

Developing Round Bale Systems to Mulch Vegetable Transplants with Switch Grass

Final Report for FNC12-857

Project Type: Farmer/Rancher

Funds awarded in 2012: \$6,854.00

Projected End Date: 12/31/2012

Region: North Central

State: Wisconsin

Project Coordinator:

[Tony Ends](#)

Scotch Hill Farm

Project Information

Summary:

[Editor's Note: To see this report with photos, open the PDF version.]

PROJECT BACKGROUND

Our Operation: Dela and I are completing our 20th year of Community Supported Agriculture. Our central Wisconsin coalition of CSA growers, which now has 50 members, has honored us as one of 4 "CSA Pioneers" in our region. We have been relying almost entirely for income on organic crop production and value-added farmstead products (goat milk soap and natural ingredient skin care products, also pickled and preserved products from vegetables), the past 5 years. We quit all other off-farm work, formerly vital for supporting our farm family, in 2009. About 90 percent of our farm income is from crop production, primarily fresh vegetables of 60 organic and heirloom varieties. We produce and sell in rotations with vegetables, organic hay, small grains (oats, wheat, rye), straw. We sell very small quantities of meat from sheep, goats and pigs; eggs from our laying hens; and seasonally a few livestock. We rent fields (41 acres) from three property owners for producing crops; our 5-acre farmstead includes intensive crops and pasture, two high tunnel greenhouses, two cold frame greenhouses, two late-winter greenhouses for seeding flats; and farm buildings. All crop production is certified organic; all livestock is fed organic grains with access to pasture or free range. Our youngest son, who works full time for a cooperative of more than 150 cow dairy farms, is leasing two of our farm buildings and pasture to begin a licensed goat dairy in 2015. Our oldest son is now working full time with us again in vegetable production. A third son, who works full time making engine parts in a factory, helped us find, procure and fabricate equipment for this project.

Prior Sustainable Practices: We have always followed organic practices here since starting our business in 1994. We obtained our first multi-year land contract about 8 years ago and immediately began transitioning the land to organic certification through the NRCS. We have been working all this time to transition away from using black plastic mulch, which has been estimated to be in use on more than 30 million

acres of commercial vegetable and fruit crop land globally.

Almost all of this black plastic goes into landfills. Concerns have been raised that chemicals from plastic mulch may leach into ground water. Bio-degradable mulches being studied are from substances made from plant material that may be genetically modified. Organic certifiers bar GMO product use.

For our organic vegetable crops, we've been increasingly growing, making and employing various organic small grains straw and switch grass straw mulches from small square bales (compared in our first SARE grant report, 2010). For soil improvement and fertility, we've also employed livestock manure, humus from compost-making, some plow downs such as vetch and red clover, rotations and straw mulch, rather than purchasing off-farm inputs shipped from other areas or regions of the country.

PROJECT DESCRIPTION

GOALS

Project goals as identified in our grant application.

- 1) Develop alternative means to employing black plastic mulch for shading out weeds for vegetable crops in order to increase ecology and sustainability in gardens and fields.
- 2) Address challenges of meeting uniform application and density of organic mulch and labor and time required to employ small square bales of mulch around tens of thousands of transplanted commercial bedding plants each season.
- 3) Develop and test modifications to water wheel transplanting equipment to penetrate round bales of mulch applied to beds before transplanting, also means of laying down 3 500-lb. or larger round bales of switch grass mulch before transplanting vegetable starts, and compare this production with black plastic mulch use, as well as square bale mulch, post transplanting application and use.
- 4) Determine costs, performance and viability of round bale switch grass mulch in vegetable transplanting, and how this compares to square bale organic mulch and black plastic mulch in vegetable crops.
- 5) Note and endeavor to document any secondary advantages to employing round bales of switch grass mulch, in terms of greater or less plant disease or rust (as identified in our comparison with small grains mulch in a previous SARE producer grant project) and improved soil fertility, tilth and organic matter content, to which black plastic mulch cannot contribute.
- 6) Host field days, tours, workshops and attract publicity for employing organic mulch, especially switch grass, with commercial, community and back-yard gardens, farms and producers to promote ecological, sustainable practices in family farming and gardening.

PROCESS

Steps involved in conducting the project and logic behind choices made (with specifics so that other farmers and ranchers can consider what would apply to their operations and gain from our experience).

Switch grass, which we have baled to mulch organic vegetable crops for about 7 years, has compared well in weed suppression to oat and wheat straw mulch, also in field trials (previous/first SARE producer grant) at Scotch Hill Farm. We have used small grains straw and switch grass to mulch variously at least 15 field-scale vegetable crops. We have identified several challenges that we believe producers must overcome, however, in using switch grass or small grains straw. Meeting these challenges will help develop organic, ecological alternatives to black plastic and biodegradable mulch for commercial vegetable crops. It will help producers sustain their crops with an affordable perennial mulch option that also builds soil organically.

Widespread black plastic use on more than 30 million acres from polyethylene film to mulch commercial crops increasingly since the 1950s has raised concerns about leaching, both during field use and in landfills where much of it is ultimately discarded. Photodegradable and biodegradable plastic mulches, made from cornstarch or coated paper are being developed and studied. Concerns noted in and from these studies are: ability of biodegradable mulch to meet national organic standards; residues mulches may leave behind after degrading, inability of some mulches to completely degrade; and effectiveness of some alternative mulches for longer-season vegetable crops since the mulches break down too soon.

For all mulches we have used, their ability to suppress weeds has seemed to depend on how quickly we have applied the mulch after seeding or transplanting, and how thick and thorough the mulch application. Straw mulch contributes organic matter to soil and saves time required to remove black plastic at season's end. Breaking open square bales of straw to mulch vegetable transplants, however, makes achieving uniform density difficult. Too light an application allows weeds to overcome the mulch before vegetables attain size and canopy to compete with weeds for water, nutrients and sunlight. Too dense an application can provide cover to field mice and chipmunks, which can damage or consume vegetable crops.

To address these problems, we resolved to develop small and large round bale systems for mulching vegetable seedling transplants. Key to saving labor and achieving uniformity over black plastic mulch, would lie in the producer's ability to roll out or lay down round bales of mulch on tilled ground before transplanting, then transplant into the mulch with equipment capable of penetrating the blanket of switch grass or straw.

Several other contemporary factors challenging all producers regardless of their scale, greatly affected this project. Widely varying extremes in temperature and moisture that scientists increasingly attribute to climate change affected our attempts the first year, both to raise vegetable crops and to make and employ switch grass mulch. Competitive pressures to rent ground, resulting from soaring commodity prices coincident to our project, also have impacted us greatly.

A historic drought cut our switch grass production (as well as hay and oat straw) by two-thirds in 2012. Downpours exceeding normal rainfall at other times during this project have also affected harvests, planting and field work. We have lost ground where we baled switch grass formerly due to the current and intense competition for land rents.

Finally, we were unable to negotiate affordable purchase of new round baling equipment from a dealer in Texas, with whom we'd been speaking and corresponding as a prospective producer representative for the equipment in the Midwest region.

The economic downturn of 2007-2009, as well as greatly increased regional competition in fresh vegetable production, have continued for 4 of 5 years to negatively impact our vegetable crop income, hampering our ability to hire seasonal help. Many other CSA producers, large and small, have been feeling these pressures, and we found the timing not good for trying to persuade them to take on switch grass production themselves, for their own use and as a secondary income stream.

We purchased a used Heston 550 round baler (\$4,500) in spring 2012 for a third of the price of a new machine, even with the dealer discount on new equipment we had been trying to negotiate.

Right away, we were able to produce two 500-lb bales of switch grass with this used machine. However, the landowner where we made these large round bales had left

the switch grass standing over winter in the field as cover for wild turkeys. The grass was also cut fine, rather than laid down with a cycle bar or conventional haybine. Baled into a large round, the dry, chopped material fell apart on application, rather than unraveling like a carpet. We had to spread the material over tilled ground and transplant into it by hand, rather than employing our water wheel transplanter.

The drought during this year also so severely reduced yields of switch grass in another 4-acre field where we had established the prairie grass, that we were unable to use the large round baler. We were thus unable to cut and bale enough material into large rounds for this study.

In these early efforts, we had initially to borrow a neighbor's large diesel tractor with extra hydraulic ports to employ the large round baler. We later purchased a new four-port hydraulic unit for \$500 to retrofit our gasoline JD 3020 tractor to accommodate the larger machine. We pulled the first large round bale we made home with a flat rack. A neighbor lifted the bale onto the rack, and we pulled it off of the wagon with our own bucket tractor.

Other unanticipated costs in this study included the need to purchase a bale spear (\$250) to attach to our bucket tractor for moving large round bales about fields and loading for transport. We also had to buy a used 23-foot flatbed wagon to efficiently move multiple large round bales distances on highways (\$1,000 plus new tires, \$100 each).

With no cost extension granted for this project, we continued to turn our focus to purchasing and employing used round baling equipment (a restored Allis Chalmers Roto baler for making 50-lb. round bales), while also exploring possible sourcing and purchase of large round bales of switch grass mulch in the central United States.

We found a completely restored Roto baler for sale for \$2,500, about one-sixth the price of a newly manufactured machine for making small rounds imported from Japan. Small round bales of switch grass mulch could greatly help urban backyard, school and community gardeners with greater ease of transplanting, as well as weed suppression, and provide another income stream for commercial growers.

We found 500-lb. bales of switch grass mulch available from a private business for more than \$100 each in the Rock County area. However, they were square bales and not round. We found 1,000-lb. round bales of switch grass mulch available from a bio-energy business working in conjunction with a Western University of Tennessee research station for \$40 each, but we had trouble determining whether they were from ground where herbicides had been employed, and we would have had considerable shipping expense for 8 bales nearly 1,000 miles.

A huge break for our project came in April 2014 when Wisconsin DNR field staff in Rock County connected us with UW Madison Agronomy Bio-Energy field staff, who were looking for private producers to cut and bale switch grass on protected wildlife stands. Prairie planting material (predominantly switch grass) needed to be removed quickly for duck nesting habitat. Budget cutbacks made staffing and expense of controlled burns on the properties impossible. Dave Williams, UW Extension, verified that no herbicide had been used on the public lands.

On the day we took our square baler and wagons to the field for baling switch grass, Klondike Farms of Brooklyn, Wis., was also cutting, windrowing and making large round and square bales of the switch grass on the same property. We were able to purchase eight 1,000-lb. round bales from a large-scale custom straw and hay-maker, which operates on 5,000 acres of owned and rented farmland, and also custom produces on an additional 4,000 acres.

Their price was \$14 per bale, and they loaded our flatbed trailer with eight bales, which we then pulled to our field with a diesel truck that we borrowed from our son

Joel Ends, helping with this study. The custom producer indicated this price was standard for switch grass from public lands, which are sold to local dairy farmers for bedding. We also made 236 small squares of switch grass on the property and transported that with a hay wagon and second truck.

Transplanting vegetables out of our greenhouses into the field ran 2 to 6 weeks late after a particularly severe winter, followed by a cloudy, cold, wet spring. This rain persisted into summer with only one relatively short dry spell late in this growing season. Our bedding plants grew very slowly in the greenhouses, and some varieties matured slowly once transplanted as the wet weather patterns continued into early summer.

We were unable to purchase additional wheels for our waterwheel transplanter. This necessitated transplanting crops for comparison first into black plastic and bare ground for mulching later with small square bales of switch grass. Once our son had fabricated extension spades and affixed them to the points on each wheel, we then laid out the large round bales of switch grass mulch and tried transplanting directly into them.

The mulch comparison was thus three-fold: black plastic, small square bales of switch grass, large round bales of switch grass. Crops for comparison were primarily cabbage and tomatoes, but peppers were also transplanted into carpets of round bale switch grass mulch; also into bare ground, mulched thereafter with small square bales of switch grass. A final experiment involved rolling out round bales of switch grass mulch over potato starts in 2 double rows, 250 feet long.

PEOPLE

List of farmers, ranchers, or business people who assisted with the project and how they were involved. List of personnel from public agencies who assisted with this project. List of people from non-profit organizations who helped:

- David Williams, Research Specialist, UW Agronomy, Great Lakes BioEnergy Research Center, connected us to stands of switch grass maintained as nesting habitat for ducks by the Fish and Wildlife Service in Union Township of Rock County. Because of budget and staff cutbacks, researchers are periodically allowing private farm producers to cut and bale switch grass on such properties to save expense of conducting controlled burns.
- Dr. James Stute, Rock County UW Extension, and now Crop and Soil Research Director, Michael Fields Agricultural Institute, East Troy, Wis., collaborated with us in design of our project, consulted us throughout our project, attended and spoke at our August 2014 field day.
- Michael Foy, Wildlife Manager, and Brian Buenzo, field staff, South Central Region, Wisconsin Department of Natural Resources, helped connect me to public stands of switch grass mulch for baling.
- Claire Strader, Small Scale and Organic Produce Educator, Dane County UW Extension, Fair Share CSA Coalition, Madison, Wis., scheduled, advertised, promoted and attended our August 2014 field day, and also provided a photo for our report.
- State line Farm Beginnings and Collaborative Regional Alliance for Farmer Training based in Caledonia, Ill., helped advertise our August 2014 field day with their list serve.
- Sarah Lloyd, Special Projects Coordinator, Wisconsin Farmers Union helped advertise our August 2014 field day with their list serve.

- LuAnn Greiner, ORUCC Veggie Village community garden, coordinated application of 65 bales of switch grass mulch purchased from me spring 2014, and greatly praised the material in communications with other community gardens in central Wisconsin, recommending they purchase and use our mulch as well.
- Lucas Berna, owner, Paradigm Gardens, Helgesen Drive, Madison, Wis., scheduled, promoted and hosted a workshop on switch grass mulch, at which I presented to about 10 people. He also purchased and sold 10 to 40 bales of square switch grass mulch from me at a time, re-ordering half a dozen times over a year and a half, providing feedback to me on consumer comments; and encouraging me enthusiastically to keep going with this production and experimentation.
- Brett Condon, Morning Glory Farm, a strawberry and asparagus producer in Brodhead, Wis., allowed me to make two large round bales of over-wintered outside switch grass mulch in spring 2012. He took one bale to experiment with in mulching squash and melons in exchange for the other, which I used with transplanted vegetable crops. He also loaned us a tractor for the project and loaded the large bale on a flat rack for us to transport home when I did not have equipment initially to use with the large round baler.

RESULTS

For our region this study year, 2014, weed pressure brought on by above average rainfall throughout the planting and growing season was intense and relentless. Yet vegetables we transplanted into double-row beds of rolled switch grass mulch often fared as well -- in some cases even better -- than those we transplanted into black plastic mulch.

These beds of vegetables transplanted into rolled-out bales of mulch also did as well or far better than vegetables transplanted into bare, tilled ground, and then mulched thereafter with chips of switch grass from small square bales of mulch. This was true both for our own switch grass square bales made on rented ground the previous fall and stored inside over winter, and for those mulched with switch grass square bales that we made in the spring from a field left standing over winter.

In transplanting over the rolled mulch, we cut out large pieces of cardboard, fit around over metal rungs and held in place by the riders' feet. These "sleds" helped the metal water wheel transplanter glide over the dense mulch without disturbing, catching, or dragging apart the mulch. Even two volunteer subscribers who'd never ridden a transplanter before were able to apply cabbage and broccoli bedding plants through holes made by our fabricated metal points in the switch grass mulch.

Stands of transplanted vegetables in all three mulching media compared in this SARE project were in double rows, 125 to 150 feet long. The same water wheel transplanter with one-foot spacing on the wheels was used for all vegetables.

The spading extensions our son Joel fabricated and bolted to existing waterwheel points worked beautifully, penetrating the dense, rolled bale mulch and into the soil more than adequately to allow transplanting of vegetables into the soil.

Moisture from rainfall was so plentiful this growing season that none of the drip tape irrigation was employed throughout the season for any of these transplanted vegetable crops. Most of these crops typically require at least 1.5 inches of water a week. Nature exceeded requirements much of the season, and mulch in all instances helped retain moisture.

Weed pressure wherever there was no mulch was prolific, even immediately around the transplants in black plastic where the waterwheel device made holes through the plastic to allow transplanting into the ground. In walking paths between double rows, weed pressure even around and between chips of mulch was intense, and even these paths had to be mowed or hand-weeded at least mulch before season's end.

It is safe to say that without any of these varieties of mulch in this year of intense rain (and lower subscription sign-ups (affecting most if not all of the 50 growers in our central Wisconsin coalition), we would have been overwhelmed by weed pressure.

Yields for our primary mulched crops in this study (cabbage and tomatoes) were very good across all three mulch media. For most of the season, almost all of the 108 households of subscribers we served weekly for 20 weeks found our harvests bountiful. Photos of our weekly packaging of 8 to 10 varieties of vegetables have been posted on our website (www.scotthillfarm.com) and a farm Facebook page through the 20-week season, two years in a row to help subscribers identify vegetables they receive and employ recipes also now posted to the site weekly.

Since both the 500-lb. roll of switch grass mulch that we made and the 1,000-lb. rolls of switch grass mulch we purchased were from over-wintered material, cut and baled in April of 2012 and 2014, application of the rolls was not as clean as we had hoped. The grasses in both instances were dry and already in a crisp, fragile state of deterioration. Layers of the grass would collapse as we unraveled the rolls, and we had to stop to fold layers over into an adjoining bed to get a more even distribution of the mulch across a single bed. This required more time than we had hoped in application of the rolled mulch.

The fabricated points, however, successfully penetrated the mulch all across the distance of each bale of rolled mulch, almost regardless of its finished depth. A single 1,000-lb. round bale covered two double rows, plus the walking path in between, for about 100-feet before the roll had run out.

In application of the chips of mulch from small square bales of switch grass, it took about 5 bales pieced around each 70 feet of a single double-row bed. This application of this number of small square bales took about 25 minutes of a single person's time. Despite the difficulty we experienced applying the rolled mulch, it took less time to apply and it suppressed weeds better than the small square bales, longer into the season.

Some weed varieties, especially thistles, were eventually able to penetrate and emerge from the round bales of switch grass mulch. The transplanted vegetables were in all cases, though, thriving by the time any weeds were able to penetrate the mulch.

Weed grasses, notably and especially Foxtail, were intensely a problem this season wherever there was no mulch and between chips of switch grass mulched used as comparison to the large round bales and black plastic in walking paths.

We've always experienced weed-growth immediately around our transplanted and seeded crops, whether we mechanically cultivated the crops, or employed black plastic mulch. Employing the water wheel transplanter across the rolled out bales of switch grass mulch provided the cleanest establishment of transplanted vegetable crops that I can remember, in most cases as long as 4 to 6 weeks without any signs of weeds emerging.

It was especially striking to observe two double rows of potato plants a foot apart for 250 feet, emerging from the double rows of starts below carpets of rolled out switch grass mulch for many weeks, without any sign of weeds rising up through the

mulch. From the 70 lbs. of seed potatoes, we obtained more than 1200 lbs. of potatoes. Most potatoes at harvest were immediately under the mulch, right at the surface of the soil, and very little digging was necessary to complete the harvest.

To apply the large round bales of switch grass mulch, we drove a dense metal rod with a sledge through the center of each bale. We then wrapped the ends of a tie down strap, which was run through the three-point arms of the JD 3020 tractor, around the rod on each side of the bales.

The bale unraveled as we pulled it along over the tilled beds, using drip tape already stretched over the bed as a centering guide. Excess mulch where bales unraveled unevenly were folded over onto the adjoining prepared bed.

Vegetables, except in the case of potatoes already spaced along the drip tape, were then transplanted into the dense mulch.

DISCUSSION

Going into this project, we knew that switch grass mulch provided definite advantages to long-term soil fertility than black plastic mulch. This type of prairie grass had also shown important advantages over small grains straw: roughly double the tissue nitrogen content and a much lower carbon to nitrogen ratio. These differences have affected the rate of material decomposition since the Carbon-to-Nitrogen ratio is closer to the 30-to-1 ratio required for microbial breakdown.

We were able to incorporate 6 of the 8 purchased 1,000-lb. round bales into mulched beds of transplants during this study year, and in each instance, weed suppression performance was superior to beds of the same vegetable crop varieties where small square bales of switch grass were employed.

We recommend and encourage further experimentation with large round bales as a substitute for black plastic mulch in a wide variety of transplanted vegetable crops. We recommend fall-harvested switch grass over spring harvested switch grass. We believe this should allow the material to roll out more consistently as a carpet of mulch, with more even distribution. Switch grass needs to be harvested well after first frost so that any weeds or grasses in the stand have shed their seeds and do not volunteer later in the mulch.

We do not recommend any straw mulch be used over black plastic mulch in transplanting of fragile eggplant starts, however. Tiny, voracious beetles decimated 75 feet of double-row eggplant transplants where we used small square bales of switch grass as mulch this year. This has happened to us before. Not 75 feet away from this ruined crop, eggplant transplanted into black plastic reached maturity and yielded adequately despite the difficult weather conditions of this season.

Other varieties of transplants we made into rolled switch grass mulch this year (peppers, cabbage, tomatoes) did very well and seemed unaffected by any pests the medium may have harbored.

Small square bales of oat and wheat straw, switch grass mulch, too, were still effectively employed this season – and will continue to be employed on our farm in instances where 1,000-lb. rolls of mulch are impractical or impossible to use. Our high tunnel greenhouses, for instance, and shorter length or width fields make mechanical application and maneuvering with a tractor prohibitive.

In our 7 or 8 acres of field scale production of vegetable crops this year, the round bales helped us greatly, saving us time and labor, in a difficult year economically and a wet year of intense weed pressure.

PROJECT IMPACTS

Comparing the costs to our farm of renting a field to establish switch grass, mowing the field repeatedly for two years to establish the prairie grass variety, seeing area

land rents rise from \$100 per acre to \$140 per acre because of commodity price swings, experiencing low yields on baled switch grass during an extremely dry, historic drought year (from 240 bales in a good year to only 80 bales the dry year), the purchased price of eight 1,000-lb. round bales of switch grass for \$14 each is instructive.

We got a good yield on small square bales of switch grass from rented land again this year, though. And we continue to sell hundreds of bales for between \$5 and \$8 each to individual gardeners, a community garden and a garden supply center, all in Madison. Very favorable feedback about the properties of our switch grass mulch, its weed suppression and its contribution to soil over the long term continue to come back to us. Surplus mulch sales help diversify and contribute to our farm income. Often, we are able to pull a trailer of mulch on our vegetable delivery days to avoid extra costs for both the consumers/retailers and our farm.

Consumers and retailers are keenly interested in the prospects of Scotch Hill Farm making and selling small round bales of switch grass mulch (40 to 50 lbs. in size) for them to use in back yard, community and school garden settings. We are establishing a new field of switch grass this month (October 2014) on rented ground with the help of the DNR specialized drill and purchased seed. This will replace the rented field of switch grass we are losing this year. It will give us an area to employ the restored Allis Chalmers Roto baler we purchased for this grant project and are just beginning to use.

The price of our the purchased bales and their coverage area in this study year also compares well against the price of black plastic mulch. To cover the same width bed as our 1,000-lb. rolls of purchased switch grass this year, a 4-foot-wide roll of black plastic, with a coverage length of 2,000 feet would actually cost about the same as the large round bales of switch grass mulch.

Application of the black plastic mulch is easier and faster than the large round bales, but there is no removal required for the organic mulch, and its contributions to the soil are a clear advantage in the long term.

OUTREACH

For two farm tours in 2013 and 2014, also for a workshop at Paradigm Gardens in Madison in 2014 and three field days held over the 2-year period, I wrote separate press releases. These described the project and our work through SARE. I sent the releases to collaborating organizations, popular and farm press, including the Janesville Gazette, Monroe Times, Brodhead Free Press, Wisconsin State Journal, Wisconsin State Farmer, Country Today, and Isthmus.

WORT community radio Madison interviewed us about our project in advance of the workshop that Paradigm Gardens hosted, May 8, 2014. "Edible Madison" magazine featured us in their fall 2014 edition. Local papers printed briefs on our project or carried the project announcement in their calendars of events, from the press releases I sent.

List serves for the state line Collaborative Regional Alliance for Farmer Training, the Fair Share Community Supported Agriculture Coalition, MOSES and the Wisconsin Farmers Union shared advance notice on our events with their constituencies electronically.

About 15 people came to our August 2014 field day, hundreds of people came for the farm tour each year, about 35 young farmers came to the "In Her Boots" workshops and field day sponsored by MOSES on our farm, about 45 people came to the Soil Sisters farm tours (a Women in Sustainable Agriculture network) each year. Mulching of crops was among other of our farming practices covered or featured in each event on our farm.

PROGRAM EVALUATION

I commend this North Central Region SARE farmer rancher grant program. Many of the CSA growers in our region did not make their budget goals this past season. Competition is keen. Subscription interest is hampered by broad consumer concerns regarding the economy. Small business owners in many other walks of life report the same unwillingness of customers to commit to subscriptions for services, the same conservative sentiments and fears about economic conditions. Our farm's profit margins have been by more than half in 4 of 5 years over previous growth across 15 years as CSA growers. Without grant programs such as SARE, we would not be able to experiment, to take calculated risks, improve sustainability at the levels we were able to achieve by this award. We are extremely grateful and support expanded funding for your work.

(Work log for this project and list of photos follow.)

Project Activity Calendar & Work Log for 2014

Tony Ends, Project Leader – Researching, sourcing and contacting by internet and phone for equipment and 1,000-lb. round bales of switch grass mulch (Feb. 3, 12, 19, 24 and March 19 – 10 hours); writing, editing, sending press releases on switch grass workshop at Paradigm Gardens in Madison (April 8, 9 and 10 – 8 hrs.); interviewed for radio program on WORT-Madison (April 15 – 1 hr.); worked on point fabrication for water wheel transplanter with Joel, (April 18 and 19 – 10 hrs.); conducted workshop on switch grass at Paradigm Gardens, Madison (April 20 – 6 hrs.); talked with Fair Share CSA Coalition staff regarding field day (April 24 – 3 hrs.); wrote and sent press release on annual Chamber of Commerce farm tour (April 28 & 29 – 5 hrs.); baled over-wintered switch grass on public duck nesting ground in Union Township on Dane-Rock counties line (April 16 – 7 hrs.); purchased and brought home from same field eight 1000-lb. round bales of switch grass, with flatbed trailer and unloaded into our primary rented field (April 18 – 6 hrs); prepared ground for laying black plastic mulch for broccoli and cabbage (first 250-foot beds) in south field on Footville-Brodhead Road (May 3 – 2 hrs.); transplanted first two beds for comparison (broccoli and cabbage into black plastic) and mulched paths with old hay (May 5 – 2 hrs.); tilled ground and laid second row of black plastic (May 6 – 2 hrs.); tilled ground and attempted to roll out 1st round bale, but it fell apart 20 feet into row (May 7 – 2 hrs.); drove to Clearwater, MN, with Joel's truck and flatbed trailer to purchase and bring home restored Roto baler (May 8 – 20 hrs.); dismantled Roto-baler (May 9 – 2 hrs.); annual farm tour day with Chamber of Commerce and other farms (May 10 – 9 hrs.); laid three lengths of black plastic mulch and transplanted tomatoes and broccoli and cabbage for comparison (May 20 – 4 ½ hrs.); laid black plastic and transplanted tomatoes (May 21 and 22 – 4 ½ hrs.); mulched around cabbage and broccoli with small squares of switch grass for comparison (May 21 & 22 – 4 hrs.); transplanted peppers and eggplant into bare ground and began mulching with small squares of switch grass (May 30 – 4 hrs); rolled out two large round bales of switch grass over ground tilled for yellow potatoes (June 9 – 4 hrs.); finished applying first round bale of switch for cabbage comparison and transplanted 10 flats of tomatoes (June 14 – 4 hrs.); transplanted melons and peppers into ½ of a round bale (June 16 – 4 hrs) and finished mulching with small square bales of switch grass after cobra hoeing on June 30 (4 hrs.); hand-weeded thistles from between hay chips mulched into first paths and around plants in black plastic that was transplanted on May 5 (3 hrs.); also had to mow down these paths in August because of dense weeds coming up in paths through hay mulch; (4 hrs); finished mulching north side of transplants after tilling and cobra hoeing around cabbage earlier mulched with small squares for comparison (July 7 - 3 hrs.); switch grass field day (Aug. 3 – 8 hrs.); Soil Sisters field day (Aug. 10 – 8 hrs.); report preparations and emailing/ mailing (Oct. 15,16 & 17 – 12 hrs.) for a total of

212 hours.

Work done in 2012-2013 – Included trips to Monroe and Judah, Wis., to order, buy, pick up large round baler, hydraulic unit for tractor, bale spear, baling large rounds of over-wintered switch grass at Condons' farm near Brodhead, transporting large bale home, application in field; annual farm tour; In Her Boots CSA workshop for women farmers with the MOSES Upper Midwest Organic Conference; meetings with Jim Stute; reporting writing; total of 46 hours.

Joel A. Ends – machinery fabrication and installation (40 hrs.); discussions and meetings (3 hrs.); round bales pick-up, unloading and application of 1,000-lb. round bales (28 hrs.); transporting of AC Roto baler from Clearwater, MN; field work on comparison research project (12 hrs.) for a total of 83 hours on this project.

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Photo No. 9 Metal points fabricated for this project and bolted to our water wheel transplanter – Page 10

Photo No. 10 Project leader Tony Ends driving a JD 3020 tractor pulls a large round bale of switch grass over and next to double rows of potato starts laid out about a foot apart along two stretches of drip tape irrigation – Page 11

Photo No. 11 A solitary bedding plant stands in a bed of rolled switch grass mulch – Page 12

Photo No. 12 Allis Chalmers Roto baler, fully restored, that we purchased for this project in 2014 – Page 13

Photo No. 13 Participants in our Aug. 3, 2014, field day – Page 14

- [Final Report with photos, Tony Ends, FNC12-857](#)

Research

Participation Summary

Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture or SARE.



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