Assessment of Prairie Pot Transplants as a Restoration Tool

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Introduction:

Prairie restorations are typically initiated by broadcasting or drilling a seed mix that contains seeds from a wide variety of prairie species (Sauer 1998; Montalvo 2006). Often the resulting prairie is not as diverse as desired because less aggressive species, and species that do not germinate well have trouble getting established. Also, rare species are seldom represented in seed mixes intended to promote diversity in restored prairies. This summer we assessed a new restoration method. This method involves transplanting species into restored prairies using prairie pots. Prairie pots are six inch diameter pots that contain four seedlings each of a different species (resembling a simplified miniature prairie). Prairie pots were compared to planting individual transplants that had been grown with one fourth the amount of soil than was present in the prairie pots. We focus this study on transplants because it has been our experience that utilizing transplants in restoration projects can yield multiple benefits. Transplants can reach maturity more quickly than plants emerging from seed, thereby providing a source of additional seed usually within the first year. Transplants can also include the less common and more problematic species, providing the restorationist with greater control over the final outcome of the project (Packard and Mutel 1997; Sauer 1998).

Methods:

This project involved the use of six prairie species one of which was a state threatened forb, *Silphium lacinatum* (Compass plant) (Rienartz 1995; Herman et al. 2001). The other species were a mix of common and less common species which brought added diversity to the prairie at Pierce Cedar Creek Institute (PCCI) located near Hastings, MI. The seeds for all of the species were collected from local sites in Kent

County, Michigan and were all assumed to contain local genotypes (Falk 1996). All of the seeds received identical overwintering stratification treatment outside the Calvin College research greenhouse. In March, 2006, seeds from each of these species were started in germination flats in the Calvin College greenhouse. They were allowed to grow for several weeks until their first true leaves were produced. The species were organized into two groups of four which were then planted together. The first group (A) included *Silphium laciniatum* (Compass plant), *Aster laevis* (Smooth blue aster), *Schizachyrium scoparium* (Little bluestem), and *Andropogon gerardii* (Big bluestem). The other species planted together (B) were *Bromus ciliatus* (Fringed brome), *Solidago rigida* (Stiff goldenrod), *Aster laevis* (Smooth blue aster), and *Schizachyrium scoparium* (Little bluestem).

Seedlings were transplanted in their respective groups (A or B) into 6 inch diameter pots between April 29 and May 15, 2006. Individuals from each of the six species were also planted into flats of 2x2 inch individual cells on June 1-2, 2006. The cells into which individuals seedlings were transplanted held one fourth the soil volume of the prairie pots. All plants were kept in a greenhouse for 2-3 weeks and then after transplanting into cells or prairie pots moved outside to a mammal exclosure for hardening off.

On May 30, 2006 work began with labeling, measuring, and recording the height of each of the four species in every prairie pot, and each of the individual plants in the flats of 2x2 cells. This work continued through the second of June, followed by the input of the initial data into an excel file. The beginning of June also yielded a decision on where the restoration strategy should be tested. We decided on a section of prairie located

near the entrance road to PCCI. This section had been burned the previous fall (2005), and was ready for the introduction of transplants. In early June at the restored prairie habitat on PCCI property twelve 9m x 9m blocks were marked off. Within each block, eight 1m x 1m quadrats were established. I randomly assigned four of these quadrats to receive five prairie pots, and the other four quadrats to receive 20 individual transplants (five seedlings from each of the four species). This design provided 6 separate, large, replicated areas, each of which had 8 quadrats (4 with prairie pots, 4 with individual transplants) within. A flow chart of this planting strategy is included (*Figure 1*). In total 20 prairie pots as well as 80 individual transplants were introduced into each replicated site, for a total of 240 prairie pots and 960 individual transplants. The second measurement occurred in the prairie on July 11-12, 2006. The third and final measurement occurred on July 26-28, 2006.

The data collected were recorded in a laboratory notebook as well as an excel chart. The excel data were used to generate graphs and descriptive statistics. Data were also analyzed with a two sample T-test so that significance could be assigned. (Statistix 2000).

Results:

Based on previous work (Warners pers. comm.) which was corroborated by informal comparisons in this study, prairie pots were found to be a more time efficient method for introducing transplants into a prairie. When compared to individual transplants prairie pots require 50% the amount of preparation time in the greenhouse and less than 50% the amount of transplant time in the field.

Figure 2 displays the final measurements recorded in late July to represent the survivorship of each species used in the assessment of prairie pots. Survivorship is expressed by calculating the overall average of the six replicated blocks in each group (A or B) (therefore n=6). The trend in this graph is greater survivorship among the prairie pots over of the individual treatments. The only species that showed significantly greater survivorship when transplanted as individuals was *Andropogon gerardii*.

Figure 3 displays the mean height for each of the seedlings that survived, as recorded on the final day of data collection in July. The values on the graph were calculated by taking the overall average for each species in the 6 replicated blocks (n=6). Each species shows the same trend with prairie pots having more growth than the individual treatments.

Discussion:

The results from this experiment show that on three levels: time required for preparing and transplanting, survivorship, and growth the prairie pots have out performed the individual transplant seedlings. The trend in survivorship (*Fig. 2*) illustrates an advantage for all species in prairie pots except *Andropogon gerardii*. As similar experiments with prairie pots occur particular attention must be given to identify species like *A. gerardii* that grow significantly better if planted as individuals. This knowledge will aid growers of native plants as well as those involved with using transplants in restoration projects as they work to establish key elements in their restoration efforts.

Higher survivorship in prairie pots could be influenced by soil volume. Even though each prairie pot seedling has an equivalent amount of soil as the individual seedlings, it appears that 4 seedlings sharing 4x amount of soil conveys an advantage

over 1 seedling that is allocated 1x volume of the same soil. The potential for mutualistic interactions among these species is also present, even though none of the species in the study are capable of fixing nitrogen.

This was only the first year of the study, and it is possible that as the plants get larger there will be increased competition between the four species in prairie pots. The increased competition could cause greater mortality for certain species in the long term, resulting in decreased diversity. Therefore, a study such as this needs to be monitored for several seasons so that the potential long term benefit of prairie pots can be more accurately understood.

Figure 3 illustrates a trend for greater height achieved by plants in prairie pots, however when analyzing these data, only two of the six species in prairie pots had grown significantly more than the individuals. It is important to recognize that the tallest average end height was only 14 centimeters (for *Bromus ciliatus*) and perhaps given more time, differences in height between the prairie pot and individual seedlings may become more significant.

Time comparisons to maximize efficiency are a common component of species eradication efforts. However, such consideration of time investment for restoration work is less widely assessed. We do feel this is an important factor to consider and although more careful quantification is warranted, our informal comparison strongly supports the use of prairie pots as a more time efficient prairie restoration method than individual transplanting.

Conclusion: In this study we found that prairie pots led to significantly increased seedling survivorship for four of the six species used in this experiment compared to

individually transplanted seedlings. Prairie pots also yielded taller plants for each of the species compared to individuals, but these numbers were significant for only two of the six species. Finally, prairie pots require less time to prepare and outplant into a prairie proving to be a more time efficient method for transplanting seedlings than seedlings that are transplanted individually.

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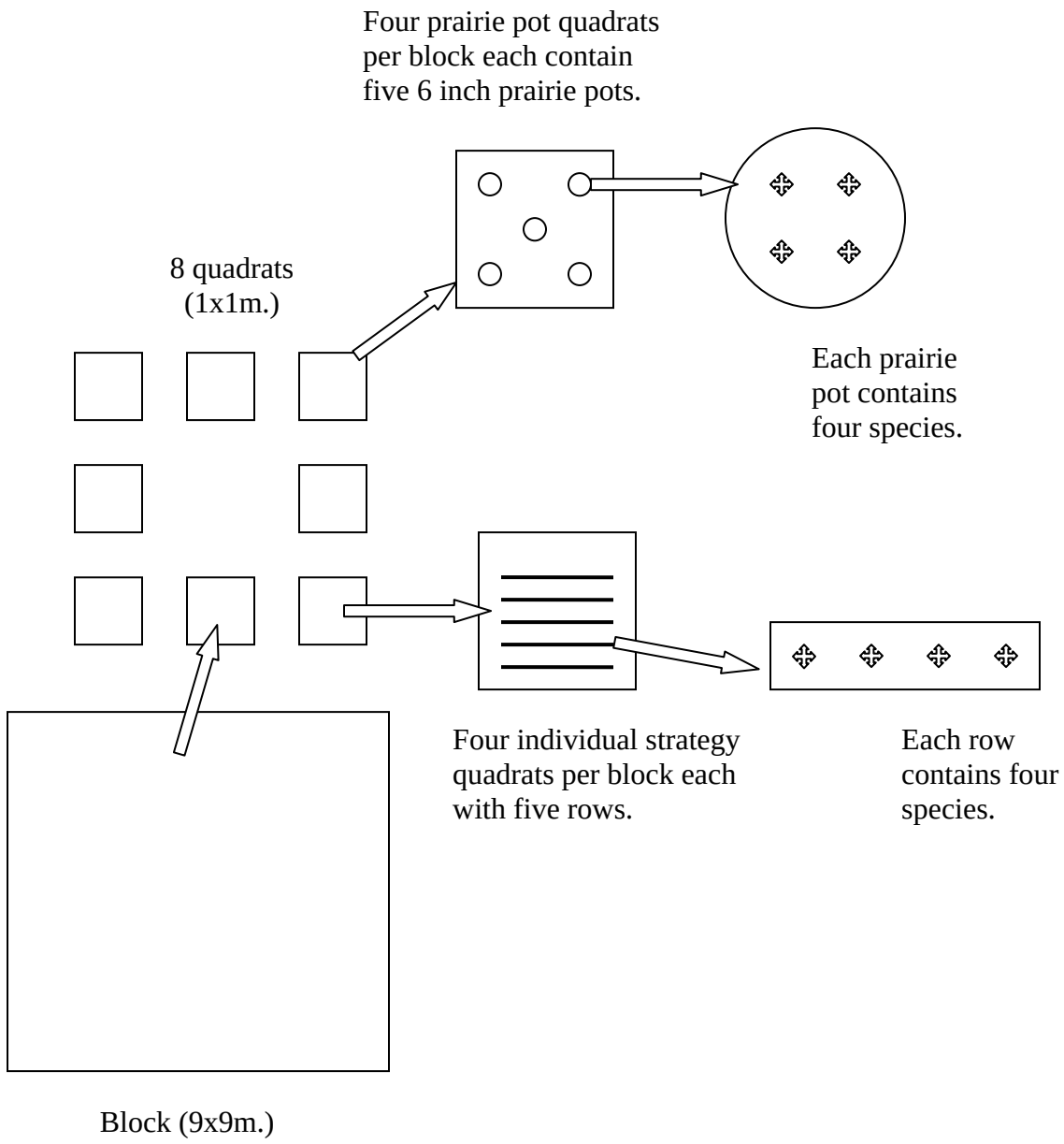

Figure 1. **Schematic diagram of experimental design.**

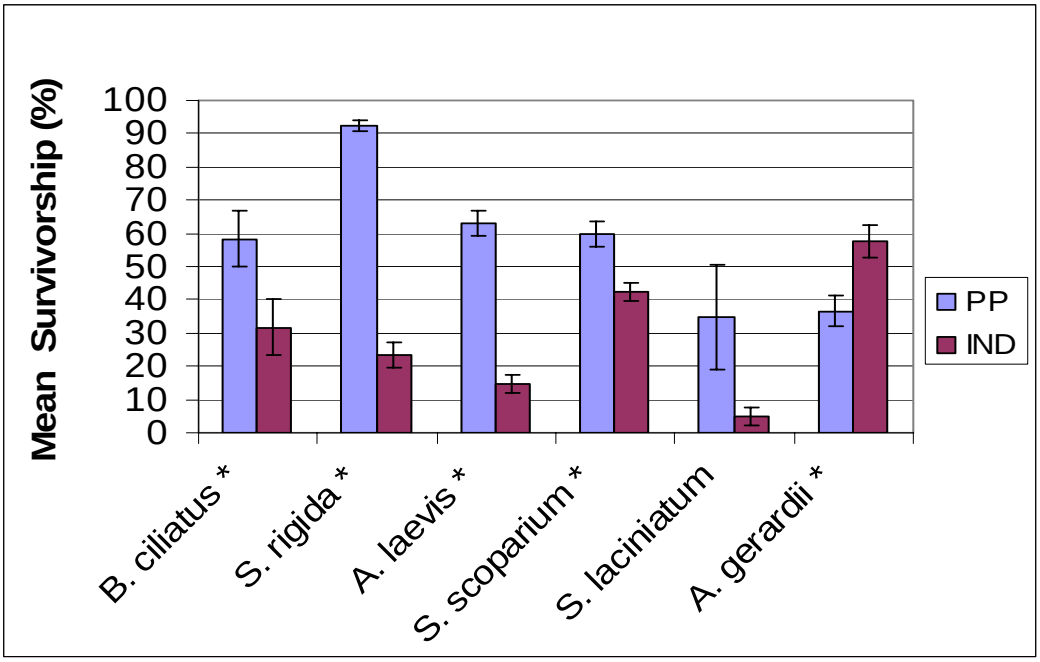

***Figure 2*. Seedling survivorship in prairie pots and as individual transplants.** Error bars represent one standard error about the mean. Asterisks indicate a significant difference using a two sample T-test ($p < .05$).

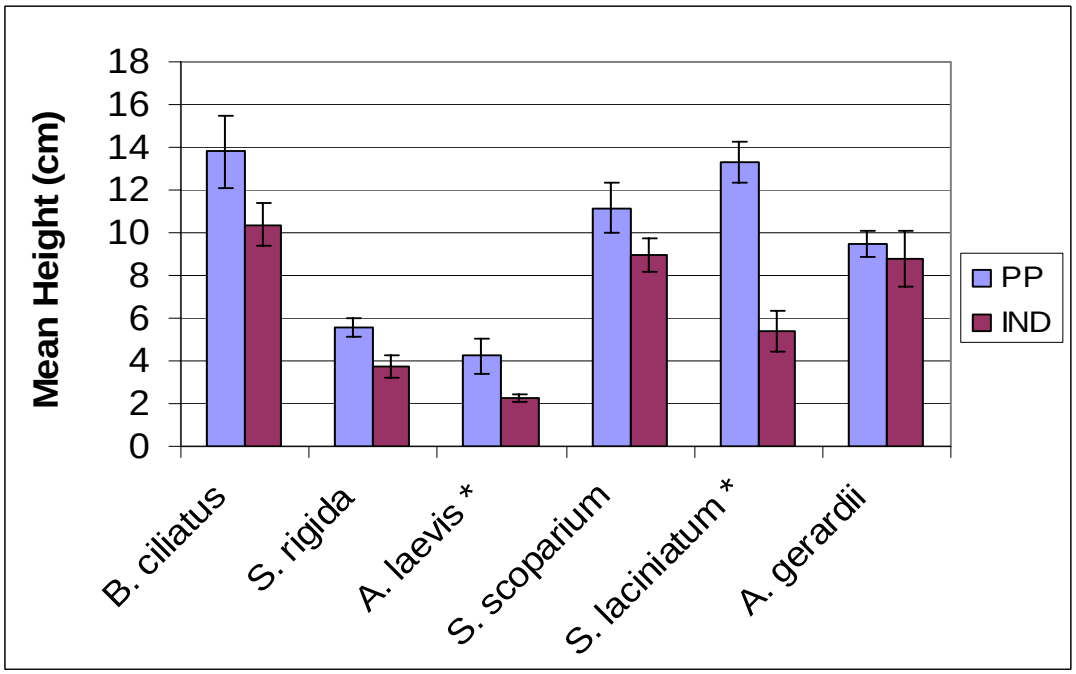

***Figure 3*. Comparison of mean height of seedlings as recorded on the final sample** date in July. Error bars represent one standard error about the mean. Asterisks indicate a significant difference using a two sample T-test ($p < .05$).

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