2017 Milkweed Production Trials

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Milkweed (*Asclepias syriaca*) is a plant native to North America and has recently become the focus of conservation programs as milkweed is the sole food source for the Monarch butterfly larvae. Milkweed has long been a foe of agricultural operations and as a result, populations have been on the decline throughout the United States. To increase the abundance and scale of conservation plantings of milkweed, the Natural Resource and Conservation Service (NRCS) has developed an incentive program to compensate landowners for establishing perennial monarch habitat including planting milkweed. Landowners in northern Vermont have a unique opportunity to expand milkweed acreage by producing it as a crop. A textile company in Quebec, Canada has recently begun processing the silky fiber (floss) from the milkweed plant for use in a wide variety of oil/chemical absorbent and clothing applications. The floss has insulative properties similar to down due to its unique hollow fiber structure which also makes it incredibly light. Furthermore, the floss is equipped with a natural water-repellant waxy coating that allows it to be waterproof while absorbing hydrophobic liquids such as petroleum products. The Monark Cooperative, who enrolls farmers in production contracts and provides seed, technical assistance, and harvesting equipment to members, is looking to increase milkweed production in Quebec and Vermont. This opportunity will require farms to learn best techniques for cultivating milkweed as a commercial crop versus the techniques they currently know which is to eliminate at first sight!

Figure 1. Milkweed in bloom

Although milkweed (Figure 1) is well adapted to a wide range of soils and growing conditions, economical commercial milkweed production has proven more difficult than initially anticipated. The main obstacle in production is weed pressure during the establishment year. Milkweed can be established during early summer in Vermont, making the slow-growing seedlings vulnerable to weed pressure from fast-growing annuals that are able to take advantage of lower temperatures early in the season. Furthermore, little is known about maintaining a milkweed stand for long-term production once it is established. To support this emerging market, UVM Extension's Northwest Crops and Soils Program installed two trials investigating best management practices for the establishment of milkweed.

Nurse crops are typically used to aid in the establishment of perennial grass or grass-legume stands. These crops are usually annual cereal grains, such as oats or wheat that can grow quickly and out-compete annual weeds while the slower perennials establish. The following season the perennials are in a more competitive position to establish a healthy, dense stand. In 2017, NWCS initiated a trial investigating the use of a variety of nurse crops to establish milkweed in Alburgh, VT.

Winter rye is a widely used cover crop in northern Vermont as it is best adapted to the cold climate, fits into common cropping systems, and has the potential to create a large quantity of biomass that can help build soil and suppress weeds. As winter rye will survive the winter in this region, management in the spring is necessary prior to establishing a cash crop. One method of terminating winter rye is using a roller-crimper. This implement, when used at the proper timing, will crimp the stem of the rye while laying it flat on the ground, causing the plant to lose the ability to move water and nutrients through the plant, killing it.

This creates a dense mat of dead plant material that suppresses weeds as it decomposes for the cash crop that is then planted into the mat. The rye can be rolled and crimped with a variety of tools, and for the purposes of this project, an I&J roller crimper unit, Gordonville, PA (Figure 2) was used to terminate the rye prior to seeding the milkweed.

were collected with the net the timer was stopped to allow for time to remove the honey bees. After 10 minutes, the insects collected in the net were transferred to a glass kill-jar for preservation and later identification. Finally, to understand bee pollination efficacy of milkweed, a 20m transect was walked for 1 hour or until 20 bees visiting milkweed flowers were located. The bees were collected, identified, and placed in a non-kill glass jar for inspection. The number of pollinia, milkweed pollen structures, stuck to each bee was recorded. The bees were released after data was collected. The timer was stopped while bees were transferred and data was collected.

Figure 3. Layout of observation areas within stands.

Variations in yield and quality can occur because of variations in genetics, soil, weather, and other growing conditions. Statistical analysis makes it possible to determine whether a difference among treatments is real or whether it might have occurred due to other variations in the field. All data was analyzed using a mixed model analysis where replicates were considered random effects. At the bottom of each table, a LSD value is presented for each variable (e.g. yield). Least Significant Differences (LSDs) at the 10% level (0.10) of probability are shown. Where the difference between two trerabetwo ield).

RESULTS

Weather data was recorded with a Davis Instrument Vantage Pro2 weather station, equipped with a WeatherLink data logger at Borderview Research Farm in Alburgh, VT (Table 2). Growing Degree Days (GDDs) were summarized using the base and maximum temperatures for corn as they are not known for milkweed specifically. Temperatures around planting were above average but generally during July and August, temperatures were slightly below the long term average. Conversely, rainfall was about 1-2 inches above normal with much of the total precipitation for these months being delivered in a few large rainstorms. The weather became warmer and drier in the fall months with above average temperatures and below average rainfall. These favorable weather conditions allowed the milkweed, despite late planting, to have time to germinate and grow.

Table 2. 2017 weather data for Alburgh, VT.

	July	August	September	October
Average temperature (°F)	68.7	67.7	64.4	57.4
Departure from normal	-1.90	-1.07	3.76	9.20

[redacted]

Establishing Milkweed [illegible]

apparent that the seed germinates at highly variable rates, some germinating within a couple of days and others taking more than 2 weeks. Therefore, plots were revisited in May 2018 to reassess the milkweed establishment. Unfortunately, the stands were even poorer in the spring with an average of 0.00333 plants ft^{-2} observed across the trial. The highest population in the spring was still observed in the milkweed-only high seeding rate treatment. However, the survival of the milkweed in the annual ryegrass and clover plots

the spring, populations had been significantly reduced with approximately 0.0133 plants ft^{-2} in the rye plots and 0.025 plants ft^{-2} in the controls. These treatments were significantly different in terms of fall weed biomass. The rolled rye treatment significantly reduced weed pressure with only 0.574 tons ac^{-1} dry matter present by the end of the season compared to almost double that in the no cover treatment. Furthermore, as demonstrated in Figure 4, most of the material that was present in the rolled rye treatment plots was winter rye that reseeded due to the late timing of using the roller crimper. At the time of rolling, the rye had formed seed heads. Given all of the available moisture and favorable fall temperatures, these seeds germinated creating competition for additional weeds.

Table 7. Roller crimper trial milkweed populations and weed biomass, 2017.

Treatment	Milkweed populations		Weed biomass
	Fall	Spring	
	plants ft^{-2}		DM tons ac^{-1}
Rolled rye	0.0826	0.0133	**0.574**
No cover crop	**0.289**	**0.025**	1.1
LSDgC30.10)	NS	NS	0.156
Trial mean	0.186	0.0192	0.839

DM- dry matter.
NS- No significant difference.

Insect Sampling in Established Milkweed Stands

Two established milkweed stands were surveyed three times between 3-Jul and 11-Jul. During these visits, bees belonging to six different genera were collected through net collections. Of these, honeybees, *Apis mellifera* were the most abundant, accounting for >95% of witnessed flower visits. This was not surprising given the proximity of these milkweed stands to managed honeybee hives. Additional insects, including butterflies, beetles, flies, and lacewings, visited milkweed flowers but in significantly lower abundance than

Figure 5. Milkweed flowers, honeybee individuals, and number of flower visits observed, 2017.

DISCUSSION

The weather conditions and delay in acquiring seed greatly impacted these milkweed trials. The lack of milkweed establishment may also be a result of poor seed quality. The nurse crop was successful at reducing weed populations and potentially providing complimentary benefits during the year of milkweed establishment. However, it was unclear if milkweed establishment was hindered by the nurse crop or if low populations were the result of poor seed quality or late seeding. Similar results and conclusions were made with the roll and crimp study. Additional research needs to be conducted to further refine these practices to properly establish milkweed stands.

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