

Taxon: <i>Symphytum officinale</i> L.	Family: Boraginaceae
Common Name(s): boneset common comfrey consound healingherb knitbone slippery-root	Synonym(s): <i>Symphytum peregrinum</i> Ledeb.

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 22 Apr 2020
WRA Score: 4.5	Designation: EVALUATE	Rating: Evaluate

Keywords: Herbaceous Perennial, Weedy, Potentially Toxic, Self-Incompatible, Ant-Dispersed

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	(0-low; 1-intermediate; 2-high) (See Appendix 2)	Low
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	n
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	y
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	y
302	Garden/amenity/disturbance weed	n=0, y = 1*multiplier (see Appendix 2)	y
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	y
304	Environmental weed		
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	n
405	Toxic to animals		
406	Host for recognized pests and pathogens	y=1, n=0	n

Qsn #	Question	Answer Option	Answer
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		
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	y
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets		
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	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	n
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	n
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	1
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	y
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	y
706	Propagules bird dispersed	y=1, n=-1	n
707	Propagules dispersed by other animals (externally)	y=1, n=-1	y
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)	y=1, n=-1	n
803	Well controlled by herbicides	y=-1, n=1	y
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	y
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

Supporting Data:

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	Schmelzer, G.H. & Gurib-Fakim, A. (Eds.). 2008. Plant Resources of Tropical Africa 11(1). Medicinal Plants 1. PROTA Foundation, Wageningen, Netherlands	[Cultivated, but not domesticated] " <i>Symphytum officinale</i> originates from Europe, where it is widespread, and has been introduced in North America and Asia. It is cultivated in several Mediterranean, African and Asian countries. In Africa it is cultivated on a small scale only, mainly in Madagascar and South Africa. "

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2020). Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2020). Personal Communication	NA

201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	Low
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 16 Apr 2020]	"Native Asia-Temperate WESTERN ASIA: Turkey CAUCASUS: Russian Federation-Ciscaucasia [Ciscaucasia] SIBERIA: Russian Federation-Western Siberia [Western Siberia (w.)] MIDDLE ASIA: Kazakhstan Europe NORTHERN EUROPE: United Kingdom MIDDLE EUROPE: Austria, Belgium, Czech Republic, Germany, Hungary, Netherlands, Poland, Slovakia, Switzerland EASTERN EUROPE: Belarus, Moldova, Russian Federation-European part, [European part] Ukraine (incl. Krym) SOUTHEASTERN EUROPE: Bulgaria, Croatia, Italy (incl. Sardinia, Sicily), Romania, Serbia, Slovenia SOUTHWESTERN EUROPE: France, Spain"

202	Quality of climate match data	High
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 16 Apr 2020]	

Qsn #	Question	Answer
203	Broad climate suitability (environmental versatility)	y
	Source(s)	Notes
	Plants for a Future. (2020). <i>Symphytum officinale</i> . https://pfaf.org/user/Plant.aspx?LatinName=Symphytum+officinale . [Accessed 20 Apr 2020]	"USDA hardiness: 3-9" [7 hardiness zones]
	Missouri Botanical Garden. (2020). <i>Symphytum officinale</i> . http://www.missouribotanicalgarden.org . [Accessed 20 Apr 2020]	"Zone: 4 to 8" [5 climate zones]

Qsn #	Question	Answer
204	Native or naturalized in regions with tropical or subtropical climates	n
	Source(s)	Notes
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	"Preferred Climate/s: Mediterranean" [No evidence]

Qsn #	Question	Answer
205	Does the species have a history of repeated introductions outside its natural range?	y
	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	"In Hawaii, comfrey is grown in full sun or partial shade in well-watered, organically rich soil."
	Schmelzer, G.H. & Gurib-Fakim, A. (Eds.). 2008. <i>Plant Resources of Tropical Africa 11(1). Medicinal Plants 1</i> . PROTA Foundation, Wageningen, Netherlands	" <i>Symphytum officinale</i> originates from Europe, where it is widespread, and has been introduced in North America and Asia. It is cultivated in several Mediterranean, African and Asian countries. In Africa it is cultivated on a small scale only, mainly in Madagascar and South Africa."

Qsn #	Question	Answer
301	Naturalized beyond native range	y
	Source(s)	Notes

Qsn #	Question	Answer
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Europe-A-94, Global-A-243, United States of America-N-101, New Zealand-N-280, Japan-N-287, Japan-W-286, western Europe-A-253, Australia-N-198, Europe, eastern-AW-272, western Europe-W-70, United States of America-W-218, Australia-C-401, Australia-N-945, Iceland- U-507, New Zealand-N-534, Canada-A- 642, Australia-AEN-310, Denmark-N-711, Canada and United States of America-N- 725, Global-A-743, South Korea-N-773, Australia-N-7, North America-X-790, Japan-N-794, Australia-W-869, Slovenia- W-883, Europe-A-889, New Zealand-N- 919, United States of America-W-946, Australia-N-354, Denmark-N-1006, Sweden-N-1006, Australia-N-1049, China- I-1055, United States of America-N-1057, Europe-N-819, United States of America-I- 1161, United States of America-N-1162, Europe-W-1191, South Korea-N-761, China-N-1215, Serbia-W-1238, Norway-N-1243, Canada-N-1252, Japan-N-1278, Finland-I-1323, Serbia-G-1326, Global-W- 1349, Finland-AW-1356, Serbia-A-1357, Serbia-W-1358, Serbia-A-1372, Taiwan-N- 1403, Australia-E-1456, Austria-N-1531, Norway-N-1535, United States of America- N-1603, Denmark-W-1609, Norway-W- 1609, Sweden-W-1609, Bolivia-N-1630, Spain-A-87, Belgium-A-87, Germany-A- 87, New Zealand-A-87, United States of America-A-87, Croatia-A-1037, Global- CD-1611, Poland-U-1716, Iceland-U-1552, United States of America-E-1736, Europe- UN-1740, Serbia-W-1766, China-I-1769, Serbia-R-1771, central Europe-A-1616, Russia-W-1671, Sweden-N-1802, Serbia- R-1848, Poland-A-1033, Serbia-R-1946, Poland-A-1966, South Korea-N-1974, -I-, - I-, Poland-A-2047, New Zealand-N-2048, Serbia-R-2057, -A-2058, Poland-A-2059, Poland-A-2060, Poland-C-2062, Slovenia- R-2078, Slovakia-A-2079, Serbia-A-2080, Australia-W-1977, Bulgaria-W-1977, Canada-W-1977, China-W-1977, Democratic Republic of Korea-W-1977, Finland-W-1977, Iceland-W-1977, India- W-1977, Japan-W-1977, Norway-W-1977, Peru-W-1977, Portugal-W-1977, Republic of Korea-W-1977, Sweden-W-1977, Taiwan-W-1977, South Korea-N-2113, North Korea--."
	Queensland Government. (2020). Weeds of Australia. <i>Symphytum officinale</i> L. https://keyserver.lucidcentral.org . [Accessed 16 Apr 2020]	"Naturalised in some parts of south-eastern and eastern Australia (i.e. in Victoria and in some coastal and sub-coastal districts of New South Wales). Also sparingly naturalised in the cooler parts of south-eastern Queensland and possibly naturalised in south-western Western Australia. Also widely naturalised in North America (i.e. Canada and the USA)."

302	Garden/amenity/disturbance weed	y
	Source(s)	Notes
	Queensland Government. (2020). Weeds of Australia. <i>Symphytum officinale</i> L. https://keyserver.lucidcentral.org . [Accessed 21 Apr 2020]	"Comfrey (<i>Symphytum officinale</i>) is regarded as an environmental weed in Victoria." [Described as an environmental weed, but no impacts have been specified. Here, conservatively classified as a weed of undescribed impacts]
	McCracken, M. (2010). Comfrey - a controversial Herb. NC State Extension. Master Gardener, Mecklenburg County. http://www.mastergardenersmecklenburg.org/ . [Accessed 21 Apr 2020]	"Comfrey also self-seeds. Between the self-seeding and root regrowth, comfrey can become invasive."

Qsn #	Question	Answer
	Peachey, E., editor. (2020). Pacific Northwest Weed Management Handbook [online]. Oregon State University, Corvallis, OR. http://pnwhandbooks.org/weed . [Accessed 22 Apr 2020]	"Comfrey was a food and feed crop, but has become weedy in gardens and fields of the Pacific Northwest. Naturally aggressive spread is accelerated by tillage that moves plant parts."
	Knight, A. 2007. A Guide to Poisonous House and Garden Plants. CRC Press, Boca Raton, FL	"Since the plants can become invasive, care should be taken to see that comfrey does not get into hay meadows, or is fed as garden clippings to corralled livestock."
	The Ohio State University. (2020). Ohio Perennial and Biennial Weed Guide. http://www.oardc.ohio-state.edu/weedguide/ . [Accessed 21 Apr 2020]	"This introduced herb is highly adaptable and has become a naturalized weed in ditches, meadows, abandoned gardens, and waste places."

303	Agricultural/forestry/horticultural weed	y
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Weed of: Carrots, Cereals, Grapevines, Orchards & Plantations, Pastures, Vegetables"

304	Environmental weed	
	Source(s)	Notes
	Queensland Government. (2020). Weeds of Australia. <i>Symphytum officinale</i> L. https://keyserver.lucidcentral.org . [Accessed 21 Apr 2020]	"Comfrey (<i>Symphytum officinale</i>) is regarded as an environmental weed in Victoria." [Potentially. Impacts unspecified]

305	Congeneric weed	y
	Source(s)	Notes
	Plants for a Future. (2020). <i>Symphytum asperum</i> . https://pfaf.org . [Accessed 21 Apr 2020]	"Plants can be invasive, often spreading freely by means of self-sown seed. They are also very difficult to remove, the root system is very deep and even small fragments of root left in the soil can produce new plants."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	Listed as naturalized and weedy in a number of locations worldwide

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

Qsn #	Question	Answer
	Schmelzer, G.H. & Gurib-Fakim, A. (Eds.). 2008. Plant Resources of Tropical Africa 11(1). Medicinal Plants 1. PROTA Foundation, Wageningen, Netherlands	"Perennial, roughly hairy herb up to 120 cm tall, with fleshy rootstock; stem stout, winged, hollow, often branched. Leaves in a rosette and alternate on the stems, simple and entire; stipules absent; petiole up to 10 cm long, stem leaves sessile; blade ovate-lanceolate to ovate, up to 25 cm × 15 cm, decurrent at base into petiole or stem, apex acuminate, pinnately veined. Inflorescence a terminal scorpioid cyme without bracts, many-flowered. Flowers bisexual, regular, 5-merous, pendulous; pedicel 2–6 mm long; calyx with lanceolate lobes; corolla with cylindrical tube 12–18 mm long and small lobes, white to pink or purple-violet, with scales at throat; stamens inserted at the middle of the corolla tube, filaments short; ovary superior, 4-celled, style slender and exserted, stigma head-shaped, small. Fruit consisting of 4 ovoid nutlets 5–6 mm long, glossy dark brown or black, enclosed by the calyx. Seedling with epigeal germination; hypocotyl 7–15 mm long, epicotyl absent; cotyledons elliptical-oblong, 1–2.5 cm long, leafy, shortly stalked."

402	Allelopathic	
	Source(s)	Notes
	Fujii, Y., & Appiah, K. S. (2018). Allelopathy for sustainable weed management. Pp. 166-190 in Korres, N. E. et al. (eds.). Weed Control: Sustainability, Hazards, and Risks in Cropping Systems Worldwide. CRC Press, Boca Raton, FL	[Potentially] "Table 9.1 summarizes the selected species that showed strong allelopathic potential through root exudates and could be useful for weed management." [Includes <i>Symphytum officinale</i> (Comfrey) in controlled laboratory experiment]

403	Parasitic	n
	Source(s)	Notes
	Wu, Z. Y. & P. H. Raven, eds. 1995. Flora of China. Vol. 16 (Gentianaceae through Boraginaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Herbs forming tussocks, 30–90 cm tall, arcuate hispid, short strigose. Main roots purplish brown, stout. Stems erect or ascending, branched. Basal leaves long petiolate, lorate-lanceolate to ovate, 30–60 × 10–20 cm, apex acuminate; middle and upper stem leaves sessile, smaller, base decurrent." [Boraginaceae. No evidence]

404	Unpalatable to grazing animals	n
	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	"The leaves are eaten in salads, cooked as a vegetable, fed to poultry and livestock, or used as a green manure or mulch in the vegetable garden or papaya grove." [Consumed by animals and people, although reported to be toxic]
	Schmelzer, G.H. & Gurib-Fakim, A. (Eds.). 2008. Plant Resources of Tropical Africa 11(1). Medicinal Plants 1. PROTA Foundation, Wageningen, Netherlands	"The leaves are occasionally eaten as a cooked vegetable and fed to livestock, but these uses should be discouraged because of the presence of toxic pyrrolizidine alkaloids."

Qsn #	Question	Answer
	Teynor, T.M., et al. (1997). Comfrey. Alternative Field Crop Manual. https://hort.purdue.edu/newcrop/afcm/comfrey.html . [Accessed 21 Apr 2020]	[Palatable to some animals. Unpalatable to others] "Comfrey has some disadvantages compared with other forage crops. Comfrey requires the addition of nitrogen fertilizer to produce a high yield and protein content, while alfalfa produces high yields and protein content without addition of nitrogen fertilizer. Alfalfa and other forages can be established more cheaply than comfrey, since it is usually planted as root cuttings, especially at the close spacing needed for maximum yield. Comfrey, like other perennials, may be difficult to eradicate in order to plant other crops. The high moisture content and unpalatability for some livestock species make utilization of comfrey as a feed difficult. The presence of toxic alkaloids is also a problem. Advantages of comfrey are that it is very winterhardy in northern environments and could stabilize soil on erodible lands. It also produces fresh forage at a time of the year (spring, fall) when forage may be short from other sources."

405	Toxic to animals	
	Source(s)	Notes
	Teynor, T.M., et al. (1997). Comfrey. Alternative Field Crop Manual. https://hort.purdue.edu/newcrop/afcm/comfrey.html . [Accessed 22 Apr 2020]	"It should be noted that consumption of comfrey is usually at lower levels than in toxicity research. Studies need to be conducted that involve the normal or low intake of comfrey for a proper evaluation of the health hazard to people or farm animals."
	Burrows, G. E., & Tyrl, R. J. (2013). Toxic Plants of North America. Second Edition. Wiley-Blackwell, Hoboken, NJ	"Species of <i>Symphytum</i> contain a variety of open diesters of heliotridine and retronecine and are of moderate to high risk. In addition to the monoester echinatine, <i>S. asperum</i> contains asperumine, acetylechinatine, heliosupine, and acetylheliosupine, all open diesters of heliotridine. <i>Symphytum officinale</i> also contains a series of open diesters, including echimidine (the most toxic), heliosupine, acetylheliosupine, lasiocarpine, and symphytine (Peterson 1985). Alkaloid concentrations are highest in the roots, at 1000 –8000ppm; concentrations are less than 100 ppm in the leaves under some conditions (Couet et al. 1996)." ... "Although these species are toxic, the risk is low for livestock because of the low likelihood of animal access to significant amounts of the plants. However, the risk for humans due to ingestion of herbal products is substantial (Ridker et al. 1985)."
	Knight, A. 2007. A Guide to Poisonous House and Garden Plants. CRC Press, Boca Raton, FL	"There is relatively little risk of comfrey causing poisoning in animals unless they are fed over a period of time supplements containing comfrey."

406	Host for recognized pests and pathogens	n
	Source(s)	Notes
	Teynor, T.M., et al. (1997). Comfrey. Alternative Field Crop Manual. https://hort.purdue.edu/newcrop/afcm/comfrey.html . [Accessed 22 Apr 2020]	"Diseases and Control: Diseases have not been a serious problem with comfrey in the United States. Comfrey rust fungus (<i>Melampsorella symphyti</i>) overwinters in roots and reduces yield of old plantings in Great Britain. This disease problem has not spread to the United States due to plant quarantine regulations on the importation of roots or plants. Insects and Other Predators: Insects have not been reported to be a problem with comfrey in the United States. "

Qsn #	Question	Answer
	Missouri Botanical Garden. (2020). <i>Symphytum officinale</i> . http://www.missouribotanicalgarden.org . [Accessed 21 Apr 2020]	"No serious insect or disease problems. Slugs and snails may attack the foliage. Plant foliage may flop after strong rains."

407	Causes allergies or is otherwise toxic to humans	y
	Source(s)	Notes
	Burrows, G. E., & Tyrl, R. J. (2013). <i>Toxic Plants of North America</i> . Second Edition. Wiley-Blackwell, Hoboken, NJ	"Although these species are toxic, the risk is low for livestock because of the low likelihood of animal access to significant amounts of the plants. However, the risk for humans due to ingestion of herbal products is substantial (Ridker et al. 1985). In a survey of commercial comfrey products from health food stores, Betz and coworkers (1994) found up to 400 ppm of pyrrolizidine alkaloids. Couet and coworkers (1996) reported PA concentrations up to 5200 ppm for tablets of comfrey, clearly a health risk. The greater risk, however, is when an individual simultaneously ingests PAs from comfrey and other PA-producing genera in mixtures such as those of herbal teas and other products (Pearson 2000; Rode 2002)."
	Quattrocchi, U. 2012. <i>CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology</i> . CRC Press, Boca Raton, FL	"This plant contains several pyrrolizidine alkaloids, which cause veno-occlusive symptoms, liver cirrhosis, and death. Humans have been affected after ingesting herbal teas and medicines. Astringent, laxative, for diarrhea, heartburn, gonorrhoea, sprains, bruises."

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	Notes
	Schmelzer, G.H. & Gurib-Fakim, A. (Eds.). 2008. <i>Plant Resources of Tropical Africa 11(1). Medicinal Plants 1</i> . PROTA Foundation, Wageningen, Netherlands	[No evidence. Unlikely given habitat and herbaceous habit] " <i>Symphytum officinale</i> occurs in its natural distribution area in damp grassland and on river banks. It tolerates most soils except the most sandy and dry ones, and grows well on heavy clay soils."

409	Is a shade tolerant plant at some stage of its life cycle	
	Source(s)	Notes
	Teynor, T.M., et al. (1997). <i>Comfrey</i> . <i>Alternative Field Crop Manual</i> . https://hort.purdue.edu/newcrop/afcm/comfrey.html . [Accessed 22 Apr 2020]	"Comfrey produces the highest yields in full sunlight and under cooler conditions."
	Plants for a Future. (2020). <i>Symphytum officinale</i> . https://pfaf.org/user/Plant.aspx?LatinName=Symphytum+officinale . [Accessed 22 Apr 2020]	"It can grow in semi-shade (light woodland) or no shade."
	Schmelzer, G.H. & Gurib-Fakim, A. (Eds.). 2008. <i>Plant Resources of Tropical Africa 11(1). Medicinal Plants 1</i> . PROTA Foundation, Wageningen, Netherlands	"It should preferably be planted in open localities or with partial shade in a deep, rich soil."
	Missouri Botanical Garden. (2020). <i>Symphytum officinale</i> . http://www.missouribotanicalgarden.org . [Accessed 22 Apr 2020]	"Sun: Full sun to part shade"

Qsn #	Question	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	Teynor, T.M., et al. (1997). Comfrey. Alternative Field Crop Manual. https://hort.purdue.edu/newcrop/afcm/comfrey.html . [Accessed 21 Apr 2020]	"Comfrey is adaptable to many soils, but prefers moist, fertile soils. Thin soils over rock will give a poor crop, but on light sands and loams, this crop will be productive if adequate nutrients are present."
	Schmelzer, G.H. & Gurib-Fakim, A. (Eds.). 2008. Plant Resources of Tropical Africa 11(1). Medicinal Plants 1. PROTA Foundation, Wageningen, Netherlands	"It tolerates most soils except the most sandy and dry ones, and grows well on heavy clay soils."

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Schmelzer, G.H. & Gurib-Fakim, A. (Eds.). 2008. Plant Resources of Tropical Africa 11(1). Medicinal Plants 1. PROTA Foundation, Wageningen, Netherlands	"Perennial, roughly hairy herb up to 120 cm tall, with fleshy rootstock; stem stout, winged, hollow, often branched."

412	Forms dense thickets	
	Source(s)	Notes
	Teynor, T.M., et al. (1997). Comfrey. Alternative Field Crop Manual. https://hort.purdue.edu/newcrop/afcm/comfrey.html . [Accessed 22 Apr 2020]	"Comfrey is an excellent weed competitor due to its rapid and dense growth." [Potentially, although dense cover may be due to cultivation. Unknown if dense growth occurs naturally]

501	Aquatic	n
	Source(s)	Notes
	Schmelzer, G.H. & Gurib-Fakim, A. (Eds.). 2008. Plant Resources of Tropical Africa 11(1). Medicinal Plants 1. PROTA Foundation, Wageningen, Netherlands	[Terrestrial] " <i>Symphytum officinale</i> occurs in its natural distribution area in damp grassland and on river banks."

502	Grass	n
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 17 Apr 2020]	Family: Boraginaceae Subfamily: Boraginoideae Tribe: Boragineae Subtribe: Boragininae

Qsn #	Question	Answer
503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 16 Apr 2020]	Family: Boraginaceae Subfamily: Boraginoideae Tribe: Boragineae Subtribe: Boragininae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y
	Source(s)	Notes
	Teynor, T.M., et al. (1997). Comfrey. Alternative Field Crop Manual. https://hort.purdue.edu/newcrop/afcm/comfrey.html . [Accessed 16 Apr 2020]	"Comfrey is a herbaceous perennial plant with short, thick, tuberous roots, a deep and expansive root system:"
	Schmelzer, G.H. & Gurib-Fakim, A. (Eds.). 2008. Plant Resources of Tropical Africa 11(1). Medicinal Plants 1. PROTA Foundation, Wageningen, Netherlands	"Perennial, roughly hairy herb up to 120 cm tall, with fleshy rootstock; stem stout, winged, hollow, often branched. "

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Schmelzer, G.H. & Gurib-Fakim, A. (Eds.). 2008. Plant Resources of Tropical Africa 11(1). Medicinal Plants 1. PROTA Foundation, Wageningen, Netherlands	[No evidence] "Symphytum officinale originates from Europe, where it is widespread, and has been introduced in North America and Asia. It is cultivated in several Mediterranean, African and Asian countries. In Africa it is cultivated on a small scale only, mainly in Madagascar and South Africa." ... "Symphytum officinale is widespread and common throughout its natural distribution area. Several cultivars and hybrids with other Symphytum spp. are commercially traded in Europe as garden ornamentals. "

602	Produces viable seed	y
	Source(s)	Notes
	Plants for a Future. (2020). Symphytum officinale. https://pfaf.org/user/Plant.aspx?LatinName=Symphytum+officinale . [Accessed 16 Apr 2020]	"Seed - sow spring or autumn in a cold frame. When they are large enough to handle, prick the seedlings out into individual pots and grow them on in the greenhouse for their first winter. "
	Schmelzer, G.H. & Gurib-Fakim, A. (Eds.). 2008. Plant Resources of Tropical Africa 11(1). Medicinal Plants 1. PROTA Foundation, Wageningen, Netherlands	"Symphytum officinale can be propagated by seed, division or through in-vitro propagation from root explants."

603	Hybridizes naturally	y
	Source(s)	Notes
	Gadella, T. W. J. (1984). Notes on Symphytum (Boraginaceae) in North America. Annals of the Missouri Botanical Garden, 71(4): 1061-1067	"Symphytum asperum (2n = 32) does not hybridize with the diploid (2n = 24) form of S. officinale in Europe but produces hybrids (and backcrosses) with the 2n = 40 and 2n = 48 cytotypes of S. officinale."

Qsn #	Question	Answer
	Schmelzer, G.H. & Gurib-Fakim, A. (Eds.). 2008. Plant Resources of Tropical Africa 11(1). Medicinal Plants 1. PROTA Foundation, Wageningen, Netherlands	"Symphytum officinale is widespread and common throughout its natural distribution area. Several cultivars and hybrids with other Symphytum spp. are commercially traded in Europe as garden ornamentals."

604	Self-compatible or apomictic	n
	Source(s)	Notes
	Schmelzer, G.H. & Gurib-Fakim, A. (Eds.). 2008. Plant Resources of Tropical Africa 11(1). Medicinal Plants 1. PROTA Foundation, Wageningen, Netherlands	"Symphytum officinale plants are long lived. The flowers are self-incompatible and are mainly pollinated by bumble bees."

605	Requires specialist pollinators	n
	Source(s)	Notes
	Denisow, B. (2008). Flowers ecology and pollen output of <i>Symphytum officinale</i> L. Journal of Apicultural Science, 2 (52): 81-89	"The dominant pollinators of <i>Symphytum officinale</i> were different <i>Bombus</i> spp. The taxon is the spring source of nectar and pollen. Besides sugars and proteins, it is highly probable that lipids are important attractants. <i>Symphytum officinale</i> should be also considered as a supplementary source of food for <i>Apis mellifera</i> . Honeybees mainly collect nectar using the holes made by bumblebees in the base of the corolla. A direct access to the flow, however, is often used by <i>Apis mellifera</i> or <i>Bombus</i> spp." ... "Short-tongued species (e.g. <i>Apis mellifera</i>) used holes nibbled by bumblebees in the base of the corolla to obtain nectar, but direct access to the corolla was used as well by bumblebees or honeybees."
	Schmelzer, G.H. & Gurib-Fakim, A. (Eds.). 2008. Plant Resources of Tropical Africa 11(1). Medicinal Plants 1. PROTA Foundation, Wageningen, Netherlands	"The flowers are self-incompatible and are mainly pollinated by bumble bees."

606	Reproduction by vegetative fragmentation	n
	Source(s)	Notes
	Schmelzer, G.H. & Gurib-Fakim, A. (Eds.). 2008. Plant Resources of Tropical Africa 11(1). Medicinal Plants 1. PROTA Foundation, Wageningen, Netherlands	" <i>Symphytum officinale</i> can be propagated by seed, division or through in-vitro propagation from root explants."

607	Minimum generative time (years)	1
	Source(s)	Notes
	Teynor, T.M., et al. (1997). Comfrey. Alternative Field Crop Manual. https://hort.purdue.edu/newcrop/afcm/comfrey.html . [Accessed 22 Apr 2020]	"Comfrey is a herbaceous perennial plant with short, thick, tuberous roots, a deep and expansive root system: Comfrey begins growth in early-April and by early May compact clusters of young leaves are visible in the crown of the old plant. Within a few weeks, the leaf blades with long petioles have grown to over 12 in. high. Basal leaves are large, lance-shaped, stalked, and coarsely hairy. The stem elongates rapidly and reaches a height of over 3 ft. Upper leaves do not have long petioles and are attached closely to the stem. Flowering starts in late May or early June and continues until fall. "

Qsn #	Question	Answer
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y
	Source(s)	Notes
	Peachey, E., editor. (2020). Pacific Northwest Weed Management Handbook [online]. Oregon State University, Corvallis, OR. http://pnwhandbooks.org/weed . [Accessed 22 Apr 2020]	"Comfrey was a food and feed crop, but has become weedy in gardens and fields of the Pacific Northwest. Naturally aggressive spread is accelerated by tillage that moves plant parts."

702	Propagules dispersed intentionally by people	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	"In Hawaii, comfrey is grown in full sun or partial shade in well-watered, organically rich soil."
	Schmelzer, G.H. & Gurib-Fakim, A. (Eds.). 2008. Plant Resources of Tropical Africa 11(1). Medicinal Plants 1. PROTA Foundation, Wageningen, Netherlands	" <i>Symphytum officinale</i> originates from Europe, where it is widespread, and has been introduced in North America and Asia. It is cultivated in several Mediterranean, African and Asian countries. In Africa it is cultivated on a small scale only, mainly in Madagascar and South Africa."

703	Propagules likely to disperse as a produce contaminant	n
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Animals, Water, Escapee"
	Teynor, T.M., et al. (1997). Comfrey. Alternative Field Crop Manual. https://hort.purdue.edu/newcrop/afcm/comfrey.html . [Accessed]	"Seed production is rare, and crops are usually established from root cuttings and crown divisions." [No evidence. Unlikely given limited seed production]

704	Propagules adapted to wind dispersal	n
	Source(s)	Notes
	Geertsema, W. (2005). Spatial dynamics of plant species in an agricultural landscape in the Netherlands. <i>Plant Ecology</i> , 178(2), 237-247	"Table 2. Overview of the studied species and some of their characteristics" [<i>Symphytum officinale</i> - Dispersal vector = Water, ants] ... "In the group of species without adaptations for long distance dispersal <i>Symphytum officinale</i> had short colonization distances,"

Qsn #	Question	Answer
705	Propagules water dispersed	y
	Source(s)	Notes
	Schmelzer, G.H. & Gurib-Fakim, A. (Eds.). 2008. Plant Resources of Tropical Africa 11(1). Medicinal Plants 1. PROTA Foundation, Wageningen, Netherlands	"Symphytum officinale occurs in its natural distribution area in damp grassland and on river banks." [Distribution suggests water may move seeds]
	Geertsema, W. (2005). Spatial dynamics of plant species in an agricultural landscape in the Netherlands. Plant Ecology, 178(2), 237-247	"Table 2. Overview of the studied species and some of their characteristics" [Symphytum officinale - Dispersal vector = Water, ants]
	Cappers, R. T. (1993). Seed dispersal by water: a contribution to the interpretation of seed assemblages. Vegetation History and Archaeobotany, 2(3), 173-186	"Table 2: Macro-remains transported by water" [Includes Symphytum officinale diaspores]

706	Propagules bird dispersed	n
	Source(s)	Notes
	Geertsema, W. (2005). Spatial dynamics of plant species in an agricultural landscape in the Netherlands. Plant Ecology, 178(2), 237-247	"Table 2. Overview of the studied species and some of their characteristics" [Symphytum officinale - Dispersal vector = Water, ants] ... "In the group of species without adaptations for long distance dispersal Symphytum officinale had short colonization distances,"

707	Propagules dispersed by other animals (externally)	y
	Source(s)	Notes
	Geertsema, W. (2005). Spatial dynamics of plant species in an agricultural landscape in the Netherlands. Plant Ecology, 178(2), 237-247	"Table 2. Overview of the studied species and some of their characteristics" [Symphytum officinale - Dispersal vector = Water, ants]

708	Propagules survive passage through the gut	n
	Source(s)	Notes
	Geertsema, W. (2005). Spatial dynamics of plant species in an agricultural landscape in the Netherlands. Plant Ecology, 178(2), 237-247	[No evidence] "Table 2. Overview of the studied species and some of their characteristics" [Symphytum officinale - Dispersal vector = Water, ants]... "In the group of species without adaptations for long distance dispersal Symphytum officinale had short colonization distances,"

801	Prolific seed production (>1000/m ²)	n
	Source(s)	Notes
	Teynor, T.M., et al. (1997). Comfrey. Alternative Field Crop Manual. https://hort.purdue.edu/newcrop/afcm/comfrey.html . [Accessed 22 Apr 2020]	"Seed production is rare, and crops are usually established from root cuttings and crown divisions."

802	Evidence that a persistent propagule bank is formed (>1 yr)	n
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Qsn #	Question	Answer
	Source(s)	Notes
	Geertsema, W. (2005). Spatial dynamics of plant species in an agricultural landscape in the Netherlands. <i>Plant Ecology</i> , 178(2), 237-247	[Longevity of seed bank unspecified, but unlikely to persist for >1 year] "Table 2. Overview of the studied species and some of their characteristics." [Symphytum officinale - Seed bank longevity index = transient]

803	Well controlled by herbicides	Y
	Source(s)	Notes
	Teynor, T.M., et al. (1997). Comfrey. <i>Alternative Field Crop Manual</i> . https://hort.purdue.edu/newcrop/afcm/comfrey.html . [Accessed 22 Apr 2020]	"Comfrey has usually been grown without herbicides. No herbicides are labeled for use on this crop in the Upper Midwest."
	Peachey, E., editor. (2020). <i>Pacific Northwest Weed Management Handbook</i> [online]. Oregon State University, Corvallis, OR. http://pnwhandbooks.org/weed . [Accessed 22 Apr 2020]	"Herbicides that gave good control were bromacil and terbacil at 6 lb ai/a; picloram at 1 lb ae/a; 2,4-D ester at 2 lb ae/a; triclopyr at 2 lb ae/a; and clopyralid at 4 lb ae/a. These rates gave nearly complete control of a new planting. Older plants might be more difficult to control."

804	Tolerates, or benefits from, mutilation, cultivation, or fire	Y
	Source(s)	Notes
	McCracken, M. (2010). Comfrey - a controversial Herb. NC State Extension. Master Gardener, Mecklenburg County. http://www.mastergardenersmecklenburg.org/ . [Accessed 21 Apr 2020]	"Mature comfrey plants can be harvested several times a year, as it will replenish itself very rapidly."
	Plants for a Future. (2020). <i>Symphytum officinale</i> . https://pfaf.org/user/Plant.aspx?LatinName=Symphytum+officinale . [Accessed 21 Apr 2020]	"The plant grows very quickly, producing a lot of bulk. It is tolerant of being cut several times a year and can be used to provide 'instant compost' for crops such as potatoes."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	WRA Specialist. (2020). Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits

- Broad climate suitability
- Naturalized outside native range (but no evidence from Hawaiian Islands to date)
- A weed of gardens, landscaping, and crops
- A potential environmental weed in Australia
- Other *Symphytum* species are invasive
- Toxic to animals and people if consumed in large quantities
- Tolerates many soil types
- Fleshy tuberous roots (a functional geophyte)
- Reproduces by seeds
- Hybridizes with other species
- Reaches maturity in one growing season
- Seeds dispersed by water, ants, and intentionally by people
- Able to be dispersed by tillage that moves plant parts
- Tolerates and grows back from repeated cutting

Low Risk Traits

- Native to regions with temperate to Mediterranean climates (may only be a threat in higher elevation tropical regions)
- Unarmed (no spines, thorns, or burrs)
- Provides fodder for livestock (palatable despite reports of toxicity)
- Not reported to naturally spread vegetatively
- Self-incompatible
- Primarily bumblebee pollinated (may limit seed production)
- Limited seed production
- Transient seed bank
- Herbicides may provide effective control

Second Screening Results for Herbs

(A) Reported as a weed of cultivated lands? Yes

(B) Unpalatable to grazers OR known to form dense stands? Palatable, but unknown if able to form dense stands

Outcome = Evaluate

