Development of milkweed seed Sources for South and West Texas

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Abstract

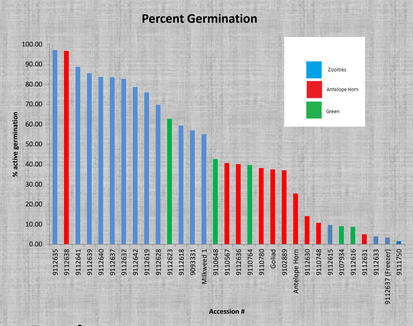
The potential for monarchs to be listed under the Endangered Species Act has become a great concern in the conservation community. Monarch butterflies almost exclusively lay their eggs on milkweeds, making these plants a high priority for restorationists. Native Texas milkweed seeds are difficult to produce commercially, resulting in available seeds being prohibitively expensive for use in large scale restoration projects. Several species of milkweed are found throughout Texas that may have merits for large scale seed production, including zizoites, broadleaf, slim, green, and antelope horns. In order to identify acceptable populations for seed production, we conducted a common garden study of 40 different accessions of these 5 species. Of the species evaluated, zizoites milkweed has been the most successful in yielding large quantities of seed. We have estimated production potential of 244 lbs. of seed per acre per harvest with the potential for multiple harvests annually. Germination tests are currently underway on seed harvested, and early results are very encouraging with seed germination averaging 80%. Even though a significant amount of seed is produced by zizoites milkweed, large scale mechanical harvesting of the seed has been difficult because pods ripen indeterminately. Another challenge to production of zizotes milkweed is insect damage, especially by aphids, which must be controlled in order to produce seed crops. Results from this project will be used to help improve commercial seed production and availability of affordable native milkweed seeds for Texas restoration efforts.

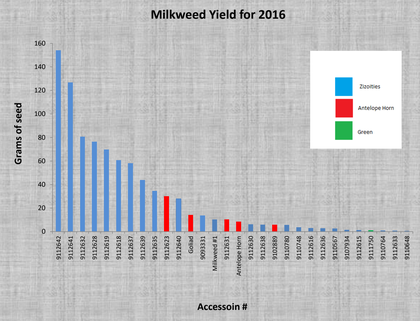
Introduction

Milkweed plants are extremely critical to the monarch population because they feed and lay their eggs exclusively on milkweed plants. Monarchs are beneficial to society because they are major pollinators of many types of plants, and are thought to be an environmental indicator species. There are several different species of milkweed found throughout the country however, only a few are inhabitable to monarch butterflies (Borders and Lee-Mäder, 2014). Milkweeds are considered a self-incompatible plant so they must have insects and other pollinators to cross pollinate in order to reproduce (Wyatt and Broyles, 1994). Researchers have correlated the 58% reduction in Monarchs to the population of milkweed which has declined 81% over the last decade (Oberhauser and Pleasants, 2012). The sudden concern with regaining a more abundant population of milkweed has become increasingly substantial in the conservation community, which has created a demand for milkweed seed. In an attempt to develop locally adapted milkweed for use in south Texas, *Texas Native Seeds* is conducting a number of experiments evaluating different accessions and mass production techniques. We are hopeful that the results of these projects will result in the commercial production of a locally adapted milkweed species.

Methods

Seed of five different species of milkweed was collected from native populations originating from 39 different counties between 2014 and 2015. Following collection, seed was planted in flats in the STN greenhouse. Once transplants had formed enough root structure to form a plug they were outplanted into two different plots in a common garden plot design located at the South Texas Natives research facility within the Caesar Kleberg Wildlife Research Institute Park on the campus of Texas A&M University – Kingsville in Kingsville, TX (27.5150˚ N, 97.8656˚ W). The climate for this region is described as semi-arid to sub-tropical with an annual high temperature of 83.1°F, and an annual low temperature of 60°F. Precipitation typically occurs bimodally with peaks in May and September, with an annual average of 28.98 inches. The soil that the milkweed was planted into was the Clareville sandy loam series consisting of very deep, well drained moderately slow and moderately permeable soils. This ecological site of clay loam 20-25 PZ is classified as a fine, smectitic, hyperthermic, pachic Argiustoll. Species of milkweed included in this study were antelopehorn (*Asclepias asperula* (Decne.) Woodson), zizotes (*Asclepias oenotheroides* Cham. & Schltdl.), green antelopehorn (*Asclepias viridis* Walter), broadleaf (*Asclepias latifolia* (Torr.) Raf.), and slim milkweed(*Asclepias linearis* Scheele). Each accession was evaluated bimonthly for plant vigor, leaf density, and forage production. Seed was harvested from each accession as it ripened during May and June 2016. Harvested seed was dried and weighed in order to determine which accession had the highest bulk yield. Following weighing seed was then tested for active germination.





Results

The overall results of this experiment have shown that the zizotes species is the best performing species in our evaluations. Zizotes species in general had the best vigor and forage production scores (Table 1). It also had the highest average seed production averaging 97 lbs an acre per harvest as well as active germination averaging 72% (Figures 1&2). The majority of the other species performed very poorly in all measurements. The only exception was the slim milkweed which has performed fairly well. The major concern with this species is its distribution.

Table 1. Data collected from evaluations during the 2015-2016 growing season (1 best, 10 worst).

Accession	vigor	foliage density	seed production	forage production	height	canopy cover	
9093331	2.33	2.50	1.67	2.17	33.33	100.00	zizoites
9102889	4.57	3.86	1.86	4.57	8.57	19.29	antelope horns
9107934	5.67	5.67	0.00	6.50	14.50	12.00	green
9110567	5.17	4.83	0.00	5.50	9.17	17.67	antelope horns
9110648	4.83	4.33	1.17	5.33	9.33	27.50	antelope horns
9110745	5.17	5.17	0.00	5.83	17.67	7.00	antelope horns
9110748	4.83	4.67	1.00	6.33	7.50	8.50	antelope horns
9110763	5.33	5.00	0.00	6.50	9.17	6.00	antelope horns
9110764	5.67	4.67	0.00	6.00	10.00	11.83	antelope horns
9110780	5.00	4.17	1.00	5.50	9.17	11.83	antelope horns
9111750	4.17	4.17	0.00	4.67	20.17	15.17	zizoites
9112031	4.00	4.50	0.00	4.33	23.33	33.33	broadleaf
9112615	4.33	4.67	0.67	4.33	28.33	16.67	broadleaf
9112616	3.67	4.00	0.00	4.67	15.00	13.33	green
9112618	2.67	2.17	1.00	2.00	35.83	81.67	zizoites
9112619	2.83	2.83	1.33	3.00	30.83	86.67	zizoites
9112623	2.00	5.00	0.67	2.67	60.00	75.00	thin leaf
9112628	3.33	2.33	1.00	2.00	33.33	88.33	zizoites
9112630	4.00	4.00	2.17	4.50	12.50	18.33	antelope horns
9112631	4.33	4.50	1.50	4.67	20.83	16.67	antelope horns
9112632	3.50	3.00	1.33	3.33	25.00	63.33	zizoites
9112633	4.67	4.67	1.67	4.67	16.67	13.00	green
9112635	4.17	3.33	1.17	3.83	17.50	50.00	zizoites
9112636	4.67	4.67	1.67	5.00	15.00	6.67	zizoites
9112637	3.17	3.33	0.67	3.17	35.00	65.00	zizoites
9112638	4.33	4.50	0.00	5.50	8.33	7.83	antelope horns
9112639	3.83	3.50	1.33	3.33	25.00	47.50	zizoites
9112640	3.67	3.50	1.17	3.67	22.50	43.33	zizoites
9112641	3.33	3.17	1.33	3.17	33.33	56.67	zizoites
9112642	4.00	3.50	1.17	4.00	18.33	45.83	zizoites
2014-0252	3.67	2.33	0.00	3.33	16.67	66.67	zizoites
2014-0253	2.17	2.00	0.00	2.17	6.00	15.00	broadleaf
antelope horns 1	4.83	4.33	2.00	5.17	9.17	15.83	antelope horns
Goliad	3.67	3.50	2.00	4.50	11.67	25.00	antelope horns
I-10	2.33	2.17	0.00	2.33	1.67	1.67	antelope horns
Milkweed 1	4.67	5.33	1.33	5.00	31.67	33.67	antelope horns
WT 2	2.67	2.67	0.00	2.67	0.50	0.33	antelope horns

Discussion

In the pursuit of commercially producing milkweed seed we have come across several complications with management, harvesting and processing. Management has been a challenge due to a number of pests that require continuous monitoring and repeated pesticide applications. The majority of the plants being evaluated have demonstrated some resistance to glyphosate and pre-emergent herbicides making weed management easier. Mass harvesting has been difficult because seed pods ripen indeterminately. According to Borders and Mäder (2014) due to indeterminate fruit maturation, combining will likely reduce the genetic diversity because typically only a portion of the plant population will be fully matured at the time of harvest. The seed yield could also decrease due to the inability to harvest seed that is matured early in the season or late in the season. Processing the seed has also been an issue because we have no efficient method of cleaning the seed in large quantities, but this is something we are currently working on. The floss has given us great difficulty and there has not been a device created to clean large quantities of seed efficiently. We are hopeful that the results of these projects will result in the commercial production of a locally adapted milkweed species.

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