Final Report - 2014
ISDA Nursery, Landscape, and Florists Grant Program

Title: Establishment of Wildflower Plantings in Urban and Suburban Sites

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Abstract

Weed competition is the single largest barrier to successful establishment of naturalized wildflower meadow plantings. This research was designed to study the effectiveness of using competitive grass species, grass-appropriate weed control methods, and transplanting of wildflwer species to improve establishment success. Initially, three weed control procedures were used, each involving the spring planting of bunch grass species, followed by mowing, application of a 2,4-D herbicide, and application of a Tri-mec herbicide. In late summer, following completion of weed control procedures, wildflower species were either seeded or transplanted into the plots. Two control plots were established for comparison. The first control treatment was designed as a common-practive comparison with grass and wildflowers seeded in the spring, with no subsequent effort to control weeds. The second contol treatment was designed to provide an optimal situation with grass planted in spring, consistent handweeding to control all weeds in the plots, followed by seeding of wildflowers in late summer. In the spring of 2014, a final weed control treatment was applied by dividing plots randomly in half and the pre-emergent herbicide Plateau applied to a half-plot while the other half was left untreated.

Factors evaluated as indicators of meadow establishment success included number of weeds (per square meter), number of grass plants (per square meter), and number of wildflower plants (per square meter). In the fall, descriptive notes were taken as a way to document plot condition and appearance.

The spring planted/ no weed control treatment adequately demonstrated the problems associated with traditional meadow establishment procedures. Weed counts averaged 1,144 per square meter. Grass and wildflower species were almost completely crowded out (1 per square meter in each case) in these plots due to extreme competition during the first year. The few plants remaining were weak and spindly. In comparison, the hand-weeded control treatment (weeded only in 2013 and left to grow in 2014) had weed counts of 11 per square meter, grass counts averaging 14, and wildflower counts of about 3.

Weed and meadow component density for the grass-based weed control treatments were more in line with the hand-weeded control than the unweeded control, indicating that the grass-based weed control procedures were successful in improving the competitive advantage for desired plants during meadow establishment. In general, the rank of treatment effectiveness, from highest to lowest, was Tri-mec application, 2,4-D application, and mowing, although the differences were small and not statistically different.

Seeding resulted in higher numbers of wildflowers than did transplanting, an expected outcome due to the much higher planting rate for the seeding treatment. However, the transplanted wildflowers were much more robust, bloomed heavier, and produced more seed. The spring Plateau herbicide treatment had not effect on the total number of weeds in the plots. However, the application did change the weed species composition, mostly by reducing or eliminating mustard species from the plots.

The grass-first planting and weed control strategy proved to be extremely effective in limiting weed competition and successfully establishing both grass and wildflower components of the meadow planting. One additional year of monitoring is needed to document the final success of the treatments, but it appears that this research should allow development of educational materials and possibly products that will allow homeowners and landscape maintenance personnel to create attractive meadow plantings.

Objectives

This project is guided by two primary objectives:

1) Determine the potential for utilizing competitive grass species and grass-dependent weed control methods for controlling weeds during establishment of naturalized wildflower areas.
2) Determine the efficacy of transplanting forbs to improve early competitiveness and long-term diversity in wildflower natural areas.

Accomplishments

Introduction: Wildflower meadows are valuable additions to low-maintenance landscapes and are desirable for an assortment of applications. Weed competition is the most significant barrier to establishing durable low-maintenance wildflower plantings. Simply seeding a combination grasses and wildflowers into a meadow site is seldom successful because the desirable plants are crowded out by persistent annual and perennial weeds. Many of these same weeds are easy to control in turf or grass monoculture meadows through herbicide applications, mowing, and consistent competition. This research will investigate the possibility using weed control options designed for grass species to enhance efforts to establish wildflowers in a meadow planting.

Methods: The plant materials for this study were for their ability to survive in a competitive, mixed-species environment. Weed control treatments were chosen for their ease of application and limited cost. Eight initial establishment treatments were chosen for this study, as follows:

1. Weedy control treatment; all grass and flower seed planted in the spring, no weed control.
2. Hand-weeded control treatment; grass planted in spring, weeds controlled completely by hand-pulling, wildflowers seeded in late summer.
3. Mowing/seeded treatment; grass planted in spring, weed competition managed by mowing at a 3 inch height, wildflowers seeded in late summer.

Established grass and wildflower meadow components as of October, 2013.

4. Mowing/transplanted treatment; grass planted in spring, weed competition reduced by mowing at a 3 inch height, wildflowers transplanted in late summer.
5. 2,4-D/seeded treatment; grass planted in spring, plots sprayed in early summer with a 2,4-D herbicide, wildflowers seeded in late summer.
6. 2,4-D/transplanted treatment; grass planted in spring, plots sprayed in early summer with a 2,4-D herbicide, wildflowers transplanted into plots in late summer.
7. Tri-mec/seeded treatment; grass planted in spring, plots sprayed in early summer with a Tri-mec herbicide, wildflowers seeded in late summer.
8. Tri-mec-transplanted treatment; grass planted in spring, plots sprayed in early summer with a Tri-mec herbicide, wildflowers transplanted into plots in late summer.

Five small to medium statured bunch grass species were selected for the study, including Idaho fescue (*Festuca idahoensis*), Indian ricegrass (*Achnatherum hymenoides*), big bluegrass (*Poa secunda*), slender wheatgrass (*Elymus trachycaulus*), and tufted hairgrass (*Deschampsia caespitosa*). For the seeded plots, sufficient seed was prepared from each grass species to plant each plot with the equivalent of 10 pure live seed per square foot. This density was chosen under the assumption it would provide competition to enhance weed control while at the same time leaving some exposed soil to make room for later planted wildflower species.

Twelve wildflowers species typified by robust growth and ability to replace themselves through seed dissemination, were chosen for the study, including yarrow (*Achillea millefolium*), Pacific aster (*Symphyotrichum chilensis*), purple prairie clover (*Dalea purpurea*), western larkspur (*Delphinium occidentale*), Jame's buckwheat (*Eriogonum*

jamesii), blanketflower (*Gaillardia aristata*), blue flax (*Linum lewisii*), Rocky Mountain penstemon (*Penstemon strictus*), firecracker penstemon (*Penstemon eatonii*), black-eyed susan (*Rudbeckia hirta*), Mexican hat (*Ratibida columnifera*), and Munro's globemallow (*Sphaeralcea munroana*). Sufficient seed was prepared from each wildflower species to plant each seeded plot with the equivalent of 4 pure live seed per square foot.

For the transplanted plots, seed of each wildflower species was planted in pots in a greenhouse to prepare seedlings for late summer establishment. At planting time, 10 plants of each species were placed in each 20 foot by 20 foot plot. Greenhouse production of delphinium and Rocky Mountain penstemon failed, meaning these plants were not established in the transplanted plots. Insufficient plants were available for firecracker penstemon resulting in only 5 plants of this species being placed in each plot.

Prior to final soil tillage and spring planting of grass species, glyphosate herbicide was applied to the entire plot area to control perennial weeds. Grass species (plus wildflower species in the unweeded control plots) were planted on June 28th. Herbicide applications were made on July 26th. Weekly mowing treatments began on July 26th. Seeding and transplanting of wildflower species was completed on August 28th.

In the spring of 2014, a final weed control treatment was applied. Plots were randomly divided in half and the pre-emergent herbicide Plateau applied to one half-plot while the other half was left untreated.

The treatments were replicated 3 times. Plant establishment was accompanied by daily irrigation until plants emerged (same irrigation schedule in the case of transplant establishment). Irrigation was then cut back to twice a week until the plants were well established. Weekly irrigation was applied in 2013 during the periods between plant establishment procedures. In 2014, irrigation was applied only as plants showed early signs of drought stress, typically at intervals ranging from one to two weeks.

Second-year (2014) weedy control plot wherein weed competition virtually eliminated the meadow grasses and wildflowers.

Results: During the establishment year in 2013, the most prominent and competitive weed species in the plots was common purslane. Most plots developed solid, uniform groundcover of this species. There were also heavy populations of redroot pigweed, koschia, and lambsquarter, and scattered plants of common mallow and hairy nightshade.

Koschia, redroot pigweed, and lambsquarter remained common in the plots in 2014, after establishment of the meadow

Plot mowed for weed control followed by seeded wildflowers. Photo taken June 23, 2014.

Plot with 2,4-D applied for weed control, followed by transplanted wildflowers. Photo taken June 23, 2014.

Plot with Tri-mec applied for weed control, followed by transplanted wildflowers. Photo taken June 23, 2014.

components. Purslane was present in much smaller numbers in 2014 and tended to be displaced by flixweed, tumble mustard, and prickly lettuce.

Establishment in 2013 of meadow components in all but the weedy control plots was very successful. Among grass species, slender wheatgrass germinated at a high rate and had strong vigor, making it dominant in the plots. The other four grass species were present in the plots in relatively high numbers with the exception of tufted hairgrass, which exhibited a sparse stand. Among wildflowers, aggressive species with rapid growth rates established best, particularly black-eyed Susan, blanketflower, Pacific aster, Mexican hat, yarrow, and blue flax. Purple prairie clover, Jame's buckwheat, and Munro globemallow were present by tended to be outcompeted by the other plants in the plots. Western larkspur, firecracker penstemon, and Rocky Mountain penstemon showed limited emergence and were largely absent from the plots.

In 2014, the weedy control treatment retained very high populations of a number of weed species (See weed and meadow component plant counts in Table 1). Measurements confirmed that meadow components had been out-competed and largely eliminated in these plots during the 2013 establishment year. Some weeds were present in the hand-weeded control plots the second year, but in comparison with the weedy control plots, weed counts were low and grass and wildflower counts high (Table 1).

Most important to the study, the plots where treatments involved planting grass first, followed by application of grass-based weed control methods, weed, grass,

and wildflower densities were more in line with the hand-weeded control than the weedy control. In every case, weed competition was reduced sufficiently to allow successful establishment of meadow components (Table 1).

Tri-mec application was the best treatment for reducing weed competition and establishing wildflower components of the meadow. Although, with the exception of grass densities, the differences were not statistically significant, the Tri-mec plots were visually the best looking.

The plant counts employed in 2014 were of minimal value is assessing the value of transplanting the wildflowers. The number of seeds applied (and emerged seedlings) to the seeded plots far outstripped the number of plants transplanted into corresponding plots. By default, the final numbers of plants in the transplanted plots was much smaller. Evaluations in subsequent years will be of greatest value in assessing the value of transplanting. However, observations and general notes made on the plots indicated that transplanted wildflowers were more robust, more visible, more competitive, produced more flowers, and resulted in more seed than seeded wildflowers. This suggests that transplanting may be an appropriate strategy for establishing wildflowers in a meadow.

Application of the pre-emergent herbicide Plateau in the spring of 2014 did not provide any visible advantage of additional weed control. Total numbers of weeds were similar in the treated and untreated plot-halves. Visible inspection did reveal a change in weed composition, mainly evident as a reduction in mustard weeds (flixweed, tumble mustard, purple mustard) in the treated plot-halves. This herbicide may have residual activity and the response will need to be reevaluated in 2015.

Table 1. Second-year density of weeds, meadow grasses, and meadow wildflowers in the seeded plots for each weed control treatment. Data from transplanted plots was removed from the analysis to avoid confounding results. Density counts were made on June 24, 2014.

Treatment	**Weed Density (No per sq M)**	**Grass Density (No per sq M)**	**Wildflower Density (No per sq M)**
Weedy control Spring seeded	1144	1	1
Hand-weeded Summer seeded	11	14	3
Mowed Summer seeded	45	14	3
2,4-D Summer seeded	36	18	4
Tri-mec Summer seeded	14	23	7
LSD (0.05)*	313	8	5

*Numbers in the same column separated by more than the value of the LSD are considered to be statistically different.

In summary, preplanting the grass species components of a meadow, followed by application of grass-appropriate weed control methods, prior to seeding or transplanting the wildflower components markedly reduced weed competition and resulted in the successful establishment of wildflower meadows. In other words, this study validated the concept of using grasses and grass-appropriate weed control methods for overcoming problems associated with weed. In retrospect, the procedure was much more effective than anticipated.

Wildflowers and grasses successfully established in a meadow planting. Photo taken June 23, 2014

In 2015, the plots will be subjected to a final round of plant density and species transition evaluations. Residual weed competition will be evaluated, grass and wildflower survival will be assessed, and overall aesthetics will be rated.

Once the final measurements have been analyzed, recommendations for meadow establishment procedures will be compiled and published in public forums. Recommendations concerning appropriate meadow components - both grass and wildflower species - will be suggested. Lastly, ideas will be presented on how to construct and market meadow establishment kits.

Expenditure Report

Category	Amount Allocated	Amount Expended
Part-time wages and fringe benefits	$1,220	$1,440
Supplies (seed, pots, labels, herbicides, etc)	$ 200	$ 190
Other expenses (field charges, motor pool)	$ 350	$ 140
Total funds allocated	$1,770	
Total expensed to date		$1,770
Amount remaining as of 31 Dec 2014	$ 0	