Minnesota Noxious Weed Risk Assessment

Developed by the Minnesota Noxious Weed Advisory Committee

Assessment information

Common name: Amur Silvergrass, Silver Banner Grass, Siler Plume Grass, Japanese Plume Grass, Ogi (Japan) and Chinese Silver Grass

Scientific name: *Miscanthus sacchariflorus* (Maxim.) Franch.

Family name: Poaceae/Gramineae

Current reviewer name and organizational affiliation: Monika Chandler, Minnesota Department of Agriculture
Date of current review: 07/05/2022
Previous reviewer name and organizational affiliation: James Calkins, Minnesota Nursery Landscape Association
Date of previous review: 09/12/2012

Species description

Photo

Photo caption: *Miscanthus sacchariflorus* on a roadside in Goodhue County. Proto credit: Minnesota Department of Agriculture

Photo caption: *Miscanthus sacchariflorus* has showy flowerheads. Photo credit: Minnesota Department of Agriculture

Why the plant is being assessed

- The assessment dated 09/12/2012 states few, if any cold-hardy seed is produced in the Upper Midwest. In recent years, seed production has been documented and infestations likely from seed have been documented. Reproduction by seed impacts the invasive potential of this plant.
- There have been many infestations documented in the upper Midwest since the previous assessment indicating that the species is problematic.

Identification, biology, and life cycle

- *Miscanthus sacchariflorus* is a perennial, warm-season, rhizomatous grass.
- An attractive ornamental grass with green leaves that turn reddish orange in the fall and showy flowerheads (panicles), *M. sacchariflorus* was planted at many locations in southern Minnesota.
- This grass grows to heights of 6-8 feet tall.
- It is native to northeastern China, Korea, Japan and Russia (Hager et al. 2014). It is hardy to USDA Cold Hardiness Zone 4 (MDA 2022). Accessions from Siberia are hardy to the equivalent USDA Cold Hardiness Zone 3 (Pignon et al. 2019)
- Similar species also grown in Minnesota include *M. sinensis* and *Miscanthus* x *giganteus*, a hybrid of *M. sinensis* and *M. sacchariflorus*.
- Additional information can be found at the University of Minnesota website Miscanthus: Ornamental and Invasive Grass (University of Minnesota 2022).

Current distribution

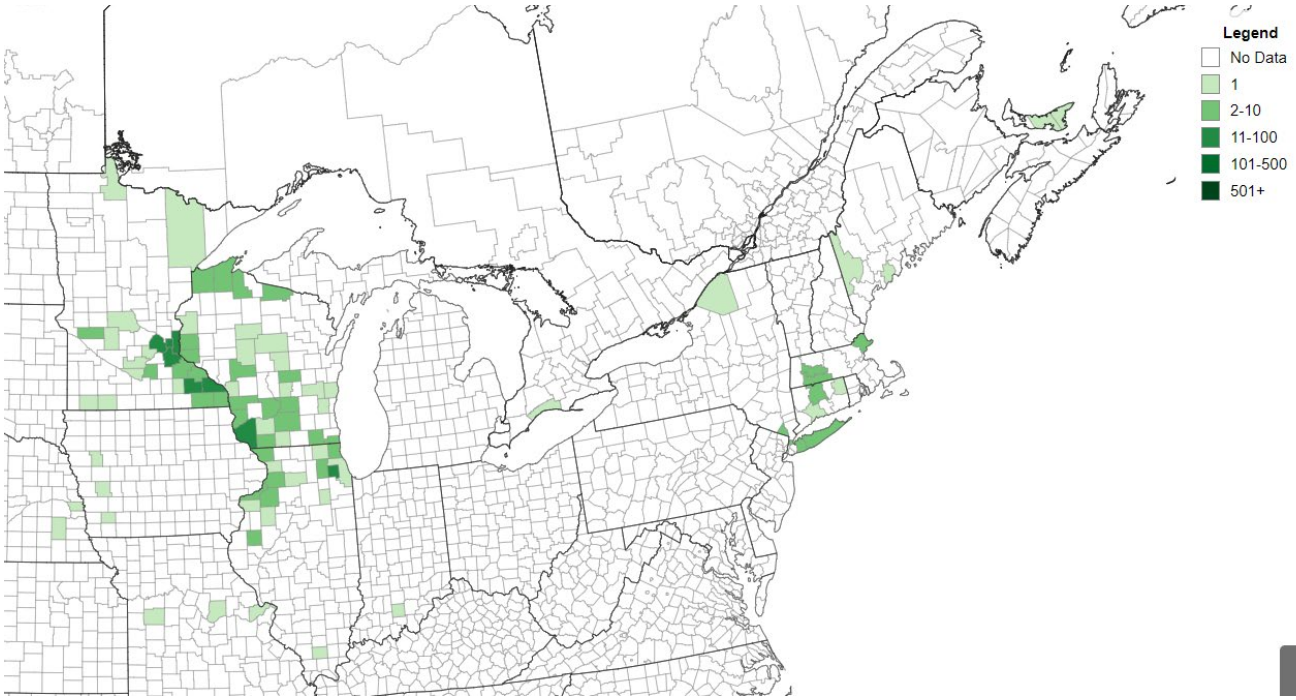

Figure caption: National level map from EDDMapS on 07/05/2022 that shows the density of records.

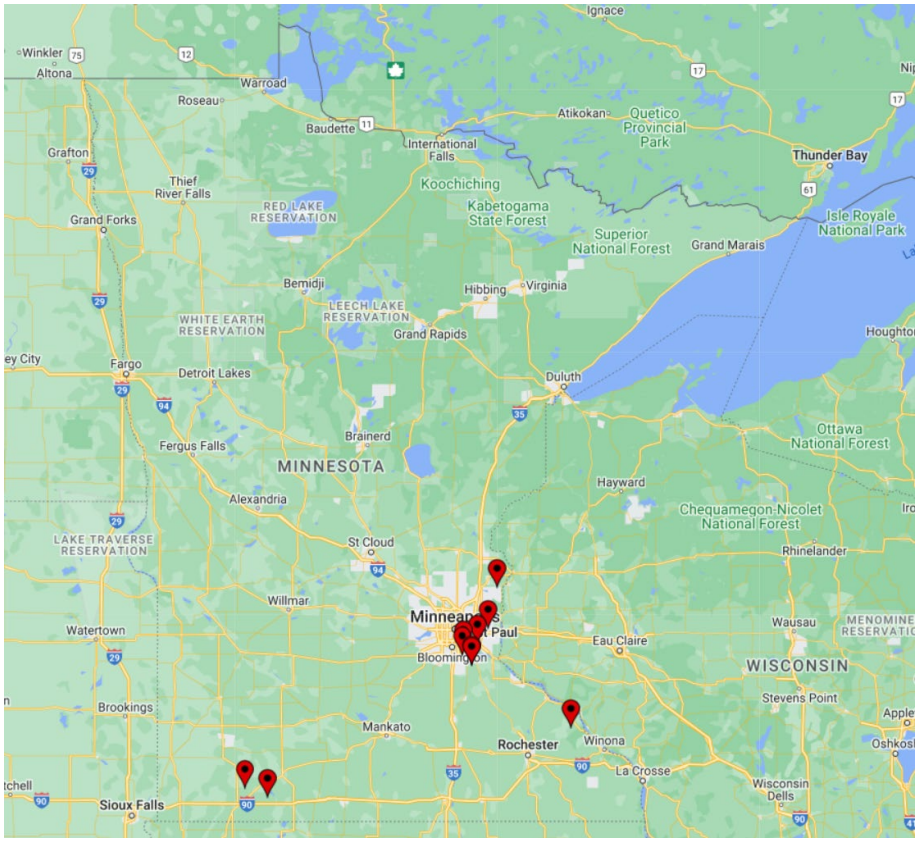

Figure caption: State level map from EDDMapS on 07/05/2022

Current regulation

This species is not regulated in Minnesota and is not federally regulated.

Risk assessment

Box 1:

Is the plant species or genotype non-native?

Answer: Yes
Outcome: Go to Box 3
Miscanthus sacchariflorus is native to northeastern China, Korea, Japan and Russia (Hager et al. 2014).

Box 2:

Does the species pose significant human or livestock concerns or have the potential to significantly harm agricultural production?

Question 2A: Does the plant have toxic qualities that pose a significant risk to livestock, wildlife, or people?
Outcome: Decision tree does not direct to this question.

Question 2B: Does the plant cause significant financial losses associated with decreased yields, reduced quality, or increased production costs?
Outcome: Decision tree does not direct to this question.

Box 3:

Is the species, or a related species, documented as being a problem elsewhere?

Answer: Yes
Outcome: Go to Box 6
The species is regulated as a Prohibited Plant in Massachusetts and as Restricted in Wisconsin with an exception for all cultivars.

Box 4:

Are the species' life history and growth requirements understood?

Answer: Yes. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***
Miscanthus sacchariflorus has been studied in its native range by numerous researchers. It has been used in the United States, Canada, and Europe for decades as an ornamental plant (Hagar et al. 2014). Information about growing the species is readily available on the internet.

Box 5:

Gather and evaluate further information

Outcome: Decision tree does not direct to this question.

Box 6:

Does the species have the capacity to establish and survive in Minnesota?

Question 6A: Is the plant, or a close relative, currently established in Minnesota?

Answer: Yes

Outcome: Go to Box 7

Populations are documented from southern to northern Minnesota (EDDMapS 2022).

Question 6B: Has the plant become established in areas having a climate and growing conditions similar to those found in Minnesota?

Outcome: Decision tree does not direct to this question.

Question 6C: Has the plant become established in areas having a climate and growing conditions similar to those projected to be present in Minnesota under future climate projections?

Answer: Yes

Answer text here: ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***

Models in EDDMapS 2022 predict this species would expand its distribution.

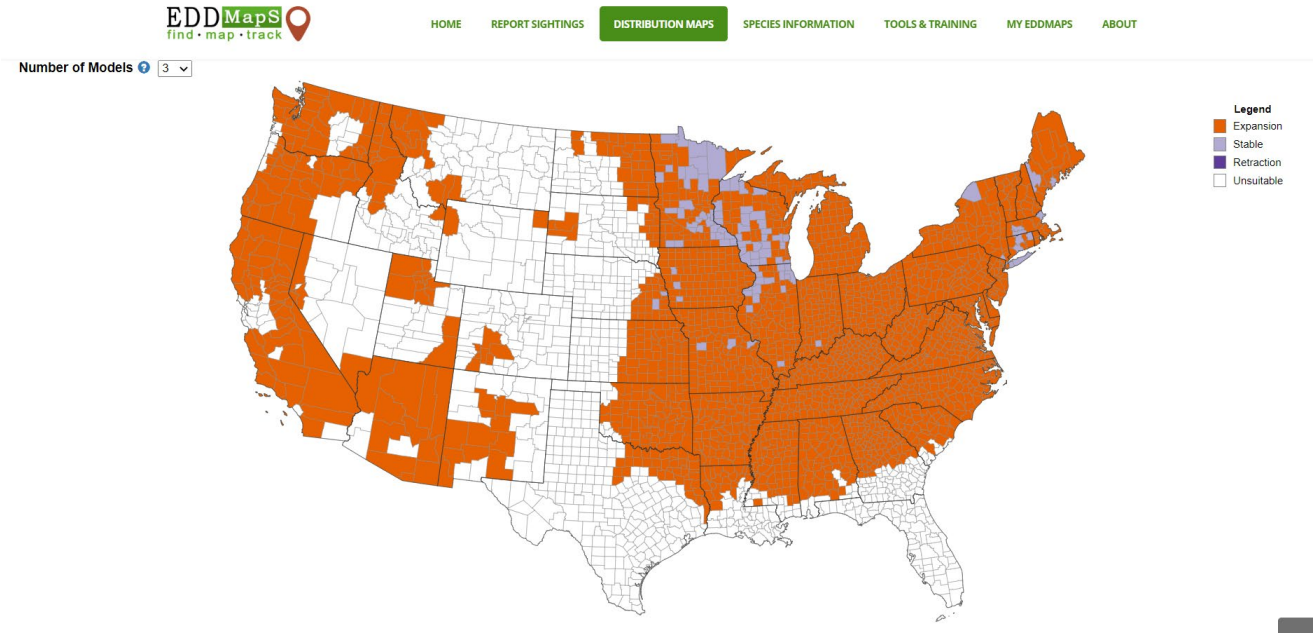

Figure caption: Models in EDDMapS predict that much of the United States, including all of Minnesota, will provide suitable climate for *Miscanthus sacchariflorus*. EDDMapS, 06/24/2022.

Box 7:

Does the species have the potential to reproduce and spread in Minnesota?

Question 7A: Are there cultivars of the plant that are known to differ in reproductive properties from the species?

Answer: Unknown

Outcome: Go to Question 7B and follow the questions and also answer Question 7J (yes) or Question 7B (no)

The author did not find studies about *M. sacchariflorus* cultivars. The cultivars 'Gotemba Gold' and 'Robustus' were listed on the University of Minnesota's Plant Information Online Database.

Accessions were recently collected from Siberia as far north as 49.3° N which is more northernly than Minnesota (Clark et al. 2016). These accessions are diploid and genetically diverse (Clark et al. 2016) so may be more likely to outcross and produce seed in Minnesota. It is expected that these accessions will be used for breeding hardier *M.* x *giganteus* for biofuel (Clark et al. 2016).

Question 7B: Does the plant reproduce by asexual/vegetative means?

Answer: Yes
Outcome: Go to Question 7C
Reproduction is primarily by rhizomes and 95% of the rhizome buds are in the top 10 cm of the soil layer and the maximum depth for most rhizomes is 15 cm (Deng et al. 2013). Larger buds in the 0-10 cm layer sprouted at the highest ratio (sprouted buds to total buds) followed by small buds in the 0-10 cm layer and large buds in the 10 to 20 cm layer followed by small buds in the 10 to 20 cm layer (Deng et al. 2013).

Question 7C: Are the asexual propagules - vegetative parts having the capacity to develop into new plants - effectively dispersed to new areas?

Answer: Yes
Outcome: Go to Question 7I
Rhizomes fragments transported to new locations can start new infestations (Deng et al. 2013). They can move along waterways (Deng et al. 2013).

Question 7D: Does the plant produce large amounts of viable, cold hardy seeds? For woody species, document the average age the species produces viable seed.

Answer: Yes. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***
Miscanthus sacchariflorus seed production was measured in a study by Meyer and Tchida 1999. At least three panicles were collected from each taxon per year. The seed was bulked for each location and year. Here is an excerpt of their findings for populations in USDA Hardiness Zones 4 and 5. This demonstrated significant seed production in Zone 5.

Zone 4

Year	# Seed Produced	% Germination
1996	0	NA
1997	9	17

Zone 5

Year	# Seed Produced	% Germination
1996	14	64
1997	270	48

Mutegi et al. (2016) studied seed production in Iowa and Minnesota in 2013. The average number of seeds per panicle ranged from zero to a maximum of 0.30 at an Iowa location and 0.27 at a location in Ramsey County in Minnesota (Zone 4b). Most populations produced seed. Their study also measured genetic structure within and between populations. They documented multilocus genotypes in all populations demonstrating that populations are not clonal. Because many of the multilocus genotypes differed by only one locus, the authors

concluded that the diversity is likely due to somatic mutation rather than reproduction by seed. The authors suggested that mutation may lead to cross-compatible individuals capable of more abundant seed production and dispersal. Dr. Mary Hockenberry Meyer suggested that *M. sacchariflorus* along Hwy 7 west of the Twin Cities appeared to be established from seed (Miscanthus in Iowa and Minnesota).

Nishiwaki et al. (2011) documented seed set ranging from 0 – 54% in *M. sacchariflorus* populations in 2008 in southern Japan. The population with the highest seed set was a triploid *M. sacchariflorus* that the authors suggested may have resulted from hybridization between 4x *M. sacchariflorus* and 2x *M. sinensis*.

Miscanthus sacchariflorus has the potential to hybridize with *M. sinensis*. Resulting hybrids may be able to produce abundant seed.

Question 7E: For species that produce low numbers of viable seeds, do they have a high level of seed/seedling vigor or remain viable for an extended period (seed bank)?

Outcome: Decision tree does not direct to this question.

Question 7F: Is the plant self-fertile?

Answer: No. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***

All Miscanthus taxa are self-incompatible (Bonin et al 2014).

Question 7G: Are sexual propagules – viable seeds – effectively dispersed to new areas? List and consider all vectors.

Answer: Yes. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***

Seeds are wind dispersed by wind (Clark et al. 2019).

Question 7H: Can the species hybridize with native species (or other introduced species) and produce viable seed and fertile offspring in the absence of human intervention?

Answer: Yes. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***

Miscanthus sacchariflorus and *M. sinensis* are the parents of *M*. x *giganteus*. Hybridization of *M. sinesis* and *M. sacchariflorus* has been documented in Japan and Korea (Niskiwaki et al. 2011 and Clark et al. 2019). A new species, *M. wangpicheonensis*, is assumed to have originated from hybridization between *M. sacchariflorus* and *M. longiberbis* (Heo et al. 2021).

Question 7I: Do natural controls, species native to Minnesota, which have been documented to effectively prevent the spread of the species in question?

Answer: No

Outcome: Go to Box 8

No natural controls are documented.

Question 7J: Was the answer to Question 7A (Are there cultivars that differ in reproductive properties from the original species) "Yes"?

Answer: ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***

Outcome: Document those cultivars and differences here (yes) or continue with risk assessment (no)
The author could not find documented differences in reproductive properties of cultivars.
The author did not find studies about M. sacchariflorus cultivars. The cultivars 'Gotemba Gold' and 'Robustus' were listed on the University of Minnesota's Plant Information Online Database (2022), but no data was found indicating that they differ in reproductive properties from the original species.

Box 8:

Does the species pose significant human or livestock concerns or have the potential to significantly harm agricultural production, native ecosystems, or managed landscapes?

Question 8A: Does the plant have toxic qualities, or other detrimental qualities, that pose a significant risk to livestock, wildlife, or people?

Answer: No
Outcome: Question 8B
Livestock graze on *M. sacchariflorus* in Asia (Clark et al. 2016 refer to Maximowicz, CJ. 1859. P*rimitiae Florae Amurensis*).

Question 8B: Does, or could, the plant cause significant financial losses associated with decreased yields, reduced crop quality, or increased production costs?

Answer: No
Outcome: Go to Question 8C
Miscanthus sacchariflorus does not impact crop production and forestry. Livestock could utilize the forage if it spread into pastures.

Question 8C: Can the plant aggressively displace native species through competition (including allelopathic effects)?

Answer: Yes
Outcome: Go to Box 9
Patches of *M. sacchariflorus* can spread rapidly along roadsides and waterways (Bonin et al. 2014) then into other open, sunny areas. It mostly invades grassland and disturbed habitats (Schnitzler and Essl 2015). It has the potential to overtake natural and managed landscapes (Bonin et al. 2014). Hager et al. 2015 documented decreased plant species abundance, richness and diversity in invaded compared to uninvaded plots with 38% of plots containing only *M. sacchariflorus*.

Question 8D: Can the plant hybridize with native species resulting in a modified gene pool and potentially negative impacts on native populations?

Outcome: Decision tree does not direct to this question.

Question 8E: Does the plant have the potential to change native ecosystems (adds a vegetative layer, affects ground or surface water levels, etc.)?

Outcome: Decision tree does not direct to this question.

Question 8F: Does the plant have the potential to introduce or harbor another pest or serve as an alternate host?

Outcome: Decision tree does not direct to this question.

Box 9:

Does the species have clearly defined benefits that outweigh associated negative impacts?

Question 9A: Is the plant currently being used or produced and/or sold in Minnesota or native to Minnesota?

Answer: Yes
Outcome: Go to Question 9B
The author could find online sales but did not find large nurseries in Minnesota selling *M. sacchariflorus*. Jim Calkins, Minnesota Nursery Landscape Association Regulatory Affairs Manager, said that he believed there are no growers producing *M. sacchariflorus* in Minnesota (Calkins, personal communication).

Question 9B: Is the plant an introduced species and can its spread be effectively and easily prevented or controlled, or its negative impacts minimized, through carefully designed and executed management practices?

Answer: No
Outcome: Question 9C
Distribution is not well documented because many occurrences are plantings on private, often residential, property. Some of these plantings are spreading.

Question 9C: Is the plant native to Minnesota?

Answer: No
Outcome: Go to Question 9D
Miscanthus sacchariflorus is native to northeastern China, Korea, Japan and Russia (Hager et al. 2014).

Question 9D: Is a non-invasive, alternative plant material or cultivar commercially available that could serve the same purpose as the plant of concern?

Answer: Yes
Outcome: Go to Box 10
From previous assessment: Yes; prairie cordgrass (*Spartina pectinate*) in wet areas and other native grasses might be considered suitable alternatives. Native grass alternatives include big bluestem (*Andropogon gerardii*), switchgrass (*Panicum virgatum*), Indiangrass (*Sorghastrum nutans*), and bluejoint (*Calamagrostis candensis*) (Minnesota Department of Natural Resources 2022).

Question 9E: Does the plant benefit Minnesota to a greater extent than the negative impacts identified at Box #8?

Outcome: Decision tree does not direct to this question.

Box 10:

Should the species be regulated as Prohibited/Eradicate, Prohibited/Control, or Restricted Noxious Weed?

Question 10A: Is the plant currently established in Minnesota?

Answer: Yes

Outcome: Go to Question 10D
Yes, it has been documented in at least 19 counties in Minnesota (EDDMapS 2022).

Question 10B: Would prohibiting this species in trade prevent the likelihood of introduction and/or establishment?

Outcome: Decision tree does not direct to this question.

Question 10C: Does this risk assessment support this species being a top priority for statewide eradication if found in the state?

Outcome: Decision tree does not direct to this question.

Question 10D: Does the plant pose a serious human health threat?

Answer: No
Outcome: Go to Question 10F
Miscanthus sacchariflorus is not toxic and does not have harmful armor such as thorns. *Miscanthus* species pollen can trigger allergic reactions as has been documented in Asia (Watanabe et al. 1999 and Hong 2015). However, the author did not find any documentation of Miscanthus pollen as an allergen in the US.

Question 10E: Is the health threat posed by the plant serious enough, and is the plant distribution sufficiently small enough to be manageable, and are management tools available and effective enough to justify listing as Prohibited / Eradicate species?

Outcome: Decision tree does not direct to this question.

Question 10F: Is the plant known to cause significant ecological or economic harm and can the plant be reliably <u>eradicated</u> (entire plant) on a statewide basis using existing practices and available resources considering the distribution, reproductive biology and potential for spread?

- *For distribution, note if the distribution is well documented, the number and acreage of known infestations and how widespread they are in the state. Note if there are infestations in border areas.*
- *For reproductive biology, note if there are reproductive biology factor that make the plant easier to control and eradication more likely (for example, long pre-reproductive period, self-incompatible pollination, short-lived seed bank).*
- *For potential for spread and re-invasion of controlled areas, note its potential to spread beyond places where it is being controlled such as deliberate planting by people, wildlife vectors, re-infestation from border states, or other factors that facilitate spread.*
- *For known management tools, note what management tools are available, potential non-target impacts, and the reasonableness of state management or mandating that landowners throughout the state use the management tools to eradicate or control existing plants.*
- *For available resources, consider the capacity of state and local personnel and availability of funding to respond to new and existing infestations.*

Answer: No
Outcome: Go to Question 10G
Distribution is not well documented because many occurrences are plantings on private, often residential property. It would be untenable to require these property owners to control a species that has not been well documented to cause widespread harm in regions as cold as Minnesota.

Question 10G: Is the plant known to cause significant ecological or economic harm and can the plant be reliably controlled to limit spread on a statewide basis using existing practices and available resources? Would the economic impacts or other hardships incurred in implementing control measures be reasonable considering any ongoing or potential future increase of ecological or economic harm?

- *Also consider all bullet points listed under 10F when evaluating 10G*

Answer: No
Outcome: Go to Question 10H
See 10F

Question 10H: Would prohibiting this species in trade have any significant or measurable impact to limit or reduce the existing populations or future spread of the species in Minnesota?
Answer: Yes
Outcome: LIST THE PLANT AS A RESTRICTED NOXIOUS WEED
Preventing the planting of additional populations and new, more cold-hardy accessions would help to limit future spread. There would be fewer populations for outcrossing therefore less seed production. Limiting seed production would reduce dispersal.

Because the plant is not sold by nurseries in Minnesota, there is no need for a phase out.

Question 10I: Are there any other measures that could be put in place as Special Regulations which could mitigate the impact of the species within Minnesota?
Outcome: Decision tree does not direct to this question.

Box 11:

The species is being proposed to be designated as a Specially Regulated Plant. What are the specific regulations proposed?
Answer: Decision tree does not direct to this question.

Final outcomes of risk assessment (2022)

NWAC Listing Subcommittee

Outcome: Recommend listing as a Restricted Noxious Weed (06/17/2022)
Comments: The most important change from the previous assessment is that low levels of seed production has been documented in Minnesota and Iowa. This is not an important plant to industry.

NWAC Full Committee

Outcome: Recommendation to list as a Restricted Noxious Weed passed (12/13/2022)

Comments: The vote was 16 in favor and 2 against.

MDA Commissioner

Outcome: List as Restricted Noxious Weed
Comments: No comments

Risk Assessment Current Summary (06-23-2022)

- *Miscanthus sacchariflorus* populations were documented producing low levels of seed in Minnesota and Iowa. Therefore, the species can now escape cultivation by seed in addition to rhizomes.
- There is genetic variation within Minnesota and Iowa *M. sacchariflorus* populations. The theory is this variation is a result of somatic mutation. As populations become more varied, there is more opportunity for outcrossing. Since M. sacchariflorus must outcross, this may result in increased seed production.
- *Miscanthus sacchariflorus* is not an important crop to the nursery industry. Therefore, there is no need for a phase out from production.
- Not planting additional populations would restrict the opportunity for outcrossing to the current populations.
- The subcommittee agreed without concerns about recommending regulation as a Restricted Noxious Weed.

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Appendix

Which Miscanthus is escaping cultivation? This is a storymap that helped iNaturalist reporters to determine the Miscanthus species they reported.