Farmer Rancher Grant Progress Report
North Central Region
Sustainable Agriculture Research and Education (NCR-SARE) Program

Progress Report Year: May 2010-Jan 2011

Progress Number: FNC09--749

Project Title: Growing Blackberries Organically under High Tunnels for Winter Protection and Increased Production

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1. WORK ACTIVITIES

Describe in detail your work activities and how you used your grant funds this year.

As part of the project, six varieties of blackberry cultivars were planted in a 96' X 30' high tunnel in Readstown, WI. For a separately funded project, two high tunnels were constructed in Rosemount, MN to test the viability of winter protecting both primocane and floricane blackberries. At this site, floricane varieties were planted in a 30' X 60' gothic style high tunnel and primocane varieties in a 12' X 40' PVC high tunnel.

In 2009, we worked with Poly-Tex of Castle Rock, MN and consulted with Terry Nennich to design a high tunnel suitable for blackberry production. Our requirements included straight side walls with sufficient height clearance to support a 7' trellis system; a gothic peak for optimal snow load capacity; and a price that is competitive with other high tunnels on the market. Using these specifications, Poly-Tex designed and developed the Field Pro high tunnel that is now installed at our farm in Readstown.

The manufacturer provides well written instructions and we recommend following them as closely as possible. When laying out the tunnel make sure to orientate the end of tunnel into the prevailing wind. Ideally, the side walls should be facing south to maximize solar radiation. Pound a single corner stake into the ground and use a 3-4-5 ratio to square the other corners 30' and 96' on center. Attach a string line at the desired top of ground post and another string line 6" beneath. Pound the remaining post approximately 2' in ground and 1' above ground. Other suggestions to make the construction go smoother include:

- Use string line and 1 ¼" tek screws set into stakes when sliding bows onto ground stakes
- Use tek screws to secure connectors to bows and end of purlins
- Duck tape all purlin connections at end of bows to prevent ripping of the plastic

- Use 1x6 pine boards for curtain and base boards and drill 1 ¼" tek screws to secure board to frame.
- Install u-channel and wiggle wire on side walls
- Install plastic on calm morning or evening (< 5 mph)
- Attach plastic to 5 -2x4 x12' lengths of lumber and pull over side walls
- Allow at least three hours of calm wind to secure plastic

The semi-automated high tunnels are composed of sensors and controllers that monitor the crop production processes, thereby reducing on-site management and better facilitating the commercialization of blackberry production. All the high tunnels employ in-line drip irrigation and Acclima moisture sensors to regulate irrigation and fertigation cycles. The emitters were spaced no more than 8 inches on either side of each bramble. In addition to moisture content as a percentage, the sensor provides soil temperature and EC. The controller has up to six zones controlling six values, each with six separate watering times.

We prepared the land for the high tunnels using black plastic to smother the weeds then fertilized the soil using well rotted horse manure and recycled mushroom compost. The plastic should be applied a minimum of 2.5 months before setting plants in the ground in order to properly destroy the weed seeds and rhizomes.

Figure 1: Site Preparation (Readstown)

Inside, the floricane high tunnels, we installed a wooden "T/V" trellis system to support the berry canes. We ran two strands of wire at the tip of each crossbar "T", for a total of 4 runs containing two wires each. The posts should be spaced 10 feet apart. Year 1 canes were tied to one side of the strand and they will bear fruit in year 2. After producing fruit, the year 2 canes will be pruned to the ground to make room for year 3 primocanes.

Figure 2: High Tunnel T/V Trellis System (Rosemount)

Figure 3: Drip Irrigation and Fertigation System (Readstown and Rosemount)

Figure 4: Acclima Moisture Sensor (Readstown and Rosemount)

The ventilation system consists of end doors, motorized side curtains, circulation fans, and gable end motorized ventilators. All of these systems are controlled using sensors.

The soil was amended by mixing in equal parts mushroom and dairy manure compost and applying one wheelbarrow per ten row feet. After, the compost was tilled into the soil using a hand rotor tiller. Once the canes were planted, we mulched each plant with a combination of mushroom compost and straw.

The floricane blackberry canes were planted in Rosemount on May 15th and in Readstown on June 10th. Both tunnels contain Triple Crown, Arapaho, Chester, Apache, Ouachita, and Natchez varieties. The canes were planted in four rows spaced at 7 feet, with the outer two rows 4.5 feet from the side walls. The plants are spaced 3 feet apart with 80 and 132 total in the Rosemount and Readstown tunnels, respectively.

Initially, the plants in Rosemount were provided 3 gallons per day per plant in two 1.5 hour cycles at 7:00 a.m. and 6:00 p.m. Once the primocane varieties began fruiting, the irrigation levels were increased to 4.5 gallons per day in three watering cycles. The brambles in Readstown were provided 4 gallons per day per plant in two 2 hour cycles at 7:00 a.m. and 6:00 p.m. On October 29th, irrigation levels were increased to 6 gallons per day per plant in order to provide extra moisture to the brambles throughout the winter when they would have no access to water. Frequently, the water moisture content of the soil failed to drop below the preset level of 40 percent, and the sensors suspended an irrigation cycle.

We used a one gallon EZ flow fertigation system and an organic fertilizer containing bat guano. The organic brands we experimented with were Algoflash, FoxFarm Big Bloom and Pure Blend Pro Bloom. It is not recommended to use fish emulsion as it has a tendency to clog the emitters. We plan to install drip tape next year in two rows of a single high tunnel and fertigate the plants 2-3 times per week. These two rows will have a separate moisture sensor, valve, and fertigation tank. Since the drip tape emitters are positioned closer together, however, we predict this approach will result in unnecessarily increased water and fertilizer inputs.

In order to control weeds, three techniques were employed. A layer of wood chips was spread on the PVC high tunnel floor. In the gothic style tunnel, we laid down sheets of cardboard before spreading wood chips. In a third high tunnel at our farm in Wisconsin, we rolled out 14-24 mil black polyester material in widths of 3 and 6 feet. The most effective technique appears to be the black polyester material, which also has the added benefit of controlling soil erosion and reducing labor.

2. **RESULTS**

List the results of your project and what you have learned so far

Overall, the project has reduced labor and input costs. The moisture sensors provide automatic irrigation and fertigation in the high tunnel. The black polyester material and wood chips dramatically decreased the amount of time devoted to weed management. The major inputs of labor occurred during site preparation and harvest (although even these periods were very manageable). The drip emitters reduced the amount of water required and the in-line fertigation provided precise amounts of liquid fertilizers. It should be noted that the same management techniques that reduce input costs also have a net positive environmental impact by conserving water and reducing soil erosion.

Last winter, we pruned the primocane varieties (Prime Jim and Jan) to the ground in the smaller PVC high tunnel. Once the primocanes reached five feet in height, the canes were tipped and laterals supporting new blossoms began to appear within weeks. Continual pruning throughout the entire growing season generated new blossoms. Once they were tall enough, the floricanes were tied to the trellis wire (see above for description of technique) and tipped at 6 feet. The laterals were also tied to the wire.

The floricane varieties in Wisconsin were not shaded and as a result experienced higher rates of growth, more lateral development, and studier canes than the Minnesota varieties. In Wisconsin, the brambles averaged at least three extra hours of sunlight throughout the growing season.

The primocane high tunnel was partially shaded, with the west end wall receiving two hours of extra direct sunlight compared to the east end wall. As a result, the plants exposed to more sunlight had higher blossom counts and generated larger yields.

We also observed better growth with the root stock versus the culture stock. Interestingly, inconsistent growth of the same variety in the same high tunnel was frequently observed among the floricanes in both Rosemount and Readstown.

The floricanes displayed no visible signs of disease or pests throughout the growing season. This is typical during the first year when foliage development is relatively minimal. The second and third years have much higher incidences of disease and pest outbreaks and the brambles will be monitored closely.

The Arapaho variety had the highest rate of growth among the brambles, adding approximately 60 inches to its planting height. The other varieties averaged between 35-45 inches of new growth. A much fuller picture will emerge next year once the brambles have experienced a full growing season under the high tunnel. At that time, we will be better able to assess the attributes and deficits of the different varieties.

The primocanes began fruiting in early August. The individual fruit size averaged between 6-15 grams. The fruit was often difficult to pick at optimal ripeness because of its softness. The thorns also required that pickers wear gloves and flannel shirts. Once fruiting commenced, the bramble water demands increased (see above) and irrigation cycles were rarely suspended.

The weekly yields from the primocane high tunnel (12 Prime Jim and 12 Prime Jan blackberry brambles) are displayed in the graph below.

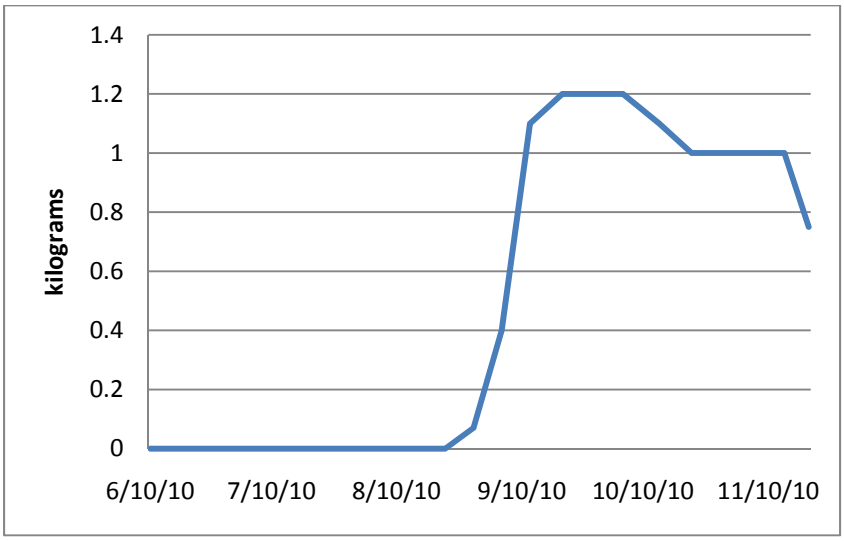

Figure 5: Weekly Primocane Blackberry Yields (Rosemount)

The major problem was maintaining temperatures inside the high tunnel at the optimal range of 80-85°F. Temperatures in excessive of 100° F prevented proper drupelet formation in some cases. This problem should be easier to remedy in the larger high tunnels because of their superior ventilation capabilities. In early September a small amount of the berries experienced Botrytis fruit rot due to cool and moist conditions. We started closing the tunnel at night to raise the temperature. The fungus mostly cleared up as the result of the warmer temperatures.

Due to a forecasted stretch of sub-freezing weather, the auxiliary heat in the primocane tunnel was suspended and the final harvest occurred on November 18th. After that date, the brambles were allowed to enter the dormant phase. It should be noted, however, that when the heat was suspended, the brambles still had significant amounts of both blossoms and fruit present. The photos below demonstrate the season extension capabilities of high tunnels when coupled with auxiliary propane heat (notice the snow on the high tunnel).

Figure 6: Primocane High Tunnel (Rosemount)

Figure 7: Photos taken on November 14th in Primocane High Tunnel (Rosemount)

Figure 8: Primocane berry cluster on November 14th (Rosemount)

The floricane high tunnel contained a few brambles that bore small yields (several berries or less per plant). The varieties that fruited were Chester, Apache, and Arapaho. Typically, floricane blackberries do not produce until the second year and no approximate cause was detected for these plants early yields.

The plants took a long time to freeze out in the late fall due to the increased warmth of the high tunnel. The snowfall in December also created an insulation effect and warmed the tunnel by 10-15°F compared to the outside temperatures. We installed a thermostatically controlled 170,000 BTU propane heater that is set to fire when the temperature drops to 5°F and turn off when temperatures reach 9° F. These are the minimum temperatures of a zone 7b climate. According to the temperature data loggers, the propane heater has not activated yet this winter in Readstown.

In the early winter months, we experienced problems with rabbits entering the high tunnels and girdling the canes. Roughly 10-15 percent of all the canes were either destroyed or badly chewed. Within two weeks, the rabbit would have destroyed all of the canes. We blocked off the possible entrances and set two traps inside.

The plants were watered heavily before the irrigation system was turned off to build up a moisture bank for the brambles during the winter months. The lack of moisture throughout the winter is a concern and we will provide updates on how this affected the plants. The expected increase in temperatures inside the high tunnel in February is also a concern as it might promote premature budding.

3. WORK PLAN

Describe your work plan for next year

In the next year, we intend to monitor the 2nd year growth of the thorn less floricane blackberries. We will perform a soil and compost nutrient analysis at the start of the growing season and amend the compost mixture based on the results. The berry plants will be mulched with straw or woodchips,

pruned, irrigated, and fertigated. In the second year, we expect to harvest a minimum quantity of berries. The blackberry crop production processes in the high tunnel will be carefully monitored and recorded. See attached spreadsheets for plant attributes. This data may also obtain by linking to our web site at http://www.scenicvalleyfarms.com/AboutUs/ScenicValleyFarmsEast.aspx. Temperature data loggers have been installed in the high tunnels, and we will utilize these measurements to make connections between average and maximum lows and their effect on yields.

We have also installed a solar thermal high tunnel. The system works by capturing the energy of the sun and releasing it to moderate temperatures. Throughout the day, thermostatically controlled intake fans draw heated air from near the peak of the high tunnel and store the energy below ground in a thermal mass. When supplemental heat is needed to maintain optimal growing conditions, these same fans pull the cooler air through the thermal mass where it is warmed before circulating back into the high tunnel.

Other research for next year includes investigating the use of drip tape, various types of organic inline fertilizers, methods to reduce plant foliage, and using leaf tissue analysis to determine nutritional management for the brambles. Besides leveraging the elevated temperatures in the solar thermal high tunnel, we also intend to delay blackberry fruiting by pruning in order to extend the growing season.

4. OUTREACH

How did you share information from your project with others? (Include the number of people who attended field days or demonstrations.) What plans do you have for sharing information next year?

Scenic Valley Farms has created several pages on our company website that detail the progress of the project in both Rosemount and Readstown. The visitor is able to access data collected throughout the growing season and images of various aspects of the project. We have also prepared a monthly newsletter that is distributed to more than 200 recipients. At the conclusion of 2010, we developed a presentation for the Minnesota Fruit and Vegetable Grower's Association annual conference. The presentation was attended by approximately 40 persons. Additionally, the presentation will be posted on the company website. Throughout the growing season, we hosted individual and small group tours for local growers of the blackberry high tunnel. Key members of the area Amish community were particularly interested in the project and several have either completed or plan to begin construction of high tunnels to produce blackberries.

As previously mentioned, our company constructed a solar thermal high tunnel in the fall of 2010 that should significantly extend the growing season. We intend to work with the Midwest Renewable Energy Association (MREA), Minnesota Renewable Energy Society (MRES), and RENEW Wisconsin to host information sessions. At these sessions, we plan to provide education on our efforts to produce blackberries in high tunnels and how the solar thermal high tunnel fits into those plans. We also intend to continue documenting our blackberry production on the Scenic Valley Farms website. The amount of traffic on the site is increasing due to our promotion of investor and grower owned SHARE farms. Additionally, we will continue to update our network of growers, distributors, grocer cooperatives, investors, and others through the company's monthly newsletter.

Progress Report Budget – 2010-2011

Personal Services	Grant Funds
Major Participants (list below)	0
Erik Gundacker	$1500
Craig Gundacker	$600
Terry Nennich	$0
Rebecca Harbut	$0
Connie King	$0
Kath Demchak	$0
Sam Skemp	$0
Chris Fanta	$0
Ron Davis	$0
Materials (drip irrigation, compost, fertilizer, HT poly covering)	$500
SubTotal	$2600

Send completed report by mail or e-mail to:

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