist. Personal Communication.	[Reproduction by vegetative fragmentation? No] No evidence.
607	2005. Cahill, J.P.. Human selection and domestication of chia (<i>Salvia hispanica</i> L.O. <i>Journal of Ethnobiology</i> . 25: 155-174.	[Minimum generative time (years)? 1] Annual.
607	2011. Small, E.. 34. Chia - not just a pet. <i>Biodiversity</i> . 12: 49-56.	[Minimum generative time (years)? 1] Fast-growing annual herb.

701	2003. Cahill, J.P.. Ethnobotany of chia. Economic Botany. 57: 604-618.	[Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)? No] Calyxes are the keystone of domestication for <i>Salvia hispanica</i> , preventing seed dispersal and effectively eliminating survival of domesticated varieties outside of human cultivation.
701	2011. Small, E.. 34. Chia - not just a pet. Biodiversity. 12: 49-56.	[Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)?] Discarded Chia Pets covered with seedlings have been claimed to be a source of introduced <i>S. hispanica</i> in New Mexico and elsewhere. However, Chia has only occasionally been collected growing outside of cultivation in the United States, and does not seem to represent an invasive weed threat.
702	2011. Small, E.. 34. Chia - not just a pet. Biodiversity. 12: 49-56.	[Propagules dispersed intentionally by people? Yes] Chia is grown commercially in Argentina, Australia, Ecuador, Guatemala, Bolivia and Mexico.
702	2012. B & T World Seeds. <i>Salvia hispanica</i> . B&T World Seeds, http://b-and-t-world-seeds.com/carth.asp?species=Salvia%20hispanica&sref=34865	[Propagules dispersed intentionally by people? Yes] B&T World Seeds offers <i>Salvia hispanica</i> for sale.
703	2003. Cahill, J.P.. Ethnobotany of chia. Economic Botany. 57: 604-618.	[Propagules likely to disperse as a produce contaminant? No] Seed needs to be threshed to be released from the calyx.
704	2003. Cahill, J.P.. Ethnobotany of chia. Economic Botany. 57: 604-618.	[Propagules adapted to wind dispersal? No] "Closed calyxes are the keystone of domestication for <i>Salvia hispanica</i> , preventing seed dispersal and effectively eliminating survival of domesticated varieties outside of human cultivation."
704	2011. Small, E.. 34. Chia - not just a pet. Biodiversity. 12: 49-56.	[Propagules adapted to wind dispersal? No] "A single Chia plant can produce thousands of seeds (technically, Chia 'seeds' are one-seeded fruits). The small seeds are 1–2mm (0.04–0.08 in.) long. They are oval, mottled with brown, grey, or black, or sometimes white in cultivated varieties."
705	2002. Cahill, J.P./Provance, M.C.. Genetics of qualitative traits in domesticated chia (<i>Salvia hispanica</i> L.). Journal of Heredity. 93: 52-55. http://jhered.oxfordjournals.org/content/93/1/52.full	[Propagules water dispersed? No] "Subsequent to fertilization, the calyxes close in all varieties of <i>S. hispanica</i> , thereby protecting the seeds during development. Seed maturity coincides with cell death in the calyx walls. As the cells die and dehydrate, the calyx opens, allowing seed dispersal in wild types. In all domesticated parental lines, the cells of the calyx walls die, however, the function of opening upon dehydration has been lost. Human selection has resulted in plants incapable of dispersing seed, and therefore unable to survive outside of cultivation. This characteristic is a hallmark of plant domestication."
706	2003. Cahill, J.P.. Ethnobotany of chia. Economic Botany. 57: 604-618.	[Propagules bird dispersed? No] Closed calyxes are the keystone of domestication for <i>Salvia hispanica</i> , preventing seed dispersal and effectively eliminating survival of domesticated varieties outside of human cultivation.
707	2003. Cahill, J.P.. Ethnobotany of chia. Economic Botany. 57: 604-618.	[Propagules dispersed by other animals (externally)? No] Closed calyxes are the keystone of domestication for <i>Salvia hispanica</i> , preventing seed dispersal and effectively eliminating survival of domesticated varieties outside of human cultivation.
707	2005. Cahill, J.P.. Human selection and domestication of chia (<i>Salvia hispanica</i> L.O. Journal of Ethnobiology. 25: 155-174.	[Propagules dispersed by other animals (externally)?] "Informant Jesus de Latorre Guterrez of Acatic, Jalisco, described his method for mechanical planting of <i>Salvia hispanica</i> . He plows furrows approximately 8 cm apart. On the ridges between the furrows, the machinery punches holes about 2.5 cm in diameter, 5 cm deep, and 50 cm apart. He then drops several seeds in each hole which is left open. The mesic microenvironment in the holes facilitates germination and within a few days the seedlings emerge. With other planting techniques, hydrated seeds tend to dry out, inhibiting germination and increasing predation by birds and ants.
708	2011. WRA Specialist. Personal Communication.	Propagules survive passage through the gut? Unknown]
801	2011. Small, E.. 34. Chia - not just a pet. Biodiversity. 12: 49-56.	[Prolific seed production (>1000/m ²)? Yes] A single Chia plant can produce thousands of seeds (technically, Chia 'seeds' are one-seeded fruits). The small seeds are 1–2mm (0.04–0.08 in.)
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. Small, E.. 34. Chia - not just a pet. Biodiversity. 12: 49-56.	[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]

