

Taxon: <i>Urochloa ruziziensis</i> x <i>U. decumbens</i> x <i>U. brizantha</i>	Family: Poaceae
Common Name(s): Brachiaria hybrid CIAT 36087 Mulato II	Synonym(s): <i>Brachiaria ruziziensis</i> x <i>B. decumbens</i> x <i>B. brizantha</i>

Assessor: Chuck Chimera	Status: Approved	End Date: 24 Aug 2023
WRA Score: 9.0	Designation: H(HPWRA)	Rating: High Risk

Keywords: Hybrid Cultivar, Palatable Forage, Shade Tolerant, Apomictic, Tolerates Fire

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)	High
202	Quality of climate match data	0 = low, 1 = intermediate, 2 = high (see Appendix 2)	Low
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	n
302	Garden/amenity/disturbance weed		
303	Agricultural/forestry/horticultural weed		
304	Environmental weed	y = 2*multiplier (see Appendix 2), n = 0	n
305	Congeneric weed	y = 1*multiplier (see Appendix 2), n = 0	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	n
407	Causes allergies or is otherwise toxic to humans		
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
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y = 1, n = 0	y

Qsn #	Question	Answer Option	Answer
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	y
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	1
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y = 1, n = -1	n
702	Propagules dispersed intentionally by people	y = 1, n = -1	y
703	Propagules likely to disperse as a produce contaminant		
704	Propagules adapted to wind dispersal	y = 1, n = -1	n
705	Propagules water dispersed		
706	Propagules bird dispersed		
707	Propagules dispersed by other animals (externally)		
708	Propagules survive passage through the gut		
801	Prolific seed production (>1000/m ²)	y = 1, n = -1	y
802	Evidence that a persistent propagule bank is formed (>1 yr)		
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
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (Brachiaria hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	[Artificial hybrid cultivar] "Cultivar Mulato II is the result of three cycles of hybridization and screening carried out by CIAT's Tropical Forages Project. Crosses were initiated in 1989 between B. ruziziensis R. Germ. & Evrard clone 44-6 (sexual tetraploid) x B. decumbens Stapf cv. Basilisk1 (apomictic tetraploid). Sexual progenies of this first cross were submitted to open pollination to generate a second generation of hybrids, from which a sexual genotype identified with code SX94NO/0612 was selected for its superior agronomic characteristics and crossed again, using the same open pollination procedure, with a series of B. brizantha accessions and apomictic and sexual hybrids. A progeny clone, FM9503/S046/024, was selected visually in 1996, for its vigor, productivity, and leafiness. Progenies of this clone confirmed its apomictic reproduction, and results with molecular markers (microsatellites) showed that it has alleles that are present in the sexual mother B. ruziziensis, in B. decumbens cv. Basilisk, and in B. brizantha accessions, including cv. Marandu."
102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2023). Personal Communication	NA
103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2023). 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"	High
	Source(s)	Notes
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (Brachiaria hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	"Brachiaria hybrid cultivar (cv.) Mulato II (CIAT 36087) is the product of three generations of hybridization and selection initiated in 1989 by the Forage Project of the Centro Internacional de Agricultura Tropical (CIAT), in Cali, Colombia, from crosses between the sexual tetraploidized clone 44-6 of Brachiaria ruziziensis and the tetraploid apomictic B. decumbens cv. Basilisk." ... "Agronomic studies carried out at different locations showed that cv. Mulato II grows well from sea level to 1800 m.a.s.l. in humid tropic environments, and in sub-humid sites with 5 to 6 dry months and annual rainfalls above 700 mm."

Qsn #	Question	Answer
202	Quality of climate match data	Low
	Source(s)	Notes
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (Brachiaria hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	"Brachiaria hybrid cultivar (cv.) Mulato II (CIAT 36087) is the product of three generations of hybridization and selection initiated in 1989 by the Forage Project of the Centro Internacional de Agricultura Tropical (CIAT), in Cali, Colombia, from crosses between the sexual tetraploidized clone 44-6 of Brachiaria ruziziensis and the tetraploid apomictic B. decumbens cv. Basilisk."

203	Broad climate suitability (environmental versatility)	y
	Source(s)	Notes
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (Brachiaria hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	"Agronomic studies carried out at different locations showed that cv. Mulato II grows well from sea level to 1800 m.a.s.l. in humid tropic environments, and in sub-humid sites with 5 to 6 dry months and annual rainfalls above 700 mm. Also, good growth of the grass has been reported in subtropical environments such as in Canelones state (Uruguay) where periodic frosts occurs." [Broad elevation range in tropical climate ecosystems.]

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (Brachiaria hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	"Agronomic studies carried out at different locations showed that cv. Mulato II grows well from sea level to 1800 m.a.s.l. in humid tropic environments, and in sub-humid sites with 5 to 6 dry months and annual rainfalls above 700 mm. Also, good growth of the grass has been reported in subtropical environments such as in Canelones state (Uruguay) where periodic frosts occurs."

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	Cook, B.G. et al. (2020). Tropical Forages: An interactive selection tool. 2nd and Revised Edn. International Center for Tropical Agriculture (CIAT), Cali, Colombia and International Livestock Research Institute (ILRI), Nairobi, Kenya. www.tropicalforages.info	"'Mulato II' (CIAT 36087, Hispanosphere); 'Convert' (HD364, Brazil). Initially released in Colombia and Mexico in 2005, and subsequently in some 50 countries around the world."

301	Naturalized beyond native range	n
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	[Cited as a quarantine weed of Australia. Was not reported as naturalized at the time.] "Urochloa ruziziensis (R. Germ. & C. M. Evrard) Crins x Urochloa decumbens (Stapf) R.Webster x Urochloa brizantha (Horst. ex. Rich.) Webster Poaceae Total N° of Refs: 1 Global Risk Score: 1.04 Rating: Low Habit: Grass Major Pathway/s: Pasture Dispersed by: Humans References: Australia-Q-1134."

Qsn #	Question	Answer
	Gallaher, T.J., Brock, K., Kennedy, B.H., Imada, C.T., Imada, K., & Walvoord, N. (2023). Plants of Hawai'i. http://www.plantsofhawaii.org . [Accessed 23 Aug 2023]	No evidence to date

302	Garden/amenity/disturbance weed	
	Source(s)	Notes
	Cook, B.G. et al. (2020). Tropical Forages: An interactive selection tool. 2nd and Revised Edn. International Center for Tropical Agriculture (CIAT), Cali, Colombia and International Livestock Research Institute (ILRI), Nairobi, Kenya. www.tropicalforages.info	"Weed potential - Likely to be similar to <i>U. brizantha</i> , having potential to colonise disturbed areas."
	Pastures Australia. (2008). <i>Brachiaria</i> hybrid. https://keys.lucidcentral.org/keys/v3/pastures/Html/Brachiaria_hybrid.htm . [Accessed 23 Aug 2023]	[Potential disturbance weed] "Ability to spread. Moderate. Plants colonise surrounding ground by expanding tussocks and rooting down at nodes of flowering and non-flowering stems under wet conditions. Weed potential. No precedent in Australia. Likely similar to signal grass: low weed potential in undisturbed natural communities but possibly a weed of disturbed areas. Possibly a weed of certain grass field and seed crops and pastures due to seed longevity and plant persistence"

303	Agricultural/forestry/horticultural weed	
	Source(s)	Notes
	Pastures Australia. (2008). <i>Brachiaria</i> hybrid. https://keys.lucidcentral.org/keys/v3/pastures/Html/Brachiaria_hybrid.htm . [Accessed 23 Aug 2023]	[Possibly] "Weed potential. No precedent in Australia. Likely similar to signal grass: low weed potential in undisturbed natural communities but possibly a weed of disturbed areas. Possibly a weed of certain grass field and seed crops and pastures due to seed longevity and plant persistence."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	In Western Australia, in 2007 designated as a Quarantine Weed. Impacts unspecified. [Q - Quarantine Weed Species prohibited entry under a countries quarantine laws, either because it's not present or present and under a management program.]

304	Environmental weed	n
	Source(s)	Notes
	Pastures Australia. (2008). <i>Brachiaria</i> hybrid. https://keys.lucidcentral.org/keys/v3/pastures/Html/Brachiaria_hybrid.htm . [Accessed 23 Aug 2023]	"Weed potential. No precedent in Australia. Likely similar to signal grass: low weed potential in undisturbed natural communities but possibly a weed of disturbed areas. Possibly a weed of certain grass field and seed crops and pastures due to seed longevity and plant persistence."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	In Western Australia, in 2007 designated as a Quarantine Weed. Impacts unspecified. [Q - Quarantine Weed Species prohibited entry under a countries quarantine laws, either because it's not present or present and under a management program.]

305	Congeneric weed	y
	Source(s)	Notes

Qsn #	Question	Answer
	CABI. (2023). Invasive Species Compendium. Wallingford, UK: CAB International. https://www.cabidigitallibrary.org/product/qi . [Accessed 23 Aug 2023]	" <i>U. decumbens</i> is a weed and an aggressive invasive grass that rapidly colonizes principally disturbed habitats and forms dense stands in the understory of open forests, woodlands, lowlands, along waterways and on floodplains (Weeds of Australia, 2015; PIER, 2015). It is also a serious problem in soyabean and sugarcane crops (I3N-Brasil, 2015). In Australia (i.e., Queensland) it has been recently listed among the top 200 most invasive plants (Weeds of Australia, 2015). In Brazil, it is invading areas in the <u>cerrado</u> and the <u>caatinga</u> where it is forming dense stands and displacing native vegetation. It also invades annual and perennial crops and orchards reducing the production and generating control and removal costs (I3N-Brasil, 2015)."
	Weber, E. (2017). Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	" <i>Urochloa mutica</i> is a fast-growing grass associated with wet habitats. It has become invasive in a number of regions and forms dense covers along streams and other water bodies. Stems grow out on the water surface and build up floating rafts. Such mats may grow up to 1 m thick. Floating stems may become up to 6 m long (Langeland and Craddock Burks, 1998). The dense and monospecific stands of the weed choke out other plant species (Cowie and Werner, 1993). The grass is tolerant of brackish water and withstands periods of drought. It reproduces and spreads primarily vegetatively by stem fragments, which are carried by water. Viable seeds are rarely produced in Florida (Langeland and Craddock Burks, 1998)."
	Smith, C.W. (1985). Impact of Alien Plants on Hawaii's Native Biota. Pp. 180-250 in Stone & Scott (eds.). Hawaii's terrestrial ecosystems: preservation & management. CPSU, Honolulu, HI	[<i>Brachiaria mutica</i> = <i>Urochloa mutica</i>] "This perennial grass can reach heights of 2 m. It forms dense monotypic stands by layering from trailing stems. It will overgrow most shrubs and trees in its habitat. It has mild allelopathic activity (Chou and Young 1975). Man is the principal dispersal agent. Fire is rare in its habitat but the dense stands rapidly regenerate from any damage that they suffer. It has not been evaluated for biological control because it is a valued pasture grass in lowland areas."

401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (<i>Brachiaria</i> hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	[No evidence] "Mulato II is a perennial, tetraploid hybrid (2n=4x=36 chromosomes), with a semi-erect growth habit, reaching heights up to 1 m. Its stems are strong, cylindrical, and pubescent; some present semi-decumbent growth habit and are capable of rooting when they come into close contact with the soil, either because of the effect of animal trampling or because of mechanical compaction. In general, however, Mulato II is less decumbent and shorter than the comparable Mulato. For example, in the subhumid tropics of Costa Rica, average plant height 4 months after establishment was significantly greater (P < 0.05) in Mulato (73.5 cm) than in Mulato II (44.9 cm). Nevertheless, soil cover was similar for the two cultivars (CIAT, 2004). Similar results have been reported in the humid tropical conditions of Huimanguillo (State of Tabasco, Mexico) in grazed paddocks that have been fertilized with nitrogen and phosphorus (Guiot, 2005a) (Photo 1). The dark green leaves of Mulato II are linear-triangular (lanceolate) in shape and approximately 3.8 cm wide. Although both sides of the leaf blade present abundant pubescence, this pubescence is shorter and less dense than that observed in Mulato. Leaf sheath pubescence, however, is similar for both cultivars. The ligule is short and membranous."

402	Allelopathic	
	Source(s)	Notes

Qsn #	Question	Answer
	Barbosa, E. G., Pivello, V. R., & Meirelles, S. T. (2008). Allelopathic evidence in <i>Brachiaria decumbens</i> and its potential to invade the Brazilian cerrados. <i>Brazilian Archives of Biology and Technology</i> , 51, 625-631	[Documented in laboratory assays for one of the hybrid parent species] "Although the results here obtained came from a laboratory assay, they indicate the capacity of <i>B. decumbens</i> to release allelopathic substances to the environment. As in natural conditions, where a great number of interactions with the physical environment, as well as with other organisms, can enhance or restrain allelopathic effects, field experiments must be carried out to test the effectiveness of such allelopathic potential under natural conditions (Inderjit and Callaway, 2003). However, the great success of <i>B. decumbens</i> on invading cerrados could in part be due to allelopathy, as suggested in other parts of the world by authors who related allelopathy to biological invasions (Hierro and Callaway, 2003; Vivanco et al., 2004; Ridenour and Callaway, 2001; Vaughn and Berhow, 1999)."
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (<i>Brachiaria</i> hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	[Possibly No] "Table 6. Comparative characteristics of <i>Brachiaria</i> hybrids cvs. Mulato and Mulato II and cv. Marandu." [Compatibility with forage legumes = Good]

403	Parasitic	n
	Source(s)	Notes
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (<i>Brachiaria</i> hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	"Mulato II is a perennial, tetraploid hybrid (2n=4x=36 chromosomes), with a semi-erect growth habit, reaching heights up to 1 m." [Poaceae]

404	Unpalatable to grazing animals	n
	Source(s)	Notes
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (<i>Brachiaria</i> hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	"Forage quality of cv. Mulato II is high compared to other tropical grasses. Percentages of CP ranging from 8 to 16%, and in vitro dry matter digestibility from 55 to 66% for forage samples with 25 to 30 days of re-growth during the wet period have been reported. Animal (bovine) intake of the grass is high, which results in significantly greater milk production compared with other <i>Brachiaria</i> cultivars such as cvs. Toledo and Mulato. It is also possible to produce good quality hay from cv. Mulato II."
	Pastures Australia. (2008). <i>Brachiaria</i> hybrid. https://keys.lucidcentral.org/keys/v3/pastures/Html/Brachiaria_hybrid.htm . [Accessed 24 Aug 2023]	"Highly palatable to grazing ruminants. Maintains palatability into the dry season due to delayed flowering. Palatability to horses unknown."
	Cook, B.G. et al. (2020). <i>Tropical Forages: An interactive selection tool</i> . 2nd and Revised Edn. International Center for Tropical Agriculture (CIAT), Cali, Colombia and International Livestock Research Institute (ILRI), Nairobi, Kenya. www.tropicalforages.info	"Selected for tolerance of high soil aluminium, plant vigour, dry matter production and forage quality. Propagation by seed. Very leafy, good quality (CP and IVDMD)."

405	Toxic to animals	n
	Source(s)	Notes
	Pastures Australia. (2008). <i>Brachiaria</i> hybrid. https://keys.lucidcentral.org/keys/v3/pastures/Html/Brachiaria_hybrid.htm . [Accessed 24 Aug 2023]	"Livestock disorders/toxicity. None reported. However, as for other <i>Brachiaria</i> species, including parents of the hybrids, may cause skin photosensitisation in cattle, deer and sheep (rarely fed to sheep) if a large component of the diet, although this is rare in Australia. Rotation with other grasses is recommended if symptoms (swelling skin and raw sores) occur. Similarly, may cause a 'big-head' disease in horses unless calcium is supplemented or alternative feed is provided."

Qsn #	Question	Answer
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (Brachiaria hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	[No evidence] "Forage quality of cv. Mulato II is high compared to other tropical grasses."

406	Host for recognized pests and pathogens	n
	Source(s)	Notes
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (Brachiaria hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	"Both controlled greenhouse tests and field observations have demonstrated that Mulato II presents antibiotic resistance to the spittlebug species <i>Aeneolamia reducta</i> , <i>A. varia</i> , <i>Zulia carbonaria</i> , <i>Z. pubescens</i> , <i>Prosapia simulans</i> , and <i>Mahanarva trifissa</i> (CIAT, 2005). It has also showed in Brasil, through tests made by EPAMIG2 and UFV3 in Viçosa/MG, using the same methodology from CIAT, resistance to several species found, including <i>Deois flavopicta</i> , <i>D. schach</i> , and <i>Notozulia entreriana</i> (Franco, 2006). This type of resistance is one of the most desirable characteristics of Mulato II because spittlebugs are the most common and most damaging pests of Brachiaria species and other tropical forage species. Similarly, Mulato II has been observed to be moderately susceptible to damage by <i>Rhizoctonia solani</i> , a foliar fungus that causes significant damage to Mulato, particularly during those times of the year with high relative humidity and high temperatures (Argel et al., 2006)."
	Pastures Australia. (2008). Brachiaria hybrid. https://keys.lucidcentral.org/keys/v3/pastures/Html/Brachiaria_hybrid.htm . [Accessed 24 Aug 2023]	"Major pests. None to date in Australia. May be affected by pests which occasionally damage signal grass, particularly fertilised pastures or seed crops: turf leaf hoppers, pasture webworms, army worms and cane grubs. Major diseases. None to date in Australia."

407	Causes allergies or is otherwise toxic to humans	
	Source(s)	Notes
	WRA Specialist. (2023). Personal Communication	Unknown. No evidence of toxicity, but pollen could potentially be an allergen.

408	Creates a fire hazard in natural ecosystems	
	Source(s)	Notes
	Pastures Australia. (2008). Brachiaria hybrid. https://keys.lucidcentral.org/keys/v3/pastures/Html/Brachiaria_hybrid.htm . [Accessed 24 Aug 2023]	"Plants can regrow after fire." [Unknown if this grass will increase fire risk in dry regions or during periods of drought.]
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (Brachiaria hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	[Unknown. During periods of drought, flammability might increase] "An important characteristic of Mulato II is its tolerance to prolonged periods of drought (up to 6 months), as demonstrated by the results of agronomic studies conducted over a period of 4.5 years in the Eastern Plains of Colombia."

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	Notes
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (Brachiaria hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	"Other important characteristics of Mulato II are its tolerance to moderate shade, its superior growth along living fences and, although it does not tolerate permanent water logging, it does adapt better to areas with deficient or poor drainage than cv. Mulato or cv. Marandu."

Qsn #	Question	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	Pastures Australia. (2008). <i>Brachiaria</i> hybrid. https://keys.lucidcentral.org/keys/v3/pastures/Html/Brachiaria_hybrid.htm . [Accessed 24 Aug 2023]	"Grows well on free-draining soils including weathered tropical soils characterised by low pH (acid) and high aluminium (Al) saturation. Tolerant of infertile soils, particularly low-phosphorous soils. Will tolerate short-term flooding, but not prolonged water-logging."
	Cook, B.G. et al. (2020). Tropical Forages: An interactive selection tool. 2nd and Revised Edn. International Center for Tropical Agriculture (CIAT), Cali, Colombia and International Livestock Research Institute (ILRI), Nairobi, Kenya. www.tropicalforages.info	"Selected for tolerance of high soil aluminium, plant vigour, dry matter production and forage quality. Propagation by seed. Very leafy, good quality (CP and IVDMD). Best in well-drained soils; stands subject to over a week of waterlogged soil conditions may die."
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (<i>Brachiaria</i> hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	"This cultivar adapts well to poor, acid soils with high aluminum (Al) content, such as the Oxisols found in the Eastern Plains of Colombia, an area with dry periods lasting 3-4 months, where Mulato II has presented forage yields similar to those reported for <i>B. brizantha</i> (cv. Marandu) and <i>B. decumbens</i> (cv. Basilisk), and much higher than those of Mulato in conditions of both high and low soil fertilization (CIAT, 2004). The absorption of nutrients (N, P, K, Ca, Mg) by aerial parts was similar for cultivars Mulato II and Marandú and much higher than that observed for cv. Basilisk."

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (<i>Brachiaria</i> hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	"Mulato II is a perennial, tetraploid hybrid (2n=4x=36 chromosomes), with a semi-erect growth habit, reaching heights up to 1 m."

412	Forms dense thickets	y
	Source(s)	Notes
	Pastures Australia. (2008). <i>Brachiaria</i> hybrid. https://keys.lucidcentral.org/keys/v3/pastures/Html/Brachiaria_hybrid.htm . [Accessed 24 Aug 2023]	[Cab exclude other vegetation] "Dense growth means careful management needed to maintain companion legumes."

501	Aquatic	n
	Source(s)	Notes
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (<i>Brachiaria</i> hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	[Terrestrial] "Mulato II grows well from sea level to 1800 m.a.s.l. in humid tropic environments, and in sub-humid sites with 5 to 6 dry months and annual rainfalls above 700 mm."

502	Grass	y
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2023). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 24 Aug 2023]	"Genus: <i>Urochloa</i> Family: Poaceae (alt. Gramineae) Subfamily: Panicoideae Tribe: Paniceae Subtribe: Melinidineae"

Qsn #	Question	Answer
503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (Brachiaria hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	Poaceae
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (Brachiaria hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	"Mulato II is a perennial, tetraploid hybrid (2n=4x=36 chromosomes), with a semi-erect growth habit, reaching heights up to 1 m. Its stems are strong, cylindrical, and pubescent; some present semi-decumbent growth habit and are capable of rooting when they come into close contact with the soil, either because of the effect of animal trampling or because of mechanical compaction."
601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (Brachiaria hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	"Cultivar Mulato II is the result of three cycles of hybridization and screening carried out by CIAT's Tropical Forages Project."
602	Produces viable seed	y
	Source(s)	Notes
	Cook, B.G. et al. (2020). Tropical Forages: An interactive selection tool. 2nd and Revised Edn. International Center for Tropical Agriculture (CIAT), Cali, Colombia and International Livestock Research Institute (ILRI), Nairobi, Kenya. www.tropicalforages.info	"Propagation by seed."
	Pastures Australia. (2008). Brachiaria hybrid. https://keys.lucidcentral.org/keys/v3/pastures/Html/Brachiarahybrid.htm . [Accessed 24 Aug 2023]	"Seed production is lower than for signal grass. 'Mulato' produces lower header harvested seed yields (~100 kg/ha) than 'Mulato II' (over 250 kg/ha)."
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (Brachiaria hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	"The grass is readily established by seed, but vegetative propagation is also possible using rooted cuttings. Flowering is abundant and well synchronized with acceptable levels of caryopsis formation, which leads to relatively good seed yields that range from 150 to 420 kg/ha of good quality pure seed. Seed yield is related to production site, crop age, management and harvest method."
603	Hybridizes naturally	
	Source(s)	Notes
	WRA Specialist. (2023). Personal Communication	Unknown if capable of backcrossing with parent species.
604	Self-compatible or apomictic	y

Qsn #	Question	Answer
	Source(s)	Notes
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (Brachiaria hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	"Cultivar Mulato II is a semi-erect tetraploid (2n=4x=36 chromosomes), perennial apomictic grass."

605	Requires specialist pollinators	n
	Source(s)	Notes
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (Brachiaria hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	"Cultivar Mulato II is a semi-erect tetraploid (2n=4x=36 chromosomes), perennial apomictic grass."

606	Reproduction by vegetative fragmentation	y
	Source(s)	Notes
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (Brachiaria hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	"Its stems are strong, cylindrical, and pubescent; some present semi-decumbent growth habit and are capable of rooting when they come into close contact with the soil, either because of the effect of animal trampling or because of mechanical compaction." ... "The grass can also be established using vegetative material, but in this case it is recommended to select rooted stock to improve establishment success. Vegetative planting is usually more expensive than sowing botanical seed, although this depends on the local cost of labor and the price of commercial seed."
	Pastures Australia. (2008). Brachiaria hybrid. https://keys.lucidcentral.org/keys/v3/pastures/Html/Brachiaria_hybrid.htm . [Accessed 24 Aug 2023]	"Plants colonise surrounding ground by expanding tussocks and rooting down at nodes of flowering and non-flowering stems under wet conditions."

607	Minimum generative time (years)	1
	Source(s)	Notes
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (Brachiaria hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	[A perennial capable of producing seed in the first growing season] "Mulato II is readily established by seed, and the emerging seedlings present vigorous growth. Pastures can be ready for grazing between 90 and 120 days after planting, with over 80% cover." ... "Mulato II produces numerous panicles with good synchronization of flowering and acceptable seed fill (caryopsis formation), which results in its seed yields being higher than those of Mulato (CIAT, 2007). Table 1 presents the results of evaluations of Mulato II, 1 year after establishment, in Atenas, Costa Rica. The date of closing cut had a significant effect (P < 0.05) on seed yield, plant height at harvest, and panicle size. At this site, where rains start in May, the July cut produced the highest yields (330 kg seed/ha) as compared with the first cut in June (179 kg/ha). Although the date of cut did not affect seed purity or seed weight, the latest cut (July) delayed the initiation of flowering by 10 days, to 17 October, whereas the pastures cut in June flowered by 7 October. Seed harvest was performed manually on 1 November for the first uniformity cut and on 7 November for the second."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
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Qsn #	Question	Answer
	Source(s)	Notes
	Queensland Government. (2022). Weeds of Australia. <i>Urochloa decumbens</i> . https://keyserver.lucidcentral.org/weeds . [Accessed 24 Aug 2023]	"The seeds may be dispersed by water and animals, and in contaminated agricultural produce (e.g. pasture seeds)." [May share similar dispersal vectors as one of the parent species. Possibly, but not identified as an important vector]
	WRA Specialist. (2023). Personal Communication	Seeds are small and lack means of external attachment, but could adhere to vehicles, equipment or footwear in soil. However, this has not been documented as a dispersal vector to date.

702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	Cook, B.G. et al. (2020). Tropical Forages: An interactive selection tool. 2nd and Revised Edn. International Center for Tropical Agriculture (CIAT), Cali, Colombia and International Livestock Research Institute (ILRI), Nairobi, Kenya. www.tropicalforages.info	"'Mulato II' (CIAT 36087, Hispanosphere); 'Convert' (HD364, Brazil). Initially released in Colombia and Mexico in 2005, and subsequently in some 50 countries around the world."

703	Propagules likely to disperse as a produce contaminant	
	Source(s)	Notes
	Pastures Australia. (2008). <i>Brachiaria</i> hybrid. https://keys.lucidcentral.org/keys/v3/pastures/Html/Brachiaria_hybrid.htm . [Accessed 24 Aug 2023]	"Possibly a weed of certain grass field and seed crops and pastures due to seed longevity and plant persistence." [Possibly if mixed in with other desirable forage crops]

704	Propagules adapted to wind dispersal	n
	Source(s)	Notes
	Queensland Government. (2022). Weeds of Australia. <i>Urochloa decumbens</i> . https://keyserver.lucidcentral.org/weeds . [Accessed 24 Aug 2023]	[Hybrid likely shares dispersal vectors similar to one of its parent species] "The seeds may be dispersed by water and animals, and in contaminated agricultural produce (e.g. pasture seeds)."

705	Propagules water dispersed	
	Source(s)	Notes
	Queensland Government. (2022). Weeds of Australia. <i>Urochloa decumbens</i> . https://keyserver.lucidcentral.org/weeds . [Accessed 24 Aug 2023]	[Hybrid likely shares dispersal vectors of one of its parent species] "The seeds may be dispersed by water and animals, and in contaminated agricultural produce (e.g. pasture seeds)."

706	Propagules bird dispersed	
	Source(s)	Notes
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (<i>Brachiaria</i> hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	[Birds act as seed predators, but may disperse viable seeds] "Broadcast planting requires higher seeding rates because many seeds are left in the open and are easily attacked by predators such as birds or ants, or simply do not have the moisture conditions required for germination."

707	Propagules dispersed by other animals (externally)	
	Source(s)	Notes

Qsn #	Question	Answer
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (Brachiaria hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	[Ants likely act as seed predators but may externally carry and disperse viable seeds] "Broadcast planting requires higher seeding rates because many seeds are left in the open and are easily attacked by predators such as birds or ants, or simply do not have the moisture conditions required for germination."

708	Propagules survive passage through the gut	
	Source(s)	Notes
	Gardener, C.J., McIvor, J.G. & Jansen, A. (1993). Survival of Seeds of Tropical Grassland Species Subjected to Bovine Digestion. <i>Journal of Applied Ecology</i> 30(1): 75-85	[Possibly. Seeds of one parent species survive gut passage] "The perennial grasses with seed which survived digestion (i.e. <i>Brachiaria decumbens</i> , <i>Cynodon dactylon</i> , <i>Axonopus affinis</i> , <i>Paspalum notatum</i> and <i>Pennisetum clandestinum</i>) have similar characteristics. All are creeping rhizomatous or stoloniferous species better adapted to more humid conditions, and all form short dense swards or lawns under heavy grazing or mowing. In the first four species, the seed heads are carried on short stalks above the sward, making it difficult for cattle to reject the seed when grazing the foliage. Similarly, fallen seed tends to lodge in foliage and be eaten later."

801	Prolific seed production (>1000/m2)	y
	Source(s)	Notes
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (Brachiaria hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	"Mulato II produces numerous panicles with good synchronization of flowering and acceptable seed fill (caryopsis formation), which results in its seed yields being higher than those of Mulato (CIAT, 2007). Table 1 presents the results of evaluations of Mulato II, 1 year after establishment, in Atenas, Costa Rica. The date of closing cut had a significant effect ($P < 0.05$) on seed yield, plant height at harvest, and panicle size. At this site, where rains start in May, the July cut produced the highest yields (330 kg seed/ha) as compared with the first cut in June (179 kg/ha). Although the date of cut did not affect seed purity or seed weight, the latest cut (July) delayed the initiation of flowering by 10 days, to 17 October, whereas the pastures cut in June flowered by 7 October. Seed harvest was performed manually on 1 November for the first uniformity cut and on 7 November for the second."

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	Notes
	Pastures Australia. (2008). Brachiaria hybrid. https://keys.lucidcentral.org/keys/v3/pastures/Html/Brachia_ria_hybrid.htm . [Accessed 24 Aug 2023]	[Unknown if seeds remain viable for >1 year] "Seed can have high dormancy levels due to either fresh dormancy or husk-induced dormancy. Seed should be at least 3 months old and may need to be scarified to increase establishment rate."
	Cook, B.G. et al. (2020). Tropical Forages: An interactive selection tool. 2nd and Revised Edn. International Center for Tropical Agriculture (CIAT), Cali, Colombia and International Livestock Research Institute (ILRI), Nairobi, Kenya. www.tropicalforages.info	[Unknown if seeds remain viable for >1 year] "The hybrid cultivars can be established from seed sown into a well-prepared seedbed at 4-6 (-10) kg/ha seed. In common with the parent species, freshly harvested seed remains dormant for several months and must be stored for at least that period or acid scarified prior to planting."

Qsn #	Question	Answer
803	Well controlled by herbicides	y
	Source(s)	Notes
	Pastures Australia. (2008). <i>Brachiaria</i> hybrid. https://keys.lucidcentral.org/keys/v3/pastures/Html/Brachiar_hybrid.htm . [Accessed 24 Aug 2023]	"Herbicide susceptibility - Selective control of grasses: tolerant of atrazine used pre- or early-post emergence. Intolerant of most other grass-controlling herbicides. Control of broadleaved weeds: tolerant of 'hormone' herbicides such as 2,4-D, picloram+2,4-D and dicamba."

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	Notes
	Pastures Australia. (2008). <i>Brachiaria</i> hybrid. https://keys.lucidcentral.org/keys/v3/pastures/Html/Brachiar_hybrid.htm . [Accessed 24 Aug 2023]	"Very tolerant of cutting and grazing by cattle once established and can be grazed at high stocking rates suitable for dairy and beef finishing in the humid tropics and sub-tropics. Plants can regrow after fire."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	Argel, M., Pedro, J., Miles, J. W., Guiot García, J. D., Cuadrado Capella, H., & Lascano, C. E. (2007). Cultivar Mulato II (<i>Brachiaria</i> hybrid CIAT 36087): A high-quality forage grass, resistant to spittlebugs and adapted to well-drained, acid tropical soils. CIAT, Cali, Colombia	[Unknown. May be tolerant of two-lined spittlebug (<i>Prosapia bicincta</i>) present in Hawaii] "Both controlled greenhouse tests and field observations have demonstrated that Mulato II presents antibiotic resistance ¹ to the spittlebug species <i>Aeneolamia reducta</i> , <i>A. varia</i> , <i>Zulia carbonaria</i> , <i>Z. pubescens</i> , <i>Prosapia simulans</i> , and <i>Mahanarva trifissa</i> (CIAT, 2005)."

Summary of Risk Traits:

The hybrid cultivar (cv.) Mulato II is the product of three generations of hybridization and selection initially released in Colombia and Mexico in 2005, and subsequently in some 50 countries around the world as a forage grass resistant to spittle bugs. Although no reports of naturalization or invasiveness have been documented to date, its ability to produce seed through apomixis, tolerance of shade, grazing and fire, and its ability to spread both by seed and vegetatively, suggest it is likely to spread and could become weedy under certain conditions.

High Risk / Undesirable Traits

- Broad elevation range and climate suitability in tropical regions
- Thrives and could spread in regions with tropical climates
- Other *Urochloa* (*Brachiaria*) species are invasive weeds
- Shade tolerant
- Tolerates many soil types (unlikely to be substrate limited)
- Capable of forming dense cover that may compete with and exclude other desirable vegetation.
- Reproduces by seeds and vegetatively by rooting at nodes of flowering and non-flowering stems.
- Apomictic (capable of asexual reproduction by seed without fertilization).
- Reaches maturity in <1 growing season
- Seeds likely dispersed by gravity, water, and through intentional cultivation, and possibly unintentionally through movement of equipment, soil and crop contamination.
- Potentially prolific seed production.
- Tolerates grazing, cutting and fire

Low Risk Traits

- Valued as a palatable pasture species, with no current reports of negative impacts or invasiveness documented worldwide.
- Unarmed (no spines, thorns, or burrs)
- Palatable to grazing animals.
- Non-toxic
- Herbicides may provide effective control
- Resistant to spittle bugs and possibly tolerant of two-lined spittle bug currently impacting pasture grasses in the Hawaiian Islands.

TAXON: *Urochloa ruzizensis* x *U. decumbens* x *U. brizantha*

SCORE: 9.0

RATING: *High Risk*