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Persistence, Spread, and Pollinator Value of Commonly Recommended Pollinator Plant Species on the Coastal Plains of the Mid-Atlantic Region

Cape May Plant Materials Center Technical Note No. 3

Preface

This publication was prepared to provide a summary of findings from studies conducted using pollinator plant research plots established at the New Jersey Plant Materials Center (NJPMC) (Cape May Court House, NJ) in 2009. The information presented may be applied by conservationists, producers, or consultants when making decisions regarding species selection for the creation or augmentation of pollinator habitat on the coastal plains of the Mid-Atlantic region. The information may be relevant to the application of NRCS Conservation Practice Standards Conservation Cover (327), Wildlife Habitat Planting (420), Critical Area Planting (342), and Filter Strip (393).

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Introduction

Managing long-term follow up operations and maintenance guidance visits of pollinator habitat establishment projects can be a challenge for Natural Resources Conservation Service (NRCS) and partner employee field office staff. In part due to the contractual nature of many pollinator habitat projects that involve NRCS programs, oftentimes only short-term assessments are conducted leaving the long-term success or failure of these projects largely unknown following planning and installation. The lack of consistent, long-term assessments suggests a need for information on the long-term persistence of commonly recommended pollinator habitat species in the Mid-Atlantic region.

To address this need, NJPMC staff compiled, organized, and analyzed data and findings from completed studies that used pollinator plant research plots established at the NJPMC in 2009 to create the tables in this publication. The plots were established in partnership with Dr. Rachael Winfree, Rutgers University Department of Ecology, Evolution, and Natural Resources, who was awarded a NJ Conservation Innovation Grant (CIG) to develop science-based pollinator restoration protocols for Farm Bill applications based on 2 years of data collection. The plots were then used for a Sustainable Agriculture Research and Education (SARE) grant to collect an additional 2 years of data. Molly Macleod used the full 4-year data set from the research plots to write her dissertation (2016) which examined how species abundance distributions affect plant/pollinator networks. Finally, the unmaintained pollinator plots were reassessed in 2018 to conduct a pollinator plant persistence and spread data collection effort.

The information presented in this publication could be of value to conservationists, producers, or consultants when making decisions regarding species selection for the creation or augmentation of pollinator habitat on the coastal plains of the Mid-Atlantic region. The information may also be relevant to the application of NRCS Conservation Practice Standards Conservation Cover (327) and Wildlife Habitat Planting (420). If enhancing wildlife benefits is a consideration, the information presented in this publication could also be applicable to the Critical Area Planting (342) and Filter Strip (393) NRCS Conservation Practice Standards.

Materials and Methods

The data compiled to create these tables were collected over the course of 9 years during the aforementioned studies using pollinator research plots established at the NJPMC. NJPMC staff planted the study plots in 2009 in a field managed with a cover crop rotation of rye (*Secale cereal*) and soybean (*Glycine max*) from 2001- 2004. From 2005 until the study plots were planted, the field was left as fallow pasture. The soil type of the entire study area is a Downer loamy sand (DocBO) (Soil Survey Staff, 2019). Average annual precipitation for the duration of the study was 46.64 inches (Rutgers University, 2021). Single species plots (1 m^2) of 16 native, perennial (with the exception of a single biennial, black eyed Susan) forbs were planted with

9 mature individual plants and replicated six times for a total of 96 plots. Species were selected based on common pollinator habitat recommendations for the Mid-Atlantic region and commercial availability. During the 4 years (2010-2013) of data collection for the CIG and SARE grant projects, the study plots were regularly maintained: weeded, watered, and any pollinator plant losses within the plots were replanted.

Pollinator visitation data was collected following the same procedure for the CIG and SARE projects. Plots were sampled for a 10-minute interval in random order twice a day for 3 days during that plant species' peak bloom period. Researchers netted and collected all flower visiting bees during the sampling periods for identification to the species level. Full details about the collection protocol are described in MacLeod's dissertation (MacLeod, 2016).

After the completion of the CIG and SARE data collection efforts (2013), the study plots were mostly unmaintained with the exception of occasional high mowing to prevent the establishment of woody species. Without maintenance, the pollinator plant species were allowed to either succeed or fail without anthropogenic interference. This hands-off approach was ideal to prepare the pollinator plot study area for a follow up pollinator plant species persistence study examining the longevity and spread of the plant species without regular maintenance. Data were collected from April-August 2018. After 4 years of minimal maintenance, plot delineations were unclear and the corners of all 96 plots had to be located and remarked. Pollinator plant long-term vigor and potential to spread was evaluated by conducting stem counts of each species inside of each plot and outside of but within 1 meter of each plot (Almeyda, 2018). Total stem count data were used to assign long-term vigor ratings to each species (Table 2). Out of plot stem count data were used to determine the potential of each species for spread (Table 3).

Discussion

Table 1 presents the compiled information on bee attractiveness and plant vigor from the CIG and SARE grant data collection efforts and the long-term vigor data collection effort conducted nine years after planting. Columns 4 and 5 exhibit the plant species that displayed the greatest aggregate bee abundance and bee species richness based on the CIG project 2010-2011 data (Macleod and Winfree, 2012). Column 6 exhibits the plant species that were most frequently visited by regionally (New Jersey) rare bee species based on the CIG report and MacLeod's (2016) dissertation. Regionally rare bee species were defined as "those that account for 10% or less of all bee species in the region" for the CIG project (MacLeod and Winfree, 2012). For her dissertation, MacLeod (2016) defined regionally rare bee species as "those present at only 1 or 2 sites out of our total 78 sites" based on existing data sets from Dr. Rachael Winfree's laboratory collected between 2003-2013 from 192 sites. Column 7 exhibits the plant species that were most frequently visited by crop service bee species. For the CIG results, MacLeod and Winfree (2012) defined "crop bees" as 12 bee species responsible for 80% of all crop visits for 14 crop species in New Jersey. In her dissertation, MacLeod (2016) defined "ecosystem service-providing (ES) bees" as 24 bee species responsible for 80% of all crop flower visits for watermelon, cranberry, blueberry, and apple crop flowers in New Jersey.

Table 2 presents the average stem counts for each species within and outside of the study plots. In addition to serving as an indicator of overall plant vigor, this information helps show which species are more likely to spread under the study site conditions. Predicting which species may aggressively spread is especially important information for planners to achieve planting goals when prescribing seed mixes for pollinator habitat creation or augmentation.

Table 1. Vigor ratings of commonly recommended species for pollinator habitat in the Mid-Atlantic region are based on total stem counts conducted nine years (2009-2018) after planting research plots at the New Jersey Plant Materials Center (Cape May Court House, NJ). Bee attractiveness trait ratings are based on CIG (2010-2011) and SARE (2012-2013) grant studies.

Long Term Vigor Rating[†]	**Scientific Name**	**Common Name**	**Bee abundance**	**Bee species variety**	**Attracts regionally rare bee species**	**Attracts crop bee species**	**No significant value reported**
Excellent	*Pycnanthemum tenuifolium*	narrowleaf mountain mint	X	X	X	X	
	Euthamia graminifolia	flat-topped goldenrod					X
	Rudbeckia laciniata	green headed coneflower	X	X			
	Solidago rugosa	roughleaf goldenrod					X
Good	*Oligoneuron rigidum*	stiff goldenrod	X	X	X	X	
	Symphyotrichum novae-angliae	New England aster				X	
	Rudbeckia hirta	black-eyed susan	X	X			
Acceptable	*Veronicastrum virginicum*	culver's root				X	
	Vernonia noveboracensis	New York ironweed					X
	Eutrochium maculatum	spotted Joe pye weed	X	X	X		
	Asclepias tuberosa	butterfly milkweed	X	X		X	
Poor	*Zizia aurea*	golden zizia					X
	Agastache scrophulariifolia	purple giant hyssop	X		X		
	Penstemon hirsutus	hairy beardtongue		X	X		
	Verbena hastata	blue vervain	X	X	X	X	
	Symphyotrichum pilosum	white heath aster					X

[†]Long-term vigor ratings were assigned using specified ranges for average total stem counts from 2018 data: excellent = >99, good = 50-99, acceptable = 10-49, and poor = 0-9.

Table 2. Average stem counts (within and out of plots) of species assigned a long-term vigor rating of “acceptable” or better are listed in descending order based on "Average Out of Plot Stem Count". Average out of plot stem counts are color coded: green is above average (higher likelihood of spreading), yellow is average, and red is below average (lower likelihood of spreading). Species that received a long-term vigor rating of poor were omitted as survival was too low to assess their potential spread. Stem counts were conducted nine years (2009-2018) after planting research plots at the New Jersey Plant Materials Center (Cape May Court House, NJ).

Scientific Name	**Common Name**	**Average In-Plot Stem Count**	**Average Out of Plot Stem Count**
Pycnanthemum tenuifolium	narrowleaf mountain mint	75.7	171.2
Euthamia graminifolia	flat-topped goldenrod	29.2	103.8
Rudbeckia laciniata	green headed coneflower	31.2	92.5
Solidago rugosa	roughleaf goldenrod	56.0	66.7
Rudbeckia hirta	black-eyed Susan	14.7	37.3
Oligoneuron rigidum	stiff goldenrod	40.2	29.0
Symphyotrichum novae-angliae	New England aster	37.3	15.8
Veronicastrum virginicum	culver's root	40.3	3.3
Eutrochium maculatum	spotted Joe pye weed	10.3	2.0
Asclepias tuberosa	butterfly milkweed	9.7	1.3
Vernonia noveboracensis	New York ironweed	18.2	0.3

Conclusion

It is important to note the limitations of the information presented in this document. The primary caveat in regard to the spread potential and vigor ratings presented here is that they are based on data gathered from study plots that were designed to examine pollinator preference of each plant species (MacLeod et al., 2019). The species list for the CIG study was assembled based on common pollinator habitat recommendations for the Mid-Atlantic region and commercial availability. Meaning that the species examined were not specifically selected for survival at the given study plot site conditions which impacted performance. Taking this into consideration, of the 20 plant species (Appendix 1) included in the CIG study, 4 species were omitted from this report based on their native and wetland indicator statuses. Common St. Johnswort (*Hypericum perforatum*) was not reported on because it is not native to the US and is listed by multiple states as a noxious weed (Sheahan, 2012). The decision to omit swamp milkweed (*Asclepias incarnata*), great blue lobelia (*Lobelia siphilitica*), and New York aster (*Symphyotrichum novi-belgii*) was made based on their obligate wetland indicator statuses which suggest they would be inappropriate species selections for restoration use at the study site location (USACE, 2018). While the wetland indicator status of a species can provide some guidance when assembling a species planting list, insight from local plant experts familiar with the growth habits and environments of native plant species should also be taken into consideration. The superior in plot stem count performance of facultative wetland species (all 6 in the top 10) and inconsistent performances of species with other indicator statuses reinforces the value of gathering information for species selection from other sources in addition to wetland indicator statuses. Although the information presented in this publication may be used to help guide the species selection process for pollinator habitat creation or augmentation, a site-specific plan developed and approved by a local plant expert is recommended.

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Appendix 1:

Table 3. Wetland indicator statuses and average in plot and out of plot stem counts from the 2018 long term plant vigor data collection for all 20 species included in the original (2010) CIG study. Studies were conducted at the New Jersey Plant Materials Center (Cape May Court House, NJ).

Scientific Name	**Common Name**	**Average In-Plot Stem Count**	**Average Out of Plot Stem Count**	**Wetland Indicator Status for Atlantic and Gulf Coastal Plain Region**
Pycnanthemum tenuifolium	narrowleaf mountain mint	75.7	171.2	FACW
Solidago rugosa	roughleaf goldenrod	56.0	66.7	FAC
Veronicastrum virginicum	culver's root	40.3	3.3	FACW
Oligoneuron rigidum	stiff goldenrod	40.2	29.0	FACU
Symphyotrichum novae-angliae	New England aster	37.3	15.8	FACW
Rudbeckia laciniata	green headed coneflower	31.2	92.5	FACW
Euthamia graminifolia	flat-topped goldenrod	29.2	103.8	FAC
Vernonia noveboracensis	New York ironweed	18.2	0.3	FACW
Rudbeckia hirta	black-eyed Susan	14.7	37.3	FACU
Eutrochium maculatum	spotted Joe pye weed	10.3	2.0	FACW
Asclepias tuberosa	butterfly milkweed	9.7	1.3	UPL
Zizia aurea	golden zizia	1.3	0.0	FAC
Agastache scrophulariifolia	purple giant hyssop	1.0	0.0	UPL
Penstemon hirsutus	hairy beardtongue	0.8	0.0	UPL
Hypericum perforatum	common St. Johnswort	0.3	5.8	FACU
Asclepias incarnata	swamp milkweed	0.3	0.0	OBL
Lobelia siphilitica	great blue lobelia	0.2	0.0	OBL
Verbena hastata	blue vervain	0.0	0.3	FAC
Symphyotrichum pilosum	white heath aster	0.0	0.0	FAC
Symphyotrichum novi-belgii	New York aster	0.0	0.0	OBL