

<b>Taxon:</b> Bromus diandrus	<b>Family:</b> Poaceae
<b>Common Name(s):</b> broncho grass giant brome great brome ripgut grass	<b>Synonym(s):</b> Bromus rigidus Roth [≡ B. diandrus .....]

<b>Assessor:</b> Chuck Chimera	<b>Status:</b> Assessor Approved	<b>End Date:</b> 29 Sep 2015
<b>WRA Score:</b> 18.0	<b>Designation:</b> H(HPWRA)	<b>Rating:</b> High Risk

**Keywords:** Annual Grass, Naturalized, Agricultural Weed, Environmental Weed, Persistent Seed Bank

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		
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		
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	n
408	Creates a fire hazard in natural ecosystems	y=1, n=0	y

Qsn #	Question	Answer Option	Answer
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	y
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	y
411	Climbing or smothering growth habit	y=1, n=0	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	y=1, n=-1	y
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	n
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	1
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	y
702	Propagules dispersed intentionally by people	y=1, n=-1	n
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	n
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 <sup>2</sup> )	y=1, n=-1	y
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		
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
	Quattrocchi, U. 2006. CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	[No evidence of domestication] "forage, low grazing value, noxious and invasive weed, the mature fruits may cause irritation and infection to the sheep, very similar to <i>Bromus rigidus</i> Roth, grows in grassland or woodland, waste ground, weedy places, in damp areas, moist sites, roadsides, sandy places, disturbed places and habitats, gardens, cultivated lands, riverbanks, closely related to <i>Bromus rigidus</i> Roth"

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. 2015. Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. 2015. 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
	USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: <a href="http://www.ars-grin.gov/">http://www.ars-grin.gov/</a> . [Accessed 25 Sep 2015]	"Native: AFRICA Macaronesia: Portugal - Madeira Islands; Spain - Canary Islands Northern Africa: Algeria; Egypt [n.]; Libya [n.]; Morocco; Tunisia ASIA-TEMPERATE Western Asia: Cyprus; Israel; Jordan; Lebanon; Syria; Turkey Caucasus: Azerbaijan; Georgia EUROPE Middle Europe: Hungary East Europe: Estonia; Lithuania; Ukraine Southeastern Europe: Croatia; Greece [incl. Crete]; Italy [incl. Sardinia, Sicily]; Romania; Slovenia Southwestern Europe: France [incl. Corsica]; Portugal; Spain [incl. Balears]"

Qsn #	Question	Answer
202	Quality of climate match data	High
	Source(s)	Notes
	USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: <a href="http://www.ars-grin.gov/">http://www.ars-grin.gov/</a> . [Accessed 25 Sep 2015]	

203	Broad climate suitability (environmental versatility)	y
	Source(s)	Notes
	Storrie, A. M. (ed). (2014). Integrated weed management in Australian cropping systems. Grains Research and Development Corporation	[Broad distribution] "Both <i>B.diandrus</i> and <i>B.rigidus</i> have a diverse habitat range including croplands, pastures, fallows, wastelands, roadsides, hilltops, coastal sand dunes, national parks and reserves."
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	[Elevation range exceeds 2000 m, demonstrating environmental versatility] "in Hawai'i naturalized and common in pastures, subalpine forest and shrubland, and disturbed areas, (5-) 550-2,270 m,"

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Native to the Mediterranean region; in Hawai'i naturalized and common in pastures, subalpine forest and shrubland, and disturbed areas, (5-) 550-2,270 m, on Kaua'i and Hawai'i. First collected on Hawai'i in 1910 (Rock 8403, BISH)"

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	Quattrocchi, U. 2006. CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"noxious and invasive weed" [Widely introduced and naturalized]

301	Naturalized beyond native range	y
	Source(s)	Notes
	Herbarium Pacificum Staff. 1999. New Hawaiian plant records for 1998. Bishop Museum Occasional Papers 58: 3-11	"Documented from Kaua'i and Hawai'i (Wagner et al., 1990), ripgut grass has now been collected from East Maui as well. The species was first documented on Maui from the 'Ulupalakua area in 1937 as a localized patch in pastureland at 1,800 ft elevation (Hosaka 1787). See Herbst & Clayton (1998) for a note concerning the present taxonomic placement of this species. Material examined. EAST MAUI: K��okea, dry scrubland downslope of Kula Hwy with <i>Sporobolus indicus</i> , <i>Ehrharta</i> , <i>Lantana</i> , <i>Bocconia</i> , <i>Gomphocarpus</i> , 2600 ft, 17 Aug 1998, C. Imada, W. Char, & C. Morden 98-11."

Qsn #	Question	Answer
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Range: Ripgut brome and red brome occur in most of the western states, except Wyoming, South and North Dakota (and Colorado for red brome)."
	Oppenheimer, H. 2008. New Hawaiian plant records for 2007. Bishop Museum Occasional Papers 100: 22-38	"Ripgut grass has been documented in Hawai'i from Kaua'i, East Maui, and Hawai'i (Wagner et al. 1999a: 1508; Herbarium Pacificum Staff 1999: 7). On Lāna'i it is locally common during wet seasons and definitely naturalized. Pavlick & Anderton (2007: 224) considered <i>B. rigidus</i> conspecific with <i>B. diandrus</i> . Material examined. LĀNA'I: 'Āwehi Rd, in the Gardenia brighamii outplanting enclosure, locally common, 760 m, 21 Mar 2007, Oppenheimer, Perlman & Tangalin H30714."
	Queensland Government. 2011. Weeds of Australia - <i>Bromus diandrus</i> . <a href="http://keyserver.lucidcentral.org/weeds/data/080c0106-040c-4508-8300-0b0a06060e01/media/html/Bromus_diandrus.htm">http://keyserver.lucidcentral.org/weeds/data/080c0106-040c-4508-8300-0b0a06060e01/media/html/Bromus_diandrus.htm</a> . [Accessed 28 Sep 2015]	"Widely naturalised in southern Australia (i.e. in south-eastern Queensland, throughout New South Wales and Victoria, in the ACT and Tasmania, in larger parts of South Australia, in the southern parts of the Northern Territory, and in the southern and western parts of Western Australia). Also naturalised on Lord Howe Island and Norfolk Island, and in other parts of the world."
	Wagner, W.L., Herbst, D.R. & Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	[ <i>Bromus diandrus</i> Roth var. <i>rigidus</i> (Roth) Sales] "in Hawai'i naturalized and common in pastures, subalpine forest and shrubland, and disturbed areas, (5-) 550-2,270 m, on Kaua'i and Hawai'i. First collected on Hawai'i in 1910 (Rock 8403, BISH)."

302	Garden/amenity/disturbance weed	
	Source(s)	Notes
	Quattrocchi, U. 2006. CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	[Disturbance-adapted grass with negative impacts on agriculture & the environment] "Widely introduced and naturalized ... grows in grassland or woodland, waste ground, weedy places, in damp areas, moist sites, roadsides, sandy places, disturbed places and habitats, gardens, cultivated lands, riverbanks"

Qsn #	Question	Answer
303	<b>Agricultural/forestry/horticultural weed</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Storrie, A. M. (ed). (2014). Integrated weed management in Australian cropping systems. Grains Research and Development Corporation	"B. diandrus and wild oats were found to be the most competitive grass weeds in wheat. Research in Western Australia demonstrated that wheat yields decreased exponentially with increasing densities of B. diandrus. One hundred B. diandrus plants/m <sup>2</sup> reduced wheat yields by 30 per cent."
	Quattrocchi, U. 2006. CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	[May impact ranching] "forage, low grazing value, noxious and invasive weed, the mature fruits may cause irritation and infection to the sheep, very similar to Bromus rigidus Roth, grows in grassland or woodland, waste ground, weedy places, in damp areas, moist sites, roadsides, sandy places, disturbed places and habitats, gardens, cultivated lands, riverbanks, closely related to Bromus rigidus Roth"
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	[Negatively impacts grazing lands] "These bromes suppress other grasses in rangeland, can infest agricultural fields, and have sharp florets that can injure grazing animals. These bromes may serve as a minor source of livestock forage early in the season, but they suppress perennial grasses that would extend the grazing season. All are fire promoters."

304	<b>Environmental weed</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Queensland Government. 2011. Weeds of Australia - Bromus diandrus. <a href="http://keyserver.lucidcentral.org/weeds/data/080c0106-040c-4508-8300-0b0a06060e01/media/html/Bromus_diandrus.htm">http://keyserver.lucidcentral.org/weeds/data/080c0106-040c-4508-8300-0b0a06060e01/media/html/Bromus_diandrus.htm</a> . [Accessed 28 Sep 2015]	"This species is regarded as an environmental weed in Victoria, South Australia and Western Australia. It is a common weed of pastures, crops and disturbed sites, but also grows in native grasslands, woodlands, coastal sites, on offshore islands and in damp sites near creeks and wetlands. It is listed as one of the top ten environmental weeds of coastal environs in the Gascoyne region of Western Australia and is also a common coastal weed in the Gulf St. Vincent area in South Australia. Great brome (Bromus diandrus) is also listed as a weed of wetlands and waterways in the southern regions of Western Australia. It often invades conservations areas (e.g. Phillip Island Nature Park in Victoria, Don River Reserve in Tasmania and Cobbler Creek Recreation Park in South Australia) and is regarded as a very serious threat to plant communities in the Goulburn Broken Catchment in Victoria."

305	<b>Congeneric weed</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Bromus inermis ... forms dense mats excluding other species and reducing native diversity." ... "Bromus rubens ... forms dense stands and competes for nutrients and water ... enhances the potential for the start and spread of fires ... " ... "Bromus tectorum ... Due to its shallow root system, it extracts soil moisture from the upper soil layers, thus preventing the establishment of other species. The early maturation and accumulation of dead and highly inflammable material greatly increases fire hazards."

Qsn #	Question	Answer
	Quattrocchi, U. 2006. CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	[Bromus catharticus] "weed species widely naturalized elsewhere" ... "...common in waste and disturbed places, lawns, gardens, riverbanks, areas under irrigation, dry to moderately moist waste places, near water, along roadsides, bottomlands and moist bottom, agricultural fields, cultivated lands, bare soil , vacant lots, slopes, orchards"

401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	[No spines, thorns, or burrs, but sharp florets can injure grazing animals] "These bromes suppress other grasses in rangeland, can infest agricultural fields, and have sharp florets that can injure grazing animals."

Qsn #	Question	Answer
402	Allelopathic	
	Source(s)	Notes
	<p>Lehoczky, E., Nelima, M. O., Szabó, R., Szalai, A., &amp; Nagy, P. (2010). Allelopathic effect of <i>Bromus</i> spp. and <i>Lolium</i> spp. shoot extracts on some crops. <i>Communications in Agricultural and Applied Biological Sciences</i>, 76(3): 537-544</p>	<p>[Extracts may be allelopathic] "Allelopathy is an untapped resource for weed control in crops that could give good possibilities for environmentally sound, integrated crop production. Allelopathy is defined as the direct or indirect harmful or beneficial effects of one plant on another through the production of chemical compounds, called allelochemicals, which escape into the environment. Allelochemicals can be produced by weeds and affect crops, and the reverse is also true. Allelopathic interactions include weed-weed, weed-crop, and crop-crop. Allelopathy offers potential for selective biological weed control for instance weed-suppressing crops and the use of plant residues in cropping systems, allelopathic rotational crops, or companion plants with allelopathic potential. <i>Bromus</i> species occur in many habitats in temperate regions of the world, including America, Eurasia, Australia, and Africa. The genus <i>Lolium</i> is one of the most important forage grasses. The weed species usually grow in the same production zones as wheat and are considered weeds since they parasitize wheat fields. Some of the weed species in these two genus have been reported to have allelopathic effect. One of the methods that has been successful in studying allelopathic activity are bioassays. Laboratory experiments were conducted to determine allelopathic effect of watery shoot extracts of four weed species of the Poaceae family, namely <i>Bromus rigidus</i>, <i>Bromus diandrus</i>, <i>Lolium multiflorum</i> and <i>Lolium temulentum</i> on germination and growth of winter wheat (<i>Triticum aestivum</i> L.), spring barley (<i>Hordeum vulgare</i> L.), corn (<i>Zea mays</i> L), perennial ryegrass (<i>Lolium perenne</i> L.), bean (<i>Phaseolus</i> sp.) and sunflower (<i>Helianthus annuus</i> L.) and on each other. The experiment was carried out during the period March 2010 to October 2010. Twenty five seeds were put into one Petri-dish on filter paper, adding 15ml of extract to each in four repeats. The germination took place in a Binder type thermostat in the dark. The timing of germination was checked in every two days and the rate of growth was estimated after a week, by counting the number of germinated seeds and measuring the length of the radicle and plumule. The measured data was statistically analyzed and the effect of the extracts on germination percentage and seedling length was evaluated."</p>

403	Parasitic	n
	Source(s)	Notes
	<p>USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: <a href="http://www.ars-grin.gov/">http://www.ars-grin.gov/</a>. [Accessed 28 Sep 2015]</p>	<p>"Family: Poaceae (alt. Gramineae) subfamily: Pooideae tribe: Bromeae" [Not parasitic]</p>

404	Unpalatable to grazing animals	n
	Source(s)	Notes

Qsn #	Question	Answer
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	[Palatable, but florets may be harmful] "These bromes suppress other grasses in rangeland, can infest agricultural fields, and have sharp florets that can injure grazing animals. These bromes may serve as a minor source of livestock forage early in the season, but they suppress perennial grasses that would extend the grazing season."

405	Toxic to animals	n
	Source(s)	Notes
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	[No evidence of toxicity. May cause mechanical injury] "These bromes suppress other grasses in rangeland, can infest agricultural fields, and have sharp florets that can injure grazing animals. These bromes may serve as a minor source of livestock forage early in the season, but they suppress perennial grasses that would extend the grazing season."
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence

406	Host for recognized pests and pathogens	y
	Source(s)	Notes
	Storrie, A. M. (ed). (2014). Integrated weed management in Australian cropping systems. Grains Research and Development Corporation	"Both <i>B. diandrus</i> and <i>B. rigidus</i> act as alternate hosts to cereal diseases: Left uncontrolled in fallow or pasture phases, brome grasses will host and carry over cereal diseases and pests to new crops. Diseases include ergot ( <i>Claviceps purpurea</i> ), take-all ( <i>Gaeumannomyces graminis</i> ), powdery mildew ( <i>Erysiphe graminis</i> ), septoria glume blotch ( <i>Leptosphaeria nodorum</i> ), black stem rust ( <i>Puccinia graminis</i> ), brown rust ( <i>Puccinia recondita</i> ), barley net blotch ( <i>Pyrenophora teres</i> ), sharp eyespot ( <i>Rhizoctonia solani</i> ), bunt ( <i>Tilletia caries</i> ) and cereal yellow dwarf virus. Pests include cereal cyst nematode ( <i>Heterodera avenae</i> ) and root knot nematodes ( <i>Meloidogyne</i> spp.)."
	CABI, 2015. <i>Bromus diandrus</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	"In addition, <i>Bromus</i> species can host cereal diseases ... "

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence

Qsn #	Question	Answer
408	Creates a fire hazard in natural ecosystems	y
	Source(s)	Notes
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"These bromes suppress other grasses in rangeland, can infest agricultural fields, and have sharp florets that can injure grazing animals." ... "All are fire promoters."

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	Notes
	Pugnaire, F. & Valladares, F. 2007. Functional Plant Ecology, Second Edition. CRC Press, Boca Raton, FL	"Facilitative shade effects are not restricted to deserts. For example herbaceous species in California oak savannas also show strong preferences to either understory or open microhabitats. Parker and Muller (1982) demonstrated higher shade tolerance of <i>Bromus diandrus</i> and <i>Pholistoma auritum</i> , two species apparently facilitated by <i>Quercus agifolia</i> (an evergreen oak), than that of <i>Avena fatua</i> , a species common in the open. In laboratory experiments, <i>B. diandrus</i> had a higher relative growth rate at low light than <i>A. fatua</i> (Mahall et al. 1981)."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	Storrie, A. M. (ed). (2014). Integrated weed management in Australian cropping systems. Grains Research and Development Corporation	" <i>B. diandrus</i> is spread from south-eastern Queensland to south-western Western Australia and tolerates a wide range of soil types (acidic or alkaline, sandy to loamy)."
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"They are often in areas with dry sandy soils where there is less competition with other vegetation, including desert communities. They are also common in urban waste places and can grow in most soil types."

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Clayton, W.D., Vorontsova, M.S., Harman, K.T. and Williamson, H. 2006 onwards. GrassBase - The Online World Grass Flora. <a href="http://www.kew.org/data/grasses-db.html">http://www.kew.org/data/grasses-db.html</a> . [Accessed 28 Sep 2015]	"HABIT Annual; culms solitary, or caespitose. Culms erect, or geniculately ascending; 35–150 cm long; 3–6 -noded. Leaf-sheaths hispid. Ligule an eciliate membrane; 3–6 mm long; lacerate. Leaf blades 4–25 cm long; 4–8 mm wide. Leaf-blade surface scaberulous; pilose."

Qsn #	Question	Answer
412	Forms dense thickets	y
	Source(s)	Notes
	Holloran, P., Mackenzie, A., Ferrell, S., & Johnson, D. (2004). The Weed Workers' Handbook: A Guide to Techniques for Removing Bay Area Invasive Plants. The Watershed Project and California Invasive Plant Council, Richmond & Berkeley, CA	"Dense stands of dead plant material make this grass very prone to fire during summer drought. In addition, the long, stiff awns are known to cause injury to wildlife. Like many invasive annual grasses, ripgut brome prevents native perennial species from becoming reestablished. For example, research indicates that it outcompetes native oak seedlings for water stored in the soil by means of early germination, sheer volume of numbers, and deep roots."

501	Aquatic	n
	Source(s)	Notes
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	[Terrestrial grass] "Habitat: Open disturbed areas, roadsides, fields, rangelands, agronomic crops, orchards, forestry sites, and many natural communities."

502	Grass	y
	Source(s)	Notes
	USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: <a href="http://www.ars-grin.gov/">http://www.ars-grin.gov/</a> . [Accessed 25 Sep 2015]	"Family: Poaceae (alt. Gramineae) subfamily: Pooideae tribe: Bromeae"

503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	Clayton, W.D., Vorontsova, M.S., Harman, K.T. and Williamson, H. 2006 onwards. GrassBase - The Online World Grass Flora. <a href="http://www.kew.org/data/grasses-db.html">http://www.kew.org/data/grasses-db.html</a> . [Accessed 25 Sep 2015]	"Annual; culms solitary, or caespitose. Culms erect, or geniculate ascending; 35–150 cm long; –6-noded. Leaf-sheaths hispid. Ligule an eciliate membrane; 3–6 mm long; lacerate. Leaf-blades –25 cm long; 4–8 mm wide. Leaf-blade surface scaberulous; pilose. "

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	DiTomaso, J. 2007. Weeds of California and Other Western States, Volume 2. UCANR Publications, Oakland, CA	"Most Bromus species have fibrous roots that are concentrated in the top 15 cm of soil."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Quattrocchi, U. 2006. CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	[No evidence. Widespread native & introduced range]

Qsn #	Question	Answer
602	Produces viable seed	y
	Source(s)	Notes
	CABI, 2015. <i>Bromus diandrus</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	" <i>B. diandrus</i> germinates, grows and produces seeds during the winter, spring and early summer. In Australia, the closely related species <i>B. rigidus</i> matured earlier than <i>B. diandrus</i> , but there was high genetic variation in the time of maturity of both species (Kon and Blacklow, 1988). Seed production can range from 600 to over 3000 seeds per plant (Cooper and Moerkerk, 2000)."
	DiTomaso, J. 2007. Weeds of California and Other Western States, Volume 2. UCANR Publications, Oakland, CA	"Reproduce by seed"

603	Hybridizes naturally	
	Source(s)	Notes
	Kon, K. F., & Blacklow, W. M. (1990). Polymorphism, outcrossing and polyploidy in <i>Bromus diandrus</i> and <i>B. rigidus</i> . <i>Australian Journal of Botany</i> , 38(6): 609-618	"No evidence of natural hybrids was found (Table 5) in the progeny from seeds collected from the Waggrakine (WE) and nearby East Chapman (EC) sites where the two species grow together in the same fields (Fig. 1). Attempts to make reciprocal crosses between the species failed."
	Kole, C. (ed.). 2011. Wild Crop Relatives: Genomic and Breeding Resources: Millets and Grasses. Springer-Verlag, Berlin, Heidelberg	[Suspected hybrid origins. Unknown if natural hybridization occurs] "The two 4x species were demonstrated to be distinct species, and the 8x <i>B. diandrus</i> appears to have originated as a hybrid between 6x <i>B. rigidus</i> and 2x <i>B. sterilis</i> . This last observation has been supported by earlier research (Fortune et al. 2008)."

604	Self-compatible or apomictic	y
	Source(s)	Notes
	Kon, K. F., & Blacklow, W. M. (1990). Polymorphism, outcrossing and polyploidy in <i>Bromus diandrus</i> and <i>B. rigidus</i> . <i>Australian Journal of Botany</i> , 38(6): 609-618	" <i>B. diandrus</i> is self-compatible with high, but significantly different, levels of seed set in open or enclosed panicles (Table 4). In 1985 both <i>B. diandrus</i> and <i>B. rigidus</i> were cleistogamous with stamens and carpels tightly enclosed within the lemmas and paleas."

605	Requires specialist pollinators	n
	Source(s)	Notes
	Zomlefer, W.B. 1994. Guide to Flowering Plant Families. The University of North Carolina Press, Chapel Hill & London	Poaceae [anemophilous. Wind-pollinated]

Qsn #	Question	Answer
606	Reproduction by vegetative fragmentation	n
	Source(s)	Notes
	CABI, 2015. <i>Bromus diandrus</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	[No evidence] "B. diandrus is an annual plant, 30-90 cm high." ... "B. diandrus germinates, grows and produces seeds during the winter, spring and early summer. In Australia, the closely related species B. rigidus matured earlier than B. diandrus, but there was high genetic variation in the time of maturity of both species (Kon and Blacklow, 1988). Seed production can range from 600 to over 3000 seeds per plant (Cooper and Moerkerk, 2000)."

607	Minimum generative time (years)	1
	Source(s)	Notes
	Quattrocchi, U. 2006. CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"Annual"

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y
	Source(s)	Notes
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Soon after maturation, the florets disperse short distances with wind and rodent activity or to greater distances by clinging to the fur, feathers, and feet of animals and to the shoes and clothing of people."
	Moerkerk, M. (2006). Risk of weed movement through vehicles, plant and equipment: results from a Victorian study. Pp. 458-461 In Proceedings of the 15th Australian Weeds Conference. Weed Management Society of South Australia,	"The 30 most frequent contaminants on vehicles and machinery are listed in Table 3. Passenger vehicles were more frequently contaminated by annual species such as <i>Lolium</i> spp., <i>Avena</i> spp., <i>Bromus diandrus</i> Roth, <i>B. hordeaceus</i> L., <i>Arctotheca calendula</i> (L.) Levyns. and <i>Panicum capillare</i> L. than machinery."
	Quattrocchi, U. 2006. CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	[Grows along roadsides] "forage, low grazing value, noxious and invasive weed, the mature fruits may cause irritation and infection to the sheep, very similar to <i>Bromus rigidus</i> Roth, grows in grassland or woodland, waste ground, weedy places, in damp areas, moist sites, roadsides, sandy places, disturbed places and habitats, gardens, cultivated lands, riverbanks, closely related to <i>Bromus rigidus</i> Roth"

702	Propagules dispersed intentionally by people	n
	Source(s)	Notes
	CABI, 2015. <i>Bromus diandrus</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	[No evidence of modern intentional dispersal] "In general, propagation is by seed. Long-distance dispersal could occur by contamination of crop seeds and forages, attachment to animals or transport in ship ballast (Cooper and Moerkerk, 2000)."

703	Propagules likely to disperse as a produce contaminant	y
	Source(s)	Notes

Qsn #	Question	Answer
	CABI, 2015. <i>Bromus diandrus</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	"In addition, <i>Bromus</i> species can host cereal diseases and are contaminants of grain and wool and they damage animal hides."
	Kleemann, S. G. L., & Gill, G. S. (2006). Differences in the distribution and seed germination behaviour of populations of <i>Bromus rigidus</i> and <i>Bromus diandrus</i> in South Australia: adaptations to habitat and implications for weed management. <i>Crop and Pasture Science</i> , 57(2): 213-219	"In wheat ( <i>Triticum aestivum</i> L.), <i>B. diandrus</i> has been shown to be extremely competitive, significantly reducing crop growth and yield (Gill and Blacklow 1984). The species is also a problematic contaminant of grain."

704	Propagules adapted to wind dispersal	y
	Source(s)	Notes
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	[Short distance wind dispersal] "Soon after maturation, the florets disperse short distances with wind and rodent activity or to greater distances by clinging to the fur, feathers, and feet of animals and to the shoes and clothing of people."

705	Propagules water dispersed	n
	Source(s)	Notes
	Holloran, P., Mackenzie, A., Ferrell, S., & Johnson, D. (2004). The Weed Workers' Handbook: A Guide to Techniques for Removing Bay Area Invasive Plants. The Watershed Project and California Invasive Plant Council, Richmond & Berkeley, CA	"Seeds are usually wind-dispersed and can travel long distances, but they can also become attached to clothing."

706	Propagules bird dispersed	n
	Source(s)	Notes
	Holloran, P., Mackenzie, A., Ferrell, S., & Johnson, D. (2004). The Weed Workers' Handbook: A Guide to Techniques for Removing Bay Area Invasive Plants. The Watershed Project and California Invasive Plant Council, Richmond & Berkeley, CA	"Seeds are usually wind-dispersed and can travel long distances, but they can also become attached to clothing.:"

707	Propagules dispersed by other animals (externally)	y
	Source(s)	Notes
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Soon after maturation, the florets disperse short distances with wind and rodent activity or to greater distances by clinging to the fur, feathers, and feet of animals and to the shoes and clothing of people."

Qsn #	Question	Answer
708	Propagules survive passage through the gut	y
	Source(s)	Notes
	Shiponeni, N. N., & Milton, S. J. (2006). Seed dispersal in the dung of large herbivores: implications for restoration of Renosterveld shrubland old fields. <i>Biodiversity &amp; Conservation</i> , 15(10): 3161-3175	"Table 1. Densities (seedlings per 1000 g of dung) of seedlings which emerged from animal dung." [Bromus diandrus recorded in Zebra = 37.6 seedlings/1000 g of dung & in Wildebeest = 6.4 seedlings/1000 g of dung]

801	Prolific seed production (>1000/m2)	y
	Source(s)	Notes
	CABI, 2015. <i>Bromus diandrus</i> . In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	"Seed production can range from 600 to over 3000 seeds per plant (Cooper and Moerkerk, 2000)."
	Holloran, P., Mackenzie, A., Ferrell, S., & Johnson, D. (2004). <i>The Weed Workers' Handbook: A Guide to Techniques for Removing Bay Area Invasive Plants</i> . The Watershed Project and California Invasive Plant Council, Richmond & Berkeley, CA	"Seed production is high, with a single plant capable of producing up to a thousand seeds."
	García, A. L., Royo-Esnal, A., Torra, J., Cantero-Martinez, C., & Recasens, J. (2014). Integrated management of <i>Bromus diandrus</i> in dryland cereal fields under no-till. <i>Weed Research</i> , 54(4): 408-417	[Yes during certain seasons] "The values of fecundity and seed rain at the end of each growing season are given in Table 3. On average, the fecundity of <i>B. diandrus</i> in 2008–09 was higher than in 2009–10 and 2010–11 growing seasons, and fecundity was influenced by the crop sowing date (D1 < D2 < D3). In 2008–09, the highest fecundity was observed in D3 (224 seeds per plant), but the highest seed rain was produced by D1 (27 782 seeds m <sup>-2</sup> ) because of higher weed density. In contrast, the values of fecundity were very low in 2009–10 and 2010–11 (ranging from 14.7 to 29.8 seeds per plant) and with no significant differences between crop sowing dates in 2010–11. In 2009–10 and 2010–11, the highest seed rain was observed in D1 (7886 and 596 seeds m <sup>-2</sup> , respectively), and the values for D3 were practically negligible (1.8 and 1.9 seeds m <sup>-2</sup> respectively)."

802	Evidence that a persistent propagule bank is formed (>1 yr)	y
	Source(s)	Notes
	DiTomaso, J. 2007. <i>Weeds of California and Other Western States</i> , Volume 2. UCANR Publications, Oakland, CA	"In Australia, seeds are dormant at maturity and require a short after-ripening period, typically through summer. Seeds appear to survive about 2-3 years under field conditions."
	Kleemann, S. G. L., & Gill, G. S. (2013). Seed dormancy and seedling emergence in rippgut brome ( <i>Bromus diandrus</i> ) populations in southern Australia. <i>Weed Science</i> , 61(2): 222-229	"Results of this study also showed that the seedbank of these highly dormant rippgut brome populations can readily persist from one year to the next. Effective management of rippgut brome populations with long seed dormancy and increased seedbank persistence would require a major change in cropping systems used by the growers in southern Australia."

Qsn #	Question	Answer
	Harradine, A. R. (1986). Seed longevity and seedling establishment of <i>Bromus diandrus</i> Roth. <i>Weed Research</i> , 26(3): 173-180	[At least 2 years] "Some aspects of the seed and seedling biology of <i>Bromus diandrus</i> Roth. were investigated with the aim of formulating non-chemical control methods. <i>B. diandrus</i> seeds remained viable for at least 2 years when dormancy was enforced by environmental conditions, although 95% of seed was capable of germinating within 27 days of shedding from the parent plant when conditions were favourable. Seeds buried at 50 or 150 mm depth in field soil germinated or lost viability within 6 months. Seedling establishment was greatest and most rapid from seeds buried at 50 mm with 97% of total seedling emergence occurring within 1 month of burial. Less than 1% of seeds buried at 150 mm produced seedlings. Establishment of seedlings from surface-sown seed occurred over 18 months. The prevention of seeding by the application of paraquat to flowering plants of <i>B. diandrus</i> in the field led to a significant reduction in the population in the following year. Control methods based on these results are suggested."

803	Well controlled by herbicides	y
	Source(s)	Notes
	DiTomaso, J.M./Kyser, G.B. et al. 2013. <i>Weed Control in Natural Areas in the Western United States</i> . Weed Research and Information Center, University of California, Davis, CA	[Multiple herbicides provide effective control] "Growth regulator herbicides: Although they do not generally kill annual grasses, many of the growth regulator herbicides, particularly aminopyralid and picloram, have been shown to reduce seed production in downy brome. In addition, aminopyralid and aminocyclopyrachlor have been shown in some studies to provide good preemergence control of downy brome at higher rates." ... "Clethodim Select, Envoy ... Remarks: Clethodim is grass-selective and safe on broadleaf species. To select for perennial grasses, apply before perennials emerge. It has no soil activity. Use a crop oil surfactant. Registered for fallow and non-crop areas, not generally for rangeland/natural areas, but has specific-use supplemental labels. Note that Envoy formulation is 1 lb a.i./gallon, Select is 2 lb a.i./gallon." ... "Fluazifop Fusilade ... Remarks: Fluazifop is grass-selective and safe on broadleaf species. To select for perennial grasses, apply before perennials emerge. It has no soil activity. Use a crop oil surfactant. Registered for fallow and non-crop areas, not generally for rangeland/natural areas, but has specific-use supplemental labels." ... "Glyphosate Roundup, Accord XRT II, and others ... Remarks: Glyphosate is a nonselective herbicide. It has no soil activity." ... "Imazapic Plateau" ... "Imazapyr Arsenal, Habitat, Chopper, Stalker, Polaris" ... "Propoxycarbazone sodium Canter R+P" ... "Rimsulfuron Matrix" ... "Sulfometuron" ... "Sulfometuron + chlorsulfuron" ... "Sulfosulfuron" ... "Hexazinone"

804	Tolerates, or benefits from, mutilation, cultivation, or fire	
	Source(s)	Notes

Qsn #	Question	Answer
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	[Tolerates mowing. Fire can provide control] "Mowing is not usually recommended, but can reduce seed production if conducted shortly after flower initiation and before seeds mature. Plants cut earlier will regrow. Plants should be mowed to about 2 inches with the bolting stems removed. Repeated mowing (every 3 weeks) can eliminate seed production in areas where herbicide applications are unacceptable." ... "Ripgut brome is susceptible to burning, if the burn is conducted before seeds mature. Burns should be conducted in late spring when most desirable vegetation is drying down but before ripgut brome heads shatter. Burning later, after seed dispersal, can increase ripgut brome densities."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	[Probably no effective natural enemies in the Hawaiian Islands] "There are no established biocontrol agents for the weedy bromes. Several soil fungi have been tested for their suppressive effect on downy brome. None have proven effective. A rhizobacterium native to Washington's soils, <i>Pseudomonas fluorescens</i> strain D7 (P.f. D7), has been shown to inhibit germinating cheatgrass, offering hope of managing the spread of this highly invasive species. Studies of the efficacy of this organism under a range of environmental conditions are under way to determine if this bacterium could inhibit cheatgrass across the western United States. Results are too preliminary to determine if it will be effective."

**Summary of Risk Traits:**

## High Risk / Undesirable Traits

- Elevation range exceeds 2000 m, demonstrating environmental versatility
- Grows in tropical climates
- Naturalized on main Hawaiian Islands & widely naturalized elsewhere
- Environmental weed in Australia
- Other Bromus species are invasive
- Contains toxic levels of nitrates (may be toxic to livestock if consumed at high levels)
- Shade tolerant
- Tolerates many soil types
- Able to form dense swards
- Reproduces by seed
- Cleistogamous (capable of automatic self-pollination) in certain conditions
- Able to reach maturity in 1 growing season
- Seeds dispersed by a variety of vectors (attached to machinery, clothing, animals, by wind, water & as a contaminant)
- Prolific seed production under certain conditions
- Seeds can form a persistent seed bank (4-5 years)
- Tolerates mowing & grazing

## Low Risk Traits

- Unarmed (no spines, thorns or burrs)
- Provides fodder for livestock (palatable despite reports of potential toxicity)
- Not reported to spread vegetatively
- Herbicides may provide effective control