

Propagation and Outplanting Trial Report: *Asclepias cordifolia* (Heartleaf Milkweed)



Background

In our continued work to help increase the availability of plant materials for pollinator conservation, Xerces staff conducted propagation and outplanting trials for *Asclepias cordifolia* (heartleaf milkweed). This species provides critical pollen and nectar resources for monarchs and other declining pollinators. *Asclepias cordifolia* is also a key early-emerging host plant for monarch butterfly caterpillars. This species has been challenging for nurseries to grow, and therefore, currently has very limited commercial availability and is not widely used in restoration projects.

We conducted previous propagation trials on *A. cordifolia* in 2023 and observed high germination rates and good initial seedling development in Deepot D16H containers with an augmented soil mix. However, despite an adequate growing period (6+ months) and good initial root development, the plants' roots were still very fragile at the time of transplanting. Our 2024–2025 trials built from this earlier work to determine what might produce sturdier transplants with a root ball that holds together through the transplanting process. We wanted to see if a longer growth period in the pots would result in better root development and stronger transplants. We also wanted to test different types of liners that can be inserted into nursery pots. Ideally, these liners would help hold the rootball together during the initial outplanting stage, but break down easily once seedlings are established at restoration sites.

These trials began with propagation trials with a partner nursery in San Joaquin County in 2024. The propagation trials were focused on testing the effects of two liner types on germination and initial seedling development.

The outplanting phase of this trial was conducted at the USDA-NRCS Plant Materials Center (CAPMC) in Lockeford, CA, in fall 2024 and spring 2025. The objectives of the



TOP TO BOTTOM—Heartleaf milkweed in bloom¹; a monarch caterpillar on a heartleaf milkweed leaf²; sowing heartleaf milkweed³. (Photos: Xerces Society / Stephanie McKnight^{1,2}; Xerces Society / Jessa Kay Cruz³.)



outplanting trials were to test the efficacy of the two liner types and to compare outplanting success at different growth intervals. We also wanted to assess the efficacy of the liners in protecting the rootball during the outplanting phase without impeding growth, and to see if allowing the plants to grow and develop longer at the nursery would impact the outplanting success.

Following the initial outplanting, Xerces staff maintained and monitored these plots through seed set and dormancy in fall 2025. Now that these initial trials are complete, our goal has shifted to managing and monitoring the outplanted plot to establish a foundation plot from which we can collect seeds for future use.

Propagation Protocol

Treatments

Seeds were cold-stratified from January 30, 2024–March 29, 2024. Seeds were then sown directly into Deepot nursery pots (D16H) that measure 2" × 7" and hold 16 in.³ of soil. There were a total of 500 seeds, which were divided into four replicates based on liner type and outplanting time. Half of the seeds (250) were sown in D16H pots with Earthpot liners (treatment A), and the other half in D16H pots using newsprint paper as a liner (treatment B). Each treatment has two outplanting times: the first after approximately six months of growth and the second after approximately one year of growth.

The Earthpot liners came pre-filled with a pH-stabilized soil mix (substrate A) of 50% peat and 50% perlite, with a granular wetting agent and Tainio (a blend of beneficial organisms, including bacteria and fungi). The newsprint liners were filled at the nursery with a different soil mix (substrate B) of 75% standard nursery mix (details unknown) and 25% crushed granite. This was the same soil mix used in previous *A. cordifolia* trials with good results.

Materials

- ☞ Total # of *A. cordifolia* seeds: 500
- ☞ Seed origin: Collected by partners from Carquinez Strait, Contra Costa and Solano counties, California.
- ☞ Container sizes: Deepot D16H (2" × 7"), 16 in.³ volume
 - ☞ Treatment A: Earthpot liners pre-filled with a pH-stabilized soil mix (substrate A) of 50% peat and 50% perlite, with a granular wetting agent and Tainio (a blend of beneficial organisms, including bacteria and fungi).
 - ☞ Treatment B: Newsprint liners filled with a soil mix (substrate B) of 75% standard nursery mix (details unknown) and 25% crushed granite.

Table 1—Treatments: *Asclepias cordifolia*

	EARTHPOT LINERS (A)		NEWSPRINT LINERS (B)	
Outplanting Timeline	6 months	1 year	6 months	1 year
Quantity	125	125	125	125

Data Collection

Germination data for all plants and treatments were collected weekly for the first eight weeks after sowing the seeds. These data included the number of plants newly germinated each week as well as the number of plants that had previously germinated and died. Anything past the eight-week mark was considered dead/not germinated.

After the eight-week germination period, monitoring shifted to a monthly basis to assess plant health and vigor as well as root development. One plant from each treatment was removed from its respective pot to be visually assessed, recorded, and photographed to track root development. Plant health and vigor were assessed, recorded, and photographed across treatments, scoring on a scale of 1 (poor) to 4 (excellent). Monthly monitoring was continued throughout the one year of seedling development at the nursery, excluding the dormancy period (October through March).

Results

Overall, we observed good germination rates with both treatments: 70.0% germination rate for treatment A and 65.4% germination rate in treatment B. Average health and vigor scores for treatment A and B were 3.0 (good) and 2.0 (fair), respectively. Compared to treatment B, treatment A had healthier and more robust seedlings and stronger root development throughout the entire growing season/data collection period.

Table 2—Seed Germination and Seedling Health and Vigor: *Asclepias cordifolia*

	GERMINATION RATE	AVERAGE HEALTH AND VIGOR SCORE
Earthpot liners (A)	70.0%	3.0 (good)
Newsprint liners (B)	65.4%	2.0 (fair)

Discussion

Germination rates were slightly higher in treatment A than in treatment B. It is possible that the treatments impacted germination rate, but the difference in rates isn’t significant enough to draw confident conclusions. Seedling growth and vigor, and root development of seedlings were significantly better in treatment A as compared to treatment B. Plants grown in treatment A appeared larger and more vigorous than those grown in treatment B, and maintained vigor and health through most of the nursery trials. Some of the differences could have been attributed to the different soil mixes, but it is also possible that the Earthpots liners (A) provided better growing conditions than the newsprint liners (B).

Outplanting Protocol

Treatments

Seedlings were outplanted on two separate occasions: October 2024 for the “six-month seedlings” of both treatments and March 2025 for the “one-year seedlings” of both treatments. All seedlings were planted at the CAPMC. The project area was prepped with light tillage to remove weeds and existing vegetation, then sheet mulched using wood mulch on corrugated cardboard. Irrigation lines were installed immediately after transplanting and fed by gravity flow from a mobile water tank. Seedlings were irrigated immediately after transplanting, and irrigation was provided on an as needed basis in the fall. The site was visited regularly to observe growth and development, and managed regularly to facilitate general plant health. These activities were conducted until November 2025, when the plants entered their natural dormancy period.

Data Collection

Data on seedling survivorship were collected one to two times per month. We tracked overall survivorship of both the fall-planted (six-month) and spring-planted (one-year) seedlings from the time of planting until the end of data collection (November 2025). We were not able to track the survivorship of treatments A and B separately.

Results

Fall seedlings established significantly better than spring seedlings, with 30.0% survival of fall (six-month) seedlings at the end of data collection, and just 4.0% survival of the spring (one-year) seedlings for both treatments. Overall, growth was slow and minimal.

Table 3—Outplanting Survival Rates Spring vs. Fall: *Asclepias cordifolia*

	FALL (6-MONTH) OUTPLANTING SURVIVAL RATE	SPRING (1-YEAR) OUTPLANTING SURVIVAL RATE
Earthpot liners (A)	30.0%	4.0%
Newsprint liners (B)		

Discussion

Earthpot liners (treatment A) were much more effective in holding together the rootball of the plants during transplanting and were easier to remove from the container. Earthpot liners were intact when transplanted at six months, and despite substantially degrading by one year, the liners still managed to hold the rootball intact. The Earthpot liners were also relatively easy to remove from the containers. By contrast, newsprint liners (treatment B) were not very effective at holding together the rootball, even at six months. Newsprint quickly deteriorated and was fragile when wet, tearing easily. They were also difficult to remove from the containers at the time of planting.

Once transplanted, there was a noticeable difference in survivability between fall- and spring-planted seedlings, with the fall-planted seedlings performing significantly better. Although we originally sought to test the effects of the amount of time spent in the containers before outplanting on root development and outplanting, it is likely that the seasonal differences, rather than the length of time in the containers, were the most significant factor.

Despite Earthpot liners (A) performing better than newsprint liners (B), and fall transplants performing better than the spring transplants, there was still overall low survivorship of all seedlings combined (23.0%). This low survivorship could be attributed to the fact that the seedlings were planted on flat land in full sun, whereas in the wild, they are most often observed in shaded areas with some degree of slope. Irrigation may have also been an influencing factor, particularly for the spring-planted seedlings, as there were at times breaks in the irrigation line from wildlife disturbances. In addition, there was not enough water pressure to maintain even distribution. There was also some evidence of predation from gophers, rabbits, and other wildlife.

Conclusion

These trials were meant to determine which liners and length of growth time worked best for *A. cordifolia* for successful growth and outplanting. Based on the results and observations made throughout the entirety of the trials, we concluded that Earthpot liners (treatment A) were better than newsprint liners (treatment B) at facilitating healthy root development and growth during the propagation and early seedling stage. Earthpot liners were also better at keeping the seedling rootballs intact during transplanting and easier to remove from the containers. Overall, fall planting was much more successful than spring planting, leading us to conclude that leaving the plants in the containers for a longer period of time does not necessarily result in better establishment.

Outplanting heartleaf milkweed; seedlings at the time of outplanting; mature heartleaf milkweed plant. (Photos: Jessa Kay Cruz / Xerces Society.)



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