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Natural Resources Conservation Service
Rose Lake Plant Materials Center
2013 Technical Report

East Lansing, Michigan

USDA-NRCS Rose Lake Plant Materials Center
7472 Stoll Road
East Lansing, MI 48823

http://plant-materials.nrcs.usda.gov/mipmc/
Center Phone: 517-641-6300
Center Fax: 855-701-4363

Cover Photo: Rose Lake Plant Materials Center Staff (L to R: John Durling, Elaine Gerona, John Leif, Sergio Pérez) in front of The Michigan Agriculture Environmental Assurance Program (MAEAP) sign. Rose Lake Plant Materials Center was MAEAP verified in summer 2013 as meeting the standards of environmental protection established by the program. By becoming verified the Plant Materials Center not only insures responsible farming techniques but also shows that they care for their community. Technical assistance was provided by the Clinton Conservation District.

The Michigan Agriculture Environmental Assurance Program is an innovative, proactive program that helps farms of all sizes and all commodities voluntarily prevent or minimize agricultural pollution risks. MAEAP's mission is to develop and implement a proactive environmental assurance program ensuring that Michigan farmers are engaging in cost-effective pollution prevention practices and working to comply with state and federal environmental regulations.

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USDA-NRCS ROSE LAKE PLANT MATERIALS CENTER STAFF and ASSOCIATED PERSONNEL

Center Staff
John Leif, Manager
John Durling, Agronomist
Sergio Pérez, Biological Sciences Technician
Elaine Gerona, Office Automation Assistant

Central Region Plant Materials Specialist
Joel Douglas

National Program Leader
John Englert

State Conservationists in Primary Service Area
Garry Lee, Michigan
Jane Hardisty, Indiana
Terry Cosby, Ohio
Jimmy Bramblett, Wisconsin

State Plant Materials Committees

Indiana	Wisconsin	Michigan	Ohio
John Leif, *ex officio*	Greg Rebman, Chair	Andy Henriksen, Chair	Bryan Lee, Chair
Barry Fisher	John Leif, *ex officio*	James Scott, Advisor	John Leif, *ex officio*
Sue Gerlach	Matt Blohowiak	John Leif, Advisor	Tom Sewell, Advisor
Susan Grivas	Brian Briski	Karen Blair	Troyce Barnett, Res Cont
Ellen Jacquart	Judy Derricks	Misa Cady	Mark DeBrock, Res Cont
Brianne Lowe	Betsy Doolittle	Jerry Davis	Mark Smith, Res Cont
Dan Rosswurm	Pattie Haack	Andrew Gust	Chris Davis
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Dave Stratman	Terry Kelly	Carol Schadd	Dave Libben
Colt VanNatta	Tom Melnarik	Jennifer Taylor	Jonathan Mauk
John Young	Phil Meyer	Kristian Williams	Nathan Rice
Shannon Zezula	Pat Murphy		
	Mike Patin		
	Brian Pillsbury		
	Merrie Schamberger		
	Jason Thomas		
	Michele Wilkinson		

Introduction

The USDA-NRCS Plant Materials Program with its 27 affiliated Plant Materials Centers develops, tests, and transfers plant science technology to meet customer and natural resource needs. High quality, productive soils; clean and abundant water; healthy plant and animal communities; and clean air have been identified as priority customer and natural resource needs at the national level. Rose Lake Plant Materials Center (PMC) addresses these national priority needs as well the more specific needs of its primary service states of Indiana, Ohio, Michigan, and Wisconsin and portions of Illinois, New York, and Pennsylvania.

Rose Lake Plant Materials Center (PMC) was established in 1958 on a 40-acre site at the Michigan Department of Natural Resources, Rose Lake Wildlife Research Station (42.798° North, 84.414° West, 875 ft ASL) located eight miles northeast of Lansing, Michigan. Soil association is Boyer-Marlette-Houghton with well drained and moderately well drained, gently sloping to steep loamy sands to loams on moraines and very poorly drained muck in depressions. Climate is described in Appendix C.

Interagency Agreement between NRCS Plant Materials Program and National Park Service – Apostle Islands National Lakeshore
Agreement Number: F6140090501
As Component of MIPMC-T-0004-CR

The Apostle Islands National Lakeshore is operated by the National Park Service and comprised of Long Island, Oak Island, Outer Island, Raspberry Island, Rocky Island, and others in Lake Superior near Bayfield, Wisconsin. Several of the islands have historic lighthouses that once guided mariners through the rough waters of Lake Superior. Continuous erosion of steep slopes has jeopardized these historic facilities.

Rose Lake PMC partners with other federal, state, and local agencies; universities; tribes; local farmers; and private entities to accomplish its missions. Occasionally partnerships result in 'reimbursable agreements' which help in technology development and information gathering for releasing Conservation Plants. Since 2000 Rose Lake PMC has worked with Apostle Islands National Lakeshore doing reimbursable projects to develop propagation protocols and produce native plant stock for stabilizing slopes, preventing erosion, preserving native plant resources, and revegetating at Apostle Islands National Lakeshore.

In 2011 Rose Lake PMC was asked to propagate several plant species including common juniper (*Juniperus communis* L.). Perhaps one reason for its success in the wild is that juniper has been genetically designed to 'wait' for the right time to germinate. Dormancy appears to result from a combination of factors.

Rose Lake PMC has tried many stratification and scarification treatments on common juniper seed to hasten germination and facilitate establishment. As individual treatments and as treatment combinations, cold stratification, warm stratification, acid treatments, and physical abrasion have not proven effective in improving germination and emergence. Heretofore, the best propagation method has been to plant seeds in the spring of 'Year 1', allow the seeds to overwinter into 'Year 2', and wait for germination to occur in the spring of 'Year 2'.

A trial was designed to evaluate the effect that separating juniper seed has on germination. These treatments were imposed:

1) Whole berries without stratification.
2) Seeds without stratification but separated by soaking berries for 48 hours in a dilute lye solution (1 tsp/gal water), rinsing, and rubbing on a metal screen. Seed and pulp were soaked in water for 8 hours allowing the viable seed to sink to the bottom and the non-viable seed and pulp to float. Viable seeds were air dried.
3) Whole berries with stratification treatment consisting of placing seeds into a cloth bag, moistening, and placing in a zip lock bag containing moist peat for 16 weeks.
4) Seeds separated as in treatment (2) above and stratified as in treatment (3) above.

All treatments were refrigerated for 16 weeks. On 30 April 2012 seeds and berries were planted in peat-based potting mixture in 5-inch yellow Cone-tainers™ in the greenhouse. There were approximately 98 berries (Treatments 1 and 3) or 98 seeds (Treatments 2 and 4) per treatment. (A berry contains 1 to 3 seeds.) Experimental design was completely randomized with three replicates.

No emergence was observed during 2012. Cone-tainers™ were kept outdoors and protected through the winter of 2012-13. Cone-tainer™ were brought into the greenhouse in late March 2013. Table 1 shows emergence data as observed and recorded on 19 April 2013 and 7 May 2013 and subjected to analysis of variance. In all cases separated seeds exhibited significantly higher emergence rates than whole berries.

Table 1. Emergence of common juniper seed subjected to various treatments.

Treatment	% Emergence	
	19 April 2013	7 May 2013
1: whole berries; no stratification	1a	5a
2: seeds; lye	26b	25b
3: whole berries; stratification	3a	3a
4: seeds; stratification	26b	32b

Within columns, means followed by the same letter are not significantly different as determined by LSD at $P \leq 0.05$

Yellow Alfalfa [*Medicago sativa* L. ssp. *falcata* (L.) Arcang.] Release
MIPMC-P-0910-PA

Objectives of this study are to evaluate and produce foundation seed of yellow-flowered alfalfa for use in conservation practices. Seed produced at Rose Lake PMC will be returned to South Dakota State University for release (tentatively named 'Yellowjacket') through their Agricultural Experiment Station.

Yellow alfalfa (AKA yellow-flowered alfalfa) is a subspecies of alfalfa (*Medicago sativa*). Introduced from Siberia, it has been grown in the United States since the early 1900s. Plant characteristics and growth requirements are similar to purple-flowered alfalfa. However, it blooms for a longer duration and has more fibrous roots than purple-flowered alfalfa. Research at Michigan State University (MSU) has shown it to produce as much forage in a 2-cut system as purple-flowered alfalfa produces in a 3-cut system. Anecdotal evidence suggests its faster recovery after grazing.

Approximately 6500 seedlings from pure *Medicago sativa* ssp. *falcata* synthetic cultivar (SD 201) were started in the greenhouse and transplanted into a ¼-acre field at Rose Lake PMC in spring 2010. Blue-flowered and other off-type plants have been hand rogued. To increase seed-set leafcutter bees were imported from Canada in 2011 and placed near the production field in a shelter containing nesting blocks. Leafcutter bees were not imported in 2012 and 2013.

Seed was harvested in early August in 2011 to 2013. Harvest was preceded by applications of a desiccant (paraquat) and Spodnam® to control pod shatter. Bulk seed yield for three years of production was 20 to 25 lbs. Seed is being stored at Rose Lake PMC while South Dakota finds a certified seed producer.

Evaluation of Wildrye (*Elymus* spp.) Cover Crops in Tree Establishment
MIPMC-T-1001-WO

Forestland accounts for up to 30 percent of agricultural land in Michigan. Considerable emphasis has been placed on establishing, maintaining, and improving forestland in Michigan. In addition to forestland, trees are used in windbreaks, riparian areas, filter strips, and wildlife corridors. Evaluating cover crop and herbicides treatment combinations for establishing trees, this study falls within PM Program Objective 1.1 (Conserve and enhance soil resources with plant science technology) and Objective 1.2 (Improve water quality and quantity with plant science technology) and within the national priority of Transition to Organics.

This study was developed to address the following questions as they relate to the utility of cover crops and herbicides in tree establishment: How do *Elymus* spp. cover crops affect tree survival and growth? How do strip herbicide treatments affect tree survival and/or tree growth? Is there interaction between effect of cover crop and herbicide treatments?

Study was sited on approximately 0.6 acre plot east of buildings at Rose Lake PMC on Boyer complex soil (0-6% slope, well drained, loamy sand). Canada wildrye (*Elymus canadensis* L.) and Virginia wildrye (*Elymus virginicus* L.) were drilled at 4.6 PLS lbs/a and 5.2 PLS lbs/a, respectively in Sept 2011. Seedling red oak (*Quercus rubra* L.) and shagbark hickory (*Carya ovata* [Mill.] K. Koch) were transplanted in May 2012. Tree tubes were placed around the transplanted trees and staked.

Data are being collected on tree survival and height and on cover identity and biomass. Analysis of variance of survival and height data will be conducted separately on the oak and hickory.

Wild Rice Propagation Techniques
MIPMC-T-1202-OT

Wild rice (*Zizania aquatica* and *Zizania palustris*) is a native grass of the northern United States that grows in shallow waters of lakes and streams. It is also grown commercially. An annual, it requires new seedling establishment each year. Plants will often drop (shatter) some of their seed in the fall, thus providing the seed source for subsequent year's establishment.

Seeding depth, water quality, and fertility are some of the cultural factors that influence wild rice establishment and growth. Wild rice obtained by Rose Lake PMC from Missouri is reported to do best in 2 to 4 inches of water when grown in ponds or streams. Reports from Minnesota indicate wild rice grown in paddies has good emergence and development in 6 to 12 inches of water.

The purpose of this study was to acquire experience in propagating wild rice in order to provide training to internal and external customers, particularly several Native American Tribes
A greenhouse trial was established to compare germination and emergence of seed at these moisture regimens: field capacity, saturation, and submergence. Plastic tray-based cells were filled within ¼ inch of the top with peat-based potting media. Five wild rice seeds were planted in each cell and the seeds were covered with potting media to the top of the cell. Each 30-cell tray was randomly assigned to one treatment and there were four replicates per treatment in a completely randomized design. Each tray was maintained at the designated moisture regime through the duration of the trial.

Emergence date, number of cells with plants at 30 days after planting (DAP), height at 30 and 60 DAP, and above-cell biomass were observed and recorded for each treatment. Data were analyzed using analysis of variance.

Tallest plants (at both 30- and 60-DAP) and most biomass were with submerged seed (Table 2). Conversely, shortest plants and least biomass were with seeds at field capacity. Results with saturated seeds were intermediate. There was no significant treatment response in number of cells with plants and emergence date was the same with all treatments.

Table 2. Wild rice emergence and early development response to water regimen.

Water regimen	Emergence date (DAP)	Cells w/ plants @ 30 DAP	Height (inch)		Biomass (g) at 60 DAP
			30 DAP	60 DAP	
Field capacity	6a	25.0a	2.6c	5.8c	1.4c
Saturation	6a	27.5a	6.5b	10.5b	5.8b
Submergence	6a	28.0a	11.4a	15.8a	9.0a

Within columns, means followed by the same letter are not significantly different as determined by LSD at $P \leq 0.05$

Effect of Winter Cover Crop Combinations
On Yield and Profitability of Subsequent Corn Crop
MIPMC-T-1301-CP

Cover crops may be grown during or between primary cropping seasons. Rather than being grown mainly for harvest, they are grown to benefit the environment or subsequent crops. Cover crops protect the soil, maintain or increase nutrient availability, and generally enhance soil health.

Grasses, legumes, and brassicas in monoculture and mixtures have been used as over-winter cover crops to provide protection for soil and to increase subsequent corn yield. This study, conducted by USDA-NRCS Rose Lake PMC and hosted by Lee Farms in Laingsburg, Michigan, was designed to measure the effect of these cover crops on yield and profitability of a subsequent corn crop in southwest Shiawassee County, Michigan.

Cover crop plots were no-till drilled on 20 Aug 2012, about one month after wheat harvest. Field plot design was a randomized complete block with three replicates. Cover crop and bulk seeding rate treatments were:

- Annual ryegrass @ 20 lbs/a
- Red clover @ 10 lbs/a
- Oilseed radish @ 10 lbs/a
- Annual ryegrass, red clover, and oilseed radish @ 7, 3, and 3 lbs/a, respectively
- Annual ryegrass @ 10 lbs/a and red clover @ 5 lbs/a
- Annual ryegrass @ 10 lbs/a and oilseed radish @ 5 lbs/a
- Red clover @ 5 lbs/a and oilseed radish @ 5 lbs/a
- Control with no cover crop

Cover crop height, groundcover, plant population, and biomass were measured and recorded at approximately 30, 45, 60, and 70 days after planting and in the spring. (Tables 4 to 7 show exact dates.) Corn was planted in spring 2013 with nitrogen in the starter fertilizer at 10 lbs/a. Plots were split which allowed additional nitrogen application to approximate ‘0’, ½, and full recommended rates. (‘0’ nitrogen rate included 10 lbs/a nitrogen applied as starter fertilizer.) Corn was hand harvested in fall 2013 and yield of dry shelled corn was determined. Cover crop growth and corn yield data were subjected to analysis of variance. Enterprise budgets were developed for each treatment. Corn production practices are shown in Table 3.

Cover crop growth measurements are show in Tables 4 to 7. These data are likely to be used in the WEPS (Wind Erosion Prediction System) model as similar data collected by Rose Lake PMC that have been extensively used in such. Oilseed radish in monoculture and/or mixtures provided the earliest and most groundcover in the fall. Annual ryegrass in monoculture and/or mixtures provided the most groundcover in the spring. Biomass accumulation by species and sampling date followed the same trends as groundcover. Unevenly distributed volunteer wheat that was included in samples (as represented in Tables 4 to 7) increased data variability.

Corn yield response to nitrogen fertilizer rate was positive (Table 8). No significant corn yield response to cover crop treatment was observed within the same nitrogen regimen.

With no yield response to cover crops and with their added costs for seed and seeding, maximum economic return (profit) was achieved with no cover crop at each nitrogen rate. (Budgets are not shown.) However, such analyses tend to undervalue the role covers in the cropping system as they do not adequately account for any decrease in nutrient leaching and runoff, nitrous oxide emission, and soil erosion; long-term improvement in soil health and stabilization of crop yields; increase in carbon sequestration and oxygen generation; enhancement of aesthetics; and increased snow capture.

Field research reported and analyzed above is from just one cropping location-year. Corn yield response to cover crop treatments may be different in other years and locations, although corn yield response to the '0', ½, and full nitrogen rates as observed in this study is corroborated by hundreds of other location-years of field research as well as by farmer experience. Additional location-years of research with similar cropping systems and treatments are being considered.

Table 3. Selected crop production and research practices and site characteristics. Lee Farms, Laingsburg, MI 2013.

Date	Practice
25-Apr-13	WeatherMAX® (glyphosate) @ 2 qt/a w/ ammonium sulfate + 2,4-D @ 1 pt/a
9-May-13	Garst 88M51GT @ 33K corn seeds/a (Garst 88M51GT is a glyphosate resistant hybrid)
	6-row, 6400 White planter w/ 3 Rawson coulters/row
	5-15-40 + 3%S @ 200 lbs/a at planting
	SureStart® (acetochlor, flumetsulam, and clopyralid) preemergence @ 1 qt/a
16-May-13	28% UAN solution at 0, 50, and 110 lbs/a actual N (to approximate '0', 1/2, and full rates, respectively)
10-Jun-13	glyphosate @ 1 qt/a w/ ammonium sulfate
18-Oct-13	hand harvested 0.001 acre/plot, shelled, dried, and converted to bushels of shelled corn @ 15.5% moisture
Soil: Celina loam	
History: corn, soybeans, and wheat in rotation; 30 years of no-till with livestock manure and some cover crops	
Soil test: above optimum P; optimum K and Mg; 6.7 CEC in top 6 inches (fall 2012); lime applied to maintain 6.5 pH	
Soil organic matter: 1.2% (fall 2013)	

Table 4. Height of cover crop and cover crop combinations. Lee Farms, Laingsburg, MI. 2012-13.

	20-Sep-12	2-Oct-12	16-Oct-12	1-Nov-12	6-May-13
	----------height (inches)----------				
annual ryegrass	4.3	5.3	5.3	6.7	7.0
red clover	1.3	1.3	1.7	4.0	5.3
oilseed radish	6.0	8.7	11.0	13.3	6.0
control	1.3	2.3	3.7	3.3	6.7
annual ryegrass + red clover + oilseed radish	2.7	6.7	7.7	12.0	6.7
annual ryegrass + red clover	3.7	4.0	3.7	4.7	6.7
annual ryegrass + oilseed radish	5.0	5.7	9.3	10.0	6.0
red clover + oilseed radish	2.7	6.0	7.7	9.0	4.7
$LSD_{.05}$ (within column)	2.1	2.1	2.1	2.3	2.5

Table 5. Groundcover provided by cover crop and cover crop combinations. Lee Farms, Laingsburg, MI. 2012-13.

	20-Sep-12	2-Oct-12	16-Oct-12	1-Nov-12	6-May-13
	----------percent----------				
annual ryegrass	23	43	57	73	57
red clover	3	0	3	37	13
oilseed radish	83	90	97	90	13
control	3	7	13	40	7
annual ryegrass + red clover + oilseed radish	50	67	80	90	47
annual ryegrass + red clover	20	43	43	47	47
annual ryegrass + oilseed radish	70	70	73	90	27
red clover + oilseed radish	23	63	73	63	17
$LSD_{.05}$ (within column)	38	27	30	36	25

Table 6. Plant population of cover crop and cover crop combinations. Lee Farms, Laingsburg, MI. 2012-13.

	20-Sep-12	2-Oct-12	16-Oct-12	1-Nov-12	6-May-13
	----------plants/ft^2----------				
annual ryegrass	127	144	201	146	138
red clover	6	19	13	13	17
oilseed radish	10	11	20	14	13
control	3	16	25	17	43
annual ryegrass + red clover + oilseed radish	48	39	36	59	101
annual ryegrass + red clover	61	80	63	101	133
annual ryegrass + oilseed radish	44	41	45	44	55
red clover + oilseed radish	12	24	12	9	19
$LSD_{.05}$ (within column)	37	34	93	22	36

Table 7. Biomass of cover crop and cover crop combinations. Lee Farms, Laingsburg, MI. 2012-13.

	20-Sep-12	2-Oct-12	16-Oct-12	1-Nov-12	6-May-13
	----------ton/a oven dry biomass----------				
annual ryegrass	0.32	1.34	1.63	2.51	1.06
red clover	0.06	0.11	0.09	0.23	0.22
oilseed radish	0.62	1.27	1.37	2.48	0.06
Control	0.05	0.14	0.24	0.40	0.30
annual ryegrass + red clover + oilseed radish	0.32	0.92	1.58	2.64	0.80
annual ryegrass + red clover	0.29	0.68	0.67	2.28	1.20
annual ryegrass + oilseed radish	0.51	1.05	1.98	2.29	0.31
red clover + oilseed radish	0.16	0.76	0.94	1.60	0.17
$LSD_{.05}$ (within column)	0.29	0.67	0.80	1.33	0.32

Table 8. Corn yield response to nitrogen fertilizer and cover crop and cover crop combinations. Lee Farms, Laingsburg, MI. 2013.

	‘0’ N rate	1/2 N rate	Full N rate
	----------corn yield (bu/a)----------		
annual ryegrass	100	138	153
red clover	98	139	144
oilseed radish	117	148	170
control	96	134	151
annual ryegrass + red clover + oilseed radish	105	139	171
annual ryegrass + red clover	94	126	159
annual ryegrass + oilseed radish	95	159	166
red clover + oilseed radish	121	141	169
average	103	141	160
Statistical significance (within column)	n.s.	n.s.	n.s.

Tolerance of Selected Wildflower Species to Herbicides
MIPMC-T-1302-WI

Wildflower species are required or suggested plants for use in a number of USDA-NRCS Conservation Practices and cost share programs. Once established these plants survive well and provide habitat and pollen for pollinator insects such as bees, butterflies, and moths. However, competition from weedy plant species can make it difficult for wildflowers to become established. The objective of this project was to screen selected wildflower species for tolerance to herbicide applications.

Twenty wildflower species were selected from the Michigan CRP-SAFE eligible wildflower list dated July 2010. Ten preemergence herbicides and 10 post emergence herbicides were selected with assistance from Dr. Christy Sprague, MSU weed scientist. Crown vetch (*Securigera varia*) was also included in the trial because it has been a noted competitor during wildflower establishment at Rose Lake PMC. Following is a description of a portion of the study involving 19 species and 10 post emergence herbicides.

Wildflower seed was obtained from a commercial source and their seed stratification recommendations were followed. Seed was planted in pots of peat-based planting media and subjected to optimum growing conditions in a greenhouse. At the 6-8 leaf stage of growth seedlings were thinned to the same number of healthy plants per pot and blocked in three replicates for similar height. Because not all plants achieved the desired growth stage at the same time, treatments were imposed on several dates. Post emergence herbicide treatments were applied to experimental units at rates shown in Table 9. No herbicide was applied to a control.

Number of surviving wildflowers, plant height, and injury symptoms were recorded at 14, 28, and 42 days after treatment (DAT). Figure 1 shows the decision tool established to determine tolerance and non-tolerance.

Results are shown in Table 9. Spiderwort (*Tradescantia ohiensis*) was tolerant to the most herbicides and Common Beggar-Tick (*Bidens frondosa*) and Lance-leaved Coreopsis (*Coreopsis lanceolata*) were tolerant to the least.

Reported results are conservative in that even a wildflower that survived and was not shortened by a herbicide treatment would be deemed not tolerant if it showed herbicide injury symptoms at 42 DAT. This conservative definition of tolerance was employed for these reasons: (1) with the limited number of plants, some comparisons were made among species treated with different herbicides but not with a non-treated control, and (2) whether or not affected plants would have outgrown herbicide injury symptoms observed at 42 DAP was not assessed because plants had become too large to be maintained in their small pots.

Regardless of findings of this study by USDA-NRCS Rose Lake PMC, USDA-NRCS does not make herbicide recommendations. Herbicide use is subject to the herbicide label and few if any of the herbicides used in this trial are labeled for wildflowers.

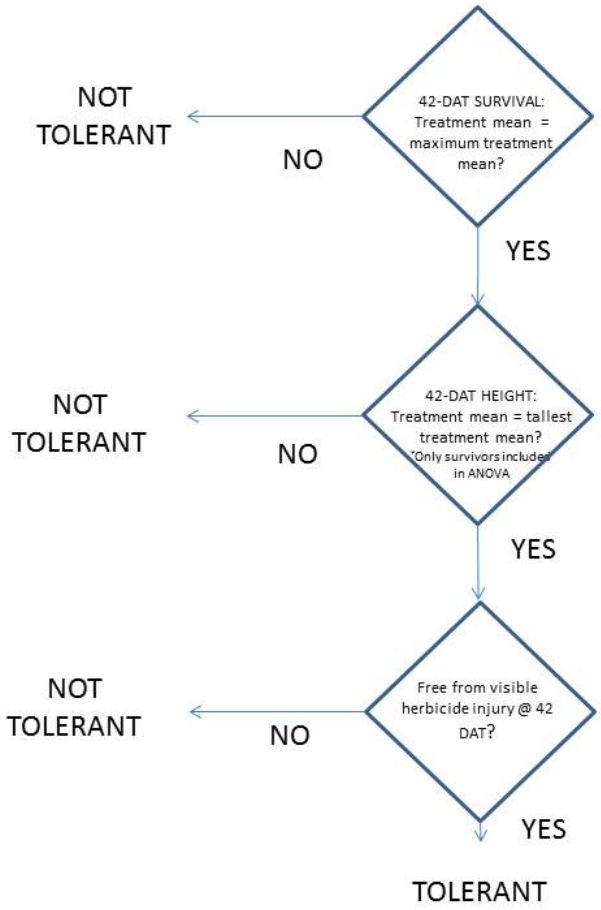

Figure 1. Decision tool used to evaluate plant tolerance to post emergence herbicides.

Table 9. Tolerance of selected wildflowers to postemergence herbicides registered for agronomic crops in Michigan. Rose Lake Plant Materials Center. 2013.

Wildflower			Trade name, Product use Rate, and Adjuvant									
common name	*scientific name*	Family	Butyrac 200	Accent Q 54.5WG	Beacon 75WG	Permit 75DF	Stinger 3SL	Impact 2.8SC	Basagran 4SL	Buctril 2EC	Flexstar 1.88L	Callisto 4SC
			12 fl oz/a	0.9 oz/a	0.76 oz/a	0.67 oz/a	4 fl oz/a	0.75 fl oz/a	2 fl pt/a	1 fl pt/a	1 fl pt/a	3 fl oz/a
			none	COC + AMS	COC	NIS	none	MSO + AMS	COC	none	COC + AMS	COC + AMS
Rattlesnake Master	*Eryngium yuccifolium*	Apiaceae	T	N	N	N	N	N	N	N	T	N
Butterflyweed	*Asclepias tuberosa*	Asclepiadaceae	N	N	N	T	N	N	N	N	N	N
Yarrow	*Achillea millefolium*	Asteraceae	T		N	N	N		N	N	N	N
Com. Beggar-Tick	*Bidens frondosa*	Asteraceae	N	N	N	N	N	N	N	N	N	N
Lance-leaved Coreopsis	*Coreopsis lanceolata*	Asteraceae	N	N	N	N	N	N	N	N	N	N
Purple Coneflower	*Echinacea purpurea*	Asteraceae	N		N	N	N	N	T	N	N	N
Rough Blazingstar	*Liatris aspera*	Asteraceae	N		N				N	T	N	T
Rosin Weed	*Silphium integrifolium*	Asteraceae	T		N	N	N	N	N	N	N	N
Showy Goldenrod	*Solidago speciosa*	Asteraceae	T				T		N	N	N	T
New England Aster	*Symphyotrichum novae-angliae*	Asteraceae	T	N	N	N	N	N	N	N	N	N
Spiderwort	*Tradescantia ohiensis*	Commelinaceae	T				T		T	T	T	N
Leadplant	*Amorpha canescens*	Fabaceae	T		N		N	N	T	T	N	N
White False Indigo	*Baptisia alba*	Fabaceae	T						N		N	
Canada Tick Trefoil	*Desmodium canadense*	Fabaceae	T		N		N		T	T	N	N
Roundhead Bush-Clover	*Lespedeza capitata*	Fabaceae	T		N	N	T	N	T	N	N	T
Crown vetch	*Securigera varia*	Fabaceae	T		N	N	N	N	N	N	N	N
Wild Bergamot	*Monarda fistulosa*	Lamiaceae	T						T	T	N	N
Evening Primrose	*Oenothera biennis*	Onagraceae	N	N	N	N	N	N	T	N	N	N
Culver's Root	*Veronicastrum virginicum*	Scrophulariaceae	T						T			

T = tolerant
N = non-tolerant
= no results

Vegetative Barrier Establishment Method Case Study
MIPMC-T-1303-CP

Vegetative barriers as defined in USDA-NRCS Conservation Practice Standard 601 are narrow, parallel strips of stiff, erect, dense grass planted close to the contour.

Vegetative barriers can be used to:

- Reduce sheet and rill erosion.
- Reduce ephemeral gully erosion.
- Manage water flow.
- Stabilize steep slopes.
- Trap sediment.

These barriers cross concentrated flow areas at convenient angles for farming. This practice differs from other conservation buffers because vegetative barriers are managed in such a way that any soil berms that develop are not smoothed out during maintenance operations.

This case study was developed to evaluate no-till seeding and Filtrexx® WadiSoxx™ establishment of vegetative barrier grasses, both as potentially cost-effective alternatives to sod strips and transplants. (Filtrexx® WadiSoxx™ is a mesh, potting-soil filled tube with greenhouse-grown grasses for establishment as a pre-assembled vegetative barrier. USDA-NRCS has not evaluated Filtrexx® WadiSoxx™ for vegetative barrier purposes nor is university or other independent field-trial data available. Neither discrimination nor endorsement is intended is use of manufacturer and trade names in this study.)

Vegetative barriers were established in a Barry County, Michigan farm field in 2011-12 (Table 10). Baseline data collection began when the barriers were established. Vegetative barrier porosity, soil deposition upstream from the vegetative barrier, and conformity to Conservation Practice Standard 601 will be observed for the duration of the study and partial budgets for establishment will be developed. Data is not yet available for publication.

Table 10. Vegetative Barriers established by Rose Lake PMC and partners in NE 1/4 Sec. 4, Castelton Twp, Barry County, Michigan				
Barrier Number	Establishment Month & Year	Plant Material	Field Application	Length (ft)
1	June 2011	*Miscanthus sinensis* Filtrexx® WadiSoxx™ and transplants	2 parallel 40-ft Filtrexx® WadiSoxx™ 2-3 ft apart. Plants 6-9 inches apart in Filtrexx® WadiSoxx™. Filtrexx® WadiSoxx™ flanked by transplants. Transplants arranged in staggered pattern. Planted into wheat.	97
2	August 2011	*Miscanthus ×giganteus* Filtrexx® WadiSoxx™ and transplants	2 parallel 40-ft Filtrexx® WadiSoxx™ 2-3 ft apart. Plants 6-9 inches apart in Soxx. Filtrexx® WadiSoxx™ flanked by transplants. Transplants arranged in staggered pattern. Planted into wheat.	80
3	August 2011	*Panicum virgatum* 'Thundercloud' transplants	2 parallel rows 2-ft apart. Plants 18 inches apart in rows. Transplants in staggered pattern. Planted into wheat stubble.	45
4	August 2011	*Panicum virgatum* 'Northwind' Filtrexx® WadiSoxx™ and transplants	2 parallel 40-ft Filtrexx® WadiSoxx™ 2-3 ft apart with plants 6-9 in apart in Soxx. Filtrexx® WadiSoxx™ flanked by transplants. Transplants staggered. 12-inch spacing between transplants in rows. Planted into wheat. Addional dormant 'Dust Devil' plugs on North end, 16 in apart in rows and rows ≈ 20 ft long.	63
5	August 2011	*Panicum virgatum* 'Thundercloud' Filtrexx® WadiSoxx™ and transplants	2 parallel 40-ft Filtrexx® WadiSoxx™ 2-3 ft apart with plants 6-9 in apart in Soxx. Filtrexx® WadiSoxx™ flanked by transplants. Transplants staggered. 12-inch spacing between transplants in rows. Planted into wheat.	40
6	November 2011	*Panicum virgatum* 'Shelter' dormant seeding	6 lbs/a PLS no-till drilled in 18-inch wide row upstream and downstream of 63 ft length of straw bales. Planted into corn stubble.	110
7	November 2011	*Panicum virgatum* 'Dust Devil' Filtrexx® WadiSoxx™ and transplants	2 parallel 70-ft Filtrexx® WadiSoxx™ 2-ft apart. Plants at 7-inch spacing in Filtrexx® WadiSoxx™ . Filtrexx® WadiSoxx™ flanked by transplants. Transplants in staggered pattern. 16-inch spacing between transplants. Planted into corn stubble.	132
8	November 2011	*Panicum virgatum* 'Dust Devil' Filtrexx® WadiSoxx™ and transplants	2 parallel 40-ft Filtrexx® WadiSoxx™ 2-ft apart. Plants at 7-inch spacing in Filtrexx® WadiSoxx™. Filtrexx® WadiSoxx™ flanked by transplants. Transplants in staggered pattern. 16-inch spacing between transplants in rows. Planted into corn stubble.	80

Warm Season Grasses as Living Snow Fences
MIPMC-T-1304-CR

Living snow fences are trees and/or shrubs and grasses strategically planted to trap or control blowing and drifting snow. Windbreak/Shelterbelt Establishment (USDA-NRCS Conservation Practice Standard 380) includes snow deposition management as a stated purpose.

Living snow fences have been used in conservation systems to more evenly distribute snow across a large area of a field to provide winter protection and improve moisture retention for crop production. Living snow fences have also been used to protect roads, railroads, feedlots, and farmyards from drifting snow, resulting in increased public safety and reduced snow removal costs. Research has shown that living snow fences intended for even snow distribution should be planted to achieve a porosity of 60 to 75 percent during periods of expected snow cover and that fences intended for roadway drift protection should be planted to achieve a porosity of 40 to 50 percent during periods of expected snow cover.

The objective of this research is to evaluate the effectiveness for snow fence purposes of two grass species at two within-row plant spacings. The hypothesis is that within row plant spacing will affect the time required for those plants to achieve the required porosity for effective snow management. Species differences may also affect the time required to achieve the required porosity.

Field trials were established in 2012 and 2013 at five cooperating locations (Figure 2) with known snow blowing and drifting problems. In consideration of cooperator preference, 'Northwind' switchgrass (*Panicum virgatum*) and giant miscanthus (*Miscanthus ×giganteus*) were selected for these sites. Within-row plant spacings were 18 inches for the single row and 24 inches for the double row. Double-row plants were staggered between rows. Rows were perpendicular to prevailing winter wind.

Expected duration of the study is through 2016. Plant survival and height and snow distribution will be measured and recorded at each site. Digital photographs will be taken for porosity determinations. Data is not yet available for publication.

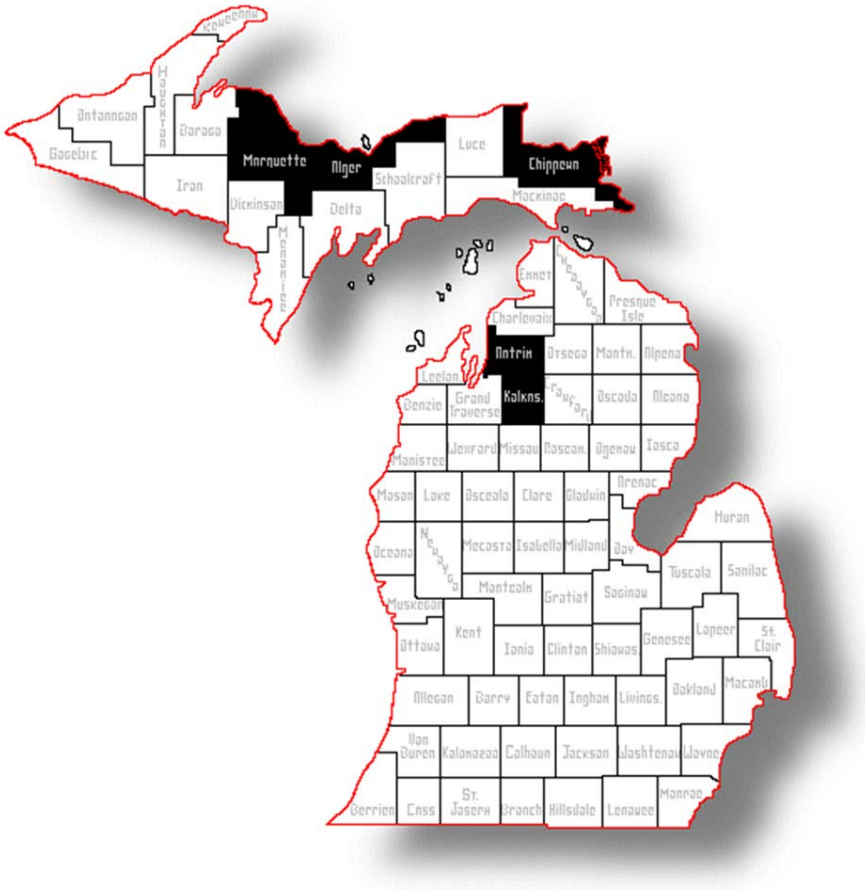

Figure 2. Locations of living snow fence trials conducted by Rose Lake PMC. 2012-16.

Plants to Improve Air Quality around CAFOs
MIPMC-T-1305-WI

NRCS has promoted windbreaks from its inception. Windbreaks are the subject of this and two other current field studies (i.e. "Vegetative Barrier Establishment Method Case Study" and "Warm Season Grasss as Living Snow Fences") being conducted by USDA-NRCS Rose Lake PMC. In this study Rose Lake PMC is collaborating with MSU Extension (MSUE) to evaluate herbaceous and woody plant material for use in odor abatement around confined animal feeding operations (CAFOs). One of the stated purposes of USDA-NRCS Conservation Practice Standard 380 (Windbreak/Shelterbelt Establishment) is to "Improve air quality by reducing and intercepting air borne particulate matter, chemicals and odors."

Odor emissions are among the environmental challenges that CAFOs currently face. Trends toward more concentrated livestock operations and the popular migration from urban to rural areas have exacerbated this issue. Cost-effective measures for addressing this environmental issue are needed.

Plants have the potential to abate odor by several mechanisms. Odor plumes can be forced upward, mixed, and diluted when they encounter windbreaks downwind from their source. Reduced wind speeds caused by windbreaks can cause odor-bearing particulates to settle out of the odor plume. Dust and particulates can be intercepted and collected on leaf surfaces and other plant parts. Another means by which windbreaks control odor is through adsorption and absorption of the odorous chemicals on the leaves and other plant parts and the utilization of these chemicals by plant physiological processes or subsequent breakdown via microbial activity. Moreover, there seems to be a major socio-psychological component to the perception of odor being a nuisance such that when people see verdant vegetation they are less apt to smell manure.

Both Rose Lake PMC and MSUE were engaged in the development of this study and the search for a cooperating livestock or poultry farm. A swine farm in St. Joseph County where four barns house 5000 feeder pigs each was selected. As the study progresses Rose Lake PMC will become more involved in evaluating plant response to exhaust and MSUE in measuring the actual odor abatement. Both Rose Lake PMC and MSUE were involved in establishing windbreaks as described below.

These trees were established in 2013 via transplants at 60 ft away from pit exhaust fans in a pattern that will be amenable to replicated evaluation of plant response (e.g. survival, vigor, and height) to exhaust and the measurement of odor abatement by windbreaks and comparison with a control:

- Carolina poplar (*Populus canadensis* 'Imperial')
- Austree hybrid willow (*Salix matsudana* x *alba*)
- Tamarack (*Larix laricina*)

Likewise, these grasses (miscanthus and switchgrass in monoculture and all in mixed stands) were established via plugs at 15 ft and 20 ft away from pit exhaust fans in a pattern that is amenable to measurements as with the trees:

- Switchgrass (*Panicum virgatum* ‘Northwind’)
- Coastal Panicgrass (*Panicum amarum* ‘Atlantic’)
- Giant Miscanthus (*Miscanthus x giganteus*)
- Indiangrass (*Sorghastrum nutans*) Southlow MI Germplasm

Data collection is expected to continue for the five year anticipated duration of the study.

Note: This study is formally titled: “Investigation of Various Plant Species for Use as Vegetative Environmental Buffers (VEBs) to Improve Air Quality around Swine Production Facilities.”

Appendix A

Released Material

'Affinity' (*Thuja occidentalis* L.) Northern White Cedar
Released: 1993 (FY1993)
Accession Number: 477011 (PI Number: 477011)
Release Type: cultivar
Plant Origin: native
Collection Location: Pulaski Co., IN
Plant Type: tree
Plant Duration: perennial
Propagation: seed
Uses: field and farmstead windbreaks, screen or border planting in urban situations, and winter browse

Alcona Germplasm [*Desmodium glabellum* (Michx.) DC.] Dillenius' Tick-Trefoil
Released: 2006 (FY2006)
Accession Number: 9055415 (PI Number: 654405)
Release Type: tested germplasm
Plant Origin: native
Collection Location: Alcona Co., MI
Plant Type: legume
Plant Duration: perennial
Propagation: seed
Uses: wildlife food plots as an alternative to introduced plant species

Grant Germplasm [*Desmodium paniculatum* (L.) DC.] Panicledleaf Tick-Trefoil
Released: 2006 (FY2006)
Accession Number: 9055428 (PI Number: 654406)
Release Type: tested germplasm
Plant Origin: native
Collection Location: Grant Co., WI
Plant Type: legume
Plant Duration: perennial
Propagation: seed
Uses: wildlife food plots as an alternative to introduced plant species

Icy Blue Germplasm (*Elymus canadensis* L.) Canada Wildrye
Released: 2004 (FY2004)
Accession Number: 9084347 (PI Number: 641962)
Release Type: tested germplasm
Plant Origin: native
Collection Location: LaPorte Co., IN
Plant Type: cool-season grass
Plant Duration: perennial
Propagation: seed
Uses: restoration, wildlife cover, and erosion control
Registration Document: Durling, J.C., J.W. Leif, and D.W. Burgdorf. 2006. Registration of Icy Blue Canada Wildrye Germplasm. Crop Sci. 46:2330-2331.

'Imperial' *Populus* ×*canadensis* Moench (pro sp.) [*deltoides* × *nigra*] Carolina Poplar
Released: 1979 (FY1979)
Accession Number: 432347 (PI Number: 432347)
Release Type: cultivar
Plant Origin: introduced
Collection Location: Rice Co., MN
Plant Type: tree
Plant Duration: perennial
Propagation: vegetative
Uses: windbreaks (especially around orchards) and pulpwood

'Indigo' (*Cornus amomum* P. Mill.) Silky Dogwood
Released: 1982 (FY1982)
Accession Number: 468117 (PI Number: 468117)
Release Type: cultivar
Plant Origin: native
Collection Location: Clinton Co., MI
Plant Type: shrub
Plant Duration: perennial
Propagation: seed or vegetative
Uses: single row windbreak under center pivot irrigation, field and farmstead windbreak, soil bioengineering, and wildlife food

Koch Germplasm [*Calamovilfa longifolia* (Hook.) Scribn. var. *magna* Scribn. & Merr.] Prairie Sandreed
Released: 2007 (FY2007)
Accession Number: 9086408 (PI Number: Ames 29312)
Release Type: selected
Plant Origin: native
Collection Location: costal zones along Lakes Michigan and Huron
Plant Type: warm-season grass
Plant Duration: perennial
Propagation: seed or vegetative
Uses: wind erosion control, dune stabilization, and water quality improvement

'Lancer' (*Lathyrus latifolius* L.) Perennial Pea
Released: 1984 (FY1984)
Accession Number: (PI Number: 477009)
Release Type: cultivar
Plant Origin: naturalized
Collection Location: MI
Plant Type: legume
Plant Duration: perennial
Propagation: seed
Uses: erosion control plant, wildlife cover plant, land reclamation, brush management, roadside seeding mixtures, critical area planting where objective includes beautification

Leelanau Germplasm (*Viburnum opulus* L. var. *americanum* Ait.) Highbush Cranberry
Released: 1999 (FY1999)
Accession Number: 9031863 (PI Number: 608015)
Release Type: selected
Plant Origin: native
Collection Location: Leelanau Co., MI
Plant Type: shrub
Plant Duration: perennial
Propagation: vegetative
Uses: windbreaks (especially on wet or organic soils) and wildlife habitat

'Magenta' (*Malus sp*.) Hybrid Crabapple
Released: 1990 (FY1990)
Accession Number: 9005032 (PI Number: 514275)
Release Type: cultivar
Plant Origin: introduced
Collection Location: Clinton Co., MI
Plant Type: tree
Plant Duration: perennial
Propagation: seed
Uses: small tree for single row windbreaks & beautification

Marion Germplasm [*Desmodium glabellum* (Michx.) DC.] Dillenius' tick-trefoil
Released: 2009 (FY2009)
Accession Number: 9005087
Release Type: tested germplasm
Plant Origin: native
Collection Location: Marion Co., WI
Plant Type: legume
Plant Duration: perennial
Propagation: seed
Uses: wildlife food plots as an alternative to introduced plant species
Registration Document: Leif JW, Durling JC, Burgdorf DW. 2010. Notice of release of Dillenius' tick-trefoil: a selected class of natural germplasm. Native Plants Journal 11(1):23-25.

Prairie View Indiana Germplasm (*Andropogon gerardii* Vitman) Big Bluestem
Released: 2005 (FY2005)
Accession number: 9086588 (PI Number: 642389)
Release Type: Selected
Plant Origin: Native
Collection Location: Indiana
Plant Type: warm-season grass
Plant Duration: perennial
Propagation: seed
Uses: wildlife food/cover, erosion control, increased species diversity, and native environment restoration

Prairie View Indiana Germplasm [*Schizachyrium scoparium* (Michx.)] Little Bluestem
Released: 2005 (FY2005)
Accession number: 9086577 (PI Number: 642388)
Release Type: Selected
Plant Origin: Native
Collection Location: Indiana
Plant Type: warm-season grass
Plant Duration: perennial
Propagation: seed
Uses: wildlife food/cover, erosion control, increased species diversity, and native environment restoration

Prairie View Indiana Germplasm [*Sorghastrum nutans* (L.) Nash] Indiangrass
Released: 2005 (FY2005)
Accession number: 9086556 (PI Number: 642387)
Release Type: Selected
Plant Origin: Native
Collection Location: Indiana
Plant Type: warm-season grass
Plant Duration: perennial
Propagation: seed
Uses: wildlife food/cover, erosion control, increased species diversity, and native environment restoration

Riverbend Germplasm (*Salix sericea* Marsh.) Silky Willow
Released: 2003 (FY2003)
Accession Number: 9069052 (PI Number: Ames 27796)
Release Type: tested
Plant Origin: native
Collection Location: Daviess Co., IN
Plant Type: shrub
Plant Duration: perennial
Propagation: vegetative
Uses: streambank/shoreline restoration and riparian corridors

'Roselow' (*Malus sargentii* Rehder) Sargent's Crabapple
Released: 1978 (FY1978)
Accession Number: 477986 (PI Number: 477986)
Release Type: cultivar
Plant Origin: introduced
Collection Location: Japan
Plant Type: tree
Plant Duration: perennial
Propagation: seed
Uses: farm and field windbreaks

Southlow Michigan Germplasm (*Andropogon gerardii* Vitman) Big Bluestem
Released: 2001 (FY2001)
Accession number: 9084510 (PI Number: 642398)
Release Type: Source Identified
Plant Origin: Native
Collection Location: Southern Lower Michigan
Plant Type: warm-season grass
Plant Duration: perennial
Propagation: seed
Uses: wildlife cover filter strips
Registration Document: Durling, J.C., J.W. Leif, and D.W. Burgdorf. 2007. Registration of Southlow Michigan Big Bluestem Germplasm. Crop Sci. 47:455.

Southlow Michigan Germplasm (*Panicum virgatum* L.) Switchgrass
Released: 2001 (FY2001)
Accession number: 9084512 (PI Number: 642395)
Release Type: Source Identified
Plant Origin: Native
Collection Location: Southern Lower Michigan
Plant Type: warm-season grass
Plant Duration: perennial
Propagation: seed
Uses: wildlife food/cover, erosion control, increased species diversity, and native environment restoration
Registration Document: Durling, J.C., J.W. Leif, and D.W. Burgdorf. 2008. Registration of Southlow Michigan Germplasm Switchgrass. Journal of Plant Registrations. 2:60.

Southlow Michigan Germplasm [*Schizachyrium scoparium* (Michx.) Nash] Little Bluestem
Released: 2001 (FY2001)
Accession number: 9084511 (PI Number: 642397)
Release Type: Source Identified
Plant Origin: Native
Collection Location: Southern Lower Michigan
Plant Type: warm-season grass
Plant Duration: perennial
Propagation: seed
Uses: wildlife food/cover, erosion control, increased species diversity, and native environment restoration
Registration Document: Durling, J.C., J.W. Leif, and D.W. Burgdorf. 2007. Registration of Southlow Michigan Little Bluestem Germplasm. Journal of Plant Registrations. 1:134.

Southlow Michigan Germplasm (*Sorghastrum nutans* L. Nash) Indiangrass
Released: 2001 (FY2001)
Accession number: 9084513 (PI Number: 642396)
Release Type: Source Identified
Plant Origin: Native
Collection Location: Southern Lower Michigan
Plant Type: warm-season grass
Plant Duration: perennial
Propagation: seed
Uses: wildlife food/cover, erosion control, increased species diversity, and native environment restoration
Registration Document: Durling, J.C., J.W. Leif, and D.W. Burgdorf. 2008. Registration of Southlow Michigan Germplasm Indiangrass. Journal of Plant Registrations. 2:56.

Vintage Germplasm Common Elderberry [*Sambucus nigra* L. ssp. *canadensis* (l.) R. Bolli]
Released: 2010
Accession number: 9084126
Release Type: Selected
Plant Origin: Native
Collection Location: Tipton County, Indiana
Plant Type: shrub
Plant Duration: perennial
Propagation: seed or vegetative
Uses: streambank and shoreline stabilization, enhancement of riparian corridors, and food and shelter for wildlife
Registration Document: Leif, J.W., J.C. Durling, and D.W. Burgdorf. 2011. Notice of release of Vintage germplasm common elderberry: a selected class of natural germplasm. Native Plants Journal. 12(2):129-131.

Appendix B

Publications and Presentations

Results of experiments and observations at Rose Lake PMC are disseminated through publications, presentations at professional and grower meetings, and other means. These were presented, posted to the website (http://plant-materials.nrcs.usda.gov/mipmc/), or otherwise disseminated in 2013:

Bota. 2013. Farmers in Ionia County Eligible for Conservation Assistance: Interview with John Durling. Ionia Sentinel-Standard, 20 March.

Durling and Leif. 2013. Rose Lake PMC 2012 Technical Report. Rose Lake PMC, E. Lansing, MI. 38p.

Durling and Leif. 2013. Availability of Conservation Plant Releases from Rose Lake PMC, Michigan Biology Technical Note No. 19. Rose Lake PMC, E. Lansing, MI. 7p.

Durling, adapter. 2013. Pollinator Biology and Habitat. USDA-NRCS Michigan Biology Technical Note No. 20. 36p. (Original work by Vaughn, Mace and Eric Mader and adapted for Illinois by Gene Barickman. 2008. Xercex Society for Invertebrate Conservation.)

Leif and Durling. 2013. Apostle Islands National Lakeshore Annual Report. Rose Lake PMC, E. Lansing, MI. 4p.

Leif, Durling, and Perez. 2013. Soil Health and Cover Crop Workshop Shiawassee Conservation District. Owosso, MI. 14 February.

Leif. 2013. Mulching Materials for Control of Soil Erosion, Michigan Agronomy Technical Note No. 64. Rose Lake PMC, E. Lansing, MI. 6p.

Leif. 2013. Dillenius' Ticktrefoil *(Desmodium glabellum*) Plant Guide. Rose Lake PMC, E. Lansing, MI. 2p.

Leif. 2013. Living Snow Fences: they work! MACD Summer Conference, Gaylord, MI. 25 June.

Leif. 2013. Panicled Leaf Ticktrefoil (*Desmodium paniculatum* [L.] DC.) Plant Guide. Rose Lake PMC, E. Lansing, MI. 2p.

Leif. 2013. Saltmeadow Cordgrass (*Spartina patens* [Aiton] Muhl.) Plant Guide. Rose Lake PMC, E. Lansing, MI. 3p.

Appendix C

Weather and Climate

Growing season temperature and precipitation data, 2013† and long-term‡, for Rose Lake PMC.						
	May	June	July	August	September	Growing Season
Average Daily Maximum (°F)	74.3	78.2	82.9	80.1	74.5	78.0
	69.7	79.9	83.7	82.0	74.4	77.9
Average Daily Minimum (°F)	48.0	56.3	59.5	56.2	49.0	53.8
	45.3	55.5	59.2	57.7	50.5	53.6
Precipitation (in)	4.75	4.81	2.99	3.45§	0.76§	16.76
	2.95	3.64	2.97	3.08	2.58	15.22

†2013 data as recorded by Campbell Scientific automatic weather station at Rose Lake PMC.
‡Long-term data as median of Clinton, Ingham, and Shiawassee values from respective soil surveys.
§Missing Rose Lake PMC precipitation data in August and September was replaced with precipitation data from Michigan State University Muck Research Farm, about 3 miles NE of Rose Lake PMC (http://www.enviroweather.msu.edu/).

2013 Growing Season Weather Summary Precipitation was above normal from late spring through midsummer. A precipitation event on 28 May 2013 was accompanied by severe thunderstorms and high winds at Rose Lake PMC. Hail and tornados were reported nearby. Growing season average daily temperatures were within 0.2 degrees of normal. A major winter ice event which began late on 21 December 2013 and left as many as ½ million mid-Michigan customers without electricity occurred after the growing season, but its limb-trimming and tree-toppling effects will be visible at Rose Lake PMC for some time.

Climate Rose Lake PMC is inland approximately 100 miles from Lakes Michigan, Huron, and Erie. Rose Lake PMC's proximity to the Great Lakes slightly influences the continental climate toward semi-maritime. Prevailing winds are westerly. Annual precipitation is approximately 30 inches distributed throughout the year. The frost-free growing season averages 140 – 145 days, from mid-May to early October. January and July are the coldest and warmest months, respectively.

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