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FINAL STUDY REPORT of MIPMC-T-1302-WI
Rose Lake Plant Materials Center, E. Lansing, MI

TOLERANCE OF SELECTED WILDFLOWER SPECIES TO POSTEMERGENCE HERBICIDES

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ABSTRACT

Few chemical options are known to be effective for the establishment of polyspecies mixes of perennial wildflowers. This study was designed to address that lack of knowledge. Postemergence herbicides were applied to wildflower seedlings and plant responses were observed. No herbicide was identified which did not injure some or most of the wildflowers in this study. This study suggests that the use of the postemergence herbicides evaluated in this study for establishing a polyspecies mix of wildflowers is not a viable option.

INTRODUCTION

United States Department of Agriculture-NRCS offers voluntary programs to eligible landowners and agricultural producers to provide financial and technical assistance to help manage natural resources in a sustainable manner. Perennial wildflowers plantings are a suggested or required component of many of these programs. Once established these plants survive well and provide habitat and pollen for pollinator insects such as bees, butterflies, and moths (USDA-NRCS, 2014b). However, competition from weedy plant species can make it difficult for wildflowers to become established.

MATERIALS AND METHODS

Eighteen wildflower species (Table 1) were selected from the Michigan CRP-SAFE eligible wildflower list (USDA-NRCS, 2014a). Crown vetch (*Securigera varia*) was also included in the trial because it has been a noted competitor during wildflower establishment at Rose Lake Plant Materials Center (PMC), E. Lansing, MI. Ten postemergence herbicides (Table 2) were selected with assistance from Dr. Christy Sprague, MSU weed scientist (C. Sprague, pers. comm., 2013).

Wildflower seed was obtained from a commercial source and seed stratification recommendations provided with the seed were followed. Seed was planted in pots of peat-based planting media and subjected to optimum growing conditions in a greenhouse (80° F day, 65° F night, supplemental daytime lighting, and automated overhead fertigation). Seedlings were transplanted or thinned to the same number of healthy plants per pot per species (Fig. 1) with three replicates blocked for similar height. Herbicide treatment was applied at the 6 to 8-leaf stage of growth. Because not all plants simultaneously achieved the same leaf stage, treatments were imposed on several dates. Postemergence herbicide treatments were applied using a precision backpack sprayer (Fig. 2) calibrated to deliver 20 gal/a spray mix to experimental units at active ingredient rates for agronomic crops (Crop Data Management Systems, 2014; Sprague, 2014) and as shown in Table 2. No herbicide was applied to a control. When summer greenhouse temperatures began to exceed optimums, wildflowers were moved outside to a shadehouse where automated overhead fertigation continued.

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Number of surviving wildflowers, plant height, and injury symptoms were recorded at 14, 28, and 42 days after treatment (DAT). Analysis of variance was conducted on survival and height within cohort (same species treated on same day). IF 42-DAT survival equaled maximum treatment mean for survival within cohort AND 42-DAT height equaled maximum treatment mean for height within cohort AND no plants exhibited symptoms of herbicide injury at 42 DAT THEN wildflower was considered tolerant (T). This tolerance-determination protocol is represented in Figure 3.

RESULTS AND DISCUSSION

Spiderwort (*Tradescantia ohiensis*) was tolerant to the most herbicides (4 of 5) and common beggar-tick (*Bidens frondosa*) and lance-leaved coreopsis (*Coreopsis lanceolata*) were tolerant to the least (0 of 10). Summary results are shown in Table 3.

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 any 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 within species treated with different herbicides but not with a non-treated control, and (2) whether affected plants would have outgrown herbicide injury symptoms observed at 42 DAT was not assessed because plants had become too large to be maintained in their small pots.

CONCLUSION

No herbicide was identified which did not injure some or most of the wildflowers in the study. This study suggests that the use of any of the postemergence herbicides evaluated in this study for establishing a polyspecies mix of wildflowers is not a viable option.

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

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LITERATURE CITED

Crop Data Management Systems. 2014. Pesticide Labels. http://www.cdms.net/LabelsMsds/LMDefault.aspx (accessed 8 Dec 2014).

Sprague, Christy L. 2014. Weed Control Guide for Field Crops. Michigan State University Extension Bulletin E-434. 188 pp. http://www.msuweeds.com/publications/weed-control-guide/ (accessed 8 Dec 2014).

USDA-NRCS. 2014a. Michigan CRP SAFE Eligible Wildflower List. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/mi/programs/?cid=nrcs141p2_024527 (accessed 8 Dec 2014)

USDA-NRCS. 2014b. Pollinator Biology and Habitat. Michigan Biology Technical Note No. 20. 37 pp. http://efotg.sc.egov.usda.gov/references/public/MI/Biol_TN_20_Pollinator-Biology-and-Habitat_v1-1_honey_bee_preferences.pdf (accessed 8 Dec 2014).

Figure 1. Seedlings were transplanted or thinned to the same number of healthy plants per pot per species.

Figure 2. Postemergence herbicide was applied using a precision backpack sprayer.

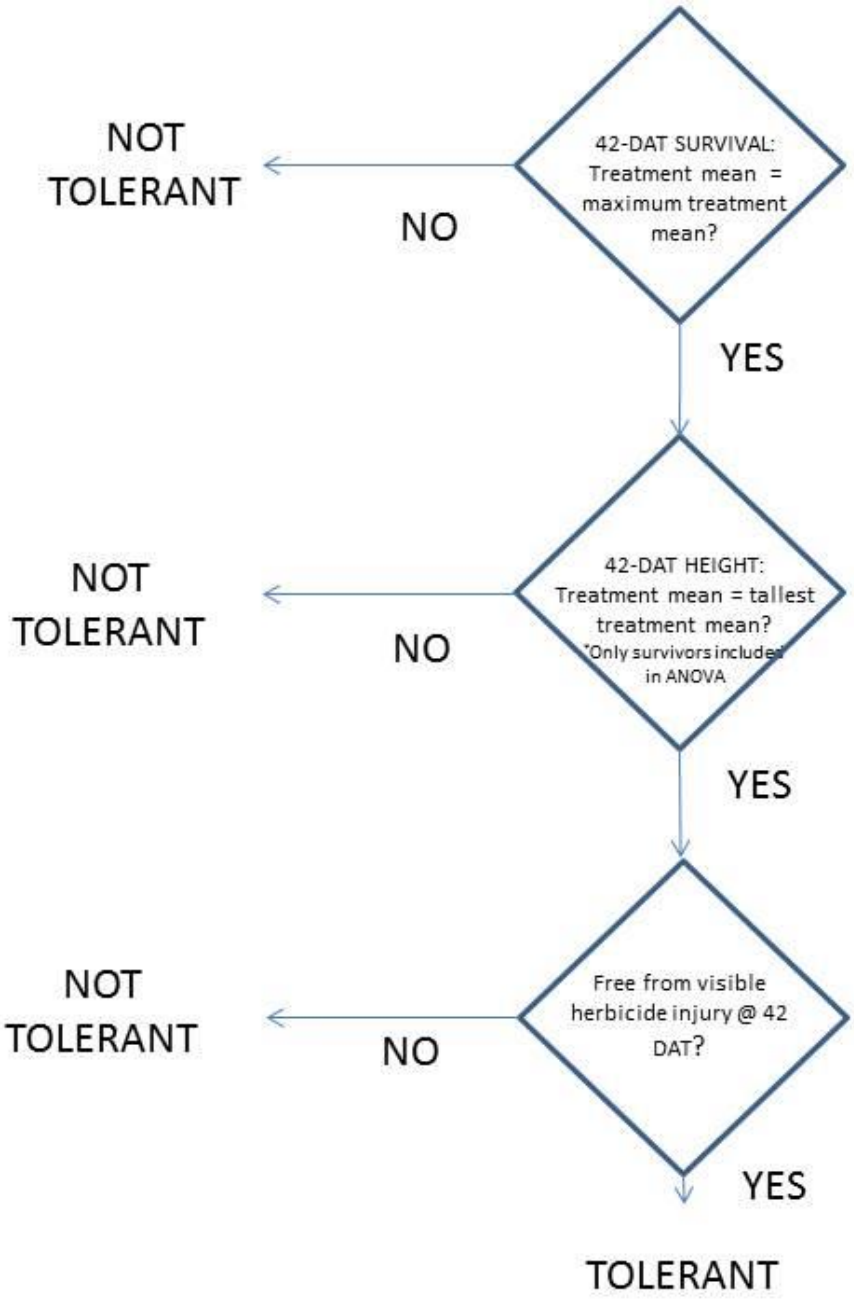

Figure 3. Decision tree was used to assess postemergence herbicide tolerance.

Table 1. Wildflower species used in postemergence herbicide screen. Rose Lake Plant Materials Center. 2013.

Wildflower		
Scientific name	Common name	Botanical family
Achillea millefolium	Yarrow	Asteraceae
Amorpha canescens	Leadplant	Fabaceae
Asclepias tuberosa	Butterflyweed	Asclepiadaceae
Baptisia alba	White False Indigo	Fabaceae
Bidens frondosa	Common Beggar-Tick	Asteraceae
Coreopsis lanceolata	Lance-leaved Coreopsis	Asteraceae
Desmodium canadense	Canada Tick Trefoil	Fabaceae
Echinacea purpurea	Purple Coneflower	Asteraceae
Eryngium yuccifolium	Rattlesnake Master	Apiaceae
Lespedeza capitata	Roundhead Bush-Clover	Fabaceae
Liatris aspera	Rough Blazingstar	Asteraceae
Monarda fistulosa	Wild Bergamot	Lamiaceae
Oenothera biennis	Evening Primrose	Onagraceae
Securigera varia	Crown Vetch	Fabaceae
Silphium integrifolium	Rosin Weed	Asteraceae
Solidago speciosa	Showy Goldenrod	Asteraceae
Symphyotrichum novae-angliae	New England Aster	Asteraceae
Tradescantia ohiensis	Spiderwort	Commelinaceae
Veronicastrum virginicum	Culver's Root	Scrophulariaceae

Table 2. Herbicides applied postemergence to wildflowers at Rose Lake Plant Materials Center. 2013.

Trade name and formulation	Common Name	Rate	Adjuvant
Accent® Q 54.5 WG	Nicosulfuron (+safener)	0.9 oz/a	COC + AMS
Basagran® 4 SL	Bentazon	2 fl pt/a	COC
Beacon® 75 WG	Primisulfuron	0.76 oz/a	COC
Buctril® 2 EC	Bromoxynil	1 fl pt/a	none
Butyrac® 200	2,4-DB	12 fl oz/a	none
Callisto® 4 SC	Mesotrione	3 fl oz/a	COC + AMS
Flexstar® 1.88 L	Formesafen	1 fl pt/a	COC + AMS
Impact® 2.8 SC	Topramezone	0.75 fl oz/a	MSO + AMS
Permit® 75DF	Halosulfuron	0.67 oz/a	NIS
Stinger® 3SL	Clopyralid	4 fl oz/a	none

Table 3. Tolerance of selected wildflowers to postemergence herbicides registered for agronomic crops in Michigan. Rose Lake Plant Materials Center. 2013.

	Herbicide									
Scientific name	Accent	Basagran	Beacon	Buctril	Butyrac	Callisto	Flexstar	Impact	Permit	Stinger
Achillea millefolium	X	N	N	N	T	N	N	X	N	N
Amorpha canescens	X	T	N	T	T	N	N	N	X	N
Asclepias tuberosa	N	N	N	N	N	N	N	N	T	N
Baptisia alba	X	N	X	X	T	X	N	X	X	X
Bidens frondosa	N	N	N	N	N	N	N	N	N	N
Coreopsis lanceolata	N	N	N	N	N	N	N	N	N	N
Desmodium canadense	X	T	N	T	T	N	N	X	X	N
Echinacea purpurea	X	T	N	N	N	N	N	N	N	N
Eryngium yuccifolium	N	N	N	N	T	N	T	N	N	N
Lespedeza capitata	X	T	N	N	T	T	N	N	N	T
Liatris aspera	X	N	N	T	N	T	N	X	X	X
Monarda fistulosa	X	T	X	T	T	N	N	X	X	X
Oenothera biennis	N	T	N	N	N	N	N	N	N	N
Securigera varia	X	N	N	N	T	N	N	N	N	N
Silphium integrifolium	X	N	N	N	T	N	N	N	N	N
Solidago speciosa	X	N	X	N	T	T	N	X	X	T
Symphyotrichum novae-angliae	N	N	N	N	T	N	N	N	N	N
Tradescantia ohiensis	X	T	X	T	T	N	T	X	X	T
Veronicastrum virginicum	X	T	X	X	T	X	X	X	X	X

T=tolerant
N=nontolerant
X = no results