

Taxon: Allium sativum	Family: Amaryllidaceae
Common Name(s): ail ajo common garlic garlic	Synonym(s): Allium ophioscorodon Link

Assessor: Assessor	Status: Assessor Approved	End Date: 12 Jan 2015
WRA Score: -2.0	Designation: L	Rating: Low Risk

Keywords: Naturalized, Domesticated, Food Crop, Geophyte, Seedless

Qsn #	Question	Answer Option	Answer
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?		
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)	Intermediate
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	Intermediate
203	Broad climate suitability (environmental versatility)	y=1, n=0	y
204	Native or naturalized in regions with tropical or subtropical climates		
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		
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	n
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	n
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	y
405	Toxic to animals		
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans		
408	Creates a fire hazard in natural ecosystems	y=1, n=0	n

Qsn #	Question	Answer Option	Answer
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	n
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets		
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	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	y
601	Evidence of substantial reproductive failure in native habitat		
602	Produces viable seed	y=1, n=-1	n
603	Hybridizes naturally		
604	Self-compatible or apomictic	y=1, n=-1	n
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	y
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	n
801	Prolific seed production (>1000/m ²)	y=1, n=-1	n
802	Evidence that a persistent propagule bank is formed (>1 yr)		
803	Well controlled by herbicides	y=-1, n=1	n
804	Tolerates, or benefits from, mutilation, cultivation, or fire		
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
	Zohary, D., Hopf, M. & Weiss, E. 2000. Domestication of Plants in the Old World: The Origin and Spread of Cultivated Plants in West Asia, Europe, and the Nile Valley. Oxford University Press, Oxford, UK	"A. sativum was found in c. 1325 BC Tutankhamun's tomb."
	Fritsch, R. M., & Friesen, N. 2002. Evolution, Domestication and Taxonomy. Pp. 5-30 in H.D. Rabinowitch and L. Currah (eds.). Allium Crop Science: Recent Advances. CAB International, Wallingford	"Like onion, garlic has been used by humans from very ancient times, when the historical traces fade away and cannot be followed either to a wild ancestor or even to the exact area of domestication. For taxonomic reasons, its wild ancestor (if still extant, or its close relatives) should grow anywhere in an area from the Mediterranean to southern Central Asia."
	Missouri Botanical Garden. 2014. Allium sativum . http://www.missouribotanicalgarden.org/PlantFinder/PlantFinderDetails.aspx?kempercode=b403 . [Accessed 6 Nov 2014]	"Native Range: Not known in wild"

102	Has the species become naturalized where grown?	y
	Source(s)	Notes
	McLaurin, W.J., Adams, D. & Eaker, T. 2012. Garlic Production for the Gardener. Circular 854. Cooperative Extension, the University of Georgia, Athens, Georgia. http://extension.uga.edu/ . [Accessed 6 Nov 2014]	"Garlic is probably native to Central Asia but has long been naturalized in southern Europe and throughout the world."

103	Does the species have weedy races?	
	Source(s)	Notes
	Stavretović, N., & Stevanović, J. 2011. Invasive plant species in lawns of Belgrade roads. African Journal of Biotechnology, 10(65), 14450-14464	"In grassy spaces around highway, 135 plant species were observed (Table 4)." [Allium (sic) sativum included in this list of plants, a potential roadside weed, but no specifics of negative impacts have been listed]
	Keighery, G. J. 1993. Weeds of Western Australia's West Coast offshore islands. Proceedings of the 10th Australian Weeds Conference: 167-171	"Very minor weeds. These weeds have only been recorded on islands with permanent settlements, Rottneest and Garden Islands. They are Allium ampeloprasum, Allium sativum, Narcissus tazetta, Ornithogalum umbellatum, Arundo donax, Typha orientalis, Cotula bipinnata, Ricinus communis and Ficus carica. With the exception of Cotula bipinnata, a kerbside weed on Rottneest Island, they are all garden escapes. Recent surveys (1992) have shown that previously recorded minor garden escapes have died out (3,5). The 9 listed species are those still persisting in 1992. It is considered unlikely that any will become even minor weeds."
	Richardson, F. J., Richardson, R. G., & Shepherd, R. C. H. 2011. Weeds of the South-East: An Identification Guide for Australia. Second Edition. RG and FJ Richardson, Victoria, Australia	[Randall (2012) cites Richardson et al. (2011) as listing Allium sativum as a weed, but this species is not listed among the weedy Allium species documented in the book]

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"	Intermediate
	Source(s)	Notes
	Natural History Museum. 2014. Seeds of Trade - Region: South Asia - Product: Onions. http://www.nhm.ac.uk/nature-online/life/plants-fungi/seeds-of-trade/page.dsm1?section=regions&ref=onions&cat_ref=&region_ID=6&time_ref=&page=wild_relatives&origTimeID=&origTimePoint=&origTpTitle=&origPage= . [Accessed 6 Nov 2014]	"Allium sativum L. (garlic) is cultivated throughout the subtropics and warm areas of the northern hemisphere..."
	Staples, G.W. & Herbst, D.R. 2005. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	"Garlic was recorded as abundant on the Hawaiian islands in 1814."

202	Quality of climate match data	Intermediate
	Source(s)	Notes
	WRA Specialist. 2009. Personal Communication	

203	Broad climate suitability (environmental versatility)	y
	Source(s)	Notes
	Messiaen, C.-M. & Rouamba, A. 2004. Allium sativum L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 12 Jan 2015]	"At present garlic is grown all over the world from the equator to latitudes of 50° in both hemispheres, but is most popular in China, the Mediterranean and Latin America. In tropical Africa, garlic is grown during the cold season in the Sahel and at high elevations in East and southern Africa. It is a popular crop in the savanna zone, with a wide genetic variation in local cultivars. It is rarely, if ever, found in hot and humid lowlands." ... "In the tropics garlic growing is possible in the highlands and is restricted in the lowlands to the cool season."

204	Native or naturalized in regions with tropical or subtropical climates	
	Source(s)	Notes
	Fritsch, R. M., & Friesen, N. 2002. Evolution, Domestication and Taxonomy. Pp. 5-30 in H.D. Rabinowitch and L. Currah (eds.). Allium Crop Science: Recent Advances. CAB International, Wallingford	[Cultivated in subtropical climates] "Garlic is the second most important Allium species. It is grown worldwide in all temperate to subtropical (and mountainous tropical) areas as an important spice and medicinal plant."
	McLaurin, W.J., Adams, D. & Eaker, T. 2012. Garlic Production for the Gardener. Circular 854. Cooperative Extension, the University of Georgia, Athens, Georgia. http://extension.uga.edu/ . [Accessed 6 Nov 2014]	[No definitive information on naturalization in tropical or subtropical regions] "Probably native to central Asia, but has become naturalized in Europe and throughout the world".

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
	Fritsch, R. M., & Friesen, N. 2002. Evolution, Domestication and Taxonomy. Pp. 5-30 in H.D. Rabinowitch and L. Currah (eds.). <i>Allium Crop Science: Recent Advances</i> . CAB International, Wallingford	"Garlic is the second most important <i>Allium</i> species. It is grown worldwide in all temperate to subtropical (and mountainous tropical) areas as an important spice and medicinal plant."
	Staples, G.W. & Herbst, D.R. 2005. <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i> . Bishop Museum Press, Honolulu, HI	"Grown worldwide."

301	Naturalized beyond native range	y
	Source(s)	Notes
	McLaurin, W.J., Adams, D. & Eaker, T. 2012. <i>Garlic Production for the Gardener</i> . Circular 854. Cooperative Extension, the University of Georgia, Athens, Georgia. http://extension.uga.edu/ . [Accessed 6 Nov 2014]	"Probably native to central Asia, but has become naturalized in Europe and throughout the world."
	Wagner, W.L., Herbst, D.R. & Lorence, D.H. 2014. <i>Flora of the Hawaiian Islands</i> . Smithsonian Institution, Washington, D.C. http://botany.si.edu/pacificislandbiodiversity/hawaiianflora/index.htm . [Accessed 6 Nov 2014]	No evidence in the Hawaiian islands

302	Garden/amenity/disturbance weed	
	Source(s)	Notes
	Keighery, G. J. 1993. <i>Weeds of Western Australia's West Coast offshore islands</i> . Proceedings of the 10th Australian Weeds Conference: 167-171	[Minor weed. No mention of impacts or control] "Very minor weeds. These weeds have only been recorded on islands with permanent settlements, Rottneest and Garden Islands. They are <i>Allium ampeloprasum</i> , <i>Allium sativum</i> , <i>Narcissus tazetta</i> , <i>Ornithogalum umbellatum</i> , <i>Arundo donax</i> , <i>Typha orientalis</i> , <i>Cotula bipinnata</i> , <i>Ricinus communis</i> and <i>Ficus carica</i> . With the exception of <i>Cotula bipinnata</i> , a kerbside weed on Rottneest Island, they are all garden escapes. Recent surveys (1992) have shown that previously recorded minor garden escapes have died out (3,5). The 9 listed species are those still persisting in 1992. It is considered unlikely that any will become even minor weeds."

303	Agricultural/forestry/horticultural weed	n
	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

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

305	Congeneric weed	y
	Source(s)	Notes
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Allium triquetrum" ... "It may form monospecific stands due to its dense growth habit, thus replacing native vegetation and preventing establishment of native species."

401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	Messiaen, C.-M. & Rouamba, A. 2004. <i>Allium sativum</i> L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed]	"Erect herb, usually grown as an annual from small bulbs (cloves), up to 150 cm tall; real stem very short, formed at the base of the plant in the form of a disk, with adventitious roots at base; bulb solitary, depressed globose to ovoid, up to 7 cm in diameter, whitish to purplish, composed of (1-)7-15(-40) sessile cloves, these ovoid to ellipsoid-oblong and borne in the axil of the 2, 3 or 4-5 last leaves, each clove consisting of a protective sheath, a single thickened storage leaf sheath and a small central bud; pseudostem formed by sheathing bases of successive leaves. Leaves 4-10, distichously alternate, glabrous, with tubular sheath; blade linear-oblong, up to 50 cm x 2.5 cm, nearly flat or V-shaped in cross-section, acute at apex, smooth or crenulate at margins."

402	Allelopathic	
	Source(s)	Notes

Qsn #	Question	Answer
	Sharangi, A. B. 2011. In search of allelopathy from common Alliaceae crops for managing weeds in coriander: An overview. International Journal of Agricultural Research 6: 209-217	[Possibly. Allelopathic chemicals documented in Allium species] "The need to reduce harmful effects from the indiscriminate use of herbicide has facilitated the development of weed management systems, which are based on ecological manipulations rather than agrochemicals. In this direction, utilizing allelopathic plants to suppress the weed may be the most cost-effective and environment-friendly method of weed control. In coriander, one of the popular seed spices, weed control is challenging as the crop is having a low degree of competitiveness against weeds particularly at the initial phases of its growth. Towards searching the allelopathic potential of some plants in managing the weeds of coriander, a few common Allium species like onion, garlic and leek are found effective as has been reported along with other crops in various parts of the world particularly due to their effects most often linked to volatile substances derived from sulphur amino acids. Reports are available on the allelopathic potential of wild onion (<i>Asphodelus tenuifolius</i>) on the germination and seedling growth of chickpea (<i>Cicer arietinum</i>). Welsh onion (<i>Allium fistulosum</i>) are found to exhibit distinct allelopathic effect on summer chrysanthemum by inhibiting rooting and early growth of the plants followed by wilting. <i>Allium ursinum</i> L. (wild garlic) is also found allelopathic for its phenolic acids and total phenolics content in the leaves, bulbs and soil. The present study is an attempt to search such potential allelopathic Alliaceae crops which are very common, useful and substantiate the economy of the growers whenever grown along with the coriander crop."

403	Parasitic	n
	Source(s)	Notes
	Messiaen, C.-M. & Rouamba, A. 2004. <i>Allium sativum</i> L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 12 Jan 2015]	"Erect herb, usually grown as an annual from small bulbs (cloves)..."

404	Unpalatable to grazing animals	y
	Source(s)	Notes
	Plants for a Future. 2015. <i>Allium sativum</i> . http://www.pfaf.org/user/plant.aspx?latinname=Allium+sativum . [Accessed 12 Jan 2015]	"Members of this genus are rarely if ever troubled by browsing deer"
	Khan, M. & Hussain, F. 2012. Palatability and animal preferences of plants in Tehsil Takht-e-Nasrati, District Karak, Pakistan. African Journal of Agricultural Research 7 (44): 5858-5872	Table 2. Differential palatability plant species, plant parts and various parts preference by "livestock." [<i>Allium sativum</i> - Less palatable (LP): Species with less first choice]

405	Toxic to animals	
	Source(s)	Notes

Qsn #	Question	Answer
	Plants for a Future. 2015. <i>Allium sativum</i> . http://www.pfaf.org/user/plant.aspx?latinname=Allium+sativum . [Accessed 12 Jan 2015]	[Potentially, if consumed accidentally by animals] "There have been cases of poisoning caused by the consumption, in large quantities and by some mammals, of this species. Dogs seem to be particularly susceptible[76]. Avoid with anticlotting medication. Breastfeeding may worsen baby's colic. Avoid several weeks prior to surgery. Bad breath!! [301]."

406	Host for recognized pests and pathogens	
	Source(s)	Notes
	Messiaen, C.-M. & Rouamba, A. 2004. <i>Allium sativum</i> L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 12 Jan 2015]	"The most important diseases of garlic are purple leaf blotch (<i>Alternaria porri</i>) and pink root (<i>Pyrenochaeta terrestris</i>). Leaf blotch is very common when air humidity is high; poor calcium nutrition and aluminium toxicity increase plant susceptibility. It can be controlled by fungicide sprays (e.g. iprodione or dithane), but healthy planting material, a low N gift, and a wider spacing may also reduce the damage. Pink root is a soilborne disease often observed in the Sahel. It is kept under control by crop rotations with 5 years without onion and garlic. The most important diseases under temperate conditions, white rot (<i>Sclerotium cepivorum</i>), stem and bulb nematodes (<i>Ditylenchus dipsaci</i>) and <i>Puccinia</i> rusts, are less problematic in the tropics, their temperature optima being rather low. However, if introduced with contaminated cloves, white rot (optimum temperature 18°C) and, still more often, stem and bulb nematodes (optimum temperature 22°C) can appear at altitudes above 1500 m. Every garlic cultivar harbours one and more often several viruses, the most noxious of which are the garlic strains of the potyviruses onion yellow dwarf virus (OYDV) and leek yellow stripe virus (LYSV). Their elimination by meristem culture allows a yield increase of 25–50% depending on cultivar and clone. White tip leaf necrosis, often erroneously ascribed to <i>Botrytis</i> , is most often non-parasitic and linked with drought and unfavourable soil conditions. Thrips <i>tabaci</i> is the most widespread pest, inducing a greyish striated discolouration. Thrips can be controlled by insecticides, but spraying water into the leaf-whorls, and even overhead irrigation can limit their development. Army worm (<i>Spodoptera</i> spp.) and other caterpillars may damage garlic leaves; however, chemical control of these insects may enhance damage by thrips because their natural enemies are also killed. Garlic leaves are occasionally damaged by the omnivorous grasshopper <i>Zonocerus variegatus</i> . During storage, the bulbs can be invaded by the dry bulb mite (<i>Aceria tulipae</i> , an eriophyid mite) proliferating between the flesh and the skin of the clove. Dusting bulbs with sulphur can control this pest."

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

Qsn #	Question	Answer
	Borrelli, F., Capasso, R. and Izzo, A. A. 2007, Garlic (<i>Allium sativum</i> L.): Adverse effects and drug interactions in humans. <i>Molecular Nutrition & Food Research</i> 51: 1386–1397	[Edible, but with potential adverse effects] "Garlic (<i>Allium sativum</i> L., Fam Liliaceae) is used medicinally mainly for the treatment of hypercholesterolemia and prevention of arteriosclerosis. Clinical trials have consistently shown that "garlic breath" and body odor are the most common (and well-documented) complaints associated to garlic intake. Case reports have highlighted the possibility that garlic use may cause allergic reactions (allergic contact dermatitis, generalized urticaria, angioedema, pemphigus, anaphylaxis and photoallergy), alteration of platelet function and coagulation (with a possible risk of bleeding), and burns (when fresh garlic is applied on the skin, particularly under occlusive dressings). Consumption of garlic by nursing mothers modifies their infant's behavior during breast-feeding. Finally, garlic may enhance the pharmacological effect of anticoagulants (e. g. warfarin, fluindione) and reduce the efficacy of anti-AIDS drugs (i. e. saquinavir)."

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	Notes
	Staples, G.W. & Herbst, D.R. 2005. <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i> . Bishop Museum Press, Honolulu, HI	[No evidence] "Annual herb" ... "...unknown in the wild..."

409	Is a shade tolerant plant at some stage of its life cycle	n
	Source(s)	Notes
	Plants for a Future. 2015. <i>Allium sativum</i> . http://www.pfaf.org/user/plant.aspx?latinname=Allium+sativum . [Accessed 12 Jan 2015]	"It cannot grow in the shade"
	Missouri Botanical Garden. 2014. <i>Allium sativum</i> . http://www.missouribotanicalgarden.org/PlantFinder/PlantFinderDetails.aspx?kempercode=b403 . [Accessed 12 Jan 2015]	"Sun: Full sun"

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	n
	Source(s)	Notes
	Messiaen, C.-M. & Rouamba, A. 2004. <i>Allium sativum</i> L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 12 Jan 2015]	"Garlic prefers a light loamy soil. It strongly dislikes soil acidity and requires a soil pH of 6–7 or somewhat higher. It is sensitive to aluminium toxicity."

411	Climbing or smothering growth habit	n
	Source(s)	Notes

Qsn #	Question	Answer
	Messiaen, C.-M. & Rouamba, A. 2004. <i>Allium sativum</i> L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 12 Jan 2015]	"Erect herb, usually grown as an annual from small bulbs (cloves), up to 150 cm tall; real stem very short, formed at the base of the plant in the form of a disk"

412	Forms dense thickets	
	Source(s)	Notes
	Staples, G.W. & Herbst, D.R. 2005. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	"...unknown in the wild state..."

501	Aquatic	n
	Source(s)	Notes
	Messiaen, C.-M. & Rouamba, A. 2004. <i>Allium sativum</i> L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 12 Jan 2015]	[Terrestrial herb] "In the tropics garlic growing is possible in the highlands and is restricted in the lowlands to the cool season. Garlic prefers a light loamy soil. It strongly dislikes soil acidity and requires a soil pH of -7 or somewhat higher. It is sensitive to aluminium toxicity."

502	Grass	n
	Source(s)	Notes
	USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/ . [Accessed 12 Jan 2015]	"Family: Amaryllidaceae subfamily: Allioideae tribe: Allieae. Also placed in: Alliaceae Liliaceae"

503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/ . [Accessed 12 Jan 2015]	"Family: Amaryllidaceae subfamily: Allioideae tribe: Allieae. Also placed in: Alliaceae Liliaceae"

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y
	Source(s)	Notes

Qsn #	Question	Answer
	Messiaen, C.-M. & Rouamba, A. 2004. <i>Allium sativum</i> L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 12 Jan 2015]	"Erect herb, usually grown as an annual from small bulbs (cloves), up to 150 cm tall; real stem very short, formed at the base of the plant in the form of a disk, with adventitious roots at base; bulb solitary, depressed globose to ovoid, up to 7 cm in diameter, whitish to purplish, composed of (1–)7–15(–40) sessile cloves, these ovoid to ellipsoid-oblong and borne in the axil of the 2, 3 or 4–5 last leaves, each clove consisting of a protective sheath, a single thickened storage leaf sheath and a small central bud; pseudostem formed by sheathing bases of successive leaves."

601	Evidence of substantial reproductive failure in native habitat	
	Source(s)	Notes
	Staples, G.W. & Herbst, D.R. 2005. <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i> . Bishop Museum Press, Honolulu, HI	[Unknown] "Garlic is another cultigen unknown in the wild state and was perhaps derived from a Central Asian species."

602	Produces viable seed	n
	Source(s)	Notes
	Fritsch, R. M., & Friesen, N. 2002. Evolution, Domestication and Taxonomy. Pp. 5-30 in H.D. Rabinowitch and L. Currah (eds.). <i>Allium Crop Science: Recent Advances</i> . CAB International, Wallingford	"Unlike the case of the seed-bearing onion, the lost ability for generative multiplication has led to a much more restricted morphological and genetic variation in garlic, irrespective of the large area where it is in cultivation."
	Messiaen, C.-M. & Rouamba, A. 2004. <i>Allium sativum</i> L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 12 Jan 2015]	[Assessment of seedless type. Some seeding cultivars exist] "Only some cultivars from Central Asia and the Caucasus produce well-developed flowers and seeds, provided the bulblets that occur among the floral buds are removed at an early stage. Recently a Mexican clone was discovered which behaves similarly. Other cultivars, even if they produce inflorescences under normal conditions, have flowers which remain seedless. Others do not produce inflorescences under normal conditions, but only if planted at higher elevations or latitudes."

603	Hybridizes naturally	
	Source(s)	Notes
	Messiaen, C.-M. & Rouamba, A. 2004. <i>Allium sativum</i> L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 12 Jan 2015]	[Unknown if natural hybrids occur] "Fruit abortive, seedless." ... "Selection of improved cultivars from seed produced by Central Asian cultivars is being carried out by several institutes (Japan, United States, Europe, Israel), and may give interesting results for temperate countries (virus resistance and cultivars that can be multiplied by seed). The recent discovery of a fertile Mexican clone might extend this type of research to tropical countries."

604	Self-compatible or apomictic	n
	Source(s)	Notes

Qsn #	Question	Answer
	Messiaen, C.-M. & Rouamba, A. 2004. <i>Allium sativum</i> L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 12 Jan 2015]	[Sterile cultivar apparently unable to self- or cross-fertilize other plants] "Flowers usually poorly developed or absent; pedicel slender, up to 1.5 cm long; tepals 6, in 2 whorls, free, lanceolate, up to 3 mm long, greenish white or pale pink; stamens 6, usually rudimentary; ovary superior, 3-celled, style shorter than tepals. Fruit abortive, seedless."

605	Requires specialist pollinators	n
	Source(s)	Notes
	Roubik, D.W. 1995. Pollination of cultivated plants in the tropics. FAO Services Bulletin 118. FAO, Rome, Italy	[No evidence, but irrelevant with no seed set] "Appendix III" ... "Allium sativum ... Pollinators - bee, Apis, fly"

606	Reproduction by vegetative fragmentation	y
	Source(s)	Notes
	Staples, G.W. & Herbst, D.R. 2005. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	"Garlic is propagated by division of the bulbs into individual cloves for replanting, or by planting the small bulbs formed in the inflorescence."
	Messiaen, C.-M. & Rouamba, A. 2004. <i>Allium sativum</i> L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 12 Jan 2015]	"Garlic is usually propagated by cloves, very rarely by bulbils from the inflorescence. "

607	Minimum generative time (years)	1
	Source(s)	Notes
	Messiaen, C.-M. & Rouamba, A. 2004. <i>Allium sativum</i> L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 12 Jan 2015]	[Annual, vegetative life cycle] "Erect herb, usually grown as an annual from small bulbs (cloves) ..." ... " The total growing period varies from 4 months (in the tropics, or strongly dormant cultivars planted in spring in temperate countries) to about 9 months (for less dormant cultivars planted in autumn in northern Mediterranean areas)."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	Source(s)	Notes
	Messiaen, C.-M. & Rouamba, A. 2004. <i>Allium sativum</i> L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 12 Jan 2015]	[No evidence of inadvertent spread] "Fruit abortive, seedless."

Qsn #	Question	Answer
702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	Fritsch, R. M., & Friesen, N. 2002. Evolution, Domestication and Taxonomy. Pp. 5-30 in H.D. Rabinowitch and L. Currah (eds.). <i>Allium Crop Science: Recent Advances</i> . CAB International, Wallingford	"Garlic is the second most important <i>Allium</i> species. It is grown worldwide in all temperate to subtropical (and mountainous tropical) areas as an important spice and medicinal plant."
703	Propagules likely to disperse as a produce contaminant	n
	Source(s)	Notes
	Staples, G.W. & Herbst, D.R. 2005. <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i> . Bishop Museum Press, Honolulu, HI	[No evidence. Unlikely given sterility of cultivars in Hawaiian Islands] "Fry abortive. Seeds none."
704	Propagules adapted to wind dispersal	n
	Source(s)	Notes
	Messiaen, C.-M. & Rouamba, A. 2004. <i>Allium sativum</i> L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 12 Jan 2015]	"Fruit abortive, seedless."
705	Propagules water dispersed	n
	Source(s)	Notes
	Staples, G.W. & Herbst, D.R. 2005. <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i> . Bishop Museum Press, Honolulu, HI	"Frt abortive, seeds none." ... "Garlic is propagated by division of the bulbs into individual cloves for replanting ... "
706	Propagules bird dispersed	n
	Source(s)	Notes
	Staples, G.W. & Herbst, D.R. 2005. <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i> . Bishop Museum Press, Honolulu, HI	"Frt abortive. Seeds none."
707	Propagules dispersed by other animals (externally)	n
	Source(s)	Notes
	Staples, G.W. & Herbst, D.R. 2005. <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i> . Bishop Museum Press, Honolulu, HI	"Frt abortive. Seeds none." ... "...propagated by division of the bulbs into individual cloves for replanting, or by planting the small bulbs formed in the inflorescences." [No means of external attachment]
708	Propagules survive passage through the gut	n

Qsn #	Question	Answer
	Source(s)	Notes
	Messiaen, C.-M. & Rouamba, A. 2004. <i>Allium sativum</i> L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 12 Jan 2015]	"Fruit abortive, seedless."

801	Prolific seed production (>1000/m ²)	n
	Source(s)	Notes
	Staples, G.W. & Herbst, D.R. 2005. <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i> . Bishop Museum Press, Honolulu, HI	"Frt abortive. Seeds none."
	Messiaen, C.-M. & Rouamba, A. 2004. <i>Allium sativum</i> L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 12 Jan 2015]	"Fruit abortive, seedless."

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	Notes
	Messiaen, C.-M. & Rouamba, A. 2004. <i>Allium sativum</i> L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 12 Jan 2015]	[Possible that cloves may remain dormant in soil under proper conditions] "Fruit abortive, seedless." ... "The dormancy of mature cloves, induced by temperatures of 25–30°C, is eliminated most quickly at 6–7°C. Vegetative growth is optimal at 18–20°C. When 12–14 leaves have been produced (when the last leaves are present, the first ones have disappeared), bulb swelling is induced at temperatures above 20°C if the day length exceeds a threshold of 12–15 hours, depending on the cultivar, and provided a 'low temperature need' following dormancy elimination has been satisfied. Because of this set of requirements garlic production in the tropics is more difficult than onion production."

803	Well controlled by herbicides	n
	Source(s)	Notes
	Peachey, E., editor. 2014. <i>Pacific Northwest Weed Management Handbook</i> [online], Oregon State University, Corvallis, OR. http://pnwhandbooks.org/weed . [Accessed 12 Jan 2015]	"Herbicide Effectiveness on Weeds in Mint" ... [PNW Management Handbook states that sethoxydim, quizalofop, clethodim, bromoxynil, oxyflourfen, diuron, trifluralin, napropamide, clopyralid and bentazon have poor effectiveness in controlling <i>A. sativum</i> in mint. Paraquat was effective]

Qsn #	Question	Answer
804	Tolerates, or benefits from, mutilation, cultivation, or fire	
	Source(s)	Notes
	WRA Specialist. 2009. Personal Communication	Unknown

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	WRA Specialist. 2009. Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits

- Able to grow in a broad range of climates, from temperate to subtropical
- Widely planted and naturalized (native range unknown)
- Regarded as a minor weed in certain settings
- Other *Allium* species have become invasive
- Potentially toxic to animals and humans at higher dosages
- Unpalatable to grazing animals
- Geophyte (able to persist from bulbs)
- Able to spread vegetatively
- Cultivated as an annual
- Poorly controlled by several herbicides

Low Risk Traits

- Highly domesticated and cultivated for a long period of time as a food crop
- Prefers a cooler climate (may only be able to persist at higher elevations in tropical regions)
- Unarmed (no spines, thorns or burrs)
- Shade intolerant
- Does not do well on acidic soils
- Fruits are abortive and no seeds are produced (although seed producing cultivars are being evaluated)
- Lack of seed production makes accidental dispersal unlikely