

Taxon: Phleum pratense L.	Family: Poaceae
Common Name(s): meadow cat's tail timothy timothy grass	Synonym(s): Phleum intermedium Jord. Phleum pratense L. f. parnassicum

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 20 Jun 2022
WRA Score: 24.0	Designation: H(HPWRA)	Rating: High Risk

Keywords: Perennial Grass, Naturalized, Crop and Environmental Weed, Valuable Forage, Prolific Seeder

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)	Intermediate
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
203	Broad climate suitability (environmental versatility)	y=1, n=0	y
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	y
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	y
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	y
302	Garden/amenity/disturbance weed	n=0, y = 1*multiplier (see Appendix 2)	n
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	y
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	y
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic	y=1, n=0	y
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	n
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens	y=1, n=0	y
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	y
408	Creates a fire hazard in natural ecosystems		
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	y

Qsn #	Question	Answer Option	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	y
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	y
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	y
503	Nitrogen fixing woody plant	y=1, n=0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally		
604	Self-compatible or apomictic		
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	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	y
704	Propagules adapted to wind dispersal	y=1, n=-1	y
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	y
801	Prolific seed production (>1000/m ²)		
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	y
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
	Davenport, E. (1910). Domesticated Animals and Plants: A Brief Treatise Upon the Origin and Development of Domesticated Races, with Special Reference to the Methods of Improvement. Ginn and Company, Boston, New York, Chicago, London	"Timothy (<i>Phleum pratense</i>). This plant, so familiar to farmers as the great hay grass, is the same as the herd's grass of New England. It is native in Europe, as the small and related <i>Phleum alpinum</i> , or mountain timothy, is native to the higher latitudes and the upper levels of the northern Appalachian Mountains. This great hay 1 grass is at best only semidomesticated, for it has never been systematically "improved," as have wheat, corn, and almost all the grain crops, so that only one variety exists."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2022). Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2022). 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"	Intermediate
	Source(s)	Notes
	Duke, J. A. (1983). <i>Phleum pratense</i> . Handbook of Energy Crops. https://hort.purdue.edu/newcrop/duke_energy/Phleum_pratense.html#Toxicity . [Accessed 16 Jun 2022]	"A native Eurasian plant, but now widely distributed throughout the temperate regions of the world; cultivated as far north as the Arctic Circle (Reed, 1976)." ... "Ranging from Boreal Moist to Rain through Subtropical Dry Forest Life Zones, timothy is reported to tolerate annual precipitation of 3.5 to 17.6 dm (mean of 64 cases = 8.3), annual temperature of 4.4 to 18.6°C (mean of 64 cases = 8.7), and pH of 4.5 to 7.8 (mean of 59 cases = 6.2) (Duke, 1978, 1979). Adapted to cool, humid, temperate climate, growing best on rather heavy, deep and moist or even wet soils. Yields lower on light dry soils and sands. Optimum temperature for growing 18.3°–21.6°C varying with day/night temperatures of 15°/10°C and 21°/15°C (Reed, 1976)."

202	Quality of climate match data	High
	Source(s)	Notes
	Duke, J. A. (1983). <i>Phleum pratense</i> . Handbook of Energy Crops. https://hort.purdue.edu/newcrop/duke_energy/Phleum_pratense.html#Toxicity . [Accessed 16 Jun 2022]	

Qsn #	Question	Answer
203	Broad climate suitability (environmental versatility)	y
	Source(s)	Notes
	Duke, J. A. (1983). <i>Phleum pratense</i> . Handbook of Energy Crops. https://hort.purdue.edu/newcrop/duke_energy/Phleum_pratense.html#Toxicity . [Accessed 17 Jun 2022]	"Ranging from Boreal Moist to Rain through Subtropical Dry Forest Life Zones, timothy is reported to tolerate annual precipitation of 3.5 to 17.6 dm (mean of 64 cases = 8.3), annual temperature of 4.4 to 18.6°C (mean of 64 cases = 8.7), and pH of 4.5 to 7.8 (mean of 59 cases = 6.2) (Duke, 1978, 1979). Adapted to cool, humid, temperate climate, growing best on rather heavy, deep and moist or even wet soils. Yields lower on light dry soils and sands. Optimum temperature for growing 18.3°–21.6°C varying with day/night temperatures of 15°/10°C and 21°/15°C (Reed, 1976)"
	Esser, L. L. (1993). <i>Phleum pratense</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/phlpra/all.html . [Accessed 17 Jun 2022]	"Timothy is adapted to a wide range of climatic and edaphic conditions but grows best on well-drained moist clay or loam soils [104,140]. Timothy is best adapted to growth in poorly drained alluvial, Humic Gley, and Brown Podzolic soils [39]. It thrives in deep, fertile, loamy, silty, and clayey soils of humid regions but can also grow in thin, gravelly, and rocky substrates if adequately moist [129]. Timothy has escaped cultivation and has become established at medium to high elevations in the mountains where it grows in moist grasslands, in aspen and conifer stands, and along roadways. It has become naturalized on sites ranging from warm, dry grasslands to cool, moist subalpine forests [32]. Timothy has a medium to high water requirement and is intolerant of drought. It does best on sites where the water table is low enough to allow at least the upper 6 inches (15 cm) of soil to remain unsaturated most of the year [108,140]. Timothy is intolerant of alkaline or acidic soils. Lower pH limit is 4.5 to 5.0 [124]. It can tolerate up to several weeks of flooding in the winter but only a few days during the growing season [39,129]. Timothy needs about 20 inches (50 cm) of precipitation per year on good soils, and up to 30 inches (76 cm) on less favorable soils. Irrigation greatly enhances productivity in dry climates [23,129]. Timothy has excellent cold tolerance and winter hardiness [129]. It will tolerate high shade but thrives in partial shade [108]. Timothy does best at medium elevations but grows up to 11,500 feet (3,506 m) in Colorado [119]."

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes

Qsn #	Question	Answer
	USDA, Agricultural Research Service, National Plant Germplasm System. (2022). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 17 Jun 2022]	"Naturalized Africa WESTERN INDIAN OCEAN: Mauritius Australasia AUSTRALIA: Australia NEW ZEALAND: New Zealand Northern America SUBARCTIC AMERICA: Greenland REGION: Canada, Mexico, United States Pacific NORTH-CENTRAL PACIFIC: United States [Hawaii] Southern America CARIBBEAN: West Indies WESTERN SOUTH AMERICA: Peru SOUTHERN SOUTH AMERICA: Argentina, Chile, Uruguay"
	Herbst, D.R.& Wagner, W.L. (1999). Contributions to the flora of Hawai'i. VII. Bishop Museum Occasional Papers 58: 12-36	" <i>Phleum pratense</i> L. New naturalized record. <i>Phleum pratense</i> was treated as an escape by O'Connor (1990: 1483). We accept it here as a naturalized species in Hawai'i. It is native to the temperate Old World. Material examined. KAUAI: Waimea Drainage Basin, west side, Waineke paddock, 3 Jul– 18 Aug 1917, Forbes 1019.K (BISH). O'AHU: Wai'anae Mountains, Mt. Ka'ala summit, occasional in disturbed places near Army installations, 4000 ft, 10 Sep 1950, Hatheway et al. 338 (BISH). MAUI: Makawao, Hawaiian Agricultural Experiment Station, branch station, in grass garden, 2100 ft, Hosaka 2597 (BISH)."

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	Stewart, A. V., Joachimiak, A. J., & Ellison, N. W. (2011). <i>Phleum</i> . In <i>Wild Crop Relatives: Genomic and Breeding Resources</i> (pp. 257-274). Springer, Berlin, Heidelberg	"Outside its original Eurasian range, <i>P. pratense</i> has now expanded to most suitable habitats around the world. It is now widespread in North America, where it is both a major and valuable forage species and, along with many introduced grasses, is of ecological concern for displacing native grasses."
	Esser, L. L. (1993). <i>Phleum pratense</i> . In: <i>Fire Effects Information System</i> , [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/phlpra/all.html . [Accessed 15 Jun 2022]	"Timothy is of Eurasian origin but was first cultivated in the United States [47]. It was found growing in New Hampshire in 1711 and was named herd's grass. In 1747, timothy spread from New England to Canada and westward [139]. Timothy is found in all 50 states and throughout Canada except Prince Edward Island and Labrador [9,113,129]. Timothy is widely cultivated in the northeastern states south to the Cotton Belt and west to the 100th meridian, in humid regions of Puget Sound, and in mountainous regions [45]."

301	Naturalized beyond native range	y
	Source(s)	Notes

Qsn #	Question	Answer
	<p>USDA, Agricultural Research Service, National Plant Germplasm System. (2022). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 15 Jun 2022]</p>	<p>"Naturalized Africa WESTERN INDIAN OCEAN: Mauritius Australasia AUSTRALIA: Australia NEW ZEALAND: New Zealand Northern America SUBARCTIC AMERICA: Greenland REGION: Canada, Mexico, United States Pacific NORTH-CENTRAL PACIFIC: United States [Hawaii] Southern America CARIBBEAN: West Indies WESTERN SOUTH AMERICA: Peru SOUTHERN SOUTH AMERICA: Argentina, Chile, Uruguay"</p>
	<p>Herbst, D.R.& Wagner, W.L. (1999). Contributions to the flora of Hawai'i. VII. Bishop Museum Occasional Papers 58: 12-36</p>	<p>"Phleum pratense L. New naturalized record. Phleum pratense was treated as an escape by O'Connor (1990: 1483). We accept it here as a naturalized species in Hawai'i. It is native to the temperate Old World. Material examined. KAUAI: Waimea Drainage Basin, west side, Waineke paddock, 3 Jul– 18 Aug 1917, Forbes 1019.K (BISH). O'AHU: Wai'anae Mountains, Mt. Ka'ala summit, occasional in disturbed places near Army installations, 4000 ft, 10 Sep 1950, Hatheway et al. 338 (BISH). MAUI: Makawao, Hawaiian Agricultural Experiment Station, branch station, in grass garden, 2100 ft, Hosaka 2597 (BISH)."</p>

302	Garden/amenity/disturbance weed	n
	Source(s)	Notes
	WRA Specialist. (2022). Personal Communication	A crop and environmental weed. Also valued as a forage and pasture grass

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: Cereals, Cotton, Grapevines, Nursery Production, Orchards & Plantations, Pastures, Pome Fruits, Vegetables"
	Esser, L. L. (1993). Phleum pratense. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/phlpra/all.html . [Accessed 16 Jun 2022]	[May hinder conifer seedling establishment in pine plantations] "Timothy seedlings can be detrimental or beneficial in young conifer plantations. They may hinder conifer seedling establishment by preemption of resources, allelopathy, attraction of insects and animals, and increased fire potential. They can be beneficial by excluding other competitive plant species. Timothy seedlings compete strongly with conifer seedlings, especially when conifer seedlings are not fully established. After establishment of conifer seedlings, approximately 5 years, timothy seeds may aid conifer seedling growth by excluding shrub competition."

Qsn #	Question	Answer
	CABI. (2022). Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[May impact agricultural crops as a seed contaminant and host of pathogens] "Seed of <i>P. pratense</i> is considered a contaminant of grass and other seed lots in the eastern US states of Delaware, Maryland, New Hampshire, New Jersey, Pennsylvania, Virginia and West Virginia (Ogle et al., 2011), thus reducing seed lot quality and price. Timothy is also a host to diseases, such as ergot (<i>Claviceps purpurea</i>), that are serious pathogens of cereal crops (Munkvold et al., 1997; Davies and Ballingall, 2008)."

304	Environmental weed	y
	Source(s)	Notes
	Queensland Government. (2022). Weeds of Australia. <i>Phleum pratense</i> . https://keyserver.lucidcentral.org/weeds . [Accessed 17 Jun 2022]	"Timothy grass (<i>Phleum pratense</i>) is regarded as an environmental weed in Victoria and as a minor environmental weed or "sleeping weed" in other temperate regions of southern Australia. This species is often planted as a pasture or fodder plant in cooler areas, or occasionally as a soil stabiliser, and prefers heavy soils in moist habitats. It has since spread from these deliberate plantings and invaded natural vegetation. Timothy grass (<i>Phleum pratense</i>) is considered to pose a significant threat to dry coastal vegetation, dry sclerophyll forests and woodlands in Victoria. It also appears on some local and regional environmental weed lists in this state (e.g. in the Goulburn Broken Catchment and at Falls Creek). In southern New South Wales, Timothy grass (<i>Phleum pratense</i>) has become naturalised in sub-alpine and montane areas of Kosciuszko National Park. It also grows in damp areas in south-western Western Australia (e.g. along the Warren River). This species is also recognised as invasive in the USA, where it has been found to reduce species richness, species diversity, and percentage cover in native fescue grasslands."

Qsn #	Question	Answer
	<p>Esser, L. L. (1993). <i>Phleum pratense</i>. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/phlpra/all.html. [Accessed 17 Jun 2022]</p>	<p>"Timothy is successfully and profitably used for reseeding rangelands where the soil is moist and the growing season long enough for seed production [119]. Before planting, managers should take into account the grazing management plan for the ranch or range unit. Seeded species can do more harm than good, and timothy may not always be the most appropriate species. Exotic grasses are one of the most disruptive factors in native fescue grasslands in Glacier National Park [118]. Timothy is the most widely distributed exotic in the park, where it is associated with substrate disturbed by post-1980 underground utility construction. Timothy was intentionally seeded by outfitters in the 1940's and by park personnel in the 1980's. Extensive tiller mats of timothy limit cryptogam colonization sites and reduce native graminoid colonization. Reduction of timothy is not a realistic option in Glacier or other natural areas; the most reasonable recommendation for resource managers is not to use it for revegetating disturbed sites [118]. The exotics of greatest concern to wildland managers are timothy and Kentucky bluegrass because they establish quickly, spread vigorously, and usually escape early detection. Timothy has the highest ability of 34 exotics tested to invade closed vegetation areas. Constancy values in forest, meadow, and alpine tundra is 99, 99, and 36 percent, respectively. Numbers and frequency of timothy increases from undisturbed sites to regularly disturbed sites. More resources are available at the latter sites because competition is greatly reduced. Timothy is of great concern because it often dominates the area it occupies. Control should include both elimination and simultaneous introduction of a desirable competitor [130]."</p>

Qsn #	Question	Answer
	<p>CABI. (2022). Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc</p>	<p>"Under ideal climatic and environmental conditions <i>P. pratense</i> can spread from cultivation into adjoining native plant communities where it can coexist or form monocultures (Ogle et al., 2011). Timothy is one of the exotics of greatest concern to wildland managers in North America because it establishes quickly, spreads vigorously and usually escapes early detection. Of 34 exotic species tested, timothy had the highest ability to invade closed vegetation areas, including forest, meadow and alpine tundra (Weaver et al., 1990). The species is capable of invading early- to mid-successional grasslands and early-seral mixed forests (NatureServe, 2015). <i>P. pratense</i> has invaded and is seen as a major problem in several national and state parks in the USA. It is the most widely distributed exotic in Glacier National Park in Montana and is one of the most disruptive factors in native fescue grasslands there, having been intentionally seeded following underground utility construction in the 1980s. Timothy is of great concern because it often dominates the areas it invades. Extensive tiller mats of timothy limit cryptogam colonization sites and reduce native grass colonization (Tyser, 1992). In Yellowstone National Park, Wyoming, Houston (1973) observed that timothy had dominated and completely altered the composition of the understorey vegetation in remnant aspen stands in the northern range and as a result these stands would not respond to burning. Wallace and Macko (1993) noted it as an alien invasive occupying large areas of the montane grasslands of Yellowstone's northern range. In Australia, <i>P. pratense</i> is regarded as an environmental weed in Victoria and as a minor environmental weed or "sleeper weed" in other temperate regions of southern Australia. It has spread from cultivation to invade natural vegetation, posing a significant threat to dry coastal vegetation, dry sclerophyll forests and woodlands in Victoria. It appears on some local and regional environmental weed lists in this state, including those of the Goulburn Broken Catchment and at Falls Creek. In southern New South Wales, timothy has become naturalized in subalpine and montane areas of Kosciuszko National Park. It has also been recorded along the Warren River in south-western Western Australia (Queensland Government, 2015). Impact on Biodiversity: Timothy can cause declines in and competitively exclude native grasses. It has the potential to inhibit secondary successional processes and modify native plant communities (Rutledge and McLendon, 1996). "</p>

305	Congeneric weed	Y
	Source(s)	Notes

Qsn #	Question	Answer
	<p>Wu, H., Zhang, P., Zhang, Y., Zhang, J., & Dong, L. (2018). Screening of main herbicides to control <i>Phleum paniculatum</i> in wheat fields. <i>Journal of Nanjing Agricultural University</i>, 41(4), 670-675</p>	<p>[<i>Phleum paniculatum</i>] "Abstract : Objectives: This study was to find out the appropriate herbicides to control a malignant weed <i>Phleum paniculatum</i> in wheat fields. Methods: Wholeplant bioassay was conducted to determine the sensitivity of <i>P. paniculatum</i> to various different herbicides. Results: Whole-plant bioassay revealed that the preemergence herbicides in wheat fields, such as diflufenican, pretilachlor, isoproturon, chlortoluron, and post emergence herbicides, including pyroxsulam, clodinafop, isoproturon, tralkoxydim, flucarbazone were most effective on controlling <i>P. paniculatum</i>. Their ED values were all below their recommended doses respectively. <i>P. paniculatum</i> was not sensitive to fenoxaprop or mesosulfuron, and the ED values were 2 and 3.5 times higher than their recommended doses respectively. Herbicides which were not used in wheat field, such as pendimethalin, acetochlor, diuron, oxyfluorfen, and amicarbazone also had significant control effect on <i>P. paniculatum</i>. Their ED values were all below their recommended doses. The selectivity index of pendimethalin and amicarbazone were 2.49 and 2.47 respectively, which were safe to wheat at a certain dose. Conclusions: <i>P. paniculatum</i> was sensitive to most wheat field herbicides, including diflufenican, pretilachlor, isoproturon, chlortoluron, pyroxsulam, clodinafop, tralkoxydim and flucarbazone, and it could be controlled effectively at their recommended doses, but was not sensitive to fenoxaprop or mesosulfuron."</p>
	<p>Randall, R.P. (2017). <i>A Global Compendium of Weeds</i>. 3rd Edition. Perth, Western Australia. R.P. Randall</p>	<p>[<i>Phleum paniculatum</i>] "Weed of: Cereals, Orchards & Plantations"</p>

401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	<p>Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). (2006). <i>Flora of China</i>. Vol. 22 (Poaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis</p>	<p>[No evidence] "Perennial forming loose or dense tussocks. Culms erect or geniculately ascending, 40–120 cm tall, 5–6-noded, lowest nodes usually swollen and cormlike. Leaf sheaths glabrous, loose; leaf blades 10–50 cm, 3–8 mm wide, glabrous, both surfaces and margins scabrid, apex acuminate; ligule 2–5 mm, rounded. Panicle narrowly cylindrical, 4–15 × 0.5–1 cm, gray-green; branches adnate to central axis. Spikelets obovate-oblong, 3–3.5 mm; rachilla extension absent; glumes oblong, membranous, scaberulous, lower softly hairy on margins, keel conspicuously pectinate-ciliate, apex truncate with stout, 0.5–1.5 mm, scabrid awn; lemma ca. 2 mm, 7-veined, puberulent, especially along veins, apex obtuse; anthers 1.5–2 mm. Caryopsis ca. 1 mm."</p>

402	Allelopathic	y
	Source(s)	Notes
	<p>Esser, L. L. (1993). <i>Phleum pratense</i>. In: <i>Fire Effects Information System</i>, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/phlpra/all.html. [Accessed 17 Jun 2022]</p>	<p>"Timothy seedlings can be detrimental or beneficial in young conifer plantations. They may hinder conifer seedling establishment by preemption of resources, allelopathy, attraction of insects and animals, and increased fire potential."</p>

Qsn #	Question	Answer
	Murphy, S. D., & Aarssen, L. W. (1995). Allelopathic pollen extract from <i>Phleum pratense</i> L.(Poaceae) reduces seed set in sympatric species. <i>International Journal of Plant Sciences</i> , 156(4), 435-444	"We studied the effect of pollen extracts from <i>Phleum pratense</i> L. (Poaceae) on seed set in sympatric species to test whether pollen-allelopathic effects exist in situ. Stigmas of six species of Poaceae (<i>Agropyron repens</i> , <i>Agrostis stolonifera</i> , <i>Bromus inermis</i> , <i>Danthonia compressa</i> , <i>Poa compressa</i> , and <i>Poa pratensis</i>) were examined in a field study. The stigmas of <i>A. repens</i> , <i>D. compressa</i> , and <i>B inermis</i> received means of 9.35, 7.20, and 7.10 pollen grains of <i>P pratense</i> , respectively. Based on data from previous in vitro experiments, the quantities of pollen of <i>P. pratense</i> found on these stigmas were sufficient to cause allelopathic reduction in sexual reproductive success. We applied acidic extracts of the equivalents of 0.1, 1, 2, 3, 4, 5, 7.5, 10, 15, 20, and 25 pollen grains of <i>P. pratense</i> /μL to stigmas of each of <i>A. repens</i> and <i>D. compressa</i> . In <i>A repens</i> , extract concentrations as low as five grains/μL caused approximately a 65% reduction in mean seed set. The decreases in mean seed set were nonlinear and similar to previous studies of the effect in vitro. In <i>D. compressa</i> the results were similar; however, the decreases in mean seed set were limited by the seed set by cleistogamous flowers. We suggest that this indicates that allelopathic pollen of <i>P. pratense</i> limits seed set in <i>A. repens</i> and <i>D. compressa</i> in oldfield communities."

403	Parasitic	n
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). (2006). <i>Flora of China</i> . Vol. 22 (Poaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Perennial forming loose or dense tussocks." [Poaceae. No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	Notes
	Quattrocchi, U. (2006). <i>CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology</i> . CRC Press, Boca Raton, FL	"highly palatable and nutritious, cultivated fodder, food plant, pasture grass, grazing and hay, forage"
	Esser, L. L. (1993). <i>Phleum pratense</i> . In: <i>Fire Effects Information System</i> , [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/phlpra/all.html . [Accessed 16 Jun 2022]	"Timothy is a palatable and nutritious forage for domestic livestock and big game animals [22,119]. It is cultivated for both hay and pasture throughout North America [140]. Timothy is valuable for range seeding because it grows under a wide variety of range and soil moisture conditions [96]. On a Douglas-fir (<i>Pseudotsuga menziesii</i>) clearcut in Montana, timothy was the preferred forage species of livestock [7]." ... "Timothy is highly palatable to all classes of livestock and big game species [119,122]. It is highly palatable to horses and cattle in spring, summer, and fall; and to sheep in summer [141]. Palatability of timothy is high for elk in the spring and summer, and high for deer in the summer [108]."

405	Toxic to animals	n
	Source(s)	Notes

Qsn #	Question	Answer
	Quattrocchi, U. (2012). CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	[No evidence of toxicity to animals] "highly palatable and nutritious" ... "A cause of hayfever."
	Esser, L. L. (1993). <i>Phleum pratense</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/phlpra/all.html . [Accessed 16 Jun 2022]	[No evidence] "Timothy is highly palatable to all classes of livestock and big game species [119,122]. It is highly palatable to horses and cattle in spring, summer, and fall; and to sheep in summer [141]. Palatability of timothy is high for elk in the spring and summer, and high for deer in the summer [108]."

406	Host for recognized pests and pathogens	y
	Source(s)	Notes
	Esser, L. L. (1993). <i>Phleum pratense</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/phlpra/all.html . [Accessed 16 Jun 2022]	"Diseases: Timothy is susceptible to winter crown and root rots. Purple spot (<i>Heterosporium phlei</i>) is widespread in timothy stands but is rarely severe. Severe infection will impair hay quality and reduce seed yields [139]."
	CABI. (2022). Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Timothy is also a host to diseases, such as ergot (<i>Claviceps purpurea</i>), that are serious pathogens of cereal crops (Munkvold et al., 1997; Davies and Ballingall, 2008)."

Qsn #	Question	Answer
	<p>Duke, J. A. (1983). <i>Phleum pratense</i>. Handbook of Energy Crops. https://hort.purdue.edu/newcrop/duke_energy/Phleum_pratense.html#Toxicity. [Accessed 17 Jun 2022]</p>	<p>"Timothy is attacked by many fungi, including the following: <i>Ascochyta phleina</i>, <i>Balansia strangulans</i>, <i>Cercospora graminicola</i>, <i>Chaetomium globosum</i>, <i>Cladochytrium gerhardtii</i>, <i>Cladosporium graminum</i>, <i>C. herbarum</i>, <i>C. phlei-pratense</i>, <i>Claviceps microcephala</i>, <i>C. purpurea</i>, <i>Colletotrichum graminicola</i>, <i>Dematium hispidulum</i>, <i>Diaporthe radicina</i> (<i>D. arctii</i>), <i>Dilophospora alopecuri</i>, <i>Entyloma crastophilum</i>, <i>E. dactylidis</i>, <i>Epichloe typhina</i>, <i>Erysiphe graminis</i> f. <i>phlei</i>, <i>Fusarium acuminatum</i>, <i>F. avenaceum</i>, <i>F. equiseti</i>, <i>F. heterosporum</i>, <i>F. poae</i>, <i>F. solani</i>, <i>F. scirpi</i> var. <i>acuminatum</i>, <i>Gibberella saubinetii</i>, <i>Helminthosporium dictyoides</i> and var. <i>phlei</i>, <i>H. giganteum</i>, <i>H. sativum</i>, <i>Hendersonia crastophila</i>, <i>Heterosporium phlei</i>, <i>Gloeosporium bolleyi</i>, <i>Lophodermium arundinaceum</i> var. <i>gramineum</i>, <i>L. phlei</i>, <i>Marssonina graminicola</i>, <i>Mastigosporium album</i>, <i>Mycosphaerella lineolata</i>, <i>Pellicularia filamentosa</i>, <i>Phaeosphaeria herpotrichoides</i>, <i>Phoma terrestris</i>, <i>Phyllachora graminis</i>, <i>Puccinia coronifera</i> f. <i>alopecuri</i>, <i>P. graminis</i>, <i>P. phlei-pratensis</i>, <i>P. poarum</i>, <i>Pyrenochaeta terrestris</i>, <i>Pythium arrhenomanes</i> var. <i>canadense</i>, <i>P. debaryanum</i>, <i>P. graminicola</i>, <i>Rhynchosporium secalis</i>, <i>Sclerophthora macrospora</i>, <i>Sclerotinia borealis</i>, <i>S. graminicola</i>, <i>Scolecotrichum graminis</i>, <i>Selenophoma donacis</i> var. <i>stomaticola</i>, <i>Septogloeum oxysporum</i>, <i>Septoria alopecuri</i>, <i>S. graminum</i>, <i>S. oxysporum</i>, <i>S. phleina</i>, <i>Sporotrichum poae</i>, <i>Stagonospora subseriata</i>, <i>Tilletia paradoxa</i>, <i>Typhula idahoensis</i>, <i>T. itoana</i>, <i>T. trifolii</i>, <i>Urocystis agropyri</i>, <i>Uromyces phlei-michelli</i>, <i>U. phlei-pratensis</i>, <i>Ustilago striiformis</i>, <i>Vermicularia culmigera</i>. It is also attacked by the bacteria <i>Xanthomonas translucens</i> f. sp. <i>phlei-pratensis</i> and var. <i>cerealis</i>. Nematodes isolated from timothy include the following: <i>Anguina</i> sp., <i>Criconemella lobata</i>, <i>Ditylenchus dipsaci</i>, <i>Helicotylenchus pseudorobustus</i>, <i>Heterodera avenae</i>, <i>Meloidogyne hapla</i>, <i>Pratylenchus neglectus</i>, <i>P. penetrans</i>, <i>P. pratensis</i>, <i>Subanguina radicola</i>, <i>Tylencholaimellus striatus</i>, <i>Tylenchorhynchus maximus</i>, <i>Tylenchus hordei</i>, <i>T. phalaridis</i>, and <i>T. tritici</i> (Golden, p.c. 1984). "</p>

Qsn #	Question	Answer
407	Causes allergies or is otherwise toxic to humans	y
	Source(s)	Notes
	Quattrocchi, U. (2012). CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"A cause of hayfever."
	CABI. (2022). Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Allergens are released from timothy pollen grains (Behrendt et al., 1999). In fact, pollen of the genus <i>Phleum</i> is second only to <i>Dactylis</i> in allergenicity, causing widespread pollinosis in early summer. <i>P. pratense</i> pollen contains at least 28 antigens, of which 15 have been shown to bind to IgE. A number of major allergens have also been detected, including Phl p 1, Phl p 4, Phl p 5, Phl p 6, Phl p 7, Phl p 12 and Phl p 13, with Phl p 5 being the dominant allergen (Steinman, 2012). "
	Duke, J. A. (1983). <i>Phleum pratense</i> . Handbook of Energy Crops. https://hort.purdue.edu/newcrop/duke_energy/Phleum_pratense.html#Toxicity . [Accessed 16 Jun 2022]	"Two allergins producing strong skin reactions and a hemagglutinating action have been isolated from timothy pollen. The pollen contains several flavonol-glycosides, among them dactylin (isorhamnetin-31,4-diglucoside)."

408	Creates a fire hazard in natural ecosystems	
	Source(s)	Notes
	Anzinger, D., & Radosevich, S. R. (2008). Fire and nonnative invasive plants in the Northwest Coastal bioregion. Pp. 197-224 In: Zouhar et al. Wildland fire in ecosystems: fire and nonnative invasive plants. Gen. Tech. Rep. RMRS-GTR-42-vol. 6. US Department of Agriculture, Forest Service, Rocky Mountain Research Station. Ogden, UT	"Table 10-1—Nonnative invasive plant species of concern in the Northwest Coastal bioregion and their approximate threat potential in each of the major plant communities covered in this chapter. L= low threat, H = high threat, P = potentially high threat, U = unknown threat, N = not invasive" [<i>Phleum pratense</i> designated H = high threat in Boreal forests of Alaska where its fire regime is not described]
	CABI. (2022). Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Timothy can also be detrimental in young conifer plantations, where its seedlings compete strongly with conifer seedlings, especially those which are not fully established, by pre-emption of resources, allelopathy, attraction of insect pests and browsing animals, and increased fire potential."
	Esser, L. L. (1993). <i>Phleum pratense</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/phlpra/all.html . [Accessed 17 Jun 2022]	[Possibly, during periods of drought] "As with most perennial grasses, timothy is well adapted to fire. Susceptibility of pasture or range vegetation to fire depends on specific fire adaptations of the species and phenological stage when burned. Timothy has underground regenerative organs that are not harmed by moderately severe fires. Timothy is harmed if burned when actively growing in the spring and summer but is fairly fire tolerant when dormant [129]. In Yellowstone National Park after the fires of 1988, timothy sprouted from the roots after being top-killed [4]. Timothy can occurs on extremely cold sites; these sites seldom burn [129]."

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	Notes

Qsn #	Question	Answer
	Esser, L. L. (1993). <i>Phleum pratense</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/phlpra/all.html . [Accessed 17 Jun 2022]	"It will tolerate high shade but thrives in partial shade [108]."
	CABI. (2022). Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Tolerant of shade"

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	Duke, J. A. (1983). <i>Phleum pratense</i> . Handbook of Energy Crops. https://hort.purdue.edu/newcrop/duke_energy/Phleum_pratense.html#Toxicity . [Accessed 17 Jun 2022]	"Adapted to cool, humid, temperate climate, growing best on rather heavy, deep and moist or even wet soils. Yields lower on light dry soils and sands. "
	Esser, L. L. (1993). <i>Phleum pratense</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/phlpra/all.html . [Accessed 17 Jun 2022]	"Timothy is adapted to a wide range of climatic and edaphic conditions but grows best on well-drained moist clay or loam soils [104,140]. Timothy is best adapted to growth in poorly drained alluvial, Humic Gley, and Brown Podzolic soils [39]. It thrives in deep, fertile, loamy, silty, and clayey soils of humid regions but can also grow in thin, gravelly, and rocky substrates if adequately moist [129]."

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). (2006). Flora of China. Vol. 22 (Poaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Perennial forming loose or dense tussocks."

412	Forms dense thickets	y
	Source(s)	Notes
	CABI. (2022). Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"However, it has become invasive and a noxious weed in parts of its introduced range, dominating other plants, altering native plant communities and often forming monocultures. Control of this grass in conservation areas is difficult."
	Weber, E. (2017). Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	" <i>Phleum pratense</i> is a variable species with at least 10 different subspecies occurring in its native range (Tropicos, 2014). Where invasive the grass forms dense swards crowding out native grasses and forbs, and preventing tree regeneration."

Qsn #	Question	Answer
501	Aquatic	n
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). (2006). Flora of China. Vol. 22 (Poaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[Terrestrial] "Grasslands, steppe, forest margins; ca. 1800 m."

502	Grass	y
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2022). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 15 Jun 2022]	Genus: Phleum Family: Poaceae (alt. Gramineae) Subfamily: Pooideae Tribe: Poeae Subtribe: Phleinae

503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2022). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 15 Jun 2022]	Genus: Phleum Family: Poaceae (alt. Gramineae) Subfamily: Pooideae Tribe: Poeae Subtribe: Phleinae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Esser, L. L. (1993). <i>Phleum pratense</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/phlpra/all.html . [Accessed 16 Jun 2022]	[Forms non-persistent corms] "Timothy has a moderately shallow and fibrous root system; roots can extend to 48 inches (120 cm) in depth [129,139]. Timothy is nonrhizomatous [114,119]. Timothy plants contain corms at their base which are annual, forming in early summer and dying the next year when the seed matures [47]."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Stewart, A. V., Joachimiak, A. J., & Ellison, N. W. (2011). <i>Phleum</i> . In <i>Wild Crop Relatives: Genomic and Breeding Resources</i> (pp. 257-274). Springer, Berlin, Heidelberg	[No evidence] "Outside its original Eurasian range, <i>P. pratense</i> has now expanded to most suitable habitats around the world. It is now widespread in North America, where it is both a major and valuable forage species and, along with many introduced grasses, is of ecological concern for displacing native grasses."

602	Produces viable seed	y
	Source(s)	Notes

Qsn #	Question	Answer
	Quattrocchi, U. (2006). CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"prolific seeder"
	Duke, J. A. (1983). <i>Phleum pratense</i> . Handbook of Energy Crops. https://hort.purdue.edu/newcrop/duke_energy/Phleum_pratense.html#Toxicity . [Accessed 16 Jun 2022]	"Reproduces by seeds and plants do not spread vegetatively or from a sod."
	Esser, L. L. (1993). <i>Phleum pratense</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/phlpra/all.html . [Accessed 16 Jun 2022]	"Sexual reproduction: Timothy reproduces mainly from seed. It is a prolific seeder [140]; the small, hard seeds are dispersed by livestock, wind, and other agents [119]. There are 1.1 to 1.3 million seeds per pound (0.495-.0585 million per kg) [133]."

603	Hybridizes naturally	
	Source(s)	Notes
	Nordenskiöld, H. (1937). Intra-and interspecific hybrids of <i>Phleum pratense</i> and <i>P. alpinum</i> . <i>Hereditas</i> , 23(3), 304-316	"Cyto-genetic studies on species of <i>Phleum</i> were also undertaken by MONTZING (1935). The author found some timothy plants with 35 and 36 chromosomes in the material of the Forage Crop Department of Svalof. They looked almost like <i>P. pratense</i> . He assumed that they had arisen through spontaneous hybridisation between <i>P. pratense</i> and <i>P. nodosum</i> , and that the plants found were products of backcrosses between the primary hybrid and <i>P. pratense</i> . They were male and female fertile and showed irregular meiosis in their pollen mother cells. That these plants were the offspring from a hybrid of <i>P. nodosum</i> X <i>P. pratense</i> is evident, but in the light of the results described in the present paper it is not necessary to presume a backcross to <i>P. pratense</i> to explain the number of their chromosomes."

Qsn #	Question	Answer
	<p>Kula, A., & Grabowska-Joachimiak, A. (2009). Analysis of probable natural hybrids between <i>Phleum commutatum</i> and <i>P. pratense</i> (Poaceae). <i>Fragmenta Floristica et Geobotanica Polonica</i>, 16(1), 65-77</p>	<p>[Possibly] "Abstract : The object of the studies were four populations of the timothy, classified by the Seed Bank from the USA (USDA, ARS, WRPIS) as <i>Phleum commutatum</i> Gaud. and <i>P. alpinum</i> L. - that is the alpine timothy. The caryopses came from natural positions in Canada, Argentina, Russia and Azerbaijan. The purpose of the study was to correctly determine their systematic affiliation on the basis of morphological and cytogenetic analyses. The morphological analyses revealed that none of the populations displayed features typical of the alpine timothy. In three populations: the Canadian, Argentinean and Azerbaijani ones, the occurrence of a hexaploid number of chromosomes $2n=6x=42$ was found, which is typical of <i>P. pratense</i> L. - meadow timothy. Only in the plants that originated from Russia the occurrence of a tetraploid number of chromosomes was found, which is characteristic of both the alpine timothy and the tetraploid cytotype of the meadow timothy. Moreover, in all the plants analysed, instability in the chromosome number in the root meristem was found, which is unusual in timothy specimens from natural positions. This phenomenon had been described, however, in their interspecific hybrids. In plants from all the four positions, the occurrence of telomeric type of heterochromatin distribution was established, characteristic of the meadow timothy and never found in the alpine timothy, in which centromeric heterochromatin dominates. Admittedly, in the Russian and Azerbaijani populations, elevated centromeric heterochromatin content was observed, however not on a level characteristic of <i>P. alpinum</i>. The banded pattern observed in those populations closely corresponded to the one previously described in experimental, tetraploid hybrids between the meadow and alpine timothy. Measurements of the amount of nuclear DNA exhibited the presence of nearly 9 pg 2C DNA in the forms from Canada, Argentina and Azerbaijan. The amount is typical of the hexaploid meadow timothy. In the Russian form, the amount was slightly over 6 pg 2C DNA, which is a value typical of the alpine timothy, tetraploid meadow timothy and the tetraploid hybrid forms. The carried out studies suggest that the analysed plants are cytotypes of <i>Phleum pratense</i> (6x, 4x), or - what appears more likely - hybrids between <i>P. commutatum</i> and <i>P. pratense</i>."</p>

604	Self-compatible or apomictic	
	Source(s)	Notes
	<p>Drolsom, P. N., & Nielsen, E. L. (1969). Use of Self-fertility in the Improvement of <i>Bromus inermis</i> and <i>Phleum pratense</i>. <i>Crop Science</i>, 9(6), 710-713</p>	<p>"Experimental populations of <i>Bromus inermis</i> Leyss. and of <i>Phleum pratense</i> L. have been formed either with nearly self-sterile plants or with plants possessing modest levels of self-fertility. Both groups within a species originated from the same population and were submitted to the same selection pressures for agronomic features and disease resistance. Experimental synthetics based upon plants with a modest level of self-fertility have indicated some superiority in disease resistance and a possible yield advantage over combinations of self-sterile plants. Seedset data after mutual- and open-pollination suggest that self-fertile plants form more seed than self-sterile plants."</p>

Qsn #	Question	Answer
	Nath, J., & Nielsen, E. L. (1961). Cytology of Plants from Self-and Open-Pollination of <i>Phleum pratense</i> . American Journal of Botany, 48(9), 772–777	[Selfing may result in reduced seed set] "Seed set following open pollinations exceeded 15 mg/cm of spike and that following self-pollination less than 1 mg. Usually it was difficult to maintain adequate inbred populations from plants of this fertility group."

605	Requires specialist pollinators	n
	Source(s)	Notes
	Wu, H., Zhang, P., Zhang, Y., Zhang, J., & Dong, L. (2018). Screening of main herbicides to control <i>Phleum paniculatum</i> in wheat fields. Journal of Nanjing Agricultural University, 41(4), 670-675	"Panicle narrowly cylindrical, 4–15 × 0.5–1 cm, gray-green; branches adnate to central axis. Spikelets obovate-oblong, 3–3.5 mm; rachilla extension absent; glumes oblong, membranous, scaberulous, lower softly hairy on margins, keel conspicuously pectinate-ciliate, apex truncate with stout, 0.5–1.5 mm, scabrid awn; lemma ca. 2 mm, 7-veined, puberulent, especially along veins, apex obtuse; anthers 1.5–2 mm." [Poaceae. Presumably wind-pollinated]

606	Reproduction by vegetative fragmentation	y
	Source(s)	Notes
	Esser, L. L. (1993). <i>Phleum pratense</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/phlpra/all.html . [Accessed 16 Jun 2022]	"Vegetative reproduction: Timothy reproduces vegetatively through tillering [2]. When timothy plants are plowed under, many become reestablished through rooting stems which develop and grow upwards to the surface. Vegetative reproduction occurs through buds in the axils of the leaves, at nodes which may or may not be adjacent to the corms [29]. Tillering suppression has been noted at the onset of sexual reproductive growth [2]."

607	Minimum generative time (years)	1
	Source(s)	Notes
	CABI. (2022). Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Timothy is relatively short-lived and spreads via seeds, which are easily dispersed by wind (NatureServe, 2015)."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Animals, Flyers, Cattle, Donkey, Horse, Livestock, Sheep, Vehicles, Water, Wind, Escapee"
	Mouissie, A. M., Lengkeek, W., & Van Diggelen, R. (2005). Estimating adhesive seed-dispersal distances: field experiments and correlated random walks. Functional Ecology, 19(3): 478-486	"From the cattle dummy, the large, smooth seed of <i>I. grandulifera</i> and small smooth seeds of <i>Medicago lupulina</i> all detached within the first few metres of walking, while only 22% of the bristly <i>K. pyramidata</i> seeds and 5% of the coarse <i>P. pratense</i> seeds detached. In contrast, on the sheep dummy all species detached at comparable rates." [Seeds attach to animals, and may adhere to clothing or footwear in a similar manner]

702	Propagules dispersed intentionally by people	y
-----	--	---

Qsn #	Question	Answer
	Source(s)	Notes
	Stewart, A. V., Joachimiak, A. J., & Ellison, N. W. (2011). <i>Phleum</i> . In <i>Wild Crop Relatives: Genomic and Breeding Resources</i> (pp. 257-274). Springer, Berlin, Heidelberg	"Outside its original Eurasian range, <i>P. pratense</i> has now expanded to most suitable habitats around the world. It is now widespread in North America, where it is both a major and valuable forage species and, along with many introduced grasses, is of ecological concern for displacing native grasses."

703	Propagules likely to disperse as a produce contaminant	y
	Source(s)	Notes
	CABI. (2022). <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	"Seed of <i>P. pratense</i> is considered a contaminant of grass and other seed lots in the eastern US states of Delaware, Maryland, New Hampshire, New Jersey, Pennsylvania, Virginia and West Virginia (Ogle et al., 2011), thus reducing seed lot quality and price."

704	Propagules adapted to wind dispersal	y
	Source(s)	Notes
	Esser, L. L. (1993). <i>Phleum pratense</i> . In: <i>Fire Effects Information System</i> , [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/phlpra/all.html . [Accessed 16 Jun 2022]	"the small, hard seeds are dispersed by livestock, wind, and other agents "

705	Propagules water dispersed	y
	Source(s)	Notes
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Animals, Flyers, Cattle, Donkey, Horse, Livestock, Sheep, Vehicles, Water, Wind, Escapee"

706	Propagules bird dispersed	n
	Source(s)	Notes
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Animals, Flyers, Cattle, Donkey, Horse, Livestock, Sheep, Vehicles, Water, Wind, Escapee"
	Esser, L. L. (1993). <i>Phleum pratense</i> . In: <i>Fire Effects Information System</i> , [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/phlpra/all.html . [Accessed 20 Jun 2022]	"the small, hard seeds are dispersed by livestock, wind, and other agents"

707	Propagules dispersed by other animals (externally)	y
	Source(s)	Notes
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Animals, Flyers, Cattle, Donkey, Horse, Livestock, Sheep, Vehicles, Water, Wind, Escapee"

Qsn #	Question	Answer
	Mouissie, A. M., Lengkeek, W., & Van Diggelen, R. (2005). Estimating adhesive seed-dispersal distances: field experiments and correlated random walks. <i>Functional Ecology</i> , 19(3): 478-486	"From the cattle dummy, the large, smooth seed of <i>I. grandulifera</i> and small smooth seeds of <i>Medicago lupulina</i> all detached within the first few metres of walking, while only 22% of the bristly <i>K. pyramidata</i> seeds and 5% of the coarse <i>P. pratense</i> seeds detached. In contrast, on the sheep dummy all species detached at comparable rates."
	CABI. (2022). <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	"Seed is reported to be transported by livestock (USDA Forest Service, 1937), although seeds lack any specific adaptations for animal dispersal (Klein, 2011)."

708	Propagules survive passage through the gut	y
	Source(s)	Notes
	Welch, D. (1985). Studies in the grazing of heather moorland in north-east Scotland. IV. Seed dispersal and plant establishment in dung. <i>Journal of Applied Ecology</i> , 22(2): 461-472	"Additional species rooted in the dung, but not elsewhere listed in this paper as being transmitted by cattle, were <i>A lopecurus pratensis</i> , <i>Avena sativa</i> , <i>Festuca rubra</i> , <i>Holcus mollis</i> , <i>Phleum pratense</i> , <i>Achillea ptarmica</i> , <i>Cirsium vulgare</i> , <i>Erica cinerea</i> , <i>E. tetra/ix</i> , <i>Genista anglica</i> , <i>Leontodon autumnalis</i> , <i>Polygala serpyllifolia</i> , <i>Triantalis europaea</i> , <i>Trifolium pratense</i> and <i>Viola palustris</i> ."
	Cosyns, E., & Hoffmann, M. (2005). Horse dung germinable seed content in relation to plant species abundance, diet composition and seed characteristics. <i>Basic and Applied Ecology</i> , 6(1): 11-24	"Table 6. Mean germinable seed density of plant species" [Includes <i>Phleum pratense</i>]
	Esser, L. L. (1993). <i>Phleum pratense</i> . In: <i>Fire Effects Information System</i> , [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/phlpra/all.html . [Accessed]	"the small, hard seeds are dispersed by livestock, wind, and other agents [119]."

801	Prolific seed production (>1000/m2)	
	Source(s)	Notes
	Esser, L. L. (1993). <i>Phleum pratense</i> . In: <i>Fire Effects Information System</i> , [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/phlpra/all.html . [Accessed 20 Jun 2022]	"Sexual reproduction: Timothy reproduces mainly from seed. It is a prolific seeder [140]; the small, hard seeds are dispersed by livestock, wind, and other agents [119]. There are 1.1 to 1.3 million seeds per pound (0.495-.0585 million per kg) [133]." [Possibly, although seed densities not specified]

802	Evidence that a persistent propagule bank is formed (>1 yr)	y
	Source(s)	Notes
	Esser, L. L. (1993). <i>Phleum pratense</i> . In: <i>Fire Effects Information System</i> , [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/phlpra/all.html . [Accessed 20 Jun 2022]	"Germination rates remain high for 1 to 2 years. Timothy seed remains viable for 4 to 5 years if kept in a dry, cool place [133]."

Qsn #	Question	Answer
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Seed Longevity: Long Term"
	Lewis, J. (1973). Longevity of crop and weed seeds: survival after 20 years in soil. Weed Research 13: 179-191	"Table 1 Gramineae: percentage viability over 20 years" [Phleum pratense seeds remain viable in mineral soil after 4 years, but none were viable in soil after 20 years]

803	Well controlled by herbicides	y
	Source(s)	Notes
	CABI. (2022). Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Glyphosate is used to control timothy and other perennial grass weeds in cereal crops with preharvest and stubble/fallow applications (Davies and Ballingall, 2008). Because of the herbicide's effects on other plant species, however, this means of control would only be effective for timothy monocultures."

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	Notes
	Esser, L. L. (1993). <i>Phleum pratense</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/phlpra/all.html . [Accessed 20 Jun 2022]	"As with most perennial grasses, timothy is well adapted to fire. Susceptibility of pasture or range vegetation to fire depends on specific fire adaptations of the species and phenological stage when burned. Timothy has underground regenerative organs that are not harmed by moderately severe fires. Timothy is harmed if burned when actively growing in the spring and summer but is fairly fire tolerant when dormant [129]. In Yellowstone National Park after the fires of 1988, timothy sprouted from the roots after being top-killed [4]."
	CABI. (2022). Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Hand pulling can be effective for controlling timothy infestations (Klein, 2011), while frequent cutting or mowing can weaken overall plant health and vigour (Rutledge and McLendon, 1996)."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	WRA Specialist. (2022). Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits

- Broad climate suitability
- Widely naturalized globally, including on Kauai, Oahu and Maui (Hawaiian Islands)
- An agricultural and environmental weed elsewhere
- Other *Phleum* species are invasive
- Allelopathic
- Host of crop pathogens
- Pollen is allergenic and contributes to hay fever
- Shade tolerant
- Tolerates many soil types
- Can form dense swards that exclude other vegetation
- Reproduces by seeds and vegetatively by stem fragments
- Rapid growth rate
- Seeds dispersed by wind, water, attached to animals and equipment, internally by grazing animals, and through intentional cultivation
- Prolific seed production
- Forms a persistent seed bank (at least 4 years in natural conditions)
- Tolerates heavy grazing, mowing and fire

Low Risk Traits

- Despite naturalization, negative impacts have not been reported from the Hawaiian Islands to date
- Valued as a palatable pasture species
- Unarmed (no spines, thorns, or burrs)
- Non-toxic
- Herbicides may provide effective control