GREENBOOK 2007

HANDS OF CHANGE

The Greenbook is dedicated to the farming families of Minnesota. Their innovation, cooperation, and persisitence are creating a more sustainable agriculture.







Greenbook 2007

Program Vision Statement

Agriculture in Minnesota will be based on dynamic, flexible farming systems that are profitable, efficient, productive, and founded on ethics of land stewardship and responsibility for the continuing vitality of local rural communities. Minnesotans will strive to understand and respect the complex interconnectivity of living systems, from soil to people, so as to protect and enhance all natural resources for future generations. Minnesota agriculture will sustain an abundance of food and other products as well as meaningful, self directed employment that supports the quality of life desired by farmers and rural communities. Agriculture will foster diversity in all its forms of production, products, markets, and cultures.

Program Mission Statement

To work toward the goal of sustainability for Minnesota agriculture by designing and implementing programs that meet the identified needs and support the creativity of Minnesota farmers.

MINNESOTA DEPARTMENT OF AGRICULTURE
FROM THE FARM TO YOUR FAMILY

July 2007

Thank you to the MDA's Agricultural Resources Management and Development Staff who helped to make *Greenbook 2007* a reality. They include: Linda Bougie, Jean Ciborowski, Alison Fish, Mary Hanks, Wayne Monsen, Meg Moynihan, and Mark Zumwinkle. A special thanks to Stacy Gulden, Information Technology Division, for the layout and design of *Greenbook 2007*.

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Introduction to the Greenbook 2007

I am pleased to introduce the 18th edition of the *Greenbook*, a publication of the Minnesota Department of Agriculture's Agricultural Resources Management and Development Division (ARMD). We highlight the project results of creative and innovative farmers and researchers involved with the Sustainable Agriculture On-farm Demonstration Grant Program.

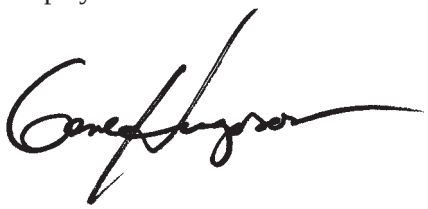
Sustainable agriculture focuses on environmentally friendly farming practices with a special emphasis on reducing inputs. It also includes diversification of crops and alternative livestock systems, and it gives farmers increased access to alternative markets.

Greenbook 2007 contains articles highlighting the results of the grantees' projects and provides practical and technical information. Each article includes personal observations and management tips from the participants. Additionally, these grantees are willing to share their knowledge and experiences with you. They are all dedicated to making Minnesota agriculture more profitable and environmentally friendly. Feel free to give them a call about their projects.

This year's *Greenbook* also includes articles on sustainable agriculture provided by the Minnesota Institute for Sustainable Agriculture (MISA), a partnership between the College of Agricultural, Food and Environmental Sciences at the University of Minnesota and the Sustainers' Coalition, a group of individuals and non-profit organizations. MISA received funding from the Sustainable Agriculture Research and Education (SARE), a program of USDA's Cooperative State Research, Education, and Extension Service (CSREES) to help farmers implement sustainable agriculture practices. The articles in *Greenbook 2007* present the work done on these projects.

Greenbook 2007 also includes updates on other ARMD projects such as organics in Minnesota and the integrated pest management program.

I hope you find *Greenbook 2007* interesting and full of new and useful ideas.



Gene Hugoson, Commissioner
Minnesota Department of Agriculture

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Sustainable Agriculture Grant Program

Program Purpose

The Grant Program provides a unique opportunity for farmers, nonprofit groups, agricultural researchers, and educators across the state to work together to explore ways of enhancing the sustainability of a wide range of farming systems.

Program Description

The Department has received over 1,033 grant applications and has approved over $2.6 million in funding for 253 projects since the program began in 1989. Project categories include: Alternative Markets and Specialty Crops, Fruits and Vegetables, Cropping Systems and Soil Fertility, and Livestock. The grant projects, located throughout the state of Minnesota, are described in *Greenbook 2007*.

Grants provide a maximum of $25,000 for on-farm demonstrations that last up to three years. The projects demonstrate farming methods or systems that increase energy efficiency, reduce agricultural chemical usage, and show environmental and economic benefits. A Technical Review Panel evaluates the applications on a competitive basis and makes recommendations to the Commissioner of Agriculture for approval. The Technical Review Panel is made up of farmers, university agricultural researchers, extension agents, and educators and works with assistance from the Sustainable Agriculture and Integrated Pest Management Program staff.

Grant Summaries

The project summaries that follow are descriptions of objectives, methods, and findings of individual grant projects funded in the past two years. To find out more details about these projects, contact the principal investigators directly through the listed telephone numbers, addresses, and email addresses.

Summary of Grant Funding (1989-2007)

Year	Number of Grants Funded	Total Funding	Average Grant Size	Ranges
1989	17	$280,000	$16,500	$3,000-25,000
1990	14	189,000	13,500	4,000-25,000
1991	4	46,000	11,500	4,000-23,000
1992	16	177,000	11,000	2,000-25,000
1993	13	85,000	6,000	2,000-11,000
1994	14	60,825	4,000	2,000-10,000
1995	19	205,600	11,000	2,000-25,000
1996	16	205,500	12,900	4,000-25,000
1997	20	221,591	11,700	1,000-25,000
1998	19	210,000	11,100	1,000-24,560
1999	23	234,500	10,200	3,000-21,000
2000	17	150,000	8,800	4,600-15,000
2001	16	190,000	11,875	5,000-25,000
2002	18	200,000	11,000	4,300-20,000
2003*	---	---	---	---
2004*	---	---	---	---
2005	10	70,000	7,000	2,000-11,600
2006	8	70,000	8,750	4,600-12,000
2007	9	70,000	7,777	2,700-12,000
Total Funded	**253**	**$2,665,016**		

**No grants were awarded in 2003 and 2004.*

Developing a Saskatoon Berry Market in the Upper Midwest

Principal Investigators

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Project Duration

2005 to 2007

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Keywords

berries, fruit, Juneberries, pick-your-own, Saskatoon berries, U-pick

Project Summary

The goals of this project are to: determine whether Saskatoon berries can be profitably grown in Minnesota; identify which varieties are best suited to Minnesota markets and growing conditions; assess the sustainability of Saskatoons, a crop that reportedly requires low fertilizer, chemical, and labor inputs; and develop a Minnesota market for fresh and/or processed Saskatoon berries. This project has also received funding from the USDA Sustainable Agriculture Research and Education (SARE) Program.

Project Description

This project is a cooperative effort by sisters, Pat Altrichter and Judy Heiling. Pat and husband Ron own 226 acres in central Minnesota where they raise alfalfa-grass hay and 80 beef brood cows. Pat wanted to start a pick-your-own berry patch to diversify the operation and help increase farm income. Judy, who has been in the nursery business for more than 20 years, identified Saskatoon berries as a likely candidate. Both enjoyed wild berries when they were growing up. "But with the land clearing and ditch spraying, the wild berries are disappearing," Pat says. While doing some research on the internet, Pat learned about Saskatoon U-pick operations in Canada, where the berries are popular.

Initial research told us that Saskatoon berries (Amelanchier alnifolia) are the most commonly cultivated species of Juneberry or serviceberry. The fruits look like blueberries, but are drier and sweeter. Native to the Great Plains and Canada, they are adaptable to many soil types and climates and grow 8' to 10' high and look like lilac bushes when they mature. Established orchards are reportedly productive for 60 or more years and require little maintenance. We hypothesized that since Saskatoons are very hardy, they would be an excellent addition to windbreaks. Since they reportedly have minimal susceptibility to disease and insect problems, an established orchard should only require light trimming, mowing, fertilization, and additional mulch.

We selected a number of varieties to try (Table 1) and began establishing Saskatoons on Pat's farm in the spring of 2004 with funds from a North Central Region Sustainable Agriculture Research and Education Program Farmer/Rancher Grant (see Greenbook 2005). We planted 648 2- and 3-year old bushes 4' apart in 18' rows for about 800 plants/A. These did well, despite a dry June and an August frost. There were no apparent insect or disease problems. By fall 2004, we had lost about 10% of that first planting, mostly to deer. In the fall of 2004, we began installing 8' woven wire fencing to keep deer out of the berries

This has been a great family project - we've had lots of help from grandchildren pulling weeds, marking rows, and planting small plants.

Table 1. Saskatoon Berry Varieties Planted

Forestburg
Honeywood
Lee 3
Lee 8
Martin
Northline
Smoky
Thiessen

and we planted another 1,200 trees, this time seedlings, from Canada. We also seeded grass in the rows and mulched around the bushes within the rows with sawdust from a nearby sawmill or wood chips from a tree service, using about one yard of mulch per 10'of row.

In the fall of 2005, we used the MDA Sustainable Agriculture Grant to plant and mulch another 420 3- and 4-year old Saskatoons that had been in Judy's nursery.

Results

2005

Planting the bushes took about 10 hr/A, with two of us working together. Mulching took us about 16 hr/A. The domestic bushes cost $3.50-4.00 each, for an investment of $2,800 to $3,200 in plants/A. The seedlings imported from Canada were more expensive due to the added costs of shipping and import permits. The cost of mulch was highly variable and depended on the source and the cost of hauling. After establishment and before picking begins, labor is required for mowing the grass planted between the rows. The bushes require occasional light trimming to remove dead or damaged branches. Heavy mulching did a good job of controlling weeds, and only a little spot spraying was needed.

By July 2005, many of the little bushes planted the previous spring had flowered, and even a few of the seedlings we planted in Fall 2004 flowered. Until the bushes begin producing, we will not be able to measure yields or profitability.

The main disadvantages to the project have been initial preparation and planting labor and costs of planting stock. We anticipate that the berries will take about five years to mature and produce a return on investment. Pat and Ron have participated in a farm business management program for eight years and say it has been an excellent tool to evaluate their farming management decisions. So it was natural for us to consult the farm business management instructor for help with financial projections.

2006

This year, we really concentrated on our fencing project, as the deer do a lot of damage to the plants. We cut tamarack trees in a nearby swamp and trimmed them into 12' posts. Tamarack is naturally rot resistant and the posts are working well. We are finding that our fencing is not entirely fool proof – we actually found one deer inside. When we startled her, she ripped a big hole in the fence to escape!

We've been noticing some other pest trouble, too. During the winter, mice like to nest in the sawdust mulch and chew on the Saskatoon bark. Rabbits have also done some munching on the trunks. We put out traps to catch the mice. After the fall freeze, we sprayed an Irish Spring®[1] soap solution on the bushes and trunks. We have found this solution works extremely well to protect the plants against pest chewing.

Weeds have also been pesky. We needed to do quite a bit of spot spraying this summer as most of the plants are still quite small. We also ran short on mulch in some areas; these were noticeably weedier. We had a very dry summer and noticed that the mulch helped hold what little moisture there was. Our other fruit trees really seemed to suffer from the drought and we watered them, but the Saskatoons looked good all summer. Some of the plants put on quite a few berries and started to show some nice suckering. We picked some of the early berries. Those that came on later in the season pretty much dried up because of the dry weather conditions.

As the hot summer progressed, the grasshoppers hatched out like crazy. They were so thick they ate most of the leaves off many of our fruit trees. They even ate the bark off some of the smaller stems. When a turkey producer neighbor asked us if we wanted some leftover birds he couldn't ship, we got the idea to put them in the orchard for grasshopper control. It really helped, and the turkeys grew like crazy!

Our neighbors are very curious about the "brush" or bushes we have growing behind our house. Judy and I have become known as "The Saskatoon Ladies!" Word of mouth

[1]*Inclusion of a trade name does not imply endorsement of that product by the Minnesota Department of Agriculture, nor does exclusion imply non-approval.*

really seems to work – it seems that everywhere we go, people are curious about the berries. We are having a lot of fun with this project and have had so much response that we designed and printed informational brochures to hand out at meetings and to the general public. In February, we spoke to a large group at the Upper Midwest Regional Fruit and Vegetable Conference in St. Cloud. We also spoke to a group in Fairmont, MN. In August, we spoke about the project at the National Sustainable Agriculture Research and Education (SARE) Conference held in Oconomowoc, WI.

We also continued to do research for ourselves, making another field trip to Grahm's Groves near Carmen, Manitoba this year. They market a lot of their berries as pies and tarts at a local farmers' market and gave us a tour of their kitchen facilities. They reported that demand for pre-picked berries, is increasing. We plan to continue traveling to Canada and elsewhere in order to learn from other Saskatoon growers and marketers.

We are still interested in doing a U-pick berry operation. U-pick berry farms are popular in central Minnesota and many older people in the area have fond memories of collecting wild Juneberries. We have asked other fruit operations about their management methods, weed control, fencing, labor, storage, and strategies for dealing with leftover fruit. Some farms find high school students are a good labor force. Others get help from residents of retirement communities and nursing homes who are spry and enjoy the work. Still other operations "pick on shares." The customer may pick two pails full, for example, and take home one bucket for free or at a reduced price, while leaving the other bucket behind as "payment" for the operation to package and sell.

We have talked to several local processors of specialty foods who are interested in buying this unique fruit for jams and jellies. We expect that as others learn about Saskatoons, there will be a market for started plants as well. Judy sells all kinds of plants at our farmers' market and already answers a lot of questions about Saskatoons there.

As the plants mature, we will continue to keep records on labor involved, costs, income, yields, etc. We will also continue our marketing research and plan to have an open house in summer 2007.

Management Tips

1. To keep deer away from tender young plants, install fences before you plant Saskatoon berries.

2. Pile on mulch – the thicker the better.

3. Establish ground cover between the rows as soon as possible – especially if you have light or sloping soil.

4. Use a soap solution to prevent pests from chewing on trees during the winter months. Irish Spring® worked great for us. Shave a couple of bars of soap into a kettle of 1 to 2 qt. hot water until you have a slurry. Dilute 2 c. slurry with 4 gal. water. Spray plants. Repeat as needed after rain events. This method seems to work particularly well when applied to tree trunks in late fall; it really cut down on the mouse and rabbit chewing.

Cooperator

Dave Stish, Farm Business Management Instructor, Staples, MN

Project Location

Go 3 miles west of Randall on Cty. Rd. 14. We are on the north side of the road.

Our squad of grasshopper-control turkeys went right to work.

Other Resources

Chaudhary, G. Nabi. N.D. Economics of Saskatoon berry production. Alberta Agriculture, Food and Rural Development. Available at: www.agric.gov.ab.ca (Type "economics of Saskatoon" into the search box.)

Government of Alberta. 2002. Beginning berry production. Available at: www.agric.gov.ab.ca (Type "beginning berry" into the search box.)

Laughlin, Kevin M., Ronald C. Smith, Robert G. Askew. 1996. Juneberry for commercial and home use on the northern great plains. North Dakota Extension Service. Available at: www.ext.nodak.edu/extpubs/plantsci/hortcrop/h938w.htm

Manitoba Agriculture, Food and Rural Initiatives. Web site: www.gov.mb.ca/agriculture/index.shtml

Mazza, G. and C.G. Davidson. 1993. Saskatoon berry: a fruit crop for the prairies. In J. Janick and J.E. Simon (eds.), New crops. pp. 516-519. Wiley, NY.

Ontario Ministry of Agriculture and Food. Web site: www.gov.on.ca/omafra

Saskatchewan Agriculture and Food. 2002. Costs and returns for a Saskatoon berry orchard. Available at: www.agr.gov.sk.ca (Click on "Crops," then "Horticulture," then "Production.")

University of Manitoba. Web site: www.umanitoba.ca

We designed and printed a brochure about Saskatoons.

Testing the Potential of Hybrid Willow as a Sustainable Biomass Energy Alternative in Northern Minnesota

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Project Duration

2005 to 2007

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Keywords

bioenergy, biomass, energy crop, fossil fuels, hybrid willow, renewable energy

Project Summary

The objective of this project is to test hybrid willow as a potential energy crop for northern Minnesota that presents both potential market and wildlife benefits. We will determine the hardiness of this crop for the meadowlands area; develop a test demonstration planting that can be used to guide future research and development; and provide a northern clonal trial to compare to a similar plot that was planted in Martin County in spring 2004.

Project Description

Renewable sources of energy are becoming more important every day and Minnesota has been a leader in the use of renewables to replace fossil fuels as a source of energy. Woody biomass offers an important option for the production of biomass for energy. In addition to the energy benefits provided by willows, they also have potential for plantings in riparian areas currently in row crop production but which are periodically flooded and have relatively low agricultural productivity. If planted in such sites as a biomass crop, willow can provide a source of income for landowners while protecting soils from erosion and taking up excess nutrients before they enter and contribute to the contamination of surface waters.

This project combines the efforts of a Minnesota farmer/landowner who is already involved in the planting and production of short rotation woody crops, researchers from the University of Minnesota and the University of Wisconsin-Stevens Point, extension educators from the University of Minnesota as well as researchers from the State University of New York who will help select willow species and varieties and provide planting stock. This unique partnership will allow the project team to test the willow varieties (Table 1) under farm conditions and provide opportunities for dissemination of results in Minnesota as well as Wisconsin contributing to the further development of biomass energy options in the North Central States while providing viable and sustainable options for Minnesota landowners.

Table 1. Varieties Used in Planting Trials

Variety	Species
S365	*Salix discolor*
SX61	*Salix sachalinensis*
SX67	*Salix miyabeana*
SV1	*Salix dasyc/ados*

Willows ready for planting.

In July, 2006, the project received and planted cuttings from Tim Volk, leader of willow research in New York State. The willows were planted in a standard research design which will allow us to compare results with trials in New York, in Meadowlands, MN (Gerald Wick - Martin County), and at the University of Minnesota, Southern Research and Outreach Center, Waseca, MN. A total of 3,900 willow cuttings were planted on Gerald Wick's farm with 2,400 cuttings in replicated block plantings following guidelines from researchers in New York and the remaining 1,500 planted following a planting scheme Gerald Wick, the landowner, has been using to establish poplar plantings. (See diagrams 1-5 below for planting schemes.)

Results

Survival was measured in the fall of 2006 and ranged from 69% to 91% among the four varieties (Table 2). The plants were trimmed back to about 2" above ground level in November of 2006 and the biomass was collected, dried, and weighed to provide an estimate of biomass production. There was considerable apparent deer damage but some stems were over 3' in height. Production was probably lower than might be expected because of the late planting date and the relatively dry late summer weather in 2006.

Survival will be measured again in Spring 2007 to determine how many plants survived the winter. Low snowfall so far in the winter of 2006-2007 will subject the plants to added stress so it will be interesting to determine how well the plantings survive a low snow winter. The trials will be monitored throughout 2007 and we hope to be able to maintain them past the end of this grant. It is also hoped that we will be able to establish similar trials in other parts of the state to determine the varieties that will perform best in the variety of soil and climatic conditions across Minnesota.

The trial will also be used as a demonstration for landowners and natural resource professionals with the first demonstration visits planned for the fall of 2007. With the assistance of the landowner and others, we hope to continue to monitor and expand willow trials in Minnesota.

Cooperators

Gerald Wick, Farmer, Meadowlands, MN
Dennis Gibson, Minnesota Agroforestry Cooperative, Montevideo, MN
Diomides Zamora, University of Minnesota, Brainerd, MN

Other Resources

Short Rotation Woody Biomass Program. State University of New York – College of Environmental Science and Forestry. Syracuse, NY. Web site: www.esf.edu/willow

University of Minnesota - Center for Integrated Natural Resources and Agricultural Management (CINRAM) is a partner-based organization that catalyzes the development and adoption of integrated land use systems. Web site: www.cinram.umn.edu

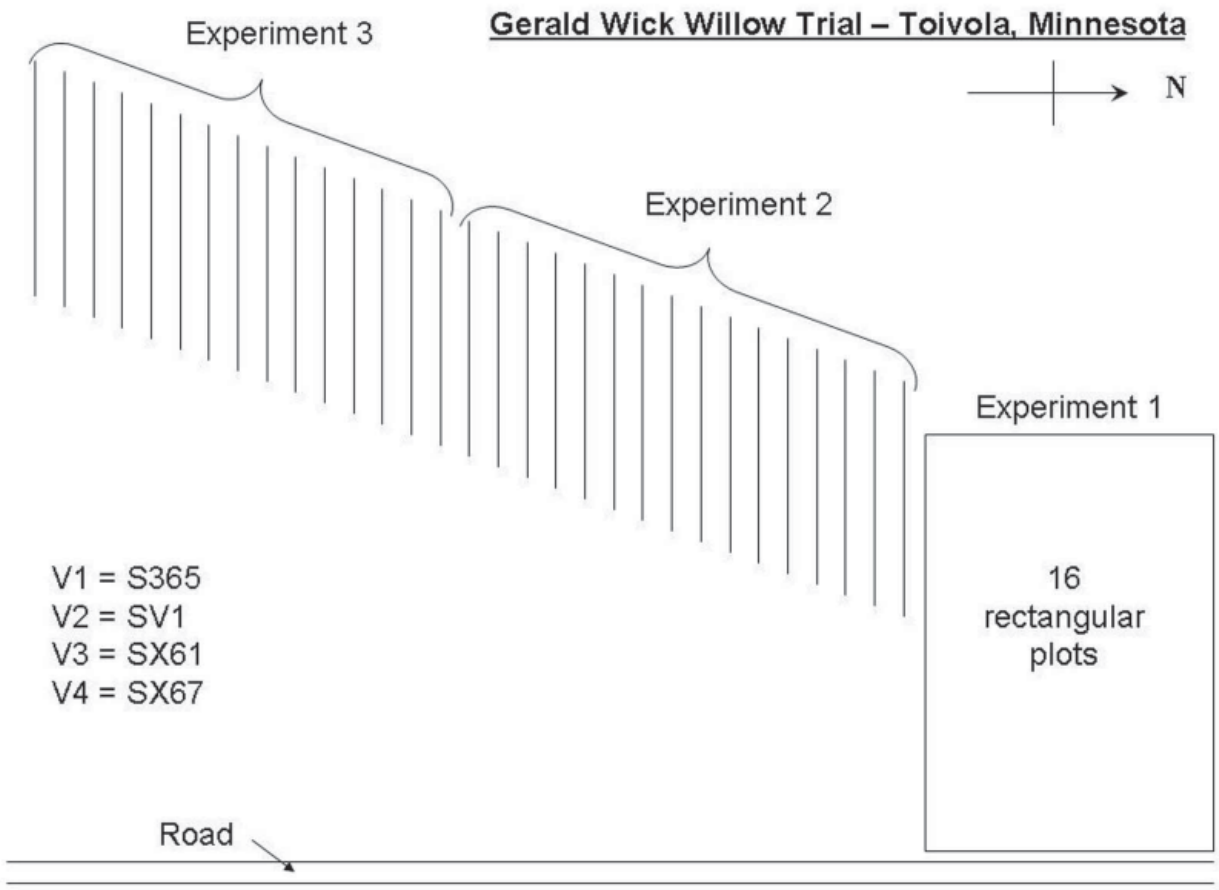
Volk, T.A. The Potential of Willow Biomass Crops for Bioenergy in Central New York. Slide show in pdf. format. State University of New York – College of Environmental Science and Forestry. Syracuse, NY. Web site: www.esf.edu/willow/ED%20MODULES/PDF%20Format/SlideShow-rev.pdf

Willow Biomass Project brochure. State University of New York – College of Environmental Science and Forestry. Syracuse, NY. Web site: www.esf.edu/willow/PDF/brochures/willowbrochure.pdf

Table 2. Initial Survival and Biomass Production of Willow Plantings

Variety	Planted - # of plants	Survival - # of plants	% Survival	Oven dry wt. of stems (g)*
S365	600	441	74	2.20
SV1	600	415	69	1.93
SX61	600	543	91	4.91
SX67	600	457	76	3.41

**An average of 18 plants/plot. There were 16 plots.*
Note: Plants were often multi-stemmed so the weight represents the weight of all the stems from one plant.



Gerald Wick Willow Trial – Toivola, Minnesota – Experiment 1

Plots: 22.5' by 50'

3 double rows run the length of the plot with 2.5' spacing within double rows and 5' between sets of double rows. 25 trees/row times 6 rows = 150 trees/plot.

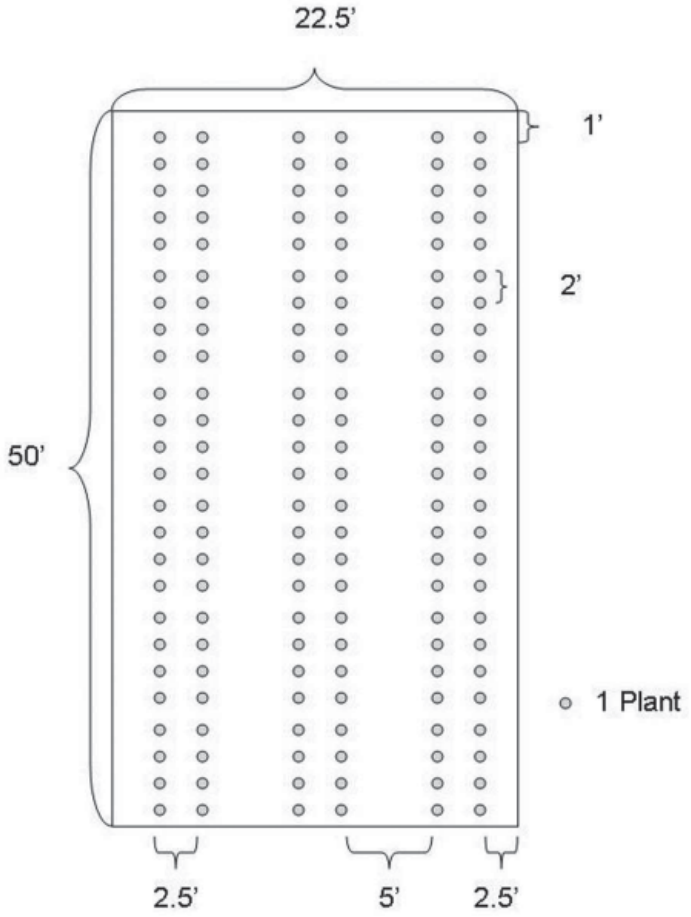
V1 = S365
V2 = SV1
V3 = SX61
V4 = SX67

N

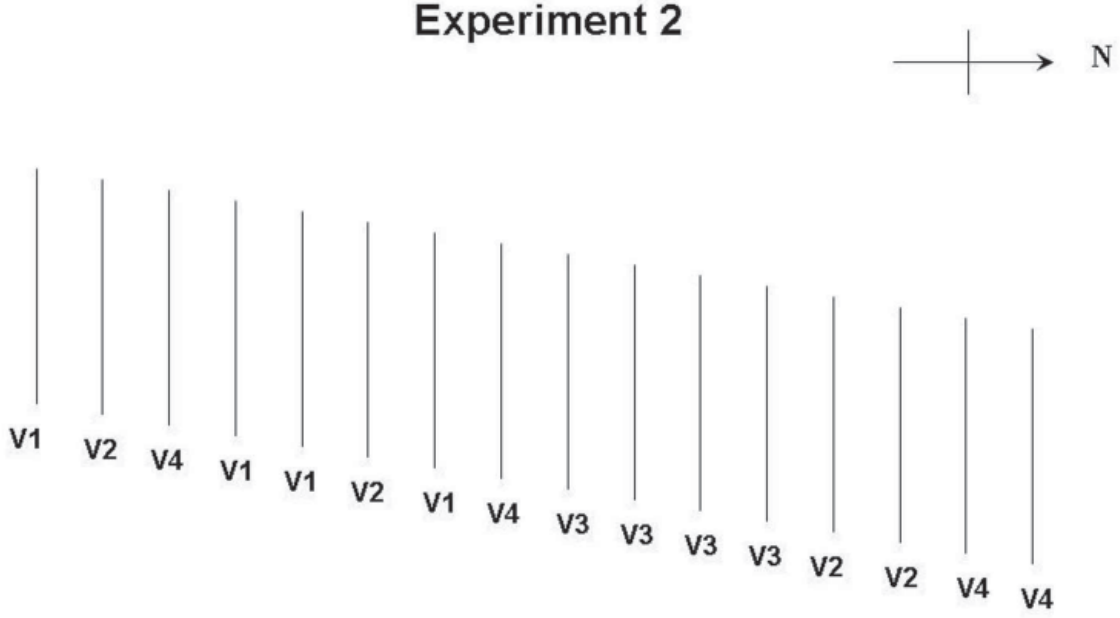
V1 S365	V2 SV1	V2 SV1	V4 SX67
V3 SX61	V2 SV1	V1 S365	V1 S365
V4 SX67	V4 SX67	V3 SX61	V1 S365
V3 SX61	V4 SX67	V2 SV1	V3 SX61

Road

Plot Layout – Experiment 1



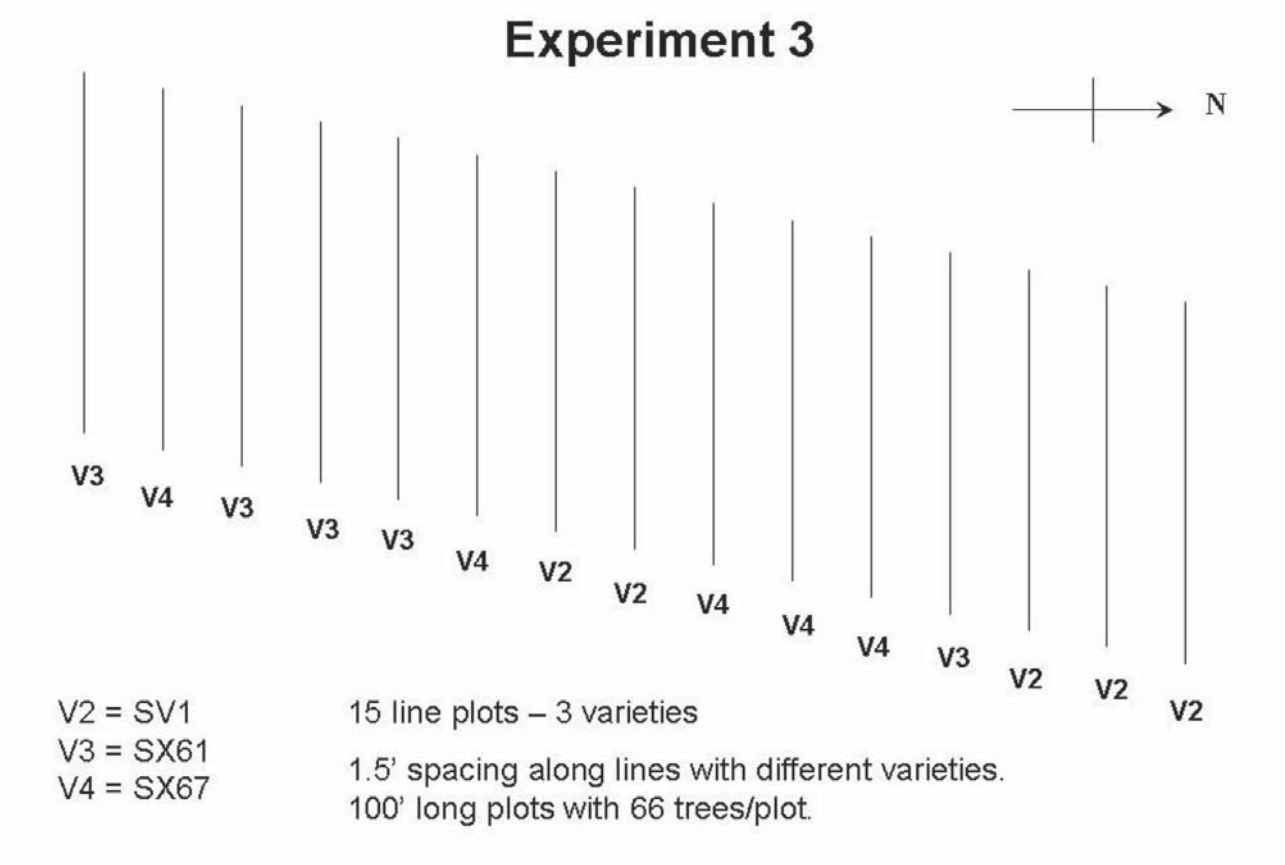
Experiment 2



V1 = S365
V2 = SV1
V3 = SX61
V4 = SX67

16 line plots – 4 varieties

2' spacing along lines with different varieties.
100' long plots with 50 trees/plot.



Willows at Toivola.

Advanced Techniques for Sustained Marketing Success of Team Farmers

Principal Investigator

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Project Duration

2004 to 2006

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Keywords

collaborative marketing, direct marketing, internet sales, lamb, local food

This sustainable agriculture demonstration project was a USDA North Central Region Sustainable Agriculture Research and Education Program producer grant.

Project Summary

The headquarters for this project, Liberty Land and Livestock, is a 180-acre family farm. The farm is primarily planted in permanent pastures that are intensively rotationally grazed. We raise approximately 250 Dorset ewes. The sheep are on an accelerated lambing program in order to have a steady, fresh, year-round supply of lamb. Beef, turkeys, chickens, and eggs are also marketed. We have been using sustainable agriculture practices for 20 years.

When we began to coordinate team marketing in 2000, we already had a successful business of selling farm-raised products directly to consumers. We marketed products through four channels: 1) restaurant sales; 2) on-farm retail store (The Lamb Shoppe) and USDA processing facility; 3) live sales to ethnic markets; and 4) Minnesota State Fair ready-to-eat food booth. All of these markets were expanding and required a team of farmers to supply the demand. We pay a premium to farmers above market value for their product and are able to command a high enough price through our branding efforts to make a profit. This project helped to further develop markets and honed and improved our team marketing skills. We increased our sales volume approximately 20% over the course of the grant.

Project Description

This project builds on the success of an earlier USDA Sustainable Agriculture Research and Education (SARE) farmer-rancher grant designed to develop a farmer marketing group to direct market lamb meat (2000-2002). Because of the work initiated with that grant, our group, of 14 farm families, has successfully marketed many products directly to consumers.

As the markets evolved and expanded there were some gaps that were identified. In order to maintain and ensure continued success of our marketing project, the grant addressed these targeted issues. We originally identified several areas to work on including:

1. Develop a mail order service for long distance customers.

2. Create and update a recordkeeping system which includes a database of customers and setting up an improved accounting system.

3. Generate consistent product labels for all product lines and incorporate new products.

4. Continue to build and nurture relationships with key consumer bases.

Results

Mail Order Service

In the first year of the grant, we put a lot of effort into this area. We advertised in a national publication geared toward eating healthy (Weston A. Price Foundation) and had a good response. We found that shipping products was time consuming and costly. We felt that it would be better to encourage consumers to buy their food locally. Consequently, the group decided to terminate the mail order portion of the business. In the second year of the grant, we focused on local sales operations.

Our up-to-date web site is still an important tool for our local and regional sales. Many customers within driving distance like to order from the web site in advance before coming to the retail store or waiting for a delivery to their area. Moreover, the web site serves the purpose of a "store catalogue" and it is very useful to our current customers as well as new customers. They like to see what's available and also see a picture of the farm and the store displays. We process roughly 10 web site orders per week.

Record Keeping and Accounting System

In the second year of the project, we saw some real progress in this area. We teamed up with a local college and a professional

accountant to set up a professional accounting system. A database of customers with detailed order history was set up. Recordkeeping is a very important part of our business and it takes time to do. Recordkeeping with team marketing can be especially challenging because you are not just tracking your sales but are tracking the source of product as well. Having an efficient set up for the recordkeeping that reduces the time we spend on this task was an important goal for this group. Our new system helped tremendously. We have more complete records and can now access a lot of information that we couldn't before, which has been important as we've expanded our markets. Because we've been able to track sales in specific markets and determine efficiency, it has helped us make good marketing decisions to improve profitability.

Product Labels and Product Development

Labels were created, printed, and successfully used. We found that this, too, is a constantly evolving process. As a part of our "branding," we created some excellent display materials. We found that the in-store signage and display material were at least as important as the label on the package itself in branding the product—attracting customers to the product, creating a good feeling about the product, and making the sale. We developed display material about our sustainable farm and product quality, and used our logo. It has been very effective. We also have recipes available for the various cuts of meat. With the help of the Agriculture Utilization Research Institute's (AURI) meat technologist, we have successfully developed a recipe free of mono-sodium glutamate (MSG) and soy products (two ingredients many of our customers are allergic to and/or do not wish to eat).

Build and Nurture Relationships

Throughout the grant process, we found that we spent the most time and effort in this area. This facet of the business continues to grow and change. It requires a lot of time to make people aware of your business—making sales connections and contacts could easily be a full time job!

Connie and Doug

We worked very hard to develop new markets for this project. We spend many hours visiting potential customers, showing material about our product, and giving samples of our product. We created a professional booth display for trade shows and attended the Living Green Expo in May, 2006 with our display and made some great connections with businesses and individual customers. Dozens of contacts were made with stores, distributors, restaurants, and meat markets. In the end, we found two new major markets that turned out to have a long-term commitment: one natural food co-op store and one restaurant. It is estimated that these two new clients will purchase a minimum of 300 lambs per year.

Management Tips

1. Be prepared to stick with it over the long haul. It is a lot of work and it takes time to build a customer base.

2. Be creative. Don't get stuck doing things the same old way. Have someone from the outside take a look at your enterprise—they bring a new way of looking at things and interesting ideas!

Cooperators

The farmers who participated as part of the marketing team included:
Bill Arndt, Hutchinson, MN
Mike and Brandon Braucher, Webster, MN
Steve, Cindy & Ruthie Calvin, Minneapolis, MN
Bob Flemming, Mayer, MN
Gerald Hoff, Darwin, MN
Scott & Theresa Hoff, Darwin, MN
Victor Hoff, Hutchinson, MN
Laverna Just, Glencoe, MN
Adam Leske, Winthrop, MN
Otto Brothers, Winthrop, MN
Don Popp, Hutchinson, MN
Dave Witte, Minneapolis, MN
Justin Witte, Hutchinson, MN
Warren Youngbloom, Litchfield, MN

Project Location

Liberty Land and Livestock is located 10 miles west of Hutchinson on Hwy 7.

Other Resources

King, R., and G. DiGiacomo. 2000. Collaborative Marketing: A Roadmap and Resource Guide for Farmers. Available at: www.misa.umn.edu or from the University of Minnesota Extension Distribution Center, St. Paul, MN, 800-876-8836. Cost is $4.75.

Dream of Wild Health Farm Indigenous Corn Propagation Project

Principal Investigator

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Cooperator

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Project Duration

2006 to 2008

Staff Contact

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Keywords

corn, heirloom, indigenous, Native American Indian, propagation

Project Summary

Peta Wakan Tipi, a 20 year old nonprofit organization, operates the Dream of Wild Health farm in Hugo, Minnesota. The Dream of Wild Health (DWH) is an American Indian agricultural and education program. We have a rare collection of 400 indigenous heirloom seeds gifted to us by elders, reservations, and seed savers around the Upper Midwest. Our purpose for this project is to explore the process and cost of growing and protecting the integrity of indigenous heirloom food crops. Specifically, we will regenerate up to ten varieties of near-extinct indigenous corn in order to serve the rural American Indian communities in our area.

Project Description

In April of 2006, after meeting with a variety of community members, we selected nine varieties of indigenous corn seed to propagate based on seed availability, viability and community needs. Working with the University of Minnesota's Center for Urban and Regional Affairs (CURA), Dr. Craig Hassel and Dr. Albert (Bud) Markhart of the University of Minnesota Department of Food Science and Nutrition and Department of Horticulture, respectively, we entrusted our seeds to their laboratory environment as the DWH greenhouse was not yet ready at that point.

In May of 2006, the seeds were photographed and a portion of each variety was imbibed along with a control of organic sweet corn from Seed Savers Inc. Imbibed seeds were planted in five gallon pots containing Sunshine Professional Growing Mix. Pots were placed in an isolated greenhouse section in the Plant Growth Facilities at the University of Minnesota. Plants were grown at 30°C day and 25°C night temperatures with supplementary light provided by high intensity discharge (HID) lights for 16 hours per 24 hour period. Germination was variable, but we were able to establish at least two plants for each variety (Table 1).

On June 8, Dr. Markhart imbibed and planted most of the remaining seed in flats and allowed them to germinate under mist. When plants were seven days old, they were planted at one of two field sites. Site one was the Student Organic Farm on the St. Paul Campus. Site two was May Farm Community Supported Agriculture (CSA) at the Wilder Forest in May Township. These sites were selected because they both follow organic practices.

Greenhouse Grown Plants: Between July 17 and August 20, plants were hand pollinated. Individual cobs were trimmed and bagged; pollen was collected from several plants, combined, and used to pollinate silks that had emerged overnight. Plants were watered and fertilized daily with high calcium fertilizer. Plants were taken to maturity and cobs harvested when plants turned brown and cobs drooped. Cobs were taken into the lab, allowed to dry till seed was easily removed from the cob.

Table 1: Seed variety, number of seeds provided and percent germination of each lot

Variety	# of Seed	Germination (%)
Chip Amber	34	44
Mandan Red Clay	8	50
Mandan Blue	18	22
Bear Island	55	50
Cherokee Flour	19	10
Lenape Blue	4	50
Quapaw Red	10	40
Red Lake Hominy	61	5
Cree Corn	62	2

Table 2: Peta Wakan Tipi Indigenous Corn Seed Increase

Variety	Seeds Supplied	Harvested Dry Weight (g)	Weight per 10 Seed (g)	Approx. # Harvested Seed	Seed Increase (%)
Chip Amber	34	503.8	2.15	2,343	6,892
Mandan Red Clay	8	92.15	2.2	419	5,238
Mandan Blue	18	43.2	2.8	154	856
Bear Island	55	237.3	2.1	1,130	2,054
Cherokee Flour	19	118.2	4.5	263	1,384
Lenape Blue	4	139.5	3	465	11,625
Quapaw Red	10	97.4	2.6	375	3,750
Red Lake Hominy	61	150	4.3	349	572
Cree Corn	62			10	---

Field Grown Plants: Transplanting the young seedlings into the field was very successful. Ninety-five percent of the transplanted plants survived. Unfortunately, about five weeks after transplanting, eight days of very high temperatures significantly affected plant growth. The major problem was that the plants produced pollen before the silks were ready. It was therefore not possible to pollinate silks with pollen from the same variety. Only one small cob of Mandan Red was produced from the field experiment. Plants were planted later than was optimal. We do not anticipate a similar problem if seed is planted earlier next year.

Results

Yields: On September 28, cobs were photographed; seeds were removed from the cobs by hand and placed in paper bags. A sample of 10 seeds was randomly selected and weighed from each variety. The total seed yield was then weighed and an approximate harvested seed number was calculated by dividing the total weight by the weight for 10 seed and then multiplying by 10. The percent seed increase was then calculated by dividing the approximate number of seed by the number of seeds supplied and multiplying by 100 (Table 2).

Significant seed increase was achieved for all varieties except the Cree Corn. Although the Cree Corn was reported to have been grown in 2002, we had only 2% germination. This germination rate yielded only two plants in the greenhouse and the one harvested cob had only ten seeds. Despite our best efforts, the Mandan Blue had one ear that was contaminated with pollen from another plant (see photo). The blue seed was separated from the yellow, only the true blue seed is provided.

Overall, the seed from all varieties looks good and we anticipate it should grow well next year. Seed will be stored in a cool (4-8°C) dry place over the winter and planted according to best practices in the spring/summer of 2007.

In 2007, we will continue to plant and produce seed stock from greenhouse propagation on the DWH farm. We will hand pollinate the corn in July. The corn will be harvested and dried in August. Some of the corn will be distributed to the community to be utilized for cooking traditional foods like hominy while some will be saved for future growing seasons at DWH.

Management Tips

1. In order for good plant survival, seeds should be started in the greenhouse and then transplanted in the field or sown directly into warm field soil. Although it is unusual to transplant sweet corn, if done when the seedlings are about 7 days post germination transplanting is very successful.

2. Seed should be stored in a cool (4-8°C) dry place over the winter.

Cooperators

Craig Hassel, University of Minnesota, St. Paul, MN
Albert (Bud) Markhart, University of Minnesota, St. Paul, MN

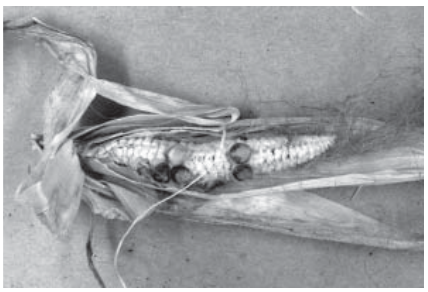
Project Location

From St. Paul, take I-35W north to Cty. Rd. 14 (Exit 123) and turn right (east) onto Hwy. 61 in Hugo. Turn left onto Hwy. 61 (north – 2.6 miles) to 170th St. (CR4) and then turn right (east – 3.2 miles) onto Jeffrey Ave. N. (you can only turn right (south) onto Jeffrey Ave. N. Take Jeffrey Ave. N. (south – 0.9 miles) to 16085 Jeffrey Ave. N. The Dream of Wild Health farm will be on the left when driving south on Jeffrey Ave. N. from 170th St.

Bear Island

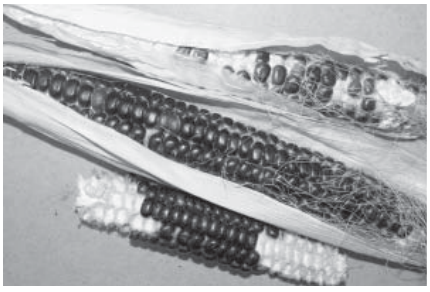
Cherokee Flour

Chip Amber



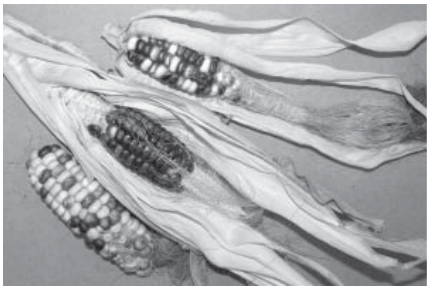
Cree Corn

Lenape Blue



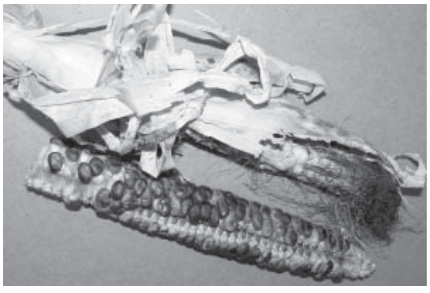
Red Lake Hominy

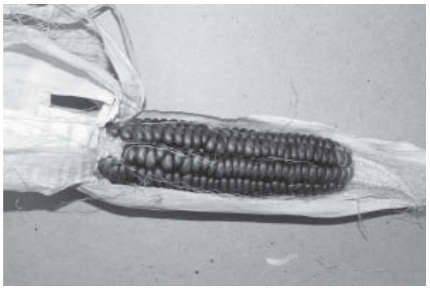
Mandan Blue



Mandan Red Clay

Quapaw Red





Quapaw Red

Bagged Silks

Decorative Woody Florals Learning Circle

Principal Investigator

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Project Duration

2004 to 2008

MN SARE Contact

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Keywords

agroforestry, decorative woody florals, learning circles, woody florals

This sustainable agriculture demonstration project was a USDA North Central Region Sustainable Agriculture Research and Education Program producer grant.

Project Summary

In many farming areas, perennial crops, which once helped protect the riparian areas of watersheds, have been removed and replaced by annual cropping systems that leave soil exposed without vegetative cover for many months of the year. The lack of perennial crops protecting riparian areas in our area results in increased erosion and lower water quality in the Minnesota River Basin. Many of the recommended conservation practices which could help address this problem do not provide income or other benefits to farmers, making it more difficult for them to adopt those systems.

Decorative woody florals are perennial plants from which cuttings are harvested and sold to florists for use in floral arrangements. We visited a Nebraska program that was developing production and marketing practices for decorative woody florals in their area. Building on their success, we propose to identify decorative woody floral species with the following characteristics:

- Hardy to southwestern Minnesota and southeastern South Dakota
- Market potential to generate income for farmers
- Provide environmental benefits as alternative perennial crops

Project Description

Decorative woody florals may be good alternative perennial crops for farms in southwestern Minnesota and southeastern South Dakota. They can reduce soil runoff from surface water in vulnerable areas and have good market potential, though markets are not yet developed in our area for these crops.

Willows and dogwoods are native to this area and do well in wet conditions. The river valley below our home is susceptible to flooding in the spring. I am familiar with decorative woody florals through my business of raising and selling dried flower arrangements, and have considered that hybrid pussy willows might grow well in the wet conditions I've observed on our farm. We have identified five other farms that are also interested in growing decorative woody florals. We are working with University of Minnesota researchers and Extension educators using a learning circle approach to identify questions, share information and experiences. Species planted in Nebraska at the Arbor Day Foundation will be interesting to try here, both in terms of their tolerance for wet conditions in Minnesota, and the possible market value of these products to wholesalers, retailers, and others interested in using the plants for their own finished arrangements. We initially planned to test

Field Day. From left to right, Diane Jenson, Jeff Jenson, Michele Skogrand, and Chad Kingstrom.

five to ten decorative woody floral species (willows and dogwoods) planted in several riparian areas subject to flooding on six farms. We planned to evaluate the species for:

- Productivity of acceptable stems for the floral industry
- Effectiveness of different weed control options, including cover crops
- Hardiness
- Marketability
- Profitability

Results

We used a "learning circle" approach to share information and on-farm research results. The Decorative Woody Floral Learning Circle met several times and made several trips during 2004, 2005, and 2006. In October, 2004, we visited the University of Minnesota's Arboretum and Horticultural Research Center (HRC). Staff demonstrated how to start dogwoods from softwood cuttings at the HRC greenhouse. A graduate student working at the University of Minnesota's Center for Integrated Natural Resources and Agricultural Management (CINRAM) presented a marketing study on decorative woody florals. The study found there is a good market for woody florals at a decent price and retailers are willing to work with individuals, but marketing collaboratively would insure sufficient volume to supply retailers and even perhaps some wholesalers.

In February, 2005, our group discussed the details of our on-farm demonstrations and ordered plant materials. We planned to establish woody florals in blocks with spacing of 5' between individual plants in a row and 5' between rows. Rows will be 150 – 200' long. We included the following woody florals in the original study:

Corkscrew willows including:
Scarlet curly willow (Salix matsudana 'Scarlet Curls')
Golden curly willow (Salix matsudana 'Golden Curls')
Tortuosa willow (Salix matsudana 'Tortuosa')
Streamco willow (Salix purpurea)
Flame willow (Salix hybrid'Flame')
French pussy willow (Salix caprea)
Yellowtwig dogwood (Cornus sericea 'Yellowtwig')
Bloodtwig dogwood (Cornus sanguinea)
Bailey redtwig dogwood (Cornus sericea 'Bailey')
Colorado dogwood (Cornus sericea 'Colorado')
Cardinal dogwood (Cornus sericea 'Cardinal')

In April, 2005, we collected willow and dogwood from various species at the Arboretum. We planted about 900 of the hardwood cuttings in flat trays with sand in the misting greenhouse on the St. Paul campus with great success (nearly all rooted). These were picked up in May and distributed to the group along with the bare root cuttings ordered from two nurseries.

On May 25, 2005, we toured the Dennis Gibson tree farm near Montevideo. University of Minnesota staff and others met to discuss our progress so far and what we want to do in the future. University researchers discussed current research with woody perennial species and got feedback from the woody floral group including identifying future research needs. Weed control was identified as a problem, often an issue in perennial species. Willow and dogwood cuttings established without mulch fabric were having trouble with weed competition.

As a result of the weed problems, mulch trials were established in June, 2005 at three of the cooperator sites. The Learning Circle met in July, 2006 with University of Minnesota staff for an update on the results from the mulch trials. The best approach to weed control was a barrier such as cloth or newspaper, covered with wood chips. We toured my willow and dogwood plantings. I had hoped that the willow and dogwoods would be able to survive in the flood plain of the Minnesota River Valley, but, if I want to grow some of the other species like curly willow, I will have to find a site that is not flooded for an extended time.

On March 24, 2007 we had a demonstration field day at Chad Kingstrom's. Chad showed the group his two-year-old woodlot and mentioned that he has already harvested and marketed cuttings. I gave a demonstration on how to start hardwood cuttings and we collected cuttings and either potted them or prepared them for planting.

We learned a great deal about starting hard and softwood cuttings. Several people in the group have had good success starting plants from cuttings. We plan to share plant material as needed to help one another establish plantings. Of the ten woody florals that we began with, after evaluating them based on their hardiness and growth on our farms the previous two years, we chose five to continue working with. We did have some difficulty coming to a consensus about which five were the best overall since some worked better at one location than another. The five varieties that we chose include scarlet curly willow, flame willow, French pussy willow, golden curly willow, and 'Tortuosa' willow as the varieties that we would continue using in the project.

Management Tips

1. Weed control and watering are important for these plants especially during the first year.

2. It is important to remember that even though these species are willow and dogwoods and are able to tolerate wet conditions this does not mean they can survive in the flood plain of the Minnesota River Valley and be under water until June. These are hybrids and are not as tough as their wild cousins.

3. It is good to initially test several different species on a small scale in your chosen location and see which ones survive flooding.

Cooperators

Chad Kingstrom, farmer cooperator, Hutchinson, MN
Robin Moore, farmer cooperator, Montevideo, MN
Richard Handeen and Audrey Arner, farmer cooperators, Montevideo, MN
John Schmidt, farmer cooperator, Marieta, MN
Paul Wymar, farmer cooperator, Montevideo, MN
Dean Current, University of Minnesota, St. Paul, MN
Sue White, former Research Fellow, University of Minnesota, St. Paul, MN
Nick Jordan, University of Minnesota, St. Paul, MN.

Project Locations

For specific locations, contact Michele Skogrand at 320-269-2105.

Other Resources

Josiah, Scott. 2000. Discovering Profits in Unlikely Places: Agroforestry Opportunities for Added Income. University of Minnesota - Minnesota Institute for Sustainable Agriculture. Publication number BU-07407. Available at: www.extension.umn.edu/distribution/naturalresources/DD7407.html

Josiah, Scott, et al. 2004. Producing Woody Floral Products in an Alleycropping System in Nebraska. HortTechnology 14: 203-207. Available at: www.nfs.unl.edu/documents/SpecialtyForest/WF%20Prod%20Paper%20Jan2004%20HortTechnology-web%20version.pdf

Willow cuttings in misting greenhouse on St. Paul campus.

Improved Management of Rye Cover Crops for Organic Soybean Production

Principal Investigator

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Project Duration
2004 to 2006

MN SARE Contact

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Keywords

cover crops, organic soybeans, rye cover crop management

This sustainable agriculture demonstration project was a USDA North Central Region Sustainable Agriculture Research and Education Program producer grant.

Project Summary

With this grant, I wanted to look at winter rye cover crop management in an organic soybean production system. For many organic producers, soybeans are a profitable crop, but weed control is an issue. While using a cover crop can greatly reduce weed problems, successful management of cover crops is challenging. One of the greatest obstacles to the successful use of rye as a cover crop is the potential for the rye to become "weedy" and compete with the crop for light and/or moisture. We felt that on-farm research and demonstrations were needed to test rye management practices to find the ones that best suppressed competition from late-emerging annual weeds, but also reduced competition of the rye with the soybeans. The different treatments controlled weeds to varying degrees, but the treatment in which we destroyed the rye and planted to rows and cultivated, out yielded the other treatments substantially. Still, the yield was not as good as I expected, and I am not sure that I would recommend planting soybeans into a standing rye cover crop in southwest Minnesota, because of the lower yield. We tend to be short on moisture in July and August, and the rye might suppress yield by competing for moisture.

Project Description

On our organic farm in southwestern Minnesota, winter rye is used as a cover crop for soil stabilization and for weed control. The goal of this project was to improve winter rye cover crop management in a soybean production system. The objective of this project was to compare a range of treatments for rye management in the spring, so that it did not compete with soybeans. The comparison was used to answer the following questions:

- What treatment best reduces rye competition with soybeans?
- What treatment best suppresses competition from late-emerging annual weeds with soybeans?

Five different treatments were tested:

1. Soybeans are sown in rows spaced 30-36" apart, mid-May, using a no-till drill, into a standing rye crop. Rye is mowed prior to soybean emergence.

2. Soybeans are sown in rows spaced 30-36" apart, early June, into standing winter rye. Rye is mowed prior to soybean emergence.

3. Soybeans are sown in rows spaced 30-36" apart, mid-May, using a no-till drill, into a standing winter rye crop. In early June, rye is mowed between the soybean rows, using a specially designed mower.

4. Soybeans are sown in rows spaced 30-36" apart, mid-May, using a no-till drill, into a standing winter rye crop. Winter rye is uniformly-mowed above the emerged soybean row, using a raised flail-chopper.

5. Rye cover crop is incorporated prior to planting. Soybeans are planted in rows spaced 30-36" apart, mid-May, using a no-till drill.

Measurement differences between Treatment 5 and the other treatments were used to determine the effect of winter rye on weed pressure, rye competitiveness, and soybean yield.

In the second year of the experiment, we added three more treatments. We looked at using rye cover management practices with solid seeded (drilled 7" row spacing) soybeans.

An experiment with similar treatments was set up at the Elwell Agroecology Farm at the Southwest Research and Outreach Center in Lamberton, MN.

Results

We planted the rye on October 6, 2004. This was planted on oat ground that had been plowed, so we had a good stand and good growth yet in the fall. In 2005, we planted the rye after corn harvest on November 1 and we didn't get any growth that fall. The following spring it came up uneven, but a fair stand.

Weed and soybean height. Weed heights did not differ among rye management strategies in 2005, but did differ in 2006 (Table 1). At Lamberton, weeds were shorter where rye was incorporated than where rye was mowed. This difference occurred both where soybeans were sown in rows and where they were drilled. At Pipestone, however, the opposite trend was noted; weed heights were greater with rye incorporation than mowing.

Table 1. Weed and soybean heights from rye cover crop near Pipestone and Lamberton, MN, in 2005 & 2006

Treatments	Lamberton				Pipestone			
	Soybean		Weed		Soybean		Weed	
	2005	2006	2005	2006	2005	2006	2005	2006
	cm							
Rowed Soybean								
Mowed Preplant (May soybean planting)	43*	43	51	60	54	27	51	27
Mowed Preplant (June soybean planting)	---	---	---	---	56	---	62	---
Mowed Above Canopy (May soybean planting)	43	32	54	54	57	28	57	28
Mowed Between Rows (May soybean planting)	39	---	45	---	44	27	44	32
Incorporated Preplant (May soybean planting)	63	17	58	38	65	31	59	47
Drilled Soybean								
Mowed Preplant (May soybean planting)	---	37	---	46	---	22	---	21
Mowed Above Canopy (May soybean planting)	---	42	---	49	---	28	---	24
Incorporated Preplant (May soybean planting)	---	21	---	39	---	36	---	41
LSD 0.05	9	18	45	8	9	7	28	3

*Weeds were measured in July of each year. Each mean represents 4 observations.

Soybean heights differed significantly with treatments at Lamberton in both years and at Pipestone in 2006. At Lamberton, soybean height was greater in 2005 - but less in 2006 - where rye was incorporated than where it was mowed. At Pipestone in 2006, soybean heights were greater where rye was incorporated than where the rye was mowed.

Soybean stand. Soybean stand was reduced at Lamberton in 2005 where rye was mowed in May prior to planting, relative to other rye treatments (Table 2). Soybean stand was also reduced at Pipestone in 2006, where soybean was drilled rather than sown in wide rows. Other site-years were unaffected.

Table 2. Soybean population densities in rye cover crop near Pipestone and Lamberton, MN, in 2005 & 2006

Treatments	Lamberton		Pipestone	
	2005	2006	2005	2006
	Plants/m			
Rowed Soybean				
Mowed Preplant (May soybean planting)	19*	30	20	34
Mowed Preplant (June soybean planting)	---	---	25	---
Mowed Above Canopy (May soybean planting)	25	33	22	37
Mowed Between Rows (May soybean planting)	25	---	23	38
Incorporated Preplant (May soybean planting)	24	29	24	36
Drilled Soybean				
Mowed Preplant (May soybean planting)	---	32	---	18
Mowed Above Canopy (May soybean planting)	---	24	---	25
Incorporated Preplant (May soybean planting)	---	28	---	26
LSD 0.05	4	12	10	8

*Soybean stands were measured in July of each year. Each mean represents 4 observations.

Soybean yield. At Lamberton, yield of drilled soybeans in 2006 was slightly greater where rye was mowed rather than incorporated, but row-planted soybean was unaffected (Table 3). At Pipestone, soybean yield in 2006 was markedly greater where rye was incorporated than where mowed.

Table 3. Soybean grain yields in rye cover crop near Pipestone and Lamberton, MN, in 2005 & 2006

Treatments	Lamberton		Pipestone	
	2005	2006	2005	2006
	Bu/A			
Rowed Soybean				
Mowed Preplant (May soybean planting)	23*	32	14	5
Mowed Preplant (June soybean planting)	---	42	20	---
Mowed Above Canopy (May soybean planting)	17	34	14	7
Mowed Between Rows (May soybean planting)	20	38	18	3
Incorporated Preplant (May soybean planting)	24	34	17	15
Drilled Soybean				
Mowed Preplant (May soybean planting)	---	34	---	2
Mowed Above Canopy (May soybean planting)	---	32	---	3
Incorporated Preplant (May soybean planting)	---	26	---	16
LSD 0.05	14	6	11	9

*Soybean yields were measured in October each year. Each mean represents 4 observations.

Overall conclusions. Our experiment did not evaluate the overall effect of the rye cover itself on soybean, i.e. there were no rye-free control treatments. The experiment only compared different rye management practices. One inspiration for this project was the work of Jeff Moyer at Rodale with rye crimping, which showed an advantage to mulching rye at the surface. However, in this study, rye management with mowing does not offer any consistent benefits, compared with incorporation, to soybean. In fact, incorporation may produce superior yields in some years.

Management Tips

1. The yield was not as good as I expected. It may not work well in our area, since we are short on moisture in July and August.

2. There is no advantage to keeping the rye on after planting the soybean, rather than incorporating prior to planting.

Cooperator

Matthew Harbur, formerly with the University of Minnesota's Southwest Research and Outreach Center in Lamberton, MN. Current contact information: Matthew Harbur, Department of Agriculture and Horticulture, SUNY College of Technology, Alfred, NY, 607-587-4797.

Project Location

Contact Don DeWeerd for project location information.

Other Resources

ATTRA - National Sustainable Agriculture Information Service. 2002. Rye as a Cover Crop. Available at: http://attra.ncat.org/attra-pub/PDF/rye.pdf

ATTRA - National Sustainable Agriculture Information Service. 2003. Overview of Cover Crops and Green Manures - Fundamentals of Sustainable Agriculture. Available at: http://attra.ncat.org/attra-pub/PDF/covercrop.pdf

Sustainable Agriculture Network. 2001. Managing Cover Crops Profitably. Available at: www.sare.org/publications/covercrops/covercrops.pdf
Note: An updated version of this publication will be available soon.

Rotational Use of High-quality Land: A Three Year Rotation of Pastured Pigs, Vegetable Production, and Annual Forage

Principal Investigator

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Project Duration

2006 to 2009

Writer

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Keywords

diversify, forage, lambs, pigs, rotation, vegetables

Project Summary

Gale Woods Farm is a working educational farm owned and managed by Three Rivers Park District. The farm produces pasture-raised beef, lamb, chicken, turkey, and eggs, and operates a sixty-share CSA organic vegetable garden. The farm also serves as a facility for agricultural and environmental education. More than 10,000 visitors a year visit for farm-sponsored events. Our Sustainable Agriculture Demonstration Grant project demonstrates a three-year rotation of pastured pigs, annual vegetable production, and annual forage for finishing market lambs.

Project Description

We divided an existing pasture located on very productive soils into three sections of approximately one and one-half acres each (Figure 1) and planned to incorporate one of three components on each section each year:

Year 1: Pig pasture – ten pigs pastured from April through November to root and dig up the pasture in the first year of the rotation. At this stocking rate of 6.67 pigs/A, we expected pigs to forage for some of their nutritional needs and root up the pasture in preparation for a garden crop in Year 2. (The pigs can also be used for a short time in the garden section to clean up leftover vegetable material after the garden harvest is completed.) The tillage would prepare for:

Year 2: Organic vegetable production – for our community supported agriculture (CSA) program, followed by:

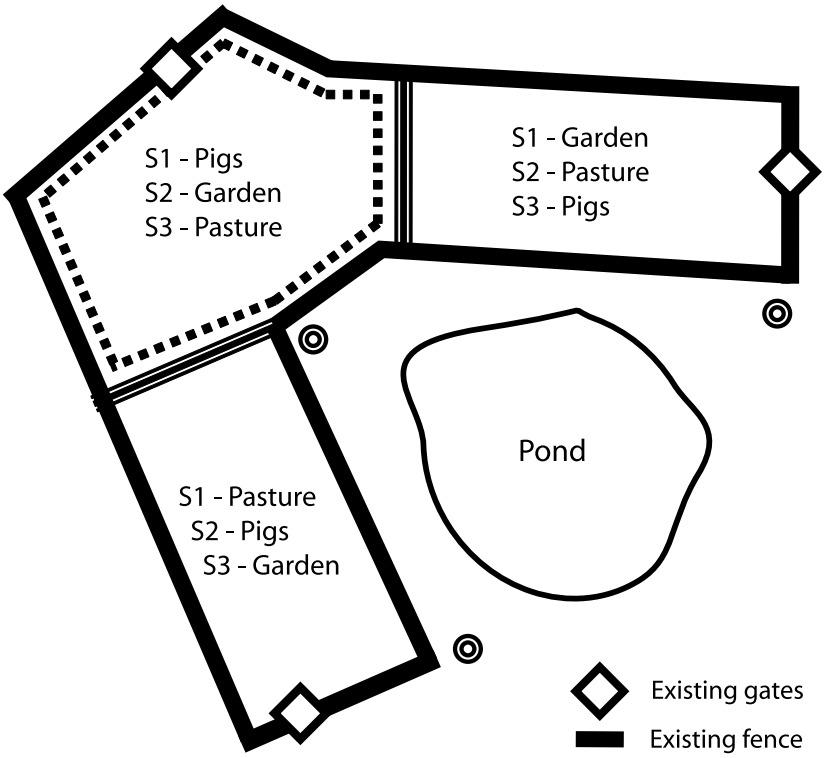
Year 3: An annual forage crop – for finishing pastured market lambs. After drilling in an annual forage crop in early spring, about half of our market lambs would be moved onto this section at the time of weaning. The remaining lambs would be raised on different pastures, allowing for a comparison of growth rates and health. The 3-year cycle on a section of land would then start again with pigs. We intended to have all three components every year.

We expect to gain several environmental and economic benefits from this project, including:

- Reduced off-farm inputs including purchased grain, tractor fuel, and labor;
- Reduced need for chemical de-wormers because the rotation should reduce parasite loads on pasture;
- Increased efficiency in pasture use by maximizing use of the pasture and making better use of areas of high soil fertility for garden production;
- Expanded organic vegetable production with reduced inputs with the addition of the rotational portion for garden;
- Diversified farm products through the introduction of pigs; and
- Demonstration of innovative land use to consumers, students, and other farmers.

Pigs rooting up the pasture to prepare the ground for vegetable production.

Figure 1. Project Design



Rotation Year Code:
S1 is 2006 and 2007, (2009 and 2010 …)
S2 is 2008 and 2009, (2011 and 2012 …)
S3 is 2010 and 2011, (2013 and 2014 …)

Existing gates
Existing fence
Temporary electric fencing to make three sections
Single wire electric fencing shown for first stage of rotation
Sites for irrigation spigots

Note: Drawing is not to scale

Results

The first year of this project was dedicated to the establishment of required fencing and watering infrastructure. We subdivided the existing pasture with temporary electronet fencing to create three separate sections. We also installed a single strand of electrical fencing tape inside the permanent perimeter fence in the pig section to prevent pigs from digging under the perimeter fence. We added a seasonal irrigation line along the perimeter of the pasture for livestock water and crop irrigation.

Rotation of Three Components

As described earlier, we intended to rotate the sections annually and take a total of three years of developing the system for all three components to function as part of the rotation. However, we discovered that ten pigs were not able to adequately root up their portion of the pasture, and we would like to give them one more season of rooting in this same pasture. In addition, the garden section had a fairly significant annual weed pressure (mainly velvet leaf and pigweed), and we would like to have another season of active cultivation before planting it to forage. The low level of pest and disease problems in this garden encouraged us to use it as garden for one more season before rotating. Therefore, we are going to maintain the current rotation for a second year in order to adequately prepare the soil for a garden rotation.

Component 1 - Pastured Pigs

In the first year, we purchased ten feeder pigs from the Van Der Pols at Pastures a' Plenty Farm in Kerkhoven, MN and put them out on pasture on May 10, 2006. These pigs were a Duroc/Berkshire cross with a trace of Chester White breeding. They were approximately two and one half months old upon arrival. We provided one Port-A-Hut shelter on the pasture and moved it as needed to spread out the digging of the pigs on pasture. The pigs were fed a two

phase ration from the local feed mill. Until butchering, the ten pigs received 1.5 tons of grower ration and 1.5 tons of finisher ration. This ration lasted until the final three weeks when they were finished on approximately 500 lb of cracked corn. In addition, they received ample quantities of garden waste and expired food from a local grocer.

The pigs rooted up approximately 40% of the 1.5 A field in five months on pasture. Eight of them were sent for processing on September 27, at about six months of age and a weight of approximately 225 to 275 lb. Their rate of gain was just less than 2 lb/day. We kept two gilts for breeding purposes. The pork was sold on-site through shares and individual cuts. Financial assessment for the first year of raising pigs on pasture is summarized in Table 1.

Table 1. Costs Associated with Raising Pigs in 2006

Costs (excluding capital and labor)	
Animal Purchase	$806
Feed	$850
Butchering	$977
Total Costs	**$2,633**
Value of Sold Pork	**$2,670**
Projected Net Profit	**$37**

We believe a simple cost/revenue analysis alone is not an accurate way to assign "value" to this project. It is difficult to assign a dollar amount to the worth of having pigs in this "pastured for tillage" part of our educational program.

Overall, the feeder pigs were relatively easy to raise on pasture. We did not encounter any health problems. In future years we will control their movement on pasture more deliberately. They were very attracted to a shady corner of the pasture and focused most of their digging efforts in this area. In order to hit more areas within the pasture, we will have to fence them into smaller portions of the pasture and move the Port-A-Hut more frequently to provide shade. We will also try to reduce the quantity of purchased feed as we develop a more reliable source of compost and expired grocery store food for them to consume. Reducing these feed costs is the best way for us to make the pork enterprise more profitable.

Component 2 – Vegetable Production
Another of the three sections was planted to pumpkins, potatoes, popcorn, and winter squash. A significant effort was required to eliminate the thick sod in this pasture of mainly reed canarygrass and bluegrass. It required approximately 30 hours of tractor time with a disc and field cultivator to eliminate this turf to prepare for garden planting. We then established garden beds and planted clover and buckwheat in the walkways. The cover crop didn't take very well, due to the lack of moisture during establishment. Due to time constraints, we didn't measure specific yields of each crop, but qualitative evaluation indicated a very good yield. We assumed that two factors primarily influenced this yield: high quality soil and low pest and disease pressure. The soil is a loamy peat, and soil tests indicated an organic matter content of 17%. It was fairly dry during the middle part of the growing season; however, due to the nature of the soils, irrigation only needed to be provided to the garden crops once or twice during August. We saw very few Colorado potato beetles with only a very late arrival of this pest. Striped cucumber beetles and squash bugs, which have been a problem in other areas of the farm, were also only present in relatively small numbers.

We hope to significantly reduce the amount of tractor hours and fuel once the garden follows the pigs in this rotational system. We also hope the annual weed pressure is significantly reduced by the presence of the pigs.

Component 3 - Annual Forage
We did not plant the third section to an annual forage crop this year, as it had not yet been tilled up by the pigs, nor planted to the garden rotation. This component will be developed once there is a field section ready for forage, following the pigs and garden use.

We estimate that the project was seen by about 4,000 people in its first year (Table 2). Since the farm is an educational facility, we have school children visiting the site almost daily from May to October. On these field trips, the students take a wagon ride to the pasture, feed the pigs, and observe them rooting up the field in preparation for the garden rotation. In order to enhance community outreach, we held five large public events within the timeframe of the project this year. Many people that hike on the trails near the farm saw the project over the course of the season. We also send out a quarterly newsletter to approximately 300 recipients, and our summer issue highlighted this project.

Table 2. Public Exposure to the Project in 2006

Estimated number of school children that visited the project	1,900
Estimated number of public program participants that visited the project	1,300
Estimated number of casual visitors that hiked by the project	800

In 2007 we intend to put up some signage for casual visitors and host a field day later in the summer.

Management Tips

1. Manage the rooting of grazing pigs intensively, in order to achieve adequate tillage.

2. Use a shade to naturally manage the movement of pigs on pasture.

3. Find a grocer or cafeteria that is willing to set aside expired producer or leftover food for pig feed. This can be an excellent free source of additional feed.

Cooperators

Wayne Martin, University of Minnesota, St. Paul, MN
Jim and LeeAnn Van Der Pol, Kerkoven, MN

Project Location

From Minneapolis/Saint Paul take I-394 west. I-394 turns into US 12. Follow US 12 until the exit for Cty. Rd. 15 west. Follow Cty. Rd. 15 for approximately 8 miles until the town of Mound. At the intersection (stoplight) with Cty. Rd. 110, take a left onto Cty. Rd. 110. In approximately 2 miles, turn right at the sign for Gale Woods Farm. This road/driveway dead-ends at the farm.

Keeping it Green and Growing: An Aerial Seeding Concept

Principal Investigator

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Project Duration

2006-2008

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Keywords

aerial seeding, cover crops, grazing, nitrogen cycling, soil erosion, winter rye (Secale cereale)

Project Summary

The goal of this project is to promote cover cropping in row crops in the Zumbro River watershed in SE Minnesota. We hope to reduce soil erosion and reduce nitrogen leaching through the soil by aerial seeding winter rye into fields of standing row crops – corn, soybeans, and sweet corn. Plant residue on these fields will be increased. Cover crops will remove carbon dioxide from the atmosphere and store it as soil organic matter. Cover crops will also provide additional fall and spring forage for livestock.

Project Description

My wife and I farm with my parents on our family farm. We have four children who love growing up on a farm. We raise corn, soybeans, hay, sweet corn, and peas. I have been involved with conservation work on our farm for several years including cover cropping, CRP, and installation of terraces and grass waterways. We use minimum till, no-till, and strip-till farming practices.

Our overall goal in our farming operation is to be good stewards of the land that we have been blessed with. We want to leave it to the next generation in as good or better condition than we have had the privilege of farming. We are working to accomplish this goal by reducing soil erosion, reducing tillage and trying to improve the soil by adding more cover crops. Cover crops build organic matter, reduce nitrate movement in the soil and increase crop residue on our fields. For several years we have been planting cover crops with a grain drill in our sweet corn and pea fields in July and August and we have seen good results. We felt our next step was to get a cover crop established on the corn and soybean fields at the right time and without a lot of expense.

We are using a helicopter to aerial seed winter rye into fields of standing row crops. The helicopter easily negotiates the small fields and rolling terrain in southeastern Minnesota. The row crops are field corn, sweet corn, and soybeans. The field corn includes fields that are harvested for grain and fields that are harvested for silage. We believe that we can establish the winter rye cover crop from two to six weeks earlier than normal by aerial seeding into crops before they are harvested.

The rye is seeded at a rate of 50-75 lb/A between August 1 and September 1. Normal harvest of the row crops occurs from two to six weeks later. The average date for harvesting is October 10 for soybeans and October 30 for corn. Corn silage harvest occurs in early September.

Winter rye is an excellent cover crop because it grows in cold weather, it overwinters, and it grows rapidly the following spring. On many of the participating farms, the rye cover is being grazed in late fall and again in spring.

The Hart family.

Results

In 2005 we successfully established rye on August 30 using a helicopter. In 2006 we promoted the aerial seeding concept in SE Minnesota and had good farmer participation. Fifteen farmers participated in Dodge, Goodhue, Olmsted and Wabasha counties, aerial seeding 1,026 acres. In Winona and Fillmore Counties, ten farmers aerial seeded a total of 435 acres.

The rye was seeded on September 6, 7, and 8, 2006. This was later than we planned. The helicopter was not available until this time due to a commitment to spray for mosquito control in the Twin Cities metro area. The cover crop was seeded on top of the ground in the standing crop and relied on rain and heavy dew for germination and early growth. It is important to seed the rye before early leaf drop in the soybeans so the soybean leaves cover the rye seed. A dry period at this time of year or a later planting date will affect the stand and growth of the cover crop. Fortunately, we did receive some rain after it was seeded.

The helicopter spread pattern at a 50 lb/A seeding rate was not as good as it was last year. We had gaps in some of the fields and we are addressing this issue for next year. Some growers used a 75 lb/A seeding rate and had a more even seeding pattern and better stand.

The farmers particularly liked the efficiency of the aerial seeding. Each farmer lined up their own winter rye seed and had it in a pickup or wagon ready to go the day the helicopter came to seed their field. Once the helicopter landed and instructions were communicated to the farmer, the helicopter was loaded and seeding commenced. The average seeding rate was 100 A/hr. Most farmers had their fields completely seeded in less than an hour. The field conditions are not an issue with aerial seeding. The fields can be very wet but this will not stop the aerial seeding. However, the helicopter cannot fly in rain or windy conditions.

Most of the farmers who participated in this program were pleased with the results and are looking forward to doing more next year as we work out the "wrinkles" in the program.

The helicopter cost was $10.00/A. The winter rye cost $5.50/A at 50 lb/A for us this year. The aerial seeding concept has proven to be a good choice. With this system, we can aerial seed a cover crop on a field before it is harvested, usually in late August when we are not so busy on our farm. When the field is harvested, the cover crop is already growing and we are done with that field until the following spring.

The benefits of cover cropping are many. We feel that we have nearly eliminated soil erosion on the soybean and corn fields that were aerial seeded in August and not tilled until the following spring. We raised the amount of residue on our fields with the addition of the rye cover (Table 1). The added residue helps to build more organic matter in the soil.

Table 1. Effect of Rye on Residue in Soybeans and Corn on Hart Farm (Fall 2006)

Crop	Cover	Residue (%)
Soybeans	Rye	70
	No Rye	45
Corn	Rye	80
	No Rye	65

Another benefit of cover crops is their capacity to reduce nitrate movement. When the current year's crop is done growing there can be left over nitrates in the soil. They can move through the soil profile to the ground water supply, increasing the levels of nitrates in drinking water. The cover crop will use the left over nitrates as fertilizer to grow and reduce the amount of nitrates moving down.

The helicopter coming in to reload.

The cover cropped area of our test field showed less nitrate in the soil compared to the non-cover cropped area. The cover cropped fields that had the best stands and tallest growing winter rye showed the biggest reduction in nitrate (Table 2). This showed us that the sooner you can get a cover crop established and growing, the more nitrate that can be captured.

Table 2. Effect of Rye on Soil Nitrate on Hart Farm (Sampling on November 2, 2005)

Crop	Cover	Nitrate in top 2' (ppm)
Sweet Corn (extensive rye developement)	Rye	6.3
	No Rye	22.3
Soybeans (intermediate rye developement)	Rye	8.6
	No Rye	23.8
Field Corn (minimal rye developement)	Rye	22.6
	No Rye	20.9

Livestock producers who graze these cover cropped fields can get a good return on their investment. We have estimated a farmer can get between one half and one ton of forage per acre of good grazing by fall grazing and spring grazing these fields. Hay cost between $60 and $100/ton this year. So the farmers return on investment can be 4 to 7 times his initial costs of $15.50/A.

Management Tips

1. In SE Minnesota seeding should be done from early August until mid-September. Aerial seeding done after mid-September can give you mixed results because the winter rye may or may not get established well enough by the aerial seeding method.

2. For later fall seeding, use a grain drill or a fertilizer spreader, working the winter rye in after spreading. The goal is to get the winter rye up and growing as soon as possible to have a good stand that will over winter. Every year is different and it depends on what kind of a fall you have. If the fall is cold and dry, rye growth will be minimal.

3. The type of crop that you aerial seed your winter rye into will determine how much the cover crop will grow that fall. The cover crop needs sunlight. The sooner you can get sunlight to the cover crop, the faster it will grow.

4. If you aerial seed rye into a sweet corn field the last week of August and it is harvested in early to mid-September, the winter rye will grow fast and will be ready to graze in late fall.

5. We do not recommend aerial seeding into corn fields that have row spacing less than 30". The corn leaves will catch much of the winter rye. It does not shake out or blow out of the corn leaves once it is captured.

6. If you seed rye in a corn field for grain the last week of August and harvest the grain the first of November, there will not be much cover crop growth because the winter rye has not been exposed to direct sunlight. If you plan on grazing this cornfield, consider harvesting this field first to allow the cover crop to be exposed to direct sunlight and grow faster in the fall.

7. Corn harvested for corn silage or high moisture corn is a good way to get direct sunlight to the cover crop. These fields are typically harvested earlier and the corn silage field will have most of the residue removed to allow sunlight in.

8. The field conditions at harvest will determine how well your cover will grow that fall. Harvesting when field conditions are wet and muddy will kill the winter rye.

Soybean harvest with rye growing in the understory.

Rye growing in the sweet corn stubble in late November.

9. Soybean fields that are aerial seeded with winter rye work real well. The ideal time to seed these fields is before the soybean leaves start to drop so the rye rests under the leaves of the soybeans. The soybeans drop their leaves quickly in September, allowing direct sunlight to the cover crop.

10. Timing is important; you do not want to seed soybean fields earlier than the last week of August in SE Minnesota. You do not want your cover crop to grow so fast that it will cause harvest issues. This has not been a problem in the past, but we have not been seeding any earlier than the last week of August.

11. Soybean fields that are no-tilled into last year's corn stalks may require higher seeding rates. We found that the winter rye was getting trapped in last year's corn stalk residue and not getting a good seed-to-soil contact. We did not experience this problem in conventionally tilled soybean fields. We are going to up the rate in these fields from 50 to 75 lb/A for the 2007 crop year.

Cooperators

Dave Copeland, Natural Resources Conservation Service, Rochester, MN
Jennifer Ronnenberg, Zumbro Watershed Partnership, Rochester, MN
Mark Zumwinkle, Minnesota Department of Agriculture, St Paul, MN

Location

The location of one of the aerial seeded fields: From Rochester, take Hwy. 63 north 6 miles to Olmsted Cty. Rd. 21, travel ¾ mile and the field is on the south side of the road.

Other Resources

Ag Opportunities on the Air. Link to a Minnesota Department of Agriculture web site with information and an audio clip about aerial seeding: www.mda.state.mn.us/news/audio/default.htm

Minnesota Department of Agriculture. *Greenbook 2003*. Soil conservation of canning crop fields, pp. 69-72. St. Paul, MN.

Minnesota Department of Agriculture. *Greenbook 2003*. Aerial seeding winter rye into no-till corn and soybeans, pp. 89-91. St. Paul, MN.

Gardening with the Three Sisters: Sustainable Production of Traditional Foods

Principal Investigator

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Project Duration

2005 to 2006

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Keywords

indigenous plants, passive solar energy, Three Sisters Gardening, traditional agricultural practices

Project Summary

A Three Sisters Garden is the optimum venue for planting and preserving traditional corn, beans, and squash. These nonlinear mounds of corn, beans, and squash create a holistic garden where everything from soil chemistry to weed control is sustained by this vegetable concert. In addition to its physical contribution to sustainability, a Three Sisters Garden carries on our culture as Indigenous farmers, and we sustain the land as we feed ourselves. Restoration of the Three Sisters Gardens allows us to share our traditional ways and knowledge with the community.

Our goal is to accomplish the following:

1. increase production of our traditional corn, beans, and squash and serve these foods to our people as well as to market them;

2. educate our community to assist in the restoration of our traditional gardening heritage through the increased use of the Three Sisters Gardens as an example of "closed-system" agriculture in gardens across the region; and

3. provide tools to our community members so they have success in growing traditional foods in general.

Project Description

The White Earth Land Recovery Project has over ten years of experience in sustainable, traditional, and organic farming operations. To date, we have two acres of organic raspberries, one acre of organic strawberries, ten acres of white flint corn, one-half acre of Three Sisters Garden, and 220 acres of sugar maple trees. In our berry patches we hand weed during the months of May and June. We use certified organic soil additives such as pyganic, calcium, and fish kelp for pest control and fortification for the plants. In our corn, we control weeds by a method of slow dragging when the plants are only a few inches tall. Weed control is maintained with regular cultivation during the early stages of corn growth. For organic farm advice, we consult with Curtis Ballard, a nearby organic

A Three Sisters mound of corn, beans, and squash at the White Earth Land Recovery Project.

farmer, and our Traditional Agriculture Steering Committee (established 2004-2005). In our pristine sugar bush, we are completing the final stages of Forest Stewardship Council certification through Smartwood, and the forest is managed according to the ecological management plan developed with Smartwood foresters. During the maple syrup season, we tap over 4,000 trees and collect the sap without the use of a pipeline system. Sap is collected by hand and carried to the evaporator by Percheron horses pulling a large tank on a homemade sled. This process is very labor intensive and requires the resources of our community and is consistent with our cultural teachings.

In our project we are establishing larger sites for Three Sisters Gardening throughout the White Earth Reservation, going from one-quarter of an acre to approximately three acres. We have additional acreage that can be developed. We have tested our soils each year and added organic fertilizers according to recommendations. The soil testing and the Three Sisters Garden planning have involved the community in the form of ongoing workshops that educate and demonstrate traditional and sustainable agriculture.

Another component of our project is utilizing greenhouses to start seeds early in an attempt to eliminate some of the labor in weed management. In our previous test plot, weed management (even though we had only 75 mounds) was labor intensive until the squash took over as ground cover. Our hope was that by using greenhouses, seeds could be started early and transferred to the mounds in the field.

Results

2005. In order to start seeds early, the White Earth Land Recovery Project built five greenhouses and turned management of them over to experienced gardeners in each of the five reservation communities. The 12' x 14' greenhouses were constructed with untreated pine framed ends and two support sections framed with salvaged PVC pipe. The recycled pipe was sunk into the ground through an untreated cedar bottom plate. The greenhouses were then covered with greenhouse grade plastic that measured approximately 15' x 25'.

Our greenhouses became hot houses because the single-layer plastic shell was unable to provide a thermal barrier. When the sun was out, the houses quickly heated up in excess of 90°F even with the doors open. When the sun went down, the heat quickly escaped. Because of these thermal swings, greenhouse caretakers had the unfortunate experience of "cooking" their vegetable plants before they were able to produce any vegetables. A temperature control system would need to be implemented in order for the greenhouses to be effective. Each greenhouse would need to be covered with an additional plastic shell and have a blower motor attached. The blower would vent into the outer layer of greenhouse plastic and blow cool outside air in between the two plastic shells. This process would create an air gap between the two sheets of plastic and prevent the greenhouse from burning the plants on a hot day. This extra shell would also help the house shed wind, resist weather, and preserve the inner shell.

Reducing temperatures during the day will keep the plants from overheating; however, it could freeze the plants in the cold of night. The greenhouses are supposed to provide our gardeners with the opportunity to successfully grow and save seeds, but, with the risk of frost, this cannot be accomplished. Our solution was to devise a passive solar heating system with propane backup, which was inspired by heating units examined at other sites in Minnesota.

The use of passive solar heaters was thought to be the ticket to maintaining temperature during the night, but in turn, the intensity of the heat build-up led to multiple fires. An alternative method for heating the greenhouses is being researched.

Weed and pest control were other areas that experienced some major problems. Beginning with our organic strawberries, right before the picking season, the plants were invaded by slugs. This was due to a rainy spring season. Even picking the slugs off by hand and other methods of removal did not deter these pests from virtually destroying the picking season for our strawberries.

With our Three Sisters Gardens, we experienced heavy populations of Canadian thistles and the only way we were able to remove them was by physically pulling them. We came to the conclusion that the horse manure we used was full of thistle seed, so organic manure was located to replace it.

Work still continues through the fall including: obtaining organic manure (for gardens and greenhouses) from a local organic farmer; planting 250 heads of garlic for the 2006 growing season; working with local tribal schools to implement vegetable patches focusing on squash production as they learn about seed saving techniques, tilling, and resource management; and seeking seed donations from traditional seed organizations for the upcoming season.

2006. We had much improved weed control and food production this year. With the hard work of our main gardeners, Carla and Emily, and the assistance of summer helpers, we were able to control the weeds, including the Canadian thistles. A new source of weed free organic manure helped reduce weed pressure.

With our increased production of white flint corn and other indigenous vegetables, our work on the reservation is being widely recognized. This has allowed us to increase our volunteer participation in the garden. Each spring we host volunteers during the maple sap season and we were able to retain the services of several volunteers to assist in all aspects of production in the Three Sisters Gardens.

The biggest challenge this year was keeping the gardens watered. A combination of moving garden hoses and hand watering paid off. For the future we are looking at the possibility of installing a solar powered irrigation system for all of our gardens.

The vegetables grown from Carla's hard work were enjoyed across the reservation in the fall. Our gardens produced an abundance of tomatoes, onions, potatoes, and fresh greens to go with the corn, beans, and squash from the Three Sisters Gardens. Much of the harvest went with Margaret Smith, Mino-Minjim coordinator, on her monthly delivery of traditional foods to the elderly and diabetic. Carla sold the remainder of produce at our organic food stand. Community members were able to purchase fresh vegetables at a reasonable price. Along with our success in providing healthy food, we are seeing an expanding interest among our community members to learn about traditional food production, obtain seeds, and learn more about greenhouses. Many visitors to the farm are not familiar with food production gardens, let alone one as unique as a Three Sisters Garden.

Cooperators

Traditional Agriculture Steering Committee:
Curtis Ballard, Organic Farmer, Ogema, MN
Steven Dahlberg, White Earth Tribal and Community College, White Earth, MN
Toni Vizenor, Traditional Gardener, White Earth, MN
Steven Roberts, Rancher, Strawberry Lake, MN
Ronald Chilton, Sustainable Communities Coordinator for the White Earth Land Recovery Project, Ogema, MN
Mike Swan, Organic Gardener and White Earth Commissioner of Natural Resources, Ponsford, MN

Project Location

The White Earth Land Recovery Project is located approximately 210 miles northwest of Minneapolis on the White Earth Indian Reservation. To get to the farm from Minneapolis, take I-94 to US Hwy. 10 West (Clearwater/ Clear Lake exit). Stay on US Hwy. 10 for approximately 130 miles until you reach Detroit Lakes. In Detroit Lakes, at the first set of stoplights, (Hwy. 10 and Roosevelt) take a right, go to the second set of stoplights (Roosevelt and Hwy. 34) take a right (onto Hwy. 34). Go east on Hwy. 34 until your reach Cty. Hwy. 37 (approx. 17 miles) take a left onto Cty. Hwy. 37. Go North on Hwy. 37 approximately 12 miles to the intersection of Cty. Hwy. 35 and 124, taking a left onto Cty. Hwy. 35. Go West on Cty. Hwy. 35 past Ice Cracking Lodge (approx. 6 miles) to the East Round Lake Rd. Take a right, go about 1¾ mile down the gravel East Round Lake Rd., the WELRP Farm is the last place on the right.

Other Resources

LaDuke, Winona. Food Is Medicine. White Earth Land Recovery Project and Honor the Earth Publishing. Book on traditional agriculture and the importance of traditional foods for Native people. Web site: www.nativeharvest.com

Seed Savers Network. Web site: www.seedsavers.org Source of traditional and heritage varieties of seeds.

Establishing Beneficial Bug Habitats in a Field Crop Setting

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Project Duration

2006 to 2009

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Keywords

beneficial insects, buffers, bugs, diversity, habitat, native, pests, soybean aphid, wildflowers

Project Summary

We are organic farmers near Moorhead, MN and are testing how well living borders around our fields attract and maintain beneficial insects, provide a long-term habitat for beneficial insects, create biological diversity within our cropping system, and serve as a buffer between our certified organic fields and neighbors' conventional land. We think this technique offers conservation benefits since the living borders should provide a barrier that reduces soil erosion and provides habitat. We are using native plants, perennials, grasses, and forage plants, and planted those plants the first year of the project. Counts of beneficial insects as well as pest insects were then taken from various parts of the field as well as the control area.

Project Description

My husband Lee and I farm 1,200 certified organic acres near Moorhead, MN. Our typical rotation includes alfalfa/timothy mixture, corn, wheat, and soybeans.

Recently, soybean aphid pressure has moved into the Upper Midwest, including our part of Minnesota, where border-to-border monocultures of one or two crops adds to pest pressure problems. As organic farmers, our methods of controlling pests must be biologically and ecologically based and approved for use in organic systems. Establishing beneficial insect habitats may be one line of defense.

We believe this project has potential in several important ways. First, we want to increase the ecological diversity on our farm by providing a habitat that encourages beneficial insects to populate. Wildflowers can provide nectar sources for pollinating insects, small trees and native grasses can provide sheltered habitat for beneficial insects. We also suspect that increasing plant diversity will also have a beneficial effect on micro and macro-biological diversity in the soil. Soil organisms can help maintain low populations of many pests through natural competition.

We think using this kind of mixed planting in our buffers will provide an economic benefit as well. Organic farmers must maintain a buffer zone between themselves and adjoining conventional land. Any production from the buffer must be considered conventional and cannot be co-mingled with organic crops, which is, harvested, stored, and sold separately. A buffer that helps attract nature's beneficial insects would reduce the management costs of segregating buffer zone production.

The Clay County Soil and Water Conservation District helped us plant our tree and shrub borders in mid-June.

This was the first year of a three-year project. We established buffer strips on two fields. One field was 65 acres (planted to soybeans) and the other was 165 acres (planted to corn). We established border plantings on three sides of each field and left one side without a border planting for a control/comparison. The corn field had growth in the borders but died out because of drought conditions. We will replant in 2007 and do more insect counts.

We had a very wet spring for planting trees in our clayey soil. We bought Juneberry, chokecherry, and ash trees from Clay County SWCD and mudded them in along the border according to United States Department of Agriculture Natural Resources Conservation Service (NRCS) spacing guidelines in early June. We used heavy plastic tree matting to suppress weeds in the tree rows (see photo). In addition, we planted wildflowers, alfalfa, and buckwheat in between the tree rows. The wildflower seed was a mixture produced for this area that we purchased from Aggasiz Seed; we wanted to make sure the seed would be hardy for our growing zone. We broadcast the wildflower seed in the first part of June and worked it in gently with hand tools. We followed the same procedure for the grasses and forages. Species included alfalfa mixed with timothy and buckwheat. We had a check area where we planted nothing between the rows of trees/shrubs. Since wildflowers look like a bunch of weeds when they are just getting started, we also planted zinnias as a marker to see where wildflowers were emerging.

North Dakota State University entomologist, Evan Lampert, was a great help to us. He taught us how to use nets to sweep for bugs and how to set up beetle traps. From the initial sweep of the border around the soybeans, the population of beetles, which feast on weed seeds, seemed to increase. We also noticed beneficials moving in at the same time as the soybean aphids. Starting in the middle of June, we used insect nets weekly to "sweep" for counting and identification. We froze some insects that we needed further help identifying.

We had one public event on the farm June 10, 2006. About 87 people came from the neighborhood and from Moorhead to our event called "Going Green on the Farm." Evan Lampert was there to educate groups about beneficial insects, and Lee conducted field tours for the visitors.

Results

By midsummer, the conditions were extremely dry and the wildflowers had a hard time competing with the weeds. The wildflowers were slow to grow and looked more like weeds themselves at times. Those wildflowers that did emerge were showy and offered many different small flowers. The various flowers seemed to attract many different insects, including beneficial insects.

We are redesigning that aspect of the project by reseeding the wildflower areas with a stronger carrier. The borders that contain alfalfa will take hold though and we will continue to do insect counts.

Because this is only the first year of the project and borders are just being established, I do not have insect counts or insect inventories to report. There have been interesting things to observe though, and we have already seen differences from when we first started the project. We observed that ground beetle numbers were higher in the alfalfa and buckwheat than in any other habitat. Beneficial insect numbers were highest after the soybean aphids started appearing in the soybean field. Green lacewings and ladybugs increased and were noted after soybean aphid levels reached between 200-250 on a plant, which is a recommended threshold for treatment. We are hoping some of the beneficials will find winter homes in the tall grasses and we will see populations early in spring.

In 2007, we're going to use untreated butterfly wildflower seed mix hoping it will be easier to tell the difference between flowers and weeds as the plants emerge. We are also planting sweet alyssum, which has been used successfully by California farmers to attract beneficial insects in both organic and conventional systems. Although some of our friends and neighbors are skeptical about the value of this project, we are already getting calls from wineries and other businesses in the area who want to know when we will have chokecherries to sell. Lee and I have also already noticed indirect benefits, such as the fact that the living borders establish a visual guide to help us differentiate between fields. They also reduce the potential for spray drift.

We used heavy plastic tree matting to suppress weeds within the tree rows.

Management Tips

1. Make sure the wildflower seed you buy is not coated with any product. This point is especially important in organic production.

2. Contact your county NRCS office to find out whether its EQIP program might provide cost-share payments for the tree plantings.

3. If you do receive cost share through the EQIP program, note that NRCS spacing guidelines must be adhered to, so be sure to consult an NRCS technician before you plant.

4. Be very careful when selecting species that you don't inadvertently plant something like buckthorn, which acts as a soybean aphid host!

5. If your beneficial border is going to abut someone else's land, be sure you are aware of the property line and discuss your plants with your neighbor. If you are planting along a roadway, check first into township regulations about the required distance from the road.

6. If you are planting near a homestead, check with your USDA County Service Center to see if there are funding programs that will underwrite tree establishment costs.

Cooperators

Evan Lampert, North Dakota State University, Fargo, ND
Phil Glogoza, University of Minnesota Extension, Moorhead, MN
Kevin Kassenborg, Clay County Soil and Water Conservation District, Moorhead, MN
Sharon Lean, USDA-NRCS, Moorhead, MN
Donna Nukuay, Moorhead Public Schools, Moorhead, MN

Project Location

From Moorhead, take US-75 north for about 9 miles until you reach Kragness. Go north on Cty. Rd. 96 for about 2.5 miles. Our mailbox and drive are at the point where the power high line crosses the road. Turn into the drive.

Other Resources

Agassiz Seed & Supply.West Fargo, ND, 701-282-8118 or www.agassizseed.com

Organic certifying agencies. Ours are Global Organic Alliance, www.goa-online.org, and Organic Crop Improvement Association, Minnesota Chapter #1, www.mnocia.org

USDA-NRCS web sites about selecting and establishing plantings to attract pollinators, www.nrcs.usda.gov (type "pollinators" into search box)

Field Windbreak/Living Snow Fence Crop Yield Assessment

Principal Investigator

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Project Duration

2005 to 2007

Staff Contact

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Keywords

blowing and drifting snow, field windbreaks, living snow fences, soil erosion

Project Summary

Modern farming practices and the trend to till all available land for annual crop production has encouraged less surface crop residue and less perennial vegetation. This has allowed our rural landscapes to become vulnerable to increasing soil erosion and blowing and drifting snow for six months of the year. Field windbreaks and living snow fences, when placed in the proper locations, can serve the direct purpose of reducing snow drifts on roadways and be very beneficial in enhancing rural landscapes.

General information on crop yields near windbreaks is available in USDA publications. Row crops in the vicinity of windbreaks have shown an increase in yield. We would like to verify and update this information using plantings in Minnesota. Local information will assist us in encouraging further use of this practice.

The goals of this project are to:

1. Compile crop yield data (using modern yield monitoring/GPS systems) for crops planted around field windbreaks and living snow fences in Minnesota;

2. Document associated variables at these sites; and

3. Summarize the data and share it with producers and other agricultural professionals.

Project Description

Field windbreaks and living snow fences (henceforth referred to collectively as windbreaks), when placed strategically, can serve multiple purposes and be very beneficial in enhancing rural landscapes. They benefit wildlife, enhance rural aesthetics, reduce blowing snow problems, protect top soil, and potentially increase crop yields. Previous USDA research suggests that there are yield advantages to these conservation plantings in the range of 12% in corn and 8% in soybeans. It is important to record crop yields around windbreaks using modern yield monitoring equipment to show producers where the yield increases and other benefits of these plantings occur. If crop yields are higher or equal to field averages, more producers may be encouraged to establish these plantings on their farm. The USDA cost share and continuous-CRP payments for these practices are economically beneficial to producers.

Our largest challenge has been the identification of existing sites for monitoring. We are identifying crop fields that not only have an established (2-30 year) windbreak planting but a farmer that has yield monitoring and GPS mapping capabilities. We are working with NRCS/SWCD staff and regional crop consultants to identify fields that make good sites to study over a three year period. Eventually, we want ten sites in the project.

Redwood County field windbreaks with Black Hills Spruce.

Yield from strips the width of the combine (commonly 30') are being measured and documented. The total number of combine strips sampled (total distance from the windbreak planting to the last row sampled) depends on the heights of the woody planting (trees or shrubs) and other variables. Yields are expected to be in the shape of a bell-curve, lowest near the woody planting, peaking at five times the distance away from the planting height, and then leveling out to the field average.

Along with yield, we are documenting the direction of the planting (north-south or east-west), soil type, age of the planting, species of tree or shrub, slope, land use history, snow cover, erosion protection, wildlife benefits, and spring crop planting delays. Seasonal photographs of each site are being taken to document snow depth distribution and crop development.

The reason we are conducting the project is to share the data collected. We want to update crop yields near tree and shrub windbreak plantings using modern yield monitoring systems. We assume there are yield differences but we want to display this with data from current farming practices.

Results

Nine farms with existing windbreaks have been located and are participating in yield data collection. We are in the second year of the study and have compiled yield data from several of the initial sites. Two examples of the yield distribution across the fields are shown below.

The Arlen Klassen farm in Cottonwood County has an east-west field windbreak of mature green ash trees approximately 40' tall. Corn yields were recorded in 30' wide strips on both the north and south sides of the windbreak. The field average corn yield for 76 acres was 154 bushels. There was a noticeable yield reduction from 0' to 30' on either side of the windbreak (Table 1 and Figure 1). From 90' to 270' on the south side the yield was 9.7% above field average. From 60' to 270' on the north side the yield was 5.7% above field average. The highest yield occurred at 150' on the north side and 180' on the south side.

The Richard Flohrs farm in Martin County has an east-west field windbreak of Amur Maple and red cedar. Corn yields were recorded in 20' wide strips on the north side of the windbreak. The field average corn yield was 184 bushels. There was a noticeable yield reduction from 0' to 20' north of the windbreak but the overall effect of the windbreak was to increase corn yields by 2.5% (Table 2).

Table 1. Corn Yield Distribution Near Mature Green Ash Field Windbreak on the Arlen Klassen Farm (Fall 2006)

	Average Yield of Entire Field (bu/A)	Average Yield Near Planting (bu/A)	Yield Increase Near Planting (%)	Top Yield Near Planting (bu/A)
North of Windbreak	154	158	2.2	170 (5th pass)*
South of Windbreak	154	159	3.1	178 (6th pass)*

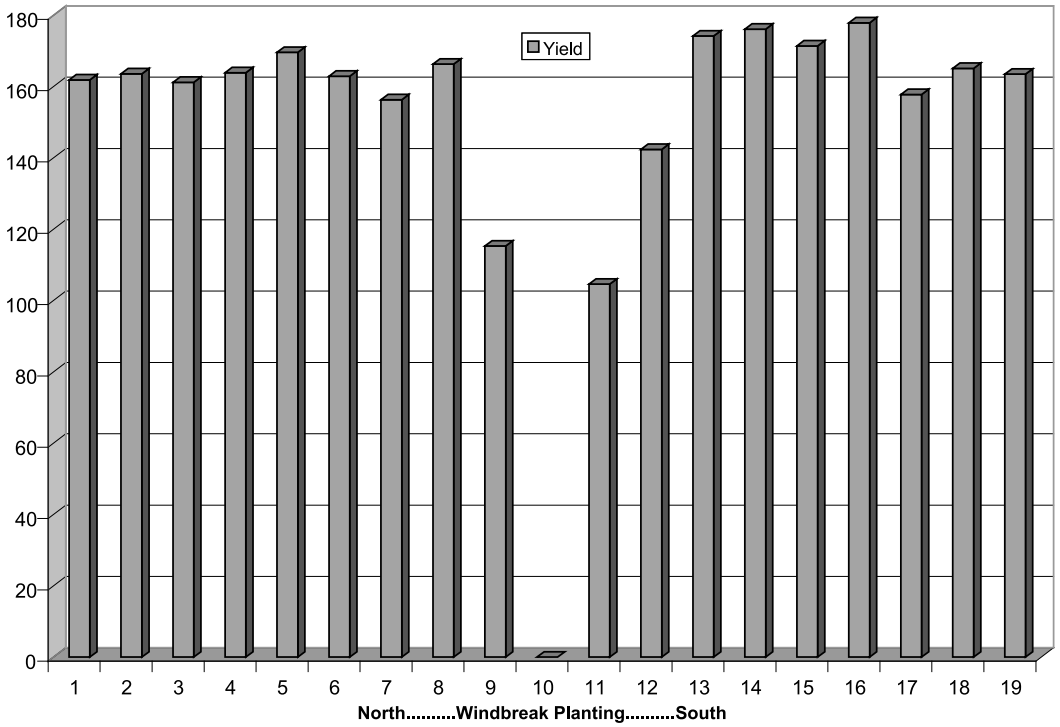
**One pass of combine = 30'*

Table 2. Corn Yield Distribution North of Amur Maple – Red Cedar Field Windbreak on the Richard Flohrs Farm (Fall 2006)

	Average Yield of Entire Field (bu/A)	Average Yield Near Planting (bu/A)	Yield Increase Near Planting (%)	Top Yield Near Planting (bu/A)
North of Windbreak	184.7	189.4	2.54	203 (5th pass)*

**One pass of combine = 30'*

Figure 1. Arlen Klassen Corn Yield (bu/A) Near Windbreak - Fall 2006



Generally, there are yield increases 30' to 300' away from the windbreaks. These increases more than offset yield reductions immediately adjacent to the conservation planting. We are commonly seeing an overall cash crop yield increase of 2-3%. Although these yield increases are not as great as found in drier parts of the country, they still justify the plantings, especially when the multiple benefits of snow capture and soil conservation are taken into consideration.

If you know of plantings that could add to the yield data in this study, please contact Gary Wyatt, 507-389-6748. The role of a cooperator is to:

- Plant the same crop variety on either side of the selected practice.
- Manage both sides equally.
- Document notable characteristics of the plot and growing season.
- Make sure the GPS and yield monitoring equipment are working properly.
- Send the yield maps and documentation to me for review and recording.

Management Tips

1. Assess your crop fields and property to see if a windbreak could benefit your land or neighborhood.

2. Siting of windbreaks should include non-yield benefits such as protecting top soil from wind erosion, increasing wildlife habitat, improving rural aesthetics, and reducing blowing and drifting snow on community roadways.

3. Contact your county FSA/NRCS/SWCD office to learn if you may be eligible for cost-share and continuous CRP incentive programs that cover windbreaks.

4. Don't be discouraged by a crop yield reduction near the planting. Depending on soil type, there is a bump in crop yield further away from the planting. Overall, there should be an increase in yield above field averages.

Project Location

Contact Gary Wyatt for directions to specific sites.

Other Resources

Gullickson, Dan, Scott Josiah, and Paul Flynn. 1999. Catching the Snow with Living Snow Fences. University of Minnesota Extension Service. Pub. # MS-07311. Web site: www.extension.umn.edu/distribution/naturalresources/DD7311.html

Josiah, Scott, and Mike Majeski. 1999. Living Snow Fences. University of Minnesota Extension Service. Pub. # FO-07277-GO. Web site: www.extension.umn.edu/distribution/naturalresources/DD7277.html

Chokecherry *(Prunus virginiana)* Production in Western Minnesota

Principal Investigators

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Project Duration

2006 to 2008

Staff Contact

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Keywords

chokecherry (Prunus virginiana), chokecherry variety "Garrington," Farmers' Market, jelly, root suckers, "wild black cherry"

Project Summary

We want to see if commercial chokecherry (Prunus virginiana) production is economically feasible with our cattle and strawberry operations. We established an experimental chokecherry orchard in a cattle pasture near our strawberry fields. In 2006, we compared growth and survival of seedling chokecherries from the nursery with root suckers we dug from wild trees in our area. Eventually, we will want to find out if chokecherries from one area of the country taste better than chokecherries from other sources.

Project Description

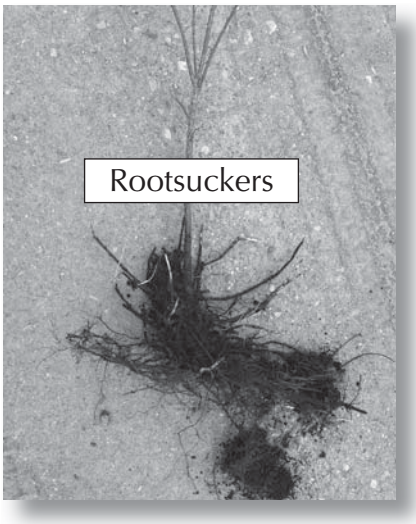
We farm 700 acres of wheat, soybeans, and corn near the city of Detroit Lakes. We graze 25 head of beef cattle on pastures near our house. Four years ago, we diversified into strawberries, with a new business called West View Berries. Currently, we farm 2.5 acres of strawberries.

By growing chokecherries, we hope to increase our on-farm income so that Michelle can spend more time with our three young sons. We hope to build on the success we have had marketing our strawberries. Michelle has been selling jellies at the local farmers' market and flea market, and she could use a reliable source of chokecherries. Chokecherries will increase the amount of money we make off land currently devoted only to pasture, and they are harvested at a time when there is little work to be done in the strawberry field.

Chokecherries are a unique berry for our area. They are popular and somewhat difficult to find. Some chokecherries are located in roadside ditches, where picking conditions are unsafe. We would like to design a production system for chokecherries that has low production costs and is easy for Michelle and the boys to harvest. Chokecherries spread underground as root suckers, and we plan to create a hedge with a maximum height of 8' so that all the fruit can be picked from the ground.

In May, 2006, we planted 250 chokecherry plants in a pasture near the strawberry field. The pasture has alkaline, rocky soil. We planted directly into the sod with no soil preparation, but we did put wood chip mulch over the rows later in the growing season. One hundred fifty seedlings (3' tall) came from Lawyer's nursery in Montana. We planted 75 root suckers that we dug from nearby wild chokecherry patches and 24 trees of the variety Garrington (also 3' tall), which has good fruit quality and is grown for commercial fruit production in Canada.

The seedlings from Montana put on 2-3" of new growth.



The root system on the same seedlings tripled in size, with many root suckers just below the soil surface.

We had planned on planting seedlings from a Minnesota nursery, but our order was cancelled due to a shortage of plants. In the fall, we measured the survival rate and the amount of new growth on all new plants.

The name "chokecherry" can turn off new customers. As producers, we cannot explain to every potential new customer that the astringent quality of chokecherries disappears in jelly or wine. Canadian fruit producers have proposed changing the name chokecherry to "wild black cherry" in order to attract new customers, just as the sour cherry producers began growing "pie cherries," and Oregon nut growers changed the name "filbert" to "hazelnut." In September, we conducted a taste test, where we compared "chokecherry jelly" with jelly from the same jars labeled as "wild black cherry jelly" to see if customers would prefer the jelly with a more attractive name.

Results

1. Obtaining plants

We had a difficult time finding all the plants we needed. The Canadians have developed several varieties that have been selected for good fruit quality. We could not buy these varieties, because chokecherries cannot be shipped from Canada into the U.S. to prevent the spread of the plum pox virus. The major chokecherry variety in the U.S. is Schubert, or Canada Red, which was selected for its red leaves rather than fruit quality and is unacceptable for fruit production. The only variety selected for fruit quality we found in U.S. nurseries was Garrington, which was six times more expensive than nursery seedlings. Minnesota nurseries were completely sold out of cherry seedlings, so we planted seedlings from Lawyer's nursery in Montana, and compared them with Garrington and local selections. Our collaborator claims that Montana chokecherries taste better than Minnesota chokecherries.

2. Plant growth the first year

The seedling plants from Lawyers grew quite well, the Garrington grew poorly, and the root suckers from local wild plants all died. The seedlings from the nursery only grew 2-3" the first year, but we were not discouraged because the plant was putting all its energy into its roots, and the plants should grow rapidly next year. We dug up one plant and found that the root system had grown extensively with 10 root suckers just below the soil surface. Next spring those root suckers will sprout. Eventually, we expect many different stems coming from each plant until the chokecherry row turns into a hedge.

We were disappointed that the root suckers we removed from wild plants all died. We have been making jelly from chokecherries near our farm for many years. We wanted to establish our patch with plants from our favorite patch. The root suckers did not grow because they had either too few roots or no roots. Most plants that spread underground, like raspberries and red osier dogwood, are easy to dig up, remove from the mother plant, and replant somewhere else. The chokecherry root suckers we dug had few or no roots. We would like to find a way to propagate native chokecherries from root suckers, but we would have to design a new propagation system.

3. Initial taste tests

People who grow up eating chokecherry jelly often show an unusual devotion to the product and are willing to pay high prices for the jelly. Unfortunately, few customers under 40 are buying chokecherry products. Several people have suggested that demand could increase if the name were changed. In the prairie provinces of Canada, fruit producers have proposed changing the name to "wild black cherry."

We conducted a taste test at the Detroit Lakes Farmers' Market. Customers were given four jelly samples to taste with gourmet bread donated by a vendor. The samples were wild plum, chokecherry labeled as "wild black cherry", red currant and chokecherry jelly. The wild black cherry and the chokecherry samples came from the same jar. People of all ages sampled the jellies, including farmers' market vendors, retirees and a group of middle school students. We conducted the test in late September, after most of the summer residents had left, and nearly all the samplers were from the Detroit Lakes and Fargo area. Two of the 42 respondents figured out that the wild black cherry and chokecherry were the same. Two-thirds of the respondents had eaten chokecherry jelly before.

People liked the chokecherry jelly regardless of its name, rating it higher than plum or red currant. On one part of the survey, people rated the jellies on a scale of 1 to 5, with 1 being the "best" (Table 1). At the end of the survey, people were asked to name their favorite and least favorite jelly. On the numeric scale, most people rated chokecherry jelly differently than chokecherry labeled as "wild black cherry", but many people preferred the chokecherry jelly. As a result, the average ratings of the two were identical among those who had previously eaten chokecherry jelly. When asked to list their favorite jelly, people did show a preference for the chokecherry labeled as wild black cherry. Sixty-one percent of all respondents chose either wild black cherry or chokecherry as their favorite, 39% chose "wild black cherry" and 22% chose chokecherry (Table 2).

Table 1: Results of jelly taste tests on a numeric scale

Type of fruit	Tasting chokecherry jelly for the first time Average Rating*	Had previously tasted chokecherry jelly Average Rating*
Plum	1.5	2.04
Wild Black Cherry	1.6	1.6
Red Currant	1.5	2.12
Chokecherry	1.4	1.6

** Jellies were rated from 1 to 5, with 1 being the best*

According to our small survey, the case for changing the name of chokecherry is fairly weak. The only time people showed a preference for jelly labeled "wild black cherry" was when they were asked to name their favorite jelly. Older consumers who seek out chokecherry products would be confused if the name was changed, and new consumers did not show a strong preference to chokecherry jelly labeled as "wild black cherry." Proposals to change the name come from the prairie provinces of Canada where no other native cherries are found. In Minnesota, black cherry refers to a large tree that grows naturally in forests in the southeastern part of the state. In supermarkets, wild black cherry refers to a type of ice cream.

Table 2: Response to the question: What was your favorite jelly? (all responses combined)

Type of fruit	% of Respondents
Plum	28
Wild Black Cherry	39
Red Currant	11
Chokecherry	22

Management Tips

1. From our experience in 2006, we would recommend buying seedling chokecherries from a nursery rather than digging up wild plants.

2. Named varieties like Garrington are too expensive to be commercially planted.

3. If you want Minnesota chokecherries, you must order plants early.

4. We suggest keeping the name chokecherry for the time being.

Cooperator

Thaddeus McCamant, Northland Community and Technical College, Detroit Lakes, MN

Project Location

West View Berries is located north of Detroit Lakes. Take US 59 north for 7.5 miles to the old town of Westbury. Turn left on 240th St. The berry patch is a mile down the road on the north side.

Other Resources

Manitoba Agriculture, Food and Rural Initiatives. February, 2006. Chokecherry Production in Manitoba. Web site: www.gov.mb.ca/agriculture/crops/fruit/bla01s00.html

Two chokecherry root suckers. The far left chokecherry has no roots, while the plant on the right has two roots.

Apple Scab Control Project

Principal Investigator

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Chisago County

Project Duration

2005 to 2007

Staff Contact

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Keywords

apple scab, ascospores, data logger, leaf wetness, sulfur sprays

Project Summary

Our farm consists of 120 certified organic apple trees on 2.5 acres of land just west of Taylors Falls, MN and the St. Croix River Valley. One of the challenges of growing certified organic apples is controlling fungal diseases on the trees and fruit using only inputs approved for certified organic apple production. We've applied sulfur to our orchard in the past and have not noticed any improvement in disease control when compared to trees that did not receive sulfur protectant sprays. Our assumption has been that the timing of our sulfur applications has not been correct, and that we needed a better method of timing our sulfur sprays. Our project involves studying the effectiveness of applications of a sulfur protectant based on degree days, leaf wetness, and temperature.

Project Description

All of the trees were planted in 1997 and started producing fruit in 2005. The trees were planted in an old livestock feedlot which has provided nitrogen rich soil for starting the young apple trees. The main challenge in managing our orchards is eradicating diseases on the apple trees and fruit using only those inputs approved for organic apple production by the federal National Organic Program and through the Organic Materials Review Institute (OMRI).

As our trees have grown, we've noticed ongoing mottling of the apple tree leaves caused by apple scab. This disease has reduced the quality and quantity of our apple production. We've also noticed that the Honeycrisp tree variety appears to be the most negatively impacted from this mottling. Apple scab has affected 50 to 70% of the total apple leaf area of the orchard in the past few years. Since the majority of our orchard is the Honeycrisp variety, solving this mottling issue would greatly improve the success of our orchard operation.

Our goal is to determine if improving the timing of protectant sulfur sprays will have any impact on reducing apple scab infections in our apple tree. There have been many studies performed that depict the life cycle of scab infections and the percentage of ascospores which will be discharged under various environmental conditions. Dr. W.D. Mills at Cornell University charted scab infection periods in the 1920s through the 1940s to show the relationship between average temperature and length of wetting period and the compounding effects on primary infection. His findings were that if the leaf surface dries soon enough, a scab infection can be prevented naturally. If, however, the optimum temperature and leaf wetness occur during the accelerated phase of ascospore maturation, a protectant needs to be applied. Sulfur has been advertised as a protectant against apple scab and is approved for use in organic apple production.

Wild Fruit Farms Orchard.

We've been using sulfur as a protectant spray for the last five years and have questioned whether the benefits outweigh the costs. We've compared the difference in scab infection between a few apple trees that were not sprayed and the rest of the orchard that received sulfur sprays. We have not noticed any appreciable difference between the sprayed trees and those trees not sprayed. In the past, our assumption has been there must have been some environmental reason for the differences. However, given the close proximity between the sprayed and unsprayed trees, that assumption does not seem logical. Our only other conclusion is that our timing of the sulfur sprays was missing the period when the leaf needed the most protection. We believe we can improve the effectiveness of our sprays by deciding when to make those sprays based on tracking the primary scab season which was between 300 and 700 degree days (where degree days are calculated by subtracting a 32 degree base temperature from the mean daily temperature, that is the high and low divided by two) and the leaf wetting period.

In addition, Dr. William MacHardy at the University of New Hampshire discovered long-wavelength red light (daytime) plus wetness are necessary to trigger spore release. Therefore, leaf wetness would only need to be tracked from sunrise to sunset. If the leaf remains wet for more than six hours and the temperature is between 60-75°F during the 300 to 700 degree day primary scab season, a sulfur spray would be applied within the six hour leaf wetness time frame.

We are testing our theory that timing is everything with sulfur sprays by setting up a weather station to track degree days and leaf wetness. Our measure of success will ultimately be the percentage of apple scab damage to the leaves and fruit. Apple scab has affected 50 to 70% of the total apple leaf area of the orchard in the past few years.

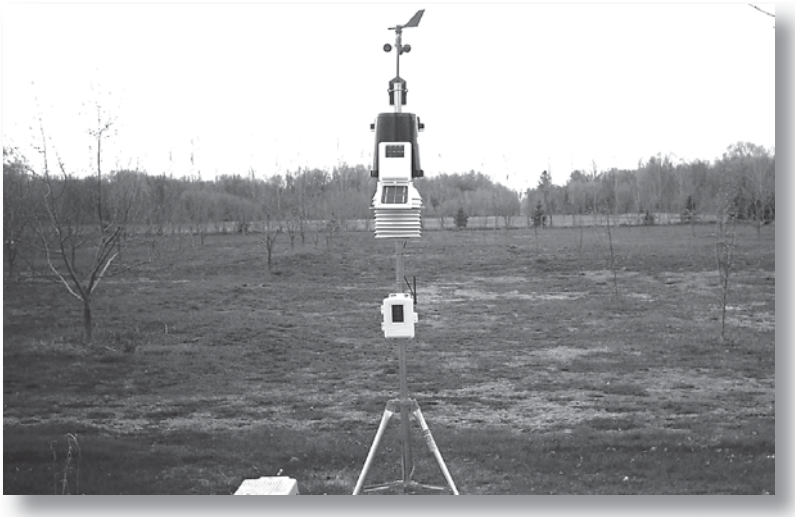
Results

2005

Our first application was a lime/sulfur spray on April 17, 2005 at a rate of five gallons of lime/sulfur for every 100 gallons of water sprayed on 2.5 acres. The lime/sulfur was used to eliminate any over-wintering spores. We began tracking degree days and leaf wetness using a weather station on April 30, 2005. Based on Dr. W.D. Mills' studies and our weather monitor data, our primary scab season in 2005 started in the middle of May at 300 degree days.

Our second application of sulfur spray was on June 5, 2005 at a rate of 1.25 gallons of sulfur for every 100 gallons of water sprayed on 2.5 acres. The second spray timing was a futile attempt to protect the trees from previous ascospore events. Due to the unusually early warm temperatures and spring rains, earlier applications of sulfur sprays would have been more effective. By the time our weather monitor was installed, we may well have been into the primary scab infection period and past the 300 degree day mark when sprays may have been more appropriately timed. By mid-June we were well past the primary scab season, secondary scab infections had a foothold, and mottling of the tree leaves was evident.

After reviewing the data collected from the weather monitoring equipment, our primary scab infection period (300 degree day reached) started on May 17 and ended on June 4 for the 2005 growing season. Using the leaf wetness sensor, sulfur should have been applied May 18, 19, 27, and 28. The other days when the leaf sensor indicated wetness periods longer than six hours had either occurred at night, early morning or evening when the exposure to red light was not present.



Weather data logger in orchard.

2006
We did not apply an early spring lime/sulfur spray to kill over wintering spores this year as it was determined from 2005 data that there weren't any noticeable differences in the persistence of scab between the sprayed and the unsprayed group of trees. It could be possible that in northern climates such as ours, spores are adequately killed off during the winter months due to low temperatures and/or that there is a sufficient amount of time for the pathogens to decompose over the winter months.

During the second year of the study, we were able to start collecting degree day information from the very start of the year. The second year we utilized three applications of flowable sulfur. Based on this information, we began spraying our trees earlier in the spring than the previous years.

Due to the unusually early spring in 2006, it didn't take long to reach the 300 degree day total on April 10, 2006. Our first application of sulfur spray was on April 22, 2006 at a rate of 1.25 gallons of sulfur for every 100 gallons of water sprayed. Our second spray was on April 28 at a rate of 1.5 gallons of sulfur for every 100 gallons of water. The third and final application took place on May 1 at a rate of 1.5 gallons of sulfur for every 100 gallons of water. All solutions were sprayed over 2.5 acres. On May 2, we had reached the 800 degree day total.

After reviewing the data collected from the weather monitoring equipment, our 300 degree day started on April 10 and raced toward our 800 degree day on May 2 for the 2006 growing season. Using the leaf wetness sensor, sulfur should have been applied April 20, 21, 22, 28, 29 30, and May 1. We were able to spray on April 22, 28, and May 1, which provided adequate coverage during these wetting periods.

As a result of the weather monitor readings and the early, well-timed sprayings, on May 23, 2006 we had come to petal-fall and had noticed little, if any, scab infection at this point. By mid-June, however, the apple scab had become established and quickly led to a secondary scab infection causing leaf mottling.

Discussion

Similar to the results of the 2005 experiment, the biggest surprise for our farm was how early the primary scab season started and ended this year. In 2006, it did not take long to reach the 300 degree days and even reach the end of the primary scab season at 800 degree days. In previous years, when we did not utilize weather monitoring equipment for tracking degree days, we always assumed that sulfur applications were best timed when the apple trees had leafed out. We have now found that the sprays should be applied earlier in the season.

Even though we did start the sulfur sprays much earlier this season, we still ended up with a secondary ascosporic infection. This may have been the result of halting the protectant too soon in the season. It was disappointing to have not yet discovered the most effective sulfur spraying regime; however, we have another season to try a more aggressive approach. Our plan for 2007 is to start the sulfur sprays early at the green tip stage and continue through until the trees have fully leafed out.

Management Tips

1. Start the sulfur sprays early (green tip stage) and continue through until the trees have fully leafed out.

2. Use flowable sulfur which mixes easily in a mixer tank for doing quick applications.

3. Clean the spray equipment thoroughly after each application, otherwise the sulfur will accumulate on the sprayer and it becomes very difficult to remove the dried sulfur.

Cooperators

Patrick Lynch, Breezy Hill Orchard, Maple Lake, MN

Project Location

From Minneapolis/St. Paul, take I-35 north to North Branch. Turn onto Hwy. 95 east through Almelund to mile marker 70. Take gravel road north (Teal Ave.) to the first red farmhouse on the left.

Other Resources

Earles, Richard, et.al. 1999. Organic and Low-Spray Apple Production. 38 pp. Available from Appropriate Technology Transfer for Rural Areas (ATTRA) – USDA. Web site: http://attra.ncat.org/attra-pub/summaries/apple.html or 800-346-9140.

La Crescent Orchard Supply in La Crescent, MN. Flowable sulfur and other orchard supplies.

Phillips, Michael. 2005. The Apple Grower, A Guide for the Organic Orchardist, 2nd Edition. Chelsea Green Publishing. 320 pp. Available at: 800-639-4099.

Sweezy, Sean L., et al. 2000. Organic Apple Production Manual. University of California. Pub. No. 3403. 72 pp. Available at: 800-994-8849.

Establishing Healthy Organic Asparagus While Utilizing Minimal Labor and Maintaining Proper Soil Nutrition

Principal Investigators

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Project Duration

2005 to 2007

Staff Contact

Jean Ciborowski
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Keywords

asparagus, organic production, soil pH, weed management

Project Summary

Breezy Hill Organic Orchard is located approximately 50 miles west of Minneapolis in Maple Lake, MN. We have been certified organic since 2002 through the Midwest Organic Service Association. We sell to west metro cooperatives as well as the Mill City Farmers' Market in Minneapolis in the summer months. Our produce is harvested, sorted, and delivered to our markets within two days. Our goal is to diversify our farm into three main crops; asparagus, summer raspberries, and apples. We have selected each crop based on customer desire and ease of growing them organically. Our project objective is to develop an effective weed control strategy for asparagus which reduces both manual and mechanical labor inputs.

Project Description

In the spring of 2007 we will have our first asparagus crop available to sell to the cooperatives. This presents our farm with a new challenge in keeping up with a new crop beginning in the spring. Our challenge is to be able to manage a 1/2 acre of asparagus using effective weed control. Because we are certified organic, we are not able to use conventional herbicides for weed control. We began this project with three test rows of asparagus in our garden. Each row is 25' in length and spaced intermittently within our garden space. Two of the rows are hand weeded while the third row has recycled tin and wood chips as a weed barrier. The weeds grow sparingly between the spears of asparagus and are fairly easy to manage. The two rows without any barriers are labor intensive for weeding and often need to be delegated to a hired hand due to other projects on the farm. Our commercial test plot is a 1/2 acre of asparagus utilizing landscape fabric and black plastic mulch. The rows are spaced 7' apart with 1.5' between the crowns.

Results

Our goal for this project is to be able to maintain a commercial asparagus crop utilizing an effective weed barrier with minimal hand and mechanical weeding. We also are focused on maintaining a healthy soil with a pH of 6.5 - 7.5 which is ideal for asparagus.

The recycled tin with wood chip cover has been effective in the first two years of growth. The drawback we noticed this summer is that the tin tends to shift and hinder the asparagus spears from proper growth on the outside edges of the rows. We have decided this is not an effective weed barrier in asparagus weed management. We removed the tin this past fall and have decided to hand weed this row next year.

The landscape fabric has proven effective as a weed barrier as long as it is laid after cultivation. We laid the fabric in August of 2005 and it was effective throughout the summer months. Our certifying inspector reminded us that we do need to remove it each fall to keep our organic certification. Fall removal and spring installation of the fabric each year is time consuming.

The black plastic mulch was laid in late April of 2006. This proved to be an effective weed barrier with minimal hand weeding through the summer months. Black plastic mulch is a cost effective mulch for small growers.

Our soil samples were consistent with a pH level of 7 in the spring and fall of 2006. We used a ball of loamy soil for our samples. The field we selected has good drainage and soil. We did experience a drought from late June through the end of summer. The asparagus maintained healthy growth through the summer months despite the weather. We did not use irrigation and do not intend to in the future for our asparagus.

We planted and laid the weed barrier with one volunteer and one hired hand. Patrick, our hired hand, and I weeded throughout the summer months. We had a small harvest of asparagus in 2006 and anticipate a favorable crop large enough to market in 2007. Our markets are waiting for locally grown, certified organic asparagus and we will be able to deliver that to them.

Management Tips

1. Select fields with good drainage and soil quality before planting asparagus.

2. Planting, weeding, and laying/removal of mulch is labor intensive.

3. Keep in mind that certified organic production of asparagus has to meet certifying standards when using synthetic mulches and fabrics.

Cooperator

Volunteer interested in organic production.

Project Location

We are located 50 miles west of Minneapolis off of Hwy 55. Go west from 494 to Cty. Rd. 37 just past Maple Lake. Take 37 south to Iresfeld Ave. NW and take a left to first farm on the left.

Other Resources

Kuepper, George and Thomas Raven. 2001. Organic Asparagus Production. Available from USDA Appropriate Technology Transfer for Rural Area (ATTRA). Web site: www.attra.org/attra-pub/summaries/asparagus.html or 800-346-9140.

Ohio State University Extension. 1993. Asparagus Production Management and Marketing Bulletin 826. Web site: http://ohioline.osu.edu/b826/

University of Minnesota Extension Service. Growing Asparagus in Minnesota - A Production Guide. Revised 2005. Pub. No. WW-01861. Web site: www.extension.umn.edu/distribution/horticulture/dg1861.html

Novel Preplant Strategies for Successful Strawberry Production

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Project Duration

2006 to 2008

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Keywords

soil solarization, strawberries, weeds

Project Summary

Our project examines the effect of the combination of preplant soil solarization and canola degradation on weed seed germination with the long term objective of reducing weed competition for strawberry plants. We tested two biodegradable plastics in combination with canola, to produce an almost weed-free planting bed for strawberry plants. After the preplant treatments, strawberries were planted in early August, 2006. They are being overwintered and will produce fruit for harvest in June, 2007. Delaying the planting until August decreased weed competition, reduced runner development, and increased branch crowns. Floating row covers were used to continue strawberry plant growth into the fall and increase soil temperatures earlier in the spring. This system avoids the flush of weed growth in the early summer, allows the strawberry plants to increase in size with little competition, and allows harvest to begin a week earlier in June.

Our objectives include reducing weed competition for strawberry plants and avoiding negative impacts on the environment by demonstrating the use of biodegradable plastic mulches and a plant-generated natural preemergent herbicide. This management strategy for weed control has led to a reduction in pesticide use and demonstrated the potential added benefits of reducing labor thus potentially increasing profitability.

Project Description

Biodegradable plastics fit into sustainable agricultural systems. They avoid the negative impacts on the environment of regular plastic mulches while having all of the desirable characteristics such as increasing soil temperatures. Research done at the University of Minnesota, Southern Research and Outreach Center in Waseca (Fritz, 2005) has shown some biodegradable plastics can increase soil temperatures to at least 90°F for varying periods of time. These plastics also have differing degradation times ranging from 3 to 10 weeks. We applied these plastics in combination with canola degradation to evaluate if there was a reduction in weed seed germination prior to planting strawberry plants. We were interested in combining these two preplant techniques with our development of the annual strawberry system to produce a low input, sustainable system for strawberry producers.

Biodegradable plastics often are thinner than traditional polyethylene but otherwise are quite similar. They may be made from renewable resources such as starch, cellulose or degradable polymers. Biodegradable plastics are degraded by sunlight, heat and mechanical stress, thus eliminating the need for pick-up and disposal at the end of the season. The biodegradable plastics eventually are converted through microbial activity in the soil to carbon dioxide, water,

Canola treatment without biodegradable plastic-good weed control.

Mater-Bi Green biodegradable mulch treatment-poor weed control.

and natural substances. Biodegradable plastics are not the same as the photodegradable mulches that were previously available and left residues in the fields.

Commercial strawberry growers in Minnesota have a limited harvest season. Add to the short season the other hurdles in production practices such as few labeled agrochemicals for pest control, and you have a very challenging crop to produce. Our producer/researcher group has pioneered the use of novel ways to produce strawberries and this project will add to the current body of knowledge. This group has successfully completed research projects in alternative weed control strategies in strawberries since 1998. Past and current research efforts have shown the value of wool mulch within the row and canola mulch between rows as a tool to suppress weeds in strawberries (Forcella, F. et al. 2003). A needle-punched wool mat was very effective in suppressing weeds within the strawberry row and was as effective as hand weeding, and possibly better than standard herbicides. The wool mulch use within the row and canola planted between rows effectively controlled weeds throughout the planting year with minimal hand labor.

Research was conducted at two sites, the West Central Research and Outreach Center (WCROC) in Morris, MN and the Berry Ridge Farm in Alexandria, MN. Our preplant protocol on both sites was the same. We planted canola on May 16, 2006. On June 18, 2006, Roundup® herbicide was sprayed to kill the canola. Four days later, June 22, the dying canola was flail mowed on the two biodegradable plastic treatments. Immediately after mowing, the canola was shallowly incorporated with a walk-behind rotovator. On the same day, we applied the plastic mulches using a plastic mulch laying machine. Drip irrigation was installed on all treatments on this same date. The two biodegradable plastics were Eco-One and Mater-Bi Green. Eco-One mulch was reported (Fritz, 2005) to degrade after approximately 21 days with soil temperatures reported at over 90°F for a three week period. Mater-Bi Green mulch degraded in approximately 48 days with soil temperatures of over 100°F for the six week period.

On August 8 and 9, respectively, dormant Honeoye strawberry transplants were planted at Morris and Alexandria. The plants were planted through what remained of the two biodegradable plastic treatments and the canola treatment. The in-row spacing of strawberry plants was 12” in a staggered double row for a high density planting. Each row was 12’ long, with 3 rows/plot. This experiment was blocked with 9 rows/block, 4 blocks/site, and two sites.

On September 22, 2006, floating row covers were laid over the strawberry plants on all treatments at both sites. Row covers, made of spunbonded polyester material, kept temperatures elevated, admitted light, air, and water thus extending the growing season into the fall. This component was a necessary part of the system to keep the plants growing later into the fall to promote increased flower development for the following year. On November 13 and 15, respectively, the row covers were removed and straw mulch was applied to the strawberry rows for winter protection at both sites. In early spring 2007, the straw will be removed and row covers reapplied to improve early season growth. The row covers will stay on until 10% bloom is achieved and then removed for pollination.

Flail mowing of canola after spraying Roundup®.

Biodegradable plastic installation next to standing canola.

Results

As stated earlier the two biodegradable plastic treatments were predicted to not degrade for approximately 21 days for Eco-One mulch and 48 days for Mater-Bi Green mulch. However, the mulches began disintegrating after 8 days for Eco-One mulch and 25 days for Mater-Bi Green mulch. This left the soil uncovered for a longer period then predicted leading to weed seed germination in the two plastic mulch treatments. The treatment with canola killed and left in place had fair to good weed control throughout the season.

From our West Central Research and Outreach Center weather records the May through August temperatures were above normal. During this same period there were nine days above 90°F. July was the second driest month on record dating back 117 years. Our original objective of applying biodegradable plastics in combination with canola degradation to reduce weed seed germination prior to planting the strawberry plants was not achieved. The warmer then normal 2006 temperatures were probably responsible for degrading the plastic mulches faster then predicted.

Our dormant strawberry plants were ordered from a reputable strawberry nursery in Nova Scotia, Canada. They were aware of our research project and tried very hard to make sure we received the plants in approximately 48 hours. Unfortunately, after the plant order crossed the Canada/US border the shipper took eight days to deliver the strawberry plants. Upon receiving the strawberry plants, we immediately planted them at both sites. Because of the delay in delivery, numerous plants did not leaf out or grow. For this system to work, plants need to be planted in early August. We could not reorder and wait additional time for new plants. Our earlier research with this annual production system concluded that any strawberry transplanted after August 10 would not be productive the following year.

Strawberry plant growth vigor will be monitored in each treatment at the beginning of the 2007 harvest season. Plant vigor will be monitored using a vigor rating of 1 to 5 (1 = poor, 5 = excellent). Strawberry plants will also be monitored visually and scored at both locations for presence of known pathogens during May and June. We will use a rating system of 1 to 5 (1 = disease present, 5 = no disease present).

During the 2007 fruit production season, all ripe fruit will be harvested from a 10’ area of the center row of each treatment plot. Fresh fruit will be weighed and recorded, and pounds per acre will be calculated. As a simple index of individual fruit size, weights will be recorded for 20 fruit at each harvest. Yield data on all treatments in pounds per acre and fruit size will be available after the 2007 picking season.

Management Tips

1. Using canola decreased labor when compared to the traditional matted row system.

2. Annual production of growing strawberries could increase land use efficiency. A cover crop or other short season cash crop (peas, radish, broccoli, cabbage, and cauliflower, etc.) could be grown on the same land before strawberries are planted in late summer.

3. Further experimentation with biodegradable plastics will continue in order to find one that lasts long enough to reduce weed competition in this annual strawberry production system.

4. A better way to ensure prompt delivery of strawberry plants in August, an off season time for nursery producers, is needed.

Cooperators

Ron Branch, owner/operator, Berry Ridge Farm, Alexandria, MN
Vincent Fritz, Professor, University of Minnesota, Southern Research and Outreach Center, Waseca, MN
Emily Hoover, Professor, Department of Horticultural Science, University of Minnesota, St. Paul, MN
Cindy Tong, Associate Professor, University of Minnesota, Department of Horticultural Science, St. Paul, MN

Project Location

This project is located at the University of Minnesota, West Central Research and Outreach Center (Hwy. #329 just east of Morris, MN) and Berry Ridge Farm (1301 Fireman's Lodge Rd. SW, Alexandria, MN).

Other Resources

Fritz, V, and J. Hebel. 2005. Optimizing Zone of Influence from Colored Plastic Mulch for Improved Reflective Benefit and Impact on Glucosinolates in Cabbage. Web site: http://sroc.coafes.umn.edu/research/horticulture/projects/2004Horticulture.pdf

Forcella, F., S. Poppe, N. Hansen, W. A. Head, E. Hoover, F. Propsom, and J. McKenzie. 2003. Biological Mulches for Managing Weeds in Transplanted Strawberry (Fragaria X ananassa) Weed Technology. 17:782-787.

Incorporating mowed canola.

Composting Bedded Pack Barns for Dairy Cows

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Project Duration

2006-2007

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Keywords

bedding, compost, composting barn, cow comfort, dairy housing

Project Summary

Dairy producers in Minnesota and beyond have expressed growing interest in the use of compost barns. The goal of this study was to investigate and compare the design, management, and economics of these barns, along with the composition of the "composted" bedding material. A total of 12 dairy farms in the state of Minnesota were visited and owners were interviewed during summer 2005. The main objective of the study was to characterize the composting bedded pack system. Funds from the MDA Sustainable Agriculture Demonstration Grant Program were used to analyze, and compare the components of bedding from all 12 operations.

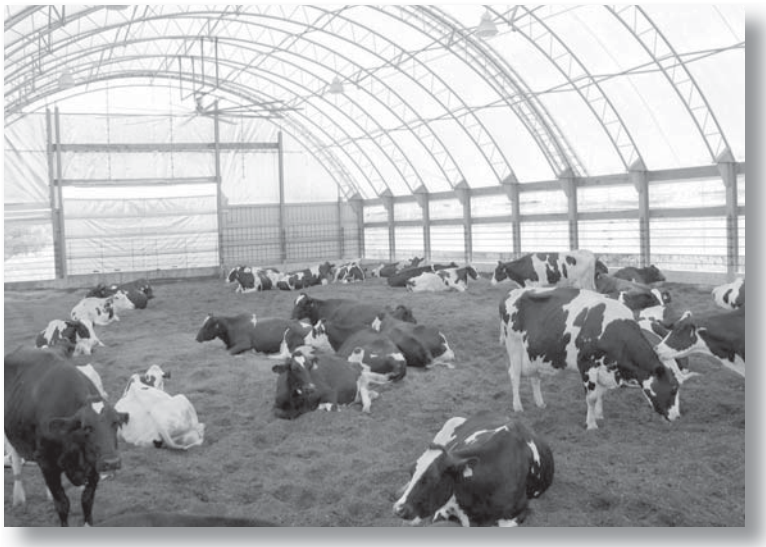
Project Description

Dairy producers are interested in using new or improved housing options in order to maintain a profitable business. Composting bedded pack barns (generally known as compost dairy barns) have raised much interest among dairy producers in the last two years. The first compost barn in Minnesota was built in late 2001 by Portner Brothers from Sleepy Eye. Many more have been built since then.

In a composting barn system, the loafing area is not scraped. Instead, bedding is added as needed and stirred or fluffed on a regular basis. The theory is that the N from cow manure and the C contained in the bedding will create a composting environment that reduces manure volume, stabilizes nutrients, and kills pathogens.

One of the reasons producers have mentioned for adopting this alternative housing system is for improved cow comfort and longevity. A composting bedded pack barn allows cows more freedom of movement than conventional tie stalls or freestalls. These barns may provide a reduction in manure storage costs and needed space, and a savings in labor and manure handling. Our project team saw a need to investigate the chemical composition of the bedding material in compost barns, since most producers spread it in their fields as fertilizer.

This study included 12 dairy farms that are using composting barns. We started with a questionnaire to learn about the farmers' reasons for building this alternative system, their economic performance, including, daily bedding costs; what the producers liked and did not like about their barns, and manure and bedding management.



Cows relax in Mike and Judy Sellner's hoop-style composting dairy barn near Sleepy Eye, MN.

Many farmers in the study used a skid steer loader to aerate the bedding. This is the Dean and Elizabeth Johnson farm near Storden, MN.

Next, we measured barn dimensions and calculated the space allowance per cow in each barn. Using a grid to determine sampling location, we measured bedding pack temperatures at 6, 12, 24, and 36" below the surface using specially designed temperature probes (according to pack depth). At the same 12 locations, we collected 1 qt bedding samples using a soil sampler at two depths per site for chemical analysis. We also took 12 surface samples of bedding material for microbial analysis.

Results

Although the types of facilities varied a little from site to site, all provided a bedded pack area where cows lie down, and a feed alley where cows eat. In general, these barns were built following a freestall barn plan; the composting bedded pack replaced the freestalls and manure alley. All but one dairy had previously used tie stall barn and straw bedding. One dairy had been using a freestall barn with mattresses. All the compost barns were newly built, rather than retrofitted.

The average herd size for the herds enrolled in the study was 73 cows. The DHIA rolling herd average was 23,005 lbs (range of 18,306 to 27,304 lbs) and milk composition was 3.69% milk fat and 3.06% milk protein for the DHIA test nearest to the date of the farm visit. The DHIA SCC was 325,000 cells/mL. The bulk tank SCC for the month prior to our visit was 261,000 cells/mL.

Barn building costs ranged from $33,000 to $300,000, with a cost per cow ranging from $625 to $1,750. The wide range in building costs was affected by how much on-farm labor was used and the amenities added to the barn. The average cost per cow (based upon a uniform space allowance of 80 ft^2/cow – the minimum space allowance recommended by our research team) was approximately $1,200.

The barns all had a 4' high wall separating the pack and feed alley, and 4' high walls around the other three sides of the bedded pack. The wall separating the bedded pack and feed alley had at least one walkway at each end (as a minimum) for cow and equipment access to the pack area. Some operations added a fence on top of the walls to prevent cows from walking over them when the pack reached three or more feet high.

The compost barns in this study were generally bedded with dry fine wood shavings or sawdust. A semi-load of bedding was added every one to five weeks, depending on season, weather conditions and cow density. Fresh bedding was added when the bedding particles became moist enough to adhere to the cows. Bedding costs ranged from $0.35 to $0.85/cow/day.

The bedding material was aerated at a depth of 8-10" at least two times per day to facilitate an aerobic composting process. Aeration of the pack was usually accomplished using a skid steer loader with a front mounted adapted cultivator. Producers said they aerated the pack in order to incorporate oxygen for aerobic decomposition and to provide a fresh surface without accumulated manure for cows to lie down on after returning from the milking parlor and eating.

The farms cleaned out their bedded pack areas entirely once each year, typically in September or October. After removal of the soiled bedding, a load of clean sawdust was added, providing a bedding layer 1 to 1.5' high to start the new pack. With the periodic addition of more sawdust, most packs averaged 4' high by the end of summer. Several farms removed a portion of the pack material in the spring to provide space for bedding accumulation during the summer.

Bedding samples were analyzed for moisture, ammonia, pH, total carbon (C), nitrogen (N), phosphorus (P), potassium (K), and electrical conductance (soluble salts) concentrations. Results are shown in Table 1.

The average carbon to nitrogen (C:N) ratio of all barns in all locations and depths was 19.5:1, which is below the preferred range of 25:1 to 30:1 for composting. A C:N ratio below 25:1 may emit ammonia odor, which may influence the ammonia levels in the compost barns. The ammonia-nitrogen concentrations were greater deeper into the pack than in the top 6 inches. Electrical conductance is a measure of electrical conductivity used to estimate the amount of soluble salts. The average electrical conductance across depths averaged 9.6 mmhols/cm, which is only slightly below the 10 mmhols/cm maximum concentration desired for composting.

The average bedding temperature across all depths, across all pack barns was 108°F, with a range of 76 to 138°F, while the ideal temperature for composting is slightly higher – between 130°F and 150°F. The pack surface temperatures were similar to the ambient temperature. Temperatures tended to be lower on three farms that utilized larger particle wood shavings rather than sawdust for bedding. Temperatures were greater in the areas of the pack that were fluffier, that were not as heavily soiled or packed by the cows. This observation is consistent with the need for oxygen and air for microbial activity that promotes composting.

Surface bedding samples were analyzed for pathogenic mastitis causing bacteria. Bacterial counts in the bedding material are positively correlated with bacterial counts on the teat ends and the rates of clinical mastitis in lactating dairy cows. Low concentrations of mastitis causing bacteria are desirable in bedding used for dairy cows. The total bacteria counts for the 12 barns in this study averaged 9,122,700 (± 6,171,520) cfu/cc with a range of 2,035,562 cfu/cc to 22,562,604 cfu/cc. It is generally recommended that bedding material have less than 1,000,000 cfu/cc. However, what is most important is not necessarily the number of bacteria found in bedding, but how well the cow preparation procedure at milking is done. Of the total bacterial counts found in bedding 10.7% were coliforms, 39.4% were environmental Streptococcus species, 17.4% were environmental Staphylococcus species and 32.5% were Bacillus species. The high bacteria counts found in compost barns emphasize the importance of excellent cow preparation procedures at milking.

It appears that like in other housing systems, management is key to maintain cow health and low levels of SCC. We found that producers using this system had varying levels of SCC which probably depended on how well they managed the pack and prepared their cows at milking time. However, there are no direct comparative data to reach a conclusion. More research is needed. We could say that compost barns can be an adequate system to house dairy cows, but they are probably similar to other systems in terms of animal performance. There was improved feet and leg health compared to previous studies in freestalls.

Table 1. Composition analysis of bedding from 12 composting dairy barns in Minnesota

	Average for barns in study	Range for barns in study	Recommended levels for composting
Bedding Temp, F	108	76 - 138	130-150
Moisture, %	54.4	28 - 78.9	50 – 60
pH	8.5	6.5 - 9.9	6.5 - 8.0
N, %	2.54*	0.57 - 4.22	
P, ppm	3,247	378 - 6,668	
K, ppm	15,270	2,568 - 29,570	
C:N ratio	19.5:1	10.9 - 87.5	25:1 – 30:1
Electrical Conductance, mmhols/cm	9.6	2.4 - 20.5	10 maximum

** Sawdust, on average, has an N content of 0.24%.*

The producers interviewed for the study cited bedding availability as their main concern. Most producers inquired about what other sources of bedding besides sawdust could be used. Our compost dairy barn team has started a follow-up study to investigate what other materials could work.

Knowing how curious dairy producers are about this system, we did a considerable outreach about the project. Results were included in the Compost Barn newsletter on the University of Minnesota Dairy Extension website (www.extension.umn.edu/dairy) and mailed to a producer mailing list. Two articles about the experiment ran in the *Dairy Star,* a dairy-oriented publication that has a circulation of about 11,000 readers in Minnesota, Northern Iowa, and South Dakota. In addition, the principal investigator gave talks at the Minnesota Dairy Health Conference, Minnesota Nutrition Conference, Midwest Dairy Expo, Wisconsin Veterinary Medical Association Annual Convention, University of British Columbia, and Cornell University (NY) Fall Conference. Most of these talks included various pictures of compost barns and therefore attendees had the opportunity to have a virtual tour of these operations.

Management Tips

1. Aerate the pack at least twice a day to provide a more comfortable surface for the cows to lie down on and possibly facilitating composting process.

2. Follow careful sanitation/preparation procedures at milking time to prevent high cell counts in milk.

3. Add bedding material as soon as you notice bedding adhering to the cows. If you wait a week for a load of sawdust to be delivered, the barn will become a “manure” pack instead of a compost pack.

Cooperators

Abby Barberg, Graduate Student, University of Minnesota. St Paul, MN
Tom and Mark Portner, Port-Haven Dairy, Sleepy Eye, MN
Ray and Cheryl Seibert, Dairy Farmers, Sebeka, MN
Ten other dairy producers also participated in the study.

Project Location

Contact the Principal Investigator for directions to the individual project sites. Please call the farms ahead of time if you want to visit. Keeping diseases and unintended microbes off of dairy farms is an important part of keeping cows healthy.

Other Resources

University of Minnesota Extension. Dairy Extension Team Compost Barns web page: www.extension.umn.edu/dairy/management/compostbarns.htm
Includes fact sheets and back issues of the *Compost Dairy Barn Newsletter*.

Comparing Alternative Laying Hen Breeds

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Project Duration

2005 to 2007

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Keywords

Aracauna, Buff Rock, chickens, eggs, hens, layers, Leghorn, Silver Gray Dorking, Speckled Sussex

Project Summary

This project was designed to help determine the feasibility of raising alternative breeds of laying hens in relation to their long-term effects on egg production. Ideally, I would like to have a flock in which individual birds only need to be replaced every four to five years. Should raising these alternative breeds prove to be successful, it will help me diversify my farm operation, as well as demonstrate to other farmers the potential benefits of raising alternative breeds. I think that doing this project is very important in order to offer farmers alternatives to raising the popular Leghorn laying hens that need to be replaced every two years. The ability to direct market a diversity of crops over an entire year is important to the success of my farming operation and for all sustainable farmers at large. I feel that it is important to investigate farming alternatives and acknowledge customer preferences.

Project Description

Most egg-laying operations consist of commercial Leghorn breed chickens, which must be replaced every one to two years. Alternative breeds, which live and produce longer, may result in savings by reducing the frequency with which hens need to be replaced. This study compares Leghorns directly with other breeds of chickens with the goal of seeing whether or not the other breeds can compete with the Leghorns over time. Other objectives include comparing the cost of production of eggs among breeds and comparing customer preference for egg color.

The breeds I used for 2006 are listed in Table 1. Speckled Sussex and Silver Gray Dorkings (Dorkings) are long-established European breeds, while Buff Rocks are a traditional American breed. All of these breeds cost roughly 1.5 to 2 times as much as Leghorns, which originated in Italy. The Sussex and Buff Rock birds are larger than Leghorns and have a longer life expectancy. While I used Dorkings in 2006, their egg production was so poor that I removed them from the project and replaced them with Arcaunas in the fall of 2006. The Aracaunas lay green eggs, and preliminary data indicates that the Aracaunas are laying satisfactorily so far. However, since they are younger than the other birds in the study, their egg-laying data cannot be directly compared.

Sue's son, David Stanislow with one of the Aracaunas.

Table 1. Layer Species Used in the Project

Breed	Egg Color
Buff Rock	Dark Brown
Dorking (2006) Aracauna (2007)	White Green
Leghorn	White
Speckled Sussex	Light Brown

I began the project on April 1, 2005 with one rooster and 15 hens of the Buff Rock, Leghorn, and Speckled Sussex breeds. The Dorkings started with 14 hens. The birds were about one year old and already laying when the project started. I kept the birds in two pens inside a converted dairy barn. Each pen contained one white egg breed and one brown egg breed, along with a nesting box and roosting area. Speckled Sussex and Dorkings (later replaced with the Aracaunas) were housed together in one pen; Buff Rocks and Leghorns were housed in the other. My research indicated that there was not a significant difference in feed consumption between breeds, so I set them up this way to make daily chores easier. Separating breeds that lay the same color eggs reduced the possibility of recording errors in monitoring egg production. The hens were allowed to go outside when the weather was warmer than freezing, and they were given continuous and unlimited access to fresh water, 19% protein fish meal feed, oyster shells, and grit (winter only).

Besides looking at egg-laying longevity, I also wanted to investigate the effect of egg color on buyer choice. I have found through my research that customers greatly prefer the brown eggs over the white eggs. It is still too early to have definitive information on customer preference between the green and white eggs.

Results

The results of my project are provided in Figure 2, which shows that the Leghorns are continuing to outlay the Buff Rocks and Speckled Sussex. The data on the Aracaunas are not yet complete enough to draw any definitive conclusions. Production, mortality rate, cost of production, and customer satisfaction information collected during the next year of this project will show how feasible it is to raise laying breeds other than the popular Leghorn.

It will be interesting to see next year's data. This information will help to determine the ideal time to butcher the birds. It will show how long I will get eggs from the different breeds while still having them alive for stewing hens.

I have also been researching different feeding methods that are cost-efficient and that are well tolerated by the chickens. Two years ago, I started with a 17% protein, corn and soybean meal mixture, but in December of 2005 I switched to a 19% protein fish meal because the chickens did not seem to like the soybean meal very well. This change in protein content improved the egg production rates in all breeds except for the Leghorns. Currently, the birds eat a bulk 19% protein mixture that I blend myself, and I buy the feed components directly from our local cooperative feed mill and a local farmer. Although the fish meal is more expensive than the soy, I am still saving money by blending the meal myself rather than purchasing ready-mixed feed. In the beginning I was hoping to produce organic eggs, but the cost of the premixed feed and transportation were prohibitive; feed costs exceeded egg revenue. I have found that it is simply not economically feasible for me to do an organic egg operation due to my small number of hens.

I have also noticed that the Aracaunas and Leghorns are much more active than the bigger Sussex and Buff Rock breeds and benefit from being allowed outside. The two smaller breeds also really like to eat hay in addition to their regular feed.

I have already noticed that most of my customers prefer brown eggs from my Buff Rocks and Speckled Sussex hens over the white eggs from the Dorkings and Leghorns. I have found that consumers appreciate what I do on my farm and buy eggs from me because they know me

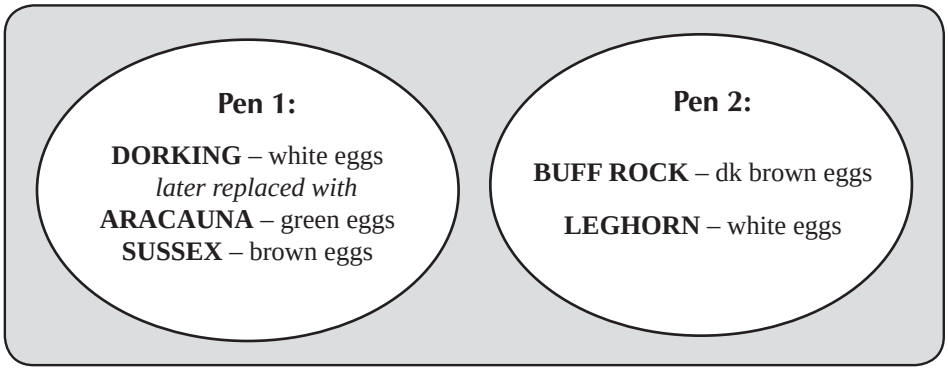
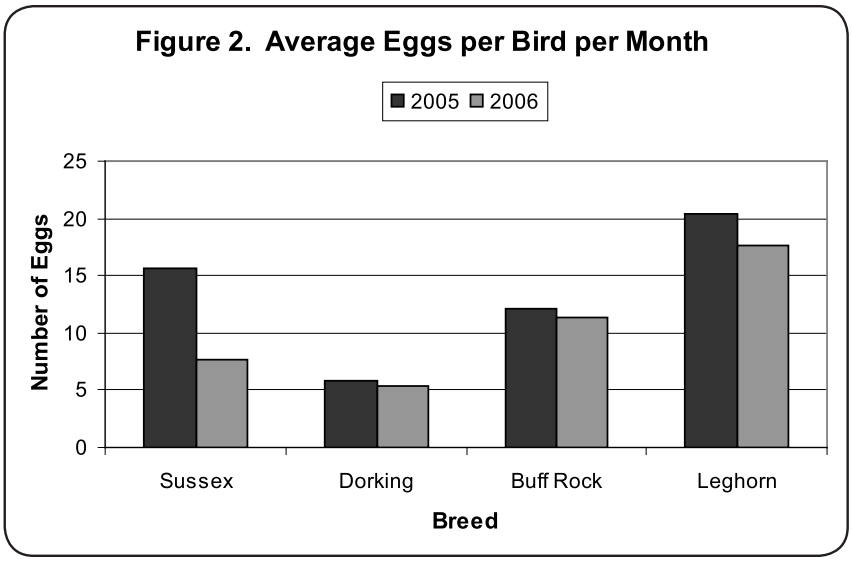


Figure 1.

Pen Setup – To make it easier for us to track laying rates accurately, each pen housed one breed that lays brown eggs and one that lays white (or, in the case of Aracauna chickens, green) eggs.



personally. But eggs are just one aspect of my farm operation. I also own Tibetan yak, Icelandic and Shetland sheep, meat/dairy cross goats, potbelly pigs, Satin Angora, French Lop, and Holland Lop rabbits, llamas, and an alpaca. We have a small market/herb garden and raise meat chickens in the summer as well. I am currently marketing my goods to the Foreston creamery and the Saint Cloud Farmers' Market. Soon I will be selling my yak meat at the Mill City Market in Minneapolis, where there is a large consumer population that is interested in purchasing yak meat.

Management Tips

1. Artificial light can boost egg production significantly during short winter days. Extra light is especially important to egg-laying ability. Fluorescent and incandescent lights are great choices.

2. Temperature does not appear to make a significant impact on production, although keeping the birds' living area above freezing is a good idea.

3. Higher protein egg mash makes a difference in egg production of some species, but had little effect on the Leghorns.

4. Pay attention to which eggs sell first; our farmers' market and direct market customers prefer brown eggs to white, and darker brown eggs over lighter brown eggs.

5. Guineas are fairly effective for rat control, although if you can convince a cat to stay in the pen with the chickens, it is even better. Rat breed dogs are also effective, but they tend to like to eat the eggs.

Cooperators

David Staneslow, Foley, MN

Project Location

From US Hwy. 10 in St. Cloud go northeast on Benton County 3 (approximately 20 miles). It will become Morrison Cty. 30 which comes to a "T", and then it becomes Morrison Cty. 26 or Nature Rd. Go right (east) at the "T". In approximately 1.5 miles the farm is on the north (left) side of the road. Sign says "Azariah Acres Farm."

Other Resources

American Pastured Poultry Producers Association. 6475 Norton Creek Rd., Blodgett, OR 97326, 541-453-4557, www.apppa.org

ATTRA-National Sustainable Agriculture Information Service. Various poultry publications available free of charge in English and Spanish. 800-346-9140 or www.attra.ncat.org

Minnesota Department of Agriculture. 2005. *Poultry Your Way.* Available by calling 651-201-6012 or at www.mda.state.mn.us (contains a chapter on pastured poultry and an extensive "Resources" section).

Salatin, Joel. 1993. *Pastured Poultry Profits.* Available from some libraries and booksellers and from Polyface, Inc., 43 Pure Meadows Ln., Swoope, VA 24479, 540-885-3590.

Sustainable Farming Association of Minnesota. Local chapters offer many field days and workshops. You can find your local chapter at: www.sfa-mn.org

Managing Hoops and Bedding and Sorting Without Extra Labor

Principal Investigator

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Swift County

Project Duration

2005 to 2006

Staff Contact

Wayne Monsen
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Keywords

alleyway, bedding, hogs, hoop barns, sorting

Project Summary

Hoop barns are economical and environmentally friendly, but there always seems to be the same questions: how do you sort pigs in an alleyway and how do you bed your hoops? These problems are not unique to our farm. Other hog producers who use hoop barns are facing the same problems. After talking to other producers and looking at different ideas, we set up an outside alleyway on one end of the hoops with a gating system design in our hoops, which we feel will allow one person to bed a hoop building without any additional laborers. Also, we feel that with this design, we can sort hogs in hoop buildings with only two people.

Project Description

Our family includes me, my wife, Jane, and our children, Amber, Kimberly, Stephanie, and Matthew, all in their early twenties or teens. Our farming operation consists of hogs, cattle, and sheep. We raise 40 purebred Berkshire hogs that we sell as breeding stock as well as market into a specialty market for export to Japan. We also have a small herd of beef cows and sell the calves for butcher. The small herd of sheep is raised for 4-H and FFA projects for our children.

The way we used to sort pigs would be to back the trailer up to the north side of the hoop and open the gate part way. We would use sorting panels to sort pigs out one at a time until we had all the pigs we needed. What an adventure! As with any operation, sorting pigs can be a very stressful experience for the pigs and especially the family.

When we cleaned the hoops in the past, we had to have all the pigs sold and out of the hoops. At times we needed to clean and spread manure before planting or before the snow flies which may not coincide with having the hoop empty.

The problem with all of this is that our children are active in sports and other school activities and not always available to help when extra sets of hands are needed. We would have to work around their schedules to sort pigs or bed the hoops instead of doing the bedding when it was needed. It will not be long before our children have all graduated

Matthew moving hogs through runway to the scale.

and left home. At that point, we would have to evaluate how to get things done or quit raising hogs, which we don't want to do.

We made the decision to construct a 12' outside alleyway because, in the past, every time we needed to bed the hoops we needed at least two of our children to help open gates and keep the pigs from running all over the yard. Also, when we needed to sort off gilts for sale as breeding stock or market hogs, we needed all our children to help as well.

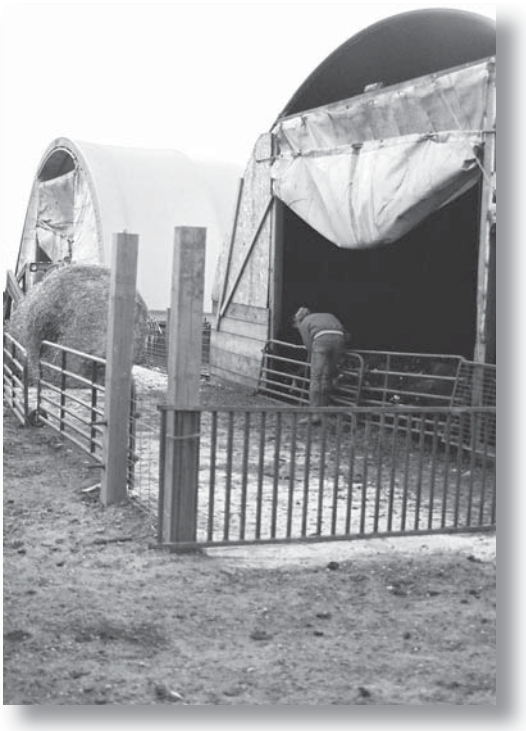
2005 Results

The 12' outside alleyway was used for the first time in 2005 and really reduced the work and the number of people needed to sort hogs, bed, and clean the hoops. The alleyway is built along one end of each of our three hoops. It is concrete with hog panels attached to posts on the outside of the concrete. Gates were setup along the fence to make it easy to go into the hoop for cleaning and sorting. We used concrete because it will be easier to clean and it will prevent the pigs from rutting as they will be spending a fair amount of time in the alleyway.

Here is a brief explanation on how I bed the hoops now. I bring as many round bales into the alleyway as we need to put into the hoops, usually two to three bales. Then I close the end gate to the alleyway and open the gates into the hoop barn. The pigs are free to go into the alleyway if they want. I then use the skid steer to bring the bales in and put them where I want them and then back the skid steer down the alleyway. Finally, I chase the pigs back into the hoop and I am done bedding the hoop all by myself.

The alleyway makes it relatively fast and easy to bed the hoops. We have timed both methods and it only takes half the time with the alleyway system. Matthew beds the hoop by himself and I am sure the girls could do it also, but Matthew won't let them run the skid steer.

The sorting system is also working fine. I feel the system is less stressful for the pigs as well as the family. I let the pigs out in the alleyway where I mark the pigs I want with a paint stick. Then with one helper, we use sorting panels to work the unmarked pigs back into the hoop barn and shut the gates. I back the livestock trailer to the end alleyway and load the pigs.



Moving bedding bale into the alleyway.

I want to try another gate system in the alleyway that would allow the pigs to sort themselves. The gate would let small pigs through and keep the big ones back.

2006 Results

In 2006, we installed the improved sorting system. We purchased some gating and set up a system to funnel the pigs into a runway with a scale at the end. We can either weigh the pigs or just let them run on through. We also found that this system works well if the pigs have a chance to get used to going along the gates and through the scales.

Another way we sort pigs is to use swing gates to make the alleyways smaller. If we have a small number of pigs in a shelter, less than 30, we will run them out into the alleyway, paint mark the ones to sell and sort them off. Matthew and I have both sorted pigs ourselves using the swing gates.

In the spring of 2006 we had the use of two tandem manure spreaders. Using our skid steer with a grapple fork Matthew and I proceeded to clean the two finishing hoop barns in eight hours. Previously when we used a loader tractor and manure bucket it would take eight hours to clean one hoop. By having the right equipment and moving the pigs to the alleyway we were able to get twice as much done and save half the fuel.

This system saves labor and makes for a much more enjoyable time when bedding and sorting hogs. Jane has helped me several times to sort and load pigs. She does not mind this job anymore knowing that it will not be a stressful experience.

The take home message from this project is: Plan a working alleyway if you plan to raise hogs in hoops. It makes your job a lot easier.

Management Tips

1. Let the pigs out in the alleyway from time to time so they become trained to go in and out with little effort.

2. One of the most important pieces of equipment for operating hoop barns is the skid steer. The skid steer must be large enough to handle round bales and clean out the hoop.

3. Cleaning a hoop with a skid steer with a manure fork and grapple hook takes one-half the time and less than half the fuel as cleaning with a tractor with a loader and manure bucket.

Cooperator

Wayne Martin, Alternative Swine Production Systems Program, University of Minnesota, St. Paul, MN

Project Location

From Kerkhoven go 1 mile south on Swift Cty. 35. Go straight ahead (south) on the gravel road for 1 mile. The Stassen farm is on the east side of the road.

Other Resources

Alternative Swine Production Systems Program, University of Minnesota Extension, 385 Animal Science Building, 1988 Fitch Ave., St Paul, MN 55108, 612-625-6224.

University of Minnesota Extension Service. 2001. Hogs your way: Choosing a hog production system in the Upper Midwest. Publication No. BU-7641-S. University of Minnesota Extension, St. Paul, MN, 612-625-8173 or 800-876-8636.

University of Minnesota Extension Service. 1999. Swine source book: Alternatives for pork producers. Publication No. PC-7289-S. University of Minnesota Extension, St. Paul, MN, 612-625-8173 or 800-876-8636.

Demonstration of How Feeding In-line Wrapped High Moisture Alfalfa/Grass Bales will Eliminate Our Fall and Winter "Flat Spot" in Grassfed Beef Production

Principal Investigator

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Chippewa County

Project Duration

2006 to 2008

Staff Contact

Wayne Monsen
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Keywords

baleage, forage, rate of gain, relative feed quality (RFQ), winter stored forage

Project Summary

Graziers who want to grass finish beef are in need of ways to achieve a consistent rate of gain on their market animals throughout the year. Having a way to store forage for winter feed that is close to the quality of forage during summer grazing is a huge challenge. This project will demonstrate the use of an in-line round bale wrapper to seal high moisture round bales as baleage for use during the non-grazing season. Weighing animals during the grazing season and during the winter will help determine if consistent weight gains are achievable year around. Both the grazing forage and the baleage will be analyzed for relative feed quality (RFQ). RFQ measures the total energy consumed by the animal.

Project Description

Four grassfed beef producers will weigh cattle on 60-90 day intervals and test the grazing forage and the stored forage to try to find a connection between the feed quality and the rate of gain. During the non-grazing time, some of the farms will use only high moisture wrapped baleage, some will use baleage and dry hay, and one will use only dry hay for the first year of the project.

All of the cattle used in the project have EID tags that identify them as they walk onto the electronic scale. The weights are automatically recorded in the scale computer which then calculates average daily gain. Information about each animal such as date of birth, breed, and other data the producer chooses to input is already recorded in the computer.

Scale and chute used for weighing the cattle.

The plant species and percent of forage and baleage at the different farm sites were:

Site #1: For grazing – 65% tall fescue, 15% white clover, 5% red clover, 15% mixed grass
For baleage – 50% alfalfa, 50% tall fescue

Site #2: For grazing – 25% tall fescue, 25% Italian rye, 25% white clover, 25% Berseem clover
For baleage – 80% alfalfa, 20% orchardgrass

Site #3: For grazing – 50% wheatgrass, 25% smooth bromegrass, 15% alfalfa, 10% ryegrass
For baleage – no baleage was used, dry hay similar to grazing mixture

Site #4: For grazing – 30% smooth bromegrass, 30% orchardgrass, 20% alfalfa, 20% red clover
For baleage – mature 30% smooth bromegrass, 30% orchardgrass, 20% alfalfa, 20% red clover

2006 Results

The baleage was made at four cuttings on one farm and only at the last cutting on two farms. Two methods of cutting were used: a 14' windrower and a 10' disc mower with a conditioner. The hay was left in a wide windrow for a day. The next morning when the hay was still tough, two windrows were raked together and the round baler was right behind as we wanted to get 40% moisture hay. The bales were hauled to the storage site and wrapped as soon as possible on the same day.

We took forage samples from each field and at each cutting. The RFQ was better on the baleage from later cuttings. We identified the rows of wrapped baleage that each sample was from so that we could use the forage that best fit the needs of the cattle. Fat cattle received the best baleage, growing calves were next, and the cows got the lowest quality usually mixed with purchased grass hay.

The RFQ samples for most of the pasture forage samples were also higher for the forage samples taken at the late summer grazing (Table 1). There was a shortage of moisture in 2006 which impacted the results of the first weight period, especially on farms #1 and #3. The RFQ at farm #4 was low due to the forage being vary mature at the time of cutting and baleage wrapping. Farm #1 grazed into December and had a high RFQ of 205 on December 11.

The average daily gain was also higher at the winter weighing than the late summer weighing (Table 2). This can also be attributed to the lack of moisture at the time of the late summer weighing causing poorer quality forage on the pasture.

Table 1. Comparison of Relative Feed Quality for 2006 on Four Farms in Western Minnesota

Farm	Date	Forage Type	Relative Feed Quality (RFQ)
#1	7/19/06	pasture	153
#1	12/11/06	pasture	205
#2	8/15/06	pasture	162
#2	9/15/06	pasture	175-230
#2	8/11/06	baleage	182-232
#3	8/15/06	pasture	152
#3	10/06/06	pasture	208
#4	9/12/06	pasture	196
#4	10/18/06	pasture	120

Forty bales were wrapped at West Central Research and Outreach Center (WCROC) during their demonstration field day. Forage samples are being taken on a scheduled basis during storage to determine storage losses. Results of the long term storage will be reported next year.

After one year of results the farmer participants are pleased with the rate of gain on their animals during the winter non-grazing periods. They see the value of having high RFQ in the forages for achieving improved rate of gain in the animals.

Management Tips

1. Forage testing at each cutting or grazing is crucial for managing to achieve good rate of gain on the animals.

2. The use of the electronic scale is a must to keep track of the cattle and allows us to easily access information on each animal.

Cooperators

Richard Handeen, grazier, Montevideo, MN
Luverne Forbord, grazier, Starbuck, MN
Mark Erickson, grazier, Donnelly, MN
Dennis Johnson, dairy scientist, WCROC, Morris, MN
Margot Rudstrom, agricultural economist, WCROC, Morris, MN

Project Location

For specific locations, call Don Struxness at 320-734-4877 or email at dbstruxness@fedteldirect.net

Other Resources

Blanchet, K., H. Moechnig, and J. DeJong-Hughes. 2000. Grazing systems planning guide. MN Publication No. BU-07606-S. University of Minnesota Extension Service, St. Paul, MN, 612-625-8173 or 800-876-8636.

Graze. PO Box 48, Belleville, WI 53508, 608-455-3311, graze@mhtc.net. Newspaper devoted to grazing. Published ten times per year.

Jeranyama, P., and A. Garcia. 2004. Understanding Relative Feed Value (RFV) and Relative Feed Quality (RFQ). SD Publication N. ExEx8149. South Dakota State University Cooperative Extension Service. Access at: http://agbiopubs.sdstate.edu/articles/ExEx8149.pdf

Jung, G.A., A.J.P. Van Wijk, W.F. Hunt, and C.E. Watson. Ryegrasses. P.605-641. In L.E. Moser et al. (ed.). Cool-season forage grasses. Agron. Mongr. 34. ASA, CSSA, SSSA, Madison, WI.

Peterson, Paul. March 16, 2006. Seeding Grasses with Alfalfa: This "Old" Idea Makes Cent$ Today. Minnesota Crop eNews. University of Minnesota Extension Service. Access at: www.extension.umn.edu/cropenews

The Stockman Grass Farmer. PO Box 2300, Ridgeland, MS 39158-2300, 800-748-9808. Monthly publication devoted to grazing.

Table 2. Comparison of Animal Weights for 2006 on Four Farms in Western Minnesota

Farm	Date	Average Weights (lb)	Average Daily Gain (lb/day)	Minimum Daily Gain (lb/day)	Maximum Daily Gain (lb/day)
#1 - initial weight	6/23/06	827			
#1 - 2nd weight	9/13/06	912	1.25	0.6	1.8
#1 - 3rd weight	12/11/06	1,054	2.3	1.7	3.2
#1 - initial wt/2006 calves	12/11/06	569			
#2 - initial weight	5/29/06	658			
#2 - 2nd weight	8/30/06	834	1.9	1.2	2.8
#2 - 3rd weight	11/14/06	994	2.5	1.6	4.1
#2 - 4th weight	1/1/07	1,133	2.39	1.6	3.5
#2 - initial wt/2006 calves	12/27/06	492			
#3 - initial weight	7/5/06	691			
#3 - 2nd weight	9/11/06	774	1.22	0.5	1.6
#3 - 3rd weight	11/18/06	906	1.94	1.4	2.4
#3 - initial wt/2006 calves	11/18/06	432			
#4 - initial weight	6/20/06	891			
#4 - 2nd weight	9/12/06	1,051	1.9	0.9	2.7
#4 - 3rd weight	12/19/06	1,169	1.2	0.7	2.0
#4 - initial wt/2006 calves	12/20/06	613			

New Demonstration Grant Projects - 2007

Alternative Markets and Specialty Crops

Introducing Cold-hardy Kiwifruit to Minnesota Farmers

James J. Luby
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1970 Folwell Ave., 342 Alderman Hall
St. Paul, MN 55108
612-624-3453
lubyx001@umn.edu
Carver County . . . . . 3 years

This project will provide Minnesota farmers with firsthand experience in the culture and management of growing tasty and highly-nutritious cold-hardy kiwifruit using a sustainable approach that prevents soil erosion, conserves soil moisture, and integrates several natural biological measures. The project will involve kiwifruit demonstration plantings on a farm and at the University of Minnesota's Landscape Arboretum to help farmers learn about growing this new crop.

Cropping Systems and Soil Fertility

Determining More Environmentally and Economically Sound Ways to Deal with Low Phosphorus Levels in Various Cropping Systems Including Organic With or Without Livestock Enterprises

Carmen Fernholz
2484 Hwy. 40
Madison, MN 56256
320-598-3010
fernholz@umn.edu
Lac qui Parle County . . . . . 3 years

This project will evaluate the management and economic values of different types of phosphorus soil treatments. We will compare a specific livestock manure application to a method that involves two kinds of organic, raw, rock phosphate applications. The goals of our project are to determine whether adequate phosphorus levels can be achieved through either of these methods and to determine the duration of effectiveness with each procedure.

Hardwood Reforestation in a Creek Valley Dominated by Reed Canary Grass

Timothy M. and Susan C.M. Gossman
31924 Ninebark Rd.
Chatfield, MN 55923
507-867-3129
timg@fmwildblue.com
Fillmore County . . . . . 3 years

The objective of our project is to reforest creek bottomland that is currently dominated by reed canary grass. We will utilize several techniques for removing the grass and replacing it with hardwood trees. This reestablished hardwood forest will increase biodiversity in the area, improve wildlife habitat, and provide salable timber, nuts, and acorns.

Energy

On-farm Biodiesel Production from Canola

Steve Dahl
1212 Seventh St. SW
Roseau, MN 56751
218-463-1569
srdahl@mncable.net
Roseau County . . . . . 2 years

This project will demonstrate and document on-farm production of biodiesel made from canola grown in northwest Minnesota. Canola oil will be extruded from the seed by utilizing an oilseed press. The canola oil will then be processed in a biodiesel reactor to produce biodiesel and glycerol and canola meal by-products. The biodiesel will be used in diesel engines, while the by-products will be fed to livestock.

Evaluation of the Potential of Hybrid Willow as a Sustainable Biomass Energy Alternative in West Central, Minnesota

Diomides S. Zamora
University of Minnesota Extension Service
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Brainerd, MN 56401
218-828-2332
zamor015@umn.edu
Wadena County . . . . . 3 years

We would like to offer agricultural options for landowners of Wadena County for generating income while simultaneously realizing the ecological benefits of planting willows as an alternative to hay. In this project we will evaluate hybrid willow from New York as a potential energy crop for the area. This tree presents both potential market material as a bioenergy crop and also ecological benefits through wildlife and water improvement.

Fruits and Vegetables

Controlling Western Striped Cucumber Beetles in Winter Squash and Pumpkin Production Using Organic Methods

Peter Hemberger
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Hutchinson, MN 55350
320-587-0310
info@augustearth.com
McLeod County . . . . . 1 year

Our project will evaluate the effectiveness of perimeter trap crops and baited sticky traps in minimizing the amount of damage to our crops caused by cucumber beetles. We will compare the results of two experimental plots with one control plot. The organic insect repellent methods serve to increase crop yields without the use of toxic, expensive, and laborious controls and will ultimately improve the quality of life on our farm and in our community.

Intercropping Within a High Tunnel to Achieve Maximum Production

Mark Boen
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218-736-2563
yoursuccesstheticket@yahoo.com
Otter Tail County . . . . . 3 years

We will measure the effects of intercropping in high tunnels. The primary crops of tomatoes, cucumbers and pole beans will be intercropped with secondary crops such as lettuce, radishes, onions, beets, and carrots. We will then measure the added productivity of each plant. A control group of each primary crop will be compared against the experimental crops to measure the effectiveness of high tunnel intercropping.

Insect and Disease Pressure in Unsprayed Apple Orchards in Central and Northern Minnesota

Thaddeus McCamant
803 Roosevelt #303
Detroit Lakes, MN 56501
218-846-0741
thaddeus@lakesnet.net
Becker, Todd, Chisago, Pope, Stearns Counties . . . . 2 yrs

In this project I will monitor codling moth, apple scab, apple maggot, and plum curculio in unsprayed apple orchards in order to demonstrate that codling moth and apple scab controls may be unnecessary in some areas of Minnesota. Through this research, I will gain insight into why apple scab is rare in northern and central Minnesota and also establish the northern and western limits of codling moth.

Livestock

A Comparison between Cornstalk and Soybean Straw for Bedding Used for Hogs, and Their Relative Nutrient Value for Fertilizer

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Henderson, MN 56044
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jdballus@yahoo.com
Sibley County . . . . . 3 years

In this project I will compare cornstalk to soybean straw and determine which makes the most effective bedding material for hogs. I will evaluate and rate the two materials in terms of how easily they can be applied to and removed from the hog barns, the ease in composting, and the nutrient value they presents when used for fertilizer bedding.

Completed Grant Projects...

Final Greenbook Article	Title of Project	Grantee

Alternative Markets and Speciality Crops

2005	Creating Public Recognition of and Demand for "Grass-Fed" Dairy Products Through the Development of Brand Standards and Promotion of These Standards to the Public	Dan French
2004	Collaborative Character Wood Production and Marketing Project	Cooperative Development Services/Isaac Nadeau
	Creating Consumer Demand for Sustainable Squash with Labels and Education	Gary Pahl
	Integrated Demonstration of Native Forb Seed Production Systems and Prairie Land Restoration	Michael Reese
	Pride of the Prairie: Charting the Course from Sustainable Farms to Local Dinner Plates	Kathleen Fernholz
2003	Demonstrating the Market Potential for Sustainable Pork	Prairie Farmers Co-op/Dennis Timmerman
	Evaluating the Benefits of Compost Teas to the Small Market Grower	Pat Bailey
	Flour Corn as an Alternative Crop	Lynda Converse
2002	Increasing Red Clover Seed Production by Saturation of Pollinators	Leland Buchholz
	Propagation of Native Grasses and Wildflowers for Seed Production	Joshua Zeithamer
2001	Establishing Agroforestry Demonstration Sites in Minnesota	Erik Streed/CINRAM
	Managed Production of Woods-grown and Simulated Wild Ginseng	Willis Runck
	Midwest Food Connection: Children Monitor on Farms	Midwest Food Connection
	Phosphorus Mobilization and Weed Suppression by Buckwheat	Curt Petrich
2000	Converting a Whole Farm Cash Crop System to Keeping an Eye on Quality of Life and the Bottom Line in Sustainable Agriculture by Using Key Farm Economic Ratios to Aid in Decision Making	Red Cardinal Farm
	Dry Edible Beans as an Alternative Crop in a Direct Marketing Operation	Bruce & Diane Milan
	Native Minnesota Medicinal Plant Production	Renne Soberg
1999	An Alternative Management System in an Organic, Community Supported Market	Candace Mullen
	Cultural and Management Techniques for Buckwheat Production and Marketing	Tom Bilek
	Pond Production of Yellow Perch	John Reynolds
1998	Establishing and Maintaining Warm Season Grasses (Native Grasses)	Pope County SWCD
	On-farm Forest Utilization and Processing Demonstrations	Hiawatha Valley RC&D

Final Greenbook Article	Title of Project	Grantee
1995	Cash Crop Windbreak Demonstration/Development	Phil Rutter
	Cutter Bee Propagation Under Humid Conditions	Theodore L. Rolling
	Red Deer Farming as an Alternative Income	Peter Bingham
	Wildflower Seeds as a Low-input Perennial Crop	Grace Tinderholt & Frank Kutka
1992	Alternative Mulch Systems for Intensive Specialty Crop Production	Ron Roller/Lindentree Farm
	Benefits of Crop Rotation in Reducing Chemical Inputs and Increasing Profits in Wild Rice Production	George Shetka
	Benefits of Weeder Geese and Composted Manures in Commercial Strawberry Production	Joan Weyandt-Fulton
	Common Harvest Community Farm	Dan Guenthner
	Mechanical Mulching of Tree Seedlings	Timothy & Susan Gossman
	Minnesota Integrated Pest Management Apple Project	John Jacobson

Cropping Systems and Soil Fertility

2006	Gardening with the Three Sisters: Sustainable Production of Traditional Foods	Winona LaDuke
2005	Chickling Vetch—A New Green Manure Crop and Organic Control of Canada Thistle in Northwest Minnesota	Dan Juneau
	Feasibility of Winter Wheat Following Soybeans in Northwest Minnesota	Jochum Wiersma
	Treating Field Runoff through Storage and Gravity-fed Drip Irrigation System for Grape and Hardwood Production	Tim Gieseke
	Use of Rye as a Cover Crop Prior to Soybean	Paul Porter
2004	Development of Eastern Gamagrass Production	Nathan Converse
	In-field Winter Drying and Storage of Corn: An Economic Analysis of Costs and Returns	Marvin Jensen
	Mechanical Tillage to Promote Aeration, Improve Water Infiltration, and Rejuvenate Pasture and Hay Land	Robert Schelhaas
	Native Perennial Grass – Illinois Bundleflower Mixtures for Forage and Biofuel	Craig Sheaffer
	Northwest Minnesota Compost Demonstration	John Schmidt & Russ Severson
	Potassium Rate Trial on an Established Grass/Legume Pasture: Determining Economic Rates for Grazing/Haying Systems	Dan & Cara Miller
	Woolly Cupgrass Research	Leo Seykora
	Yield and Feeding Value of Annual Crops Planted for Emergency Forage	Marcia Endres
2003	Aerial Seeding of Winter Rye into No-till Corn and Soybeans	Ray Rauenhorst
	Dairy Manure Application Methods and Nutrient Loss From Alfalfa	Neil C. Hansen
	Manure Spreader Calibration Demonstration and Nutrient Management	Jim Straskowski
	Replacing Open Tile Intakes with Rock Inlets in Faribault County	Faribault County SWCD/Shane Johnson
	Soil Conservation of Canning Crop Fields	Andy Hart

Final Greenbook Article	Title of Project	Grantee
	Using Liquid Hog Manure as Starter Fertilizer and Maximizing Nutrients from Heavily Bedded Swine Manure	Dakota County SWCD/Brad Becker
2002	Agricultural Use of Rock Fines as a Sustainable Soil Amendment	Carl Rosen
	A Low-cost Mechanism for Inter-seeding Cover Crops in Corn	Tony Thompson
	Annual Medic as a Protein Source in Grazing Corn and Weed Suppressant in Soybeans	Joseph Rolling
	Evaluation of Dairy Manure Application Methods and Nutrient Loss from Alfalfa	Stearns County SWCD
	Increased Forage Production Through Control of Water Runoff and Nutrient Recycling	James Sovell
	Land Application of Mortality Compost to Improve Soil and Water Quality	Neil C. Hansen
	Turkey Litter: More is Not Always Better	Meierhofer Farms
2001	Applying Manure to Corn at Agronomic Rates	Tim Becket & Jeremy Geske/Dakota County Extension & SWCD
	Cereal Rye for Reduced Input Pasture Establishment and Early Grazing	Greg Cuomo
	Establishing a Rotational Grazing System in a Semi-wooded Ecosystem: Frost Seeding vs. Impaction Seeding on CRP Land and Wooded Hillsides Using Sheep	James Scaife
	Living Snow Fences for Improved Pasture Production	Mike Hansen
	Managing Dairy Manure Nutrients in a Recycling Compost Program	Norman & Sallie Volkmann
	Reducing Chemical Usage by Using Soy Oil on Corn and Soybean	Donald Wheeler
	Techniques for More Efficient Utilization of a Vetch Cover Crop for Corn Production	Carmen Fernholz
	Using Nutrient Balances to Benefit Farmers and the Environment	Mark Muller/IATP
2000	Forage Mixture Performance	Itasca County SWCD
	Inter-seeding Hairy Vetch in Sunflower and Corn	Red Lake County Extension
	Growing Corn with Companion Crop Legumes for High Protein Silage	Stanley Smith
	Legume Cover Crops Inter-seeded in Corn as a Source of Nitrogen	Alan Olness & Dian Lopez
	Surface Application of Liming Materials	Jane Grimsbo Jewett
	The Introduction of Feed Peas and Feed Barley into Whole Farm Planning	Ken Winsel
1999	CRP in a Crop Rotation Program	Jaime DeRosier
	Evaluating Kura Clover for Long-term Persistence	Bob & Patty Durovec
	The Winona Farm Compost Strategies	Richard J. Gallien
	Timing Cultivation to Reduce Herbicide Use in Ridge-till Soybeans	Ed Huseby
1998	An Evaluation of Variable Rate Fertility Use on Ridged Corn and Soybeans	Howard Kittleson
	Farming Practices for Improving Soil Quality	Sustainable Farming Association of SC MN
	Sustainable Agriculture in Schools	Toivola-Meadowlands School/Jim Postance
1997	Converting from a Corn-Soybean to a Corn-Soybean-Oat-Alfalfa Rotation	Eugene Bakko
	Manure Application on Ridge-till: Fall vs. Spring	Dwight Ault

Final Greenbook Article	Title of Project	Grantee
1996	Biological vs. Conventional Crop Systems Demonstration	Gary Wyatt
	Building Soil Humus Without Animal Manures	Gerry Wass
	Controlled Microbial Composting to Improve Soil Fertility	Howard & Mable Brelje
	Living Mulches in West Central Minnesota Wheat Production	Dave Birong
	Making the Transition to Certified Organic Production	Craig Murphy
	No-till Barley and Field Peas into Corn Stalks, Developing Pastures on These Bare Acres	Jerry Wiebusch
	Weed Control and Fertility Benefits of Several Mulches and Winter Rye Cover Crop	Gary & Maureen Vosejpka
1995	Annual Medics: Cover Crops for Nitrogen Sources	Craig Sheaffer
	Integration of Nutrient Management Strategies with Conservation Tillage Systems for Protection of Highly Eroded Land and Lakes in West Otter Tail County	Harold Stanislawski
	Manure Management/Utilization Demonstration	Timothy Arlt
	Reducing Soil Insecticide Use on Corn Through Integrated Pest Management	Ken Ostlie
	Taconite as a Soil Amendment	Donald E. Anderson
1994	Biological Weed Control in Field Windbreaks	Tim Finseth
	Energy Conserving Strip Cropping Systems	Gyles Randall
	Fine-tuning Low-input Weed Control	David Baird
	Flame Weeding of Corn to Reduce Herbicide Reliance	Mille Lacs County Extension
1993	Chemical Free Double-cropping	Jeff Mueller
	Cooperative Manure Composting Demonstration and Experiment	Rich Vander Ziel
	Early Tall Oat and Soybean Double Crop	Charles D. Weber
	NITRO Alfalfa, Hog Manure, and Urea as Nitrogen Sources in a Small Grain, Corn, Soybean Crop Rotation	Carmen Fernholz
	Nitrogen Utilization from Legume Residue in Western Minnesota	Arvid Johnson
1992	Demonstration of Land Stewardship Techniques in the Red River Valley	Donald H. Ogaard
	Demonstration of Tillage Effects on Utilization of Dairy and Hog Manure in Southeast Minnesota	John Moncrief
	Economically and Environmentally Sound Management of Livestock Waste	Fred G. Bergsrud
	Herbicide Ban? Could You Adapt on a Budget?	David Michaelson
	Improving Groundwater Quality and Agricultural Profitability in East Central Minnesota	Steven Grosland & Kathy Zeman
	Modified Ridge-till System for Sugar Beet Production	Alan Brutlag
	Soil Building and Maintenance	Larry H. Olson
	Strip-cropping Legumes with Specialty Crops for Low-cost Mulching and Reduced Fertilizer/Herbicide Inputs	Mark Zumwinkle
	Using Nitro Alfalfa in a No-till Corn and Soybean Rotation	Jeff Johnson
1991	Alternative Methods of Weed Control in Corn	Sr. Esther Nickel
	Hairy Vetch and Winter Rye as Cover Crops	Mark Ackland

Final Greenbook Article	Title of Project	Grantee

Fruits and Vegetables

2005	Organic Strawberry Production in Minnesota	Brian Wilson & Laura Kangas
2003	Research and Demonstration Gardens for New Immigrant Farmers	Nigatu Tadesse
	Root Cellaring and Computer-controlled Ventilation for Efficient Storage of Organic Vegetables in a Northern Market	John Fisher-Merritt
	Viability of Wine Quality Grapes as an Alternative Crop for the Family Farm	Donald Reding
2002	Development and Continuation of a Community Based Sustainable Organic Grower's Cooperative and Marketing System	Patty Dease
	Flame Burning for Weed Control and Renovation with Strawberries	David Wildung
	Integrating Livestock Profitably into a Fruit and Vegetable Operation	David & Lise Abazs
	Soil Ecology and Managed Soil Surfaces	Peter Seim & Bruce Bacon
	Value Adding to Small Farms Through Processing Excess Production	Jeffrey & Mary Adelmann
2001	Bio-based Weed Control in Strawberries Using Sheep Wool Mulch, Canola Mulch and Canola Green Manure	Emily Hoover
	Biological Control of Alfalfa Blotch Leafminer	George Heimpel
	Cover Crops and Living Mulch for Strawberry Establishment	Joe Riehle
	Sustainable Weed Control in a Commercial Vineyard	Catherine Friend & Melissa Peteler
1999	Development of Mating Disruption and Mass Trapping Strategy for Apple Leafminer	Bernard & Rosanne Buehler
1998	Alternative Point Sources of Water	Joseph & Mary Routh
	Comparison of Alternative and Conventional Management of Carrot Aster Leafhoppers	MN Fruit & Vegetable Growers Association
	Jessenland Organic Fruits Project	MN New Country School
	Propane Flame Weeding Vegetable Crops	Jean Peterson & Al Sterner
	Soil Quality Factors Affecting Garlic Production	Tim King
	Wine Quality Grapes in Otter Tail County	Michael & Vicki Burke
1997	Community Shared Agriculture and Season Extension for Northern Minnesota	John Fisher-Merritt
	Living Mulch, Organic Mulch, Bare Ground Comparison	Dan & Gilda Gieske

Livestock

2006	Composting Bedded Pack Barns for Dairy Cows	Marcia Endres
	Managing Hoops and Bedding and Sorting Without Extra Labor	Steve Stassen
2005	Performance Comparison of Hoop Barns vs. Slatted Barns	Kent Dornink
	Raising Cattle and Timber for Profit: Making Informed Decisions about Woodland Grazing	Michael Demchik

Final Greenbook Article	Title of Project	Grantee
	Using a 24' x 48' Deep Bedded Hoop Barn for Nursery Age Pigs	Trent & Jennifer Nelson
2004	Comparing Performance of Hoop Buildings to an Older Conventional Building for Finishing Hogs	Kevin Connolly
	High Value Pork Production for Niman Ranch Using a Modified Swedish System	David & Diane Serfling
	Low Cost Fall Grazing and Wintering Systems for Cattle	Ralph Lentz
2003	Can New Perennial Grasses Extend Minnesota's Grazing Season	Paul Peterson
	Enhancement of On-farm Alfalfa Grazing for Beef and Dairy Heifer Production	Dennis Johnson
	Farrowing Crates vs. Pens vs. Nest Boxes	Steve Stassen
	Forage Production to Maintain One Mature Animal Per Acre for 12 Months	Ralph Stelling
	High Quality – Low Input Forages for Winter Feeding Lactating Dairy Cows	Mark Simon
	Pasture Aeration and its Effects on Productivity Using a Variety of Inputs	Carlton County Extension
	Potential of Medicinal Plants for Rotational Grazing	Management Intensive Grazing Groups/Dave Minar
	Programmatic Approach to Pasture Renovation for Cell Grazing	Daniel Persons
2002	Adding Value for the Small Producers via Natural Production Methods and Direct Marketing	Pete Schilling
	Grazing Beef Cattle as a Sustainable Agriculture Product in Riparian Areas	Frank & Cathy Schiefelbein
	Improvement of Pastures for Horses Through Management Practices	Wright County Extension
	Increasing Quality and Quantity of Pasture Forage with Management Intensive Grazing as an Alternative to the Grazing of Wooded Land	Michael Harmon
	Supplement Feeding Dairy Cattle on Pasture with Automated Concentrate Feeder	Northwest MN Grazing Group
	Viability of Strip Grazing Corn Inter-seeded with a Grass/Legume Mixture	Stephen & Patricia Dingels
2001	Annual Medic as a Protein Source in Grazing Corn	Joseph Rolling
	First and Second year Grazers in a Year Round Pasture Setting Served by a Frost Free Water System	Don & Dan Struxness
	Low Input Conversion of CRP Land to a High Profitability Management Intensive Grazing and Haying System	Dan & Cara Miller
	Reviving and Enhancing Soils for Maximizing Performance of Pastures and Livestock	Doug Rathke & Connie Karstens
	Whole System Management vs. Enterprise Management	Dennis Rabe
	Working Prairie – Roots of the Past Sustaining the Future	John & Leila Arndt
2000	Converting a Whole Farm Cash System to Sustainable Livestock Production with Intensive Rotational Grazing	Edgar Persons
	Dairy Steers and Replacement Heifers Raised on Pastures	Melissa Nelson

Final Greenbook Article	Title of Project	Grantee
	Establishing Pasture Forages by Feeding Seed to Cattle	Art Thicke
	Grass-and Forage-based Finishing of Beef, with Consumer Testing	Lake Superior Meats Cooperative
	Learning Advanced Management Intensive Grazing Through Mentoring	West Otter Tail SWCD
	Low Cost Sow Gestation in Hoop Structure	Steve Stassen
1999	Deep Straw Bedding Swine Finishing System Utilizing Hoop Buildings	Mark & Nancy Moulton
	Extending the Grazing Season with the use of Forage Brassicas, Grazing Corn and Silage Clamps	Jon Luhman
	Home on the Range Chicken Collaborative Project	Sustainable Farming Association of SE MN
	Hoop Houses and Pastures for Mainstream Hog Producers	Josh & Cindy Van Der Pol
	Management Intensive Grazing Groups	Dave Stish
	Renovation of River Bottom Pasture	Jon Peterson
	The Values Added Graziers: Building Relationships, Community and Soil	Values Added Graziers
1998	Buffalo: Animal From the Past, Key to the Future	Richard & Carolyn Brobjorg
	Marketing Development - Small Farm Strategies Project	Sustainable Farming Association of NE MN
	Pastured Poultry Production and Riparian Area Management	Todd Lein
1997	Butcher Hogs on Pasture	Michael & Linda Noble
	Developing Pastures Using Various Low-input Practices	Ralph Lentz
	Grass Based Farming in an Intensive Row Crop Community	Douglas Fuller
	Grazing Hogs on Standing Grain and Pasture	Michael & Jason Hartmann
	Grazing Sows on Pasture	Byron Bartz
	Low Input Systems for Feeding Beef Cattle or Sheep	Dennis Schentzel
	Raising Animals for Fiber	Patty Dease
	Rotational Grazing Improves Pastures	MISA Monitoring Team
	Seasonal Dairying and Value-added Enterprises in Southwest Minnesota	Robert & Sherril Van Maasdam
	Swedish Style Swine Facility	Nolan & Susan Jungclaus
1996	Dairy Waste Management Through Intensive Cell Grazing of Dairy Cattle	Scott Gaudette
	Establishing Trees in Paddocks	Dave & Diane Serfling
	Evaluating Pasture Quality and Quantity to Improve Management Skills	Land Stewardship Project
	Expanding into Outdoor Hog Production	James Van Der Pol
	Grazing Length: Season Length and Productivity	Doug & Ann Balow
1995	Evaluating Diatomaceous Earth as a Wormer for Sheep and Cattle	David Deutschlander

Final Greenbook Article	Title of Project	Grantee
	Intensive Controlled Grazing and Pasture Rejuvenation on Fragile Land	Lyle & Nancy Gunderson
	Intensive Rotational Grazing on Warm Season Grasses	Jim Sherwood
	Rotational Top-grazing as a Method of Increasing Profitability with a High-producing Dairy Herd	Alton Hanson
1994	Economics of Rotational Grazing vs. Row Crops	Harold Tilstra
1993	A Comparison Study of Intensive Rotational Grazing vs.Dry-lot Feeding of Sheep	R & K Shepherds
	Controlled Grazing of Ewes on Improved Pastures and Lambing on Birdsfoot Trefoil	Leatrice McEvilly
	Improving Permanent Pastures for Beef in Southwest Minnesota	David Larsen
	Intensive Rotational Grazing	Chad Hasbargen
	Research and Demonstration of Rotational Grazing Techniques for Dairy Farmers in Central Minnesota	Stearns County Extension
	Winter Grazing Study	Janet McNally & Brooke Rodgerson
1992	A Demonstration of an Intensive Rotational Grazing System for Dairy Cattle	Ken Tschumper
	Intensive Rotational Grazing in Sheep Production	James M. Robertson
	Using Sheep and Goats for Brush Control in a Pasture	Alan & Janice Ringer

Integrated Pest Management (IPM) Program

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Integrated Pest Management (IPM) Program

Integrated pest management (IPM) looks at pest problems using a multi-strategy approach. IPM considers all aspects of the interactions between people and pests to find the easiest way to resolve problems with the lowest overall risk to people's health and the environment. IPM looks beyond the use of preventative regularly scheduled pesticide applications. It is a dynamic system that is adaptable to diverse management approaches. Factors that allow pests to become problems in the first place are considered, and a combination of physical, cultural, biological, and chemical pest management strategies are used.

Fruit and Vegetable IPM

The *Minnesota Fruit and Vegetable IPM News* is produced in cooperation with Dr. William Hutchison at the University of Minnesota (U of MN), Entomology Department. Partial funding for the newsletter was provided through partnership agreements with the Minnesota Fruit and Vegetable Growers Association and the United States Department of Agriculture – Risk Management Agency (RMA).

The Newsletter's primary aim is to alert growers and processors about pest outbreaks, and provide timely management recommendations that also reduce environmental and economic risks to growers. When relevant, we also provide newsworthy topics related to biotechnology and specialty crops, emerging pests, invasive species, impacts of the Food Quality Protection Act (FQPA), produce marketing, and articles of broad interest concerning the benefits of IPM and sustainable agricultural practices. The newsletter is published May through August and is posted on the U of MN and MDA web sites on Fridays.

The MDA has produced four insect manuals including: *Field Guide for Identification of Pest Insects, Diseases, and Beneficial Organisms in MN Apple Orchard; Integrated Pest Management Manual for MN Apple Orchard; Field Guide for Identification of Pest Insects, Diseases, and Beneficial Organisms in MN Strawberry Fields; and, Integrated Pest Management Manual for MN Strawberry Fields.*

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IPM newsletter web site: www.mda.state.mn.us/plants/pestmanagement/ipm/ipmnews.htm

IPM manuals and other fruit IPM information web site: www.mda.state.mn.us/plants/pestmanagement/ipm/fandvipm.htm

IPM for Kids

The MDA created "Join Our Pest Patrol - A Backyard Activity Book for Kids - An Adventure in IPM" for children in grades three and four. The book includes many fun activities and is available, along with a companion "Teacher Guide" at: www.mda.state.mn.us/plants/pestmanagement/ipm/ipmpubs.htm#pestpatrol

In addition, the "Pest Patrol Action Kit," is a series of hands-on classroom activities developed from ideas taken from "Join Our Pest Patrol." These activities are available at: www.mda.state.mn.us/kids/actionkit.htm

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Insect Biological Control Program

We are in the process of establishing and rearing soybean aphid parasitoid colonies, and eventually mass rearing them for the first implementation of biological control of soybean aphid with these parasitoids in the U.S. *Binodoxys communis* is the first species approved for release from the Minnesota Agricultural Experiment Station/Minnesota Department of Agriculture High Security Containment Facility ("Quarantine Facility") located at the University of Minnesota, St. Paul campus. The first experimental releases of the parasitoids will be in Minnesota.

MDA will be assisting the USDA, Animal and Plant Health Inspection Service, Plant Protection and Quarantine, with Japanese beetle biocontrol monitoring at sites around the Twin Cities metro area in 2007. Traps will be set up at sites where parasitic flies have been released. Traps will be brought back to the lab to inspect the beetles for parasitism. When parasitized beetles are found, they can be released back into the field alive to carry out their 'control duties' against the beetles. MDA will also assist in field monitoring of establishment of *Tiphia vernalis*, a parasitic wasp biocontrol agent for Japanese beetle.

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Weed IPM Program

The MDA Weed IPM program (WIPM) was formed to assist landowners and managers in developing practical IPM strategies for dealing with nuisance plant species throughout Minnesota. The WIPM is responsible for the statewide coordination and implementation of the following activities:

1. Establishing and evaluating biological control for terrestrial weed species.

2. Developing procedures for mass rearing of potential weed biological control agents.

3. Conducting and coordinating annual surveys for nuisance and invasive weed species.

4. Developing research and demonstration projects to evaluate weed IPM methodologies.

5. Providing education, training, and outreach for professional and private land managers.

The WIPM has active biological control programs for leafy spurge and spotted knapweed. These programs are cooperator-based and depend upon the commitment of local entities to monitor for weed infestations, request biological control agents for releases in their area, and monitor sites following releases to determine establishment of agents and biological control success. The WIPM coordinates statewide collection and redistribution efforts for biological control agents and annually collects cooperator information pertaining to agent releases and site monitoring data that aids in tracking the distribution and impacts of these bioagents over time.

In addition, the WIPM is currently involved in the development of biological control for common tansy, an invasive weed of upland terrestrial landscapes. Exploration for potential biological control agents will occur in tansy's native range by European partners. This project is an international effort driven by a consortium of US and Canadian agencies and organizations. Coordination of funding and dissemination of information will occur through the Alberta Invasive Plant Council in Canada and the MDA's WIPM. Research activities include overseas exploration and host-specificity testing of potential bioagents.

The WIPM is also involved with several weed biological control agent rearing projects in 2007 and 2008. Using our new state-of-the-art laboratory facility located in St. Paul, work has begun on two projects:

1. A mass rearing protocol for the spotted knapweed biocontrol agent *Cyphocleonus achates* is being investigated to determine if these weevils can be reared on an artificial diet. Initial diet protocols have been provided to the MDA under a cooperative agreement with the United States Department of Agriculture, Animal and Plant Health Inspection Service, Center for Plant Health Science and Technology. If successful, lab-reared *C. achates* will supplement our field-collected populations, increasing total numbers of the weevil in the field.

2. Garlic mustard biocontrol agents are currently in the MAES/MDA High Security Containment Facility and are undergoing final host-specificity testing. The projected date for release from quarantine of one of these agents, a small weevil, *Ceutorhynchus scrobicollis*, is approaching. MDA is cooperating with researchers at the University of Minnesota and the Minnesota Department of Natural Resources to develop mass rearing strategies for future field releases.

One important tool for any IPM program is the use of surveys to identify pest thresholds and management needs. To improve the methodologies for tracking and recording weed distributions, emergence, and shifts in weed types over time, the WIPM developed a mobile global positioning system/geographic information system (GPS/GIS) for mapping important weeds throughout the state. In 2007, several Minnesota counties, state and federal personnel, and private non-profit groups are teaming-up with the WIPM to survey a variety of weed species throughout the state. In addition to these local survey's, the WIPM is working with the MDA's Plant Protection Division's Early Detection and Rapid Response Program to identify invasive weed species of high priority in the state. The WIPM is also redeveloping its ArcIMS web site that allows land managers to upload their field survey data and have the ability to query specific data for their management needs. The intention of this redevelopment is to create a more practical web site that better serves the needs of weed managers throughout the state. Over the past five years, the WIPM's weed survey data has allowed land managers and policy makers to make more informed decisions concerning invasive, exotic, and noxious weed management in Minnesota.

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WIPM web site: www.mda.state.mn.us/plants/weedcontrol

The Thicket!

"*Thicket!*" is an on-line newsletter for all land managers interested in weed management. It is a way to share information about the many weed management activities carried out in Minnesota by the different local, state and federal agencies, and the U of MN. If you are interested in signing up to receive the electronic "*Thicket*," please send an email to either Jean or Anthony.

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"*Thicket!*" web site: www.mda.state.mn.us/plants/thicket

The Biological Control Greenhouse and Laboratory

Greenhouse, Yard, and Indoor Plantscape Biocontrol
The Biological Control Greenhouse (BCG) is a multi-purpose greenhouse located on Metropolitan State University's main St. Paul campus. It continues to serve as the main outreach arm of the Biological Control Program by providing space dedicated to insects, infested plants, biological control of insects and weeds, and other projects related to pest management. The greenhouse also supports other MDA IPM-Biological Control Program activities and/or other programs that work with pest management.

Between January, 2006 and April, 2007, the Biological Control Facility hosted 39 groups on-site and provided live insects and plant materials for approximately 40 off-site presentations.

Specific examples of individuals and groups served by this project in 2006-2007 include:

- elementary students involved with insect study units
- high school agriculture days, Earth Day events, science and/or environmental fairs
- high school career days
- youth participating in summer work programs and day camps
- professional vegetable and/or fruit growers
- home gardeners
- community gardeners and their coordinating organizations

Most presentations include general information on insects and spiders, how to identify insects, biological control concepts and how to apply them, IPM tools and how to use them, and collecting and/or mounting insects. The presentations are driven by hands-on activities and close firsthand observations of insects and their feeding damage. Frequently, releases of live bioagents on plants purposely infested are followed by discussions of the process of releasing agents. In addition, two free workshops called *Biological Control Basics* were offered on biological control products. A total of 18 people attended these two workshops; most of them were master gardeners or associated with a community garden.

In August 2006, for the second year in a row, we setup a live and pinned insect display called *Bugnanza!* at the Minnesota State Fair (in partnership with MDA's Ag in the Classroom) at the Little Farm Hands exhibit. An estimated 5,000 people saw the *Bugnanza!* display, which included a dozen species of live insects and spiders.

The property surrounding the greenhouse is used to demonstrate how native plants attract beneficial insects, prevent erosion, and add biodiversity to a landscape. As part of this learning experience, three new apple trees were planted in an area called the northwest slope. The landscape provides an outdoor learning environment that compliments the indoor greenhouse activities.

Biological Control Laboratory
The Biological Control Laboratory also supports the Biological Control programs. It contains environmental chambers used for rearing insects and growing plants needed to feed colonies. The lab's primary activities involve maintaining insect colonies for beneficial releases, research, educational projects, insect identification, and preservation. The laboratory also works on developing or modifying mass rearing systems and diets for pests and beneficial insects, field collection and distribution of biological control agents, and monitoring the establishment and success of released agents. The laboratory houses the MDA's Insect Reference Collection which currently contains close to 20,000, mostly pinned, insect specimens and is cared for by Dr. John Luhman. Insect rearing procedures are available at: www.mda.state.mn.us/plants/pestmanagement/greenhouse.htm

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(For greenhouse tours and publications)

Dr. John Luhman, 651-201-6163
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Web site: www.mda.state.mn.us/plants/insects/plantscape/biofacility.htm
(Biological Control Facility - Teaching Greenhouse)

MDA Quarantine Facility

The Minnesota Department of Agriculture-University of Minnesota (MDA-U of MN) quarantine facility is located within the current greenhouse complex of the U of MN, St. Paul Campus. It is a biological control research facility and insect quarantine facility licensed by USDA. Current U of MN research includes screening biocontrol agents of soybean aphid and garlic mustard.

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Quarantine Facility web site: www.mda.state.mn.us/plants/quarantine

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The Status of Organic Agriculture in Minnesota – 2006

The executive summary of this report follows. To read the complete 47-page report, please visit www.mda.state.mn.us/news/publications/food/organicgrowing/organicrpt2006.pdf

Organic Production and Market Trends

The number of certified organic farms and acres in Minnesota continues to grow, along with domestic and international market demand for organic food. Retail sales of organic food are strong, and averaged just over 18% per year between 1997 and 2005 and are driving demand for organic farm products. Consumer interest in organic products is driving demand for raw organic farm products and ingredients. The market is experiencing concentration; a number of large food corporations have purchased established organic brands. Some food companies have introduced organic versions of their existing lines. Industry experts predict the consumer market will continue to grow. All organic categories are expected to continue strong sales growth, particularly meat, poultry, and fish. Pressure from low-cost imports is likely to negatively affect Minnesota producers.

Minnesota had more than 525 certified organic farms in 2006 and with slightly more than 129,000 certified organic acres as of 2005, the last year for which acreage estimates are available. Certified acres in Minnesota grew by 57% between 2000 and 2005. The state continues its number one position in organic corn and soybean acres and holds the number seven spot for organic dairy cows. It ranks in the top five for six additional crop and livestock categories.

Human Health and Environmental Considerations

A number of applied research studies have found that organic farms are profitable, even when organic premiums are halved or eliminated. Long-term studies are also finding that organic yields may meet or exceed conventional yields. Results of studies comparing the nutritional value of organic food vs. non-organic food are inconclusive, although there is evidence that antioxidant levels may be higher in organic foods. The results of two studies examining children's diets suggest that eating organic food may reduce exposure to pesticides that are metabolized by humans. Researchers are documenting and quantifying conservation and environmental benefits of organic production systems.

Grower Perceptions

By and large, organic growers express optimism about the future of agriculture. In a survey of organic growers conducted in 2004, almost three quarters of the 146 respondents said they thought organic farming was more profitable than conventional agriculture and three quarters expected that they or a family member would still be farming in 20 years. Fully 55% of these farmers were age 50 or younger. Although they have a positive outlook, they have encountered production challenges including weed management, pollen drift from genetically modified crops, soybean aphid, and availability of local processing, particularly for meat. Farmers' top research needs are effective weed management strategies, soil fertility, soil health/biology, variety selections, and pest management strategies for organic production. A separate survey of dairy farmers found that around 44% had at least some interest in organic dairy production. Their major concerns were livestock health, feed, and profitability.

The Minnesota Department of Agriculture serves organic growers and associated businesses with a variety of programs including organic certification cost share, conferences, workshops, directories, referrals, and farm management programs. Some of these services are delivered by the department alone; others are undertaken in collaboration with the University of Minnesota, nonprofit

and farm organizations, and federal agencies. The United States Department of Agriculture (USDA) has contributed financial support to a number of organic projects. A Memorandum of Understanding on Organic Agriculture exists and has been signed by the Minnesota Department of Agriculture, USDA Natural Resources Conservation Service (NRCS), Farm Service Agency, University of Minnesota Extension, and University of Minnesota College of Food, Agriculture and Natural Resource Sciences.

A number of USDA agencies offer organic agriculture programs. In Minnesota, the NRCS offers a per-acre organic transition cost share payment through its Environmental Quality Incentives Program and underwrites several organic educational events each year. Some of the technical assistance NRCS offers to farmers—such as the Web Soil Survey and a number of Tech Notes—are particularly well-suited to organic producers. Resource Conservation and Development Councils have explored collaborative marketing and promotional efforts for organic growers. The Risk Management Agency has funded organic research and projects, as has the Cooperative State Research, Education and Extension Service, particularly through the Sustainable Agriculture Research and Education (SARE) Program. The Economic Research Service collects and publishes organic acreage and market data that allow states like Minnesota to track adoption and trends.

University of Minnesota faculty members have been engaged in applied organic research for well over a decade. They teach courses on organic agriculture and conduct both small plot and on-farm organic research in areas such as soil quality, food safety, weed management, and livestock nutrition. A number of University of Minnesota Extension Educators throughout the state have conducted crop variety trials, organized educational and outreach events, and delivered technical assistance to organic and transitional growers.

Recommendations

With input from the Organic Advisory Task Force as well as stakeholders and peer agencies the MDA recommends the following:

New Policies or Programs

- Technical and financial assistance to help growers during their transition to organic.
- A voluntary registration and affidavit program to provide state documentation to organic growers who are legally exempt from certification requirements under §205.101 of the National Organic Standards (7 C.F.R., Part 205).
- Organic educational materials and presentations for consumers.
- A Minnesota organic buyer directory (processors, brokers, shippers, traders, etc.).

Policies or Programs to Continue or Enhance

- State assistance to defray the cost of certification for certified organic Minnesota farmers and processors.
- Information and technical assistance to help farmers learn about certification requirements, organic practices, and resources available to them.
- Information and technical assistance to help organic farmers understand, evaluate, and implement marketing options.
- Assistance to farmer groups to help them evaluate and pursue value-added organic business opportunities.
- Minnesota Organic Conference.
- Low-interest loans to organic farmers through the Shared Savings Loan Program administered by MDA.
- Directory of Minnesota Organic Farms.
- Enforcement of Minnesota state labeling law with regard to organic product claims.
- Farmer-to-farmer networking programs.
- Collaboration, networking, and complementary efforts by federal, state, university, and nonprofit stakeholders.
- Learning from efforts and experiences in other states.
- Expansion of the current five-partner Memorandum of Understanding on Organic Agriculture.

Current and Future Research Needs

Assess the current organic processing capacity for organic crops and livestock produced in Minnesota and identify opportunities for, major barriers to, and recommendations concerning the expansion of organic production and processing infrastructures in Minnesota and concomitant economic development impact.

Increase long-term applied organic cropping systems and organic livestock production research by faculty at the University of Minnesota and other post-secondary institutions on topics of importance to Minnesota organic farmers such as: agronomics; soil quality and health; organic crop variety development; composting; compost tea; weed, disease, and insect pest management; economics; food safety and quality; farmer and farm worker safety; and management of flies and parasites.

Improved Livestock Management in Riparian Areas

Project Coordinator

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Project Duration

2004 to 2007

Project Summary

Many of the rivers and streams in southeast Minnesota have high levels of fecal coliform bacteria, sediment, and nutrients which often cause risk of human illnesses and negative effects on recreation opportunities. The purpose of this research and demonstration project is to begin to get a handle on what contributions livestock production makes to these problems. Grazing livestock in riparian areas along rivers and streams is a very common practice in this part of the state. This project will help the area farmers with demonstration of grazing practices designed to protect the integrity of the rivers and streams.

This project is funded with federal funds obtained through Section 319 "Nonpoint Source Management" from the United States Environmental Protection Agency (EPA) and awarded by the Minnesota Pollution Control Agency (MPCA).

The project is located in Fillmore and Olmsted Counties within the Root River Watershed in southeast Minnesota. The project has three major areas of focus to improve water quality in southeast Minnesota: 1. Monitoring rainfall runoff from manured cropland, conventional grazing, and rotational grazing for fecal coliform, nutrients, and sediment; 2. Demonstrating innovative on-farm grazing management in environmentally sensitive stream riparian areas; and 3. Education and outreach.

Monitoring

Monitoring stations to collect runoff from agricultural fields are installed on three farms. A fourth monitoring station is being installed in 2007. These stations are designed to automatically collect runoff water from sub-watersheds not any bigger than a field, so that the fecal coliform, sediment, and nutrients collected are only from that field. Unfortunately, no runoff events have been collected from any of the monitoring stations to date due to limited rainfall in the area.

We are also using the Purdue Rainfall Simulator to collect runoff data. Doing this is important to this project because even in years like these where there has been a lack of rain events, we are still able to gather runoff data from these sites. However, the area covered by the rainfall simulator is very small in comparison to the sub-watershed which the overland flow monitoring stations collect. We have data from rainfall simulations from 2005 and 2006 at the three monitoring sites. The article "Use of Simulated Rainfall to Determine *E. coli* Movement. . ." on page 87 in this "Greenbook" has an update of the results from these rainfall simulation events.

Demonstrations

A portion of the 319 federal funds is being used to cost share fencing, water pipelines, water tanks, water pumps, spring access, and stream crossings. We are cooperating with

Before

After

Spring development with cattle access for drinking water from both sides.

the United States Department of Agriculture's Natural Resources Conservation Service (NRCS) to design and engineer grazing plans for participating farmers. In return for receiving cost share funds, the farmers host field days for their grazing systems and discuss the projects with other farmers, agency staff, and policy makers.

To date there are four rotational grazing systems installed and in use. There are two more that are in the planning stages that will be installed this summer. Each site has areas that are prone to environmental damage by grazing livestock. Some of the projects to address problem areas include:

- Installed a spring access for animals to water from two sides. This access keeps beef cows and calves from a wet area but still allows access for clean water.
- Pumping water from a river in a remote site using a portable gas pump to tanks over 1,000' from the river. This watering system provides water in the paddocks and greatly minimizes the need to get water from the river.
- Abandon a feedlot area adjacent to the river banks by incorporating rotational grazing with piped water to the pastures. Two frost free waterers were also installed so the cattle have access to water in the winter, eliminating the need for the cattle to return to the feedlot and barns for water. The farmer over-winters the beef cows on crop land. Field windbreaks installed along fence lines in this grazing system to provide cool breezes in the summer and block the wind in the winter.
- Managing beef cow/calf operation in a wooded ravine area with a stream running through as well as some old watering ponds. A rotational grazing system with piped water will demonstrate how providing piped water can protect the stream and provide more forage in a ravine grazing area. Winter rye planted on crop land as a cover crop also provides for early spring grazing which allows for more growth in the ravine.
- Converting row crop land along a stream to rotational grazing of feeder cattle. Some of the acres were planted to early season grasses that can be grazed before May 1 and then left for grazing after July 1 to benefit ground nesting birds. Flash grazing as a management tool is used along the stream banks.
- The use of a solar powered water pump to provide water in a remote grazing area. This solar pump is installed in a spring seep area that is wet. The trees that are in the same area make it a preferred loafing area for the cattle. The solar pump will pump water to a tank outside the seep area thus eliminating the need for the cattle to access this wet area.
- Using rotational grazing practices along a stream while using the stream for the water source. Not all riparian grazing areas are suitable for providing piped water. It may be a very remote site so it is not cost effective to install a water system. Moving the cattle often will provide adequate rest for the stream banks so they remain grass covered and protected.

Education and Outreach

Sharing information about grazing in riparian areas is a key component of this project. The farmers that receive cost share funds agree to have their practices analyzed and this information shared with the public. Each site is analyzed for the economics of using rotational grazing practices, forage condition, soil condition, animal condition, and the condition of the pastures and stream corridors for wildlife habitat and water quality. Field days will be held to discuss these findings with the farmer discussing the management of the rotational grazing system.

A publication on how to graze in the environmentally sensitive riparian areas of southeast Minnesota is being written. This publication will focus on proper grazing use of stream riparian areas and will describe management strategies for protection of the soil and water resources. The publication will also describe common plant community dynamics in stream riparian areas as a result of no grazing, proper grazing use, and over-utilization. The benefits to wildlife and fisheries with proper grazing and overall effects of watershed land use will also be addressed.

Cooperators

Willie Dux, Farmer, Stewartville, MN
Fillmore SWCD
Fillmore Water Planning
Jeff Gillespie, Farmer, Preston, MN
Robert Kappers, Farmer, Chatfield, MN
Dan Miller, Farm Business Management Instructor, Spring Valley, MN
Minnesota Department of Natural Resources
Minnesota Pollution Control Agency
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Natural Resources Conservation Service
Richard, O'Connor, Farmer, Mabel, MN
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Use of Simulated Rainfall to Determine *E. coli* Movement in Continuous Pasture, Rotational Pasture, and Soybeans

Project Summary

Fecal coliform levels are exceeding accepted thresholds in many Minnesota streams and rivers. It is often assumed that animal agriculture is a primary source of fecal coliform loading. Our objective in this study is to monitor how different grazing and row crop systems affect fecal coliform, sediment, and nutrient levels. Can management improve the ecological integrity of riparian areas and streams? Our hypothesis is that improved pasture management leads to reduced fecal coliform loading.

The project addresses this question using rain simulation and water quality analysis in the driftless area of southeast Minnesota. We applied simulated rainfall events of two inches per hour to manured row-crop sites, conventional pasture sites, and managed grazing sites. Rain simulations were replicated three times in each farm system. The water quality analysis looks at concentrations and mass loading of *E. coli*, sediment and nutrients.

Along with the above analysis, additional landscape and soils information is being collected. This collection includes stubble height, infiltration rates, and soil phosphorus levels.

The rain simulation study is a component of a larger study using small watersheds to monitor water quality. Please refer to the "Improved Livestock Management in Riparian Areas" article on page 85 of this issue of the Greenbook.

Results

The runoff volume was by far the greatest under soybean. At 60 minutes into the storm event, 22.3% of the rainfall was being lost to runoff. In comparison, continuous and rotational pastures were losing 4.3% and 1.6% of rainfall, respectively, at the same point in time (see Figure 1).

The steady state infiltration rate for soybean, continuous, and rotational pasture was 1.48, 1.90, and 1.97 in/hr, respectively. All rain simulations were performed under low soil moisture conditions. With ample room in the soil profile, the soybean system lost valuable water in the form of runoff.

There was a dramatic reduction in overland transport of most water quality parameters measured (sediment, total phosphorus, ortho phosphorus, NO3, and NH4) under both rotational and continuous pastures compared to soybean production (see Table 1, Table 2, and Figures 2-4).

The exception was *E. coli* which was similar under all three farming systems.

Figure 1. Effect of Pasture and Row Crop Systems on Runoff from Simulated of 2"/hr Storm (June 2006)

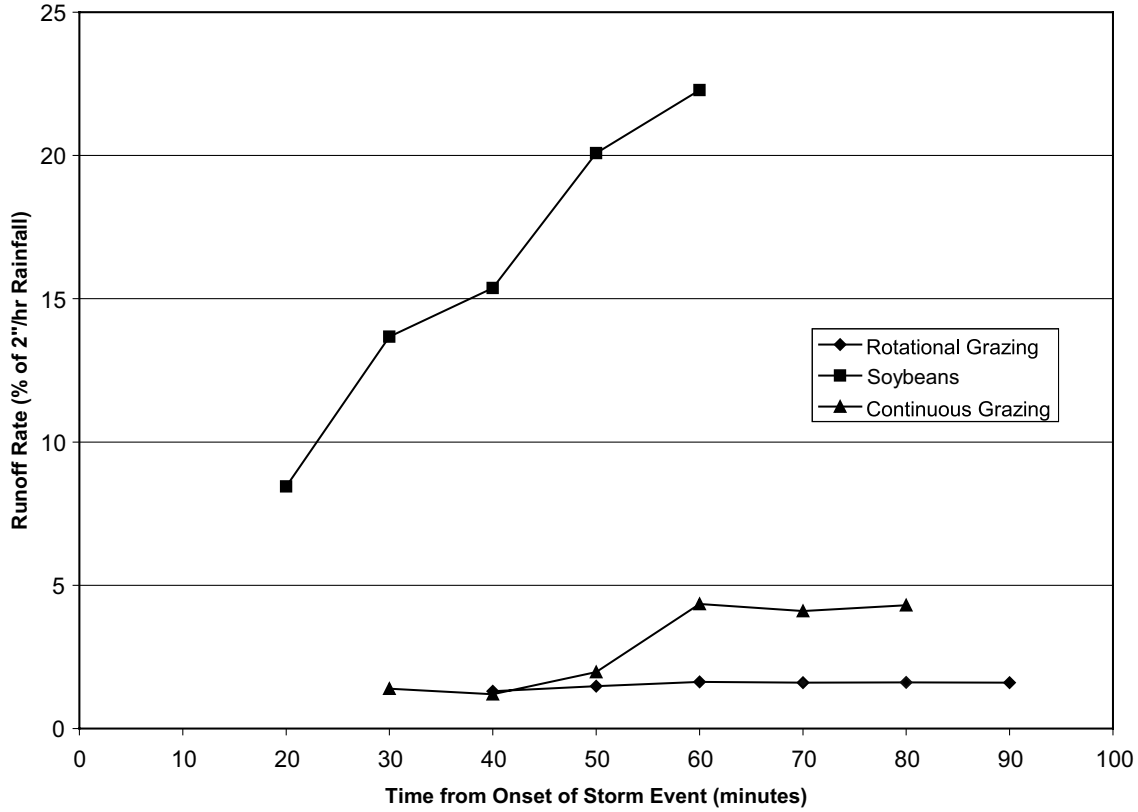

Figure 2. Cumulative Sediment Removal from Simulated 2"/hr Rainfall (June 2006)

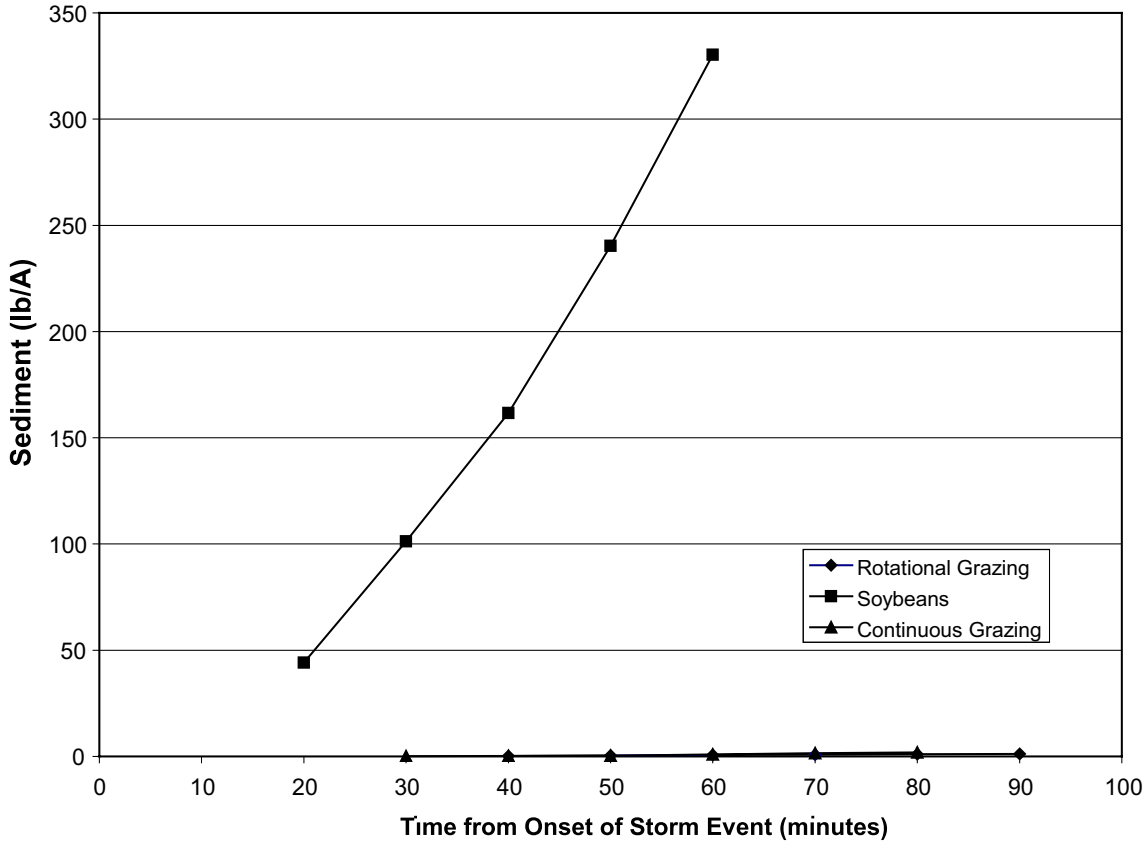

Figure 3. Cumulative Ortho Phosphorus Removal from Simulated 2"/hr Rainfall (June 2006)

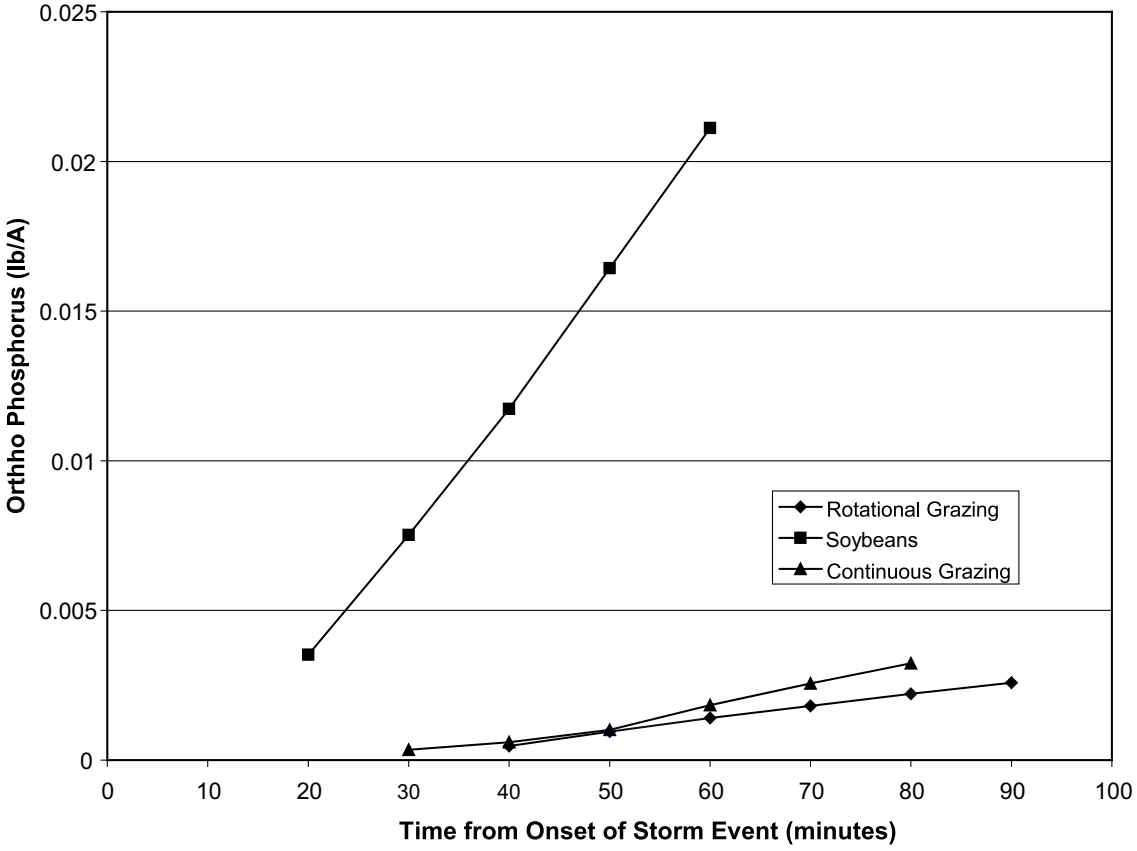

Figure 4. Cumulative E. Coli Removal from Simulated 2"/hr Rainfall (June 2006)

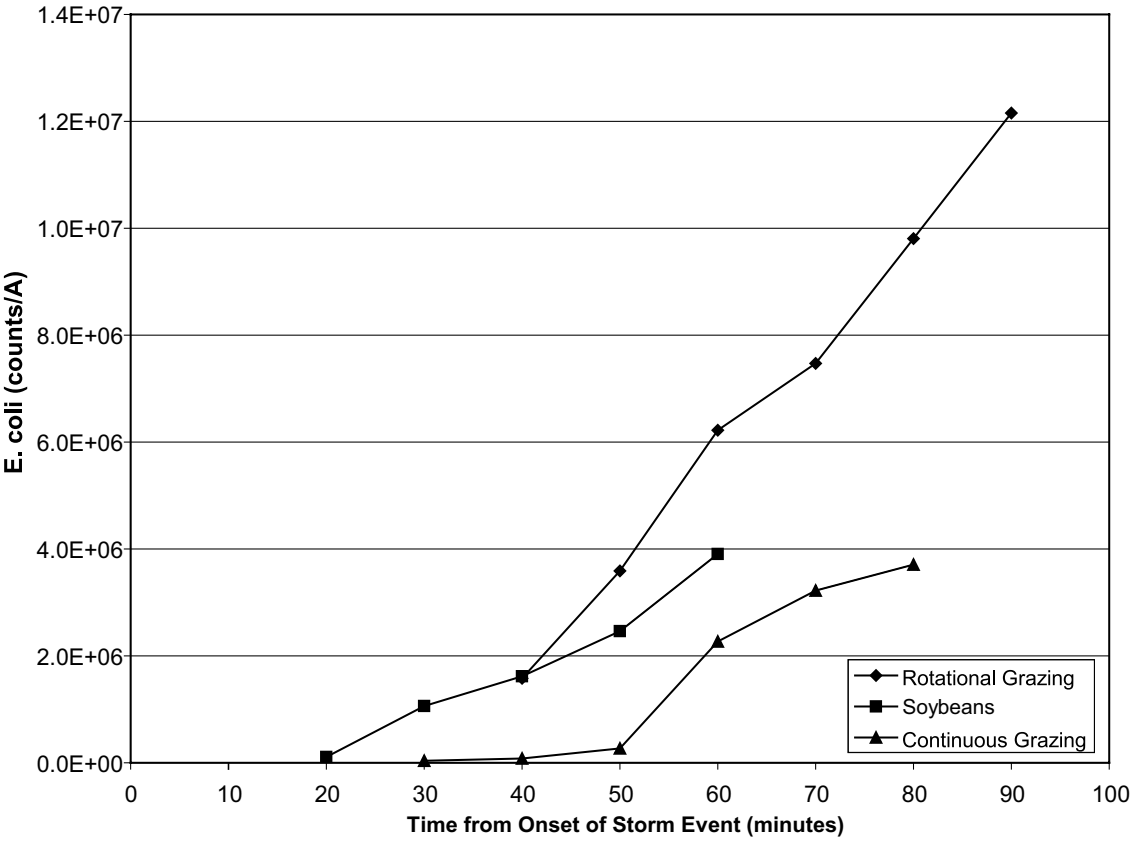

Table 1. Water Quality Parameters: Cumulative Deposition After 60 Minutes into a 2″/hr Storm Event

Farming System	Sediment	Total P	Ortho P	NO3	NH4	E. Coli
	- - - (lb/A) - - -					(counts/acre)
Rotational Grazing	0.67	0.003	0.001	0.001	0.0003	6.22E+06
Continuous Grazing	1.00	0.004	0.002	0.016	0.0012	2.27E+06
Soybeans	330.35	0.402	0.021	0.084	0.0159	3.91E+06

Table 2. Water Quality Parameters: Pollutant Loading by Pasture Systems Compared to Soybean After 60 Minutes into a 2″/hr Storm Event

Farming System	Sediment	Total P	Ortho P	NO3	NH4
	- - - - - (%) - - - - -				
Rotational Grazing	99.80*	99.25	95.20	98.80	98.10
Continuous Grazing	99.70	99.00	90.50	80.90	92.40

**Numbers are % reduction compared to soybean water quality parameter yield.*

The storm event was applied to the rotational pasture immediately after removing the animals. We have learned from a similar ongoing study that the *E. coli* counts will go down dramatically in the weeks following the removal of grazing pressure. The numbers presented here represent the expected highest levels at any point in time for the rotational pasture.

Nitrate loss in runoff was low under all systems but higher under soybean and intermediate under continuous grazing. All systems exhibited a measurable release of bioavailable phosphorus.

Individual cow pies are *E. coli* hot spots. A plume of *E. coli* releases from cow pies and can be detected by the simulated rainfall procedure. This is a validation of the sampling procedure. The *E. coli* hot spots were diluted over time as the storm progressed.

Conclusions: This study shows the potential for pasture systems to contribute dramatically to water quality improvements in agricultural watersheds. The pastures in this study slowed the rate of runoff and reduced the transport of sediment, phosphorus, and nitrogen. However, *E. coli* appears to be a special case and is released in significant quantities by both continuous and rotational systems once overland flow commences. Early in the storm event, *E. coli* is held in check in pastures by the high water infiltration rate under the sod. An intense short duration event of one-half hour will likely see little input from the pasture to the stream and much less than from soybean ground. An intense event of one hour or longer will likely find pastures contributing *E. coli* loading similar to row crop ground. Further study is needed to define under what storm intensity pastures have the potential to release a significant population of *E. coli*.

Sustainable Agriculture Loan Program

Loan Technical Review Panel for 2007

Gregg Bongard
Ag Lender

Robin Brekken
Farmer

Ralph Lentz
Farmer

Thaddeus McCamant
Farm Management Specialist

Bob Mueller
Farmer

Ray Rauenhorst
Farmer

Keith Schoenfeld
Ag Lender

Chuck Schwartau
Extension Educator

Program Purpose

The Sustainable Agriculture Loan Program was created to accelerate the adoption of sustainable farming information and technology in Minnesota. Loans of up to $25,000 per farmer or up to $100,000 for joint projects are made at a fixed 3% interest rate for a term of up to seven years. These low-interest loans are made to farmers for purchasing new or used equipment or building improvements that help make the farming system more sustainable.

Background

When this program began in 1988, the concepts of sustainable agriculture were less understood and less accepted by farmers and lenders than they are today. Many farmers had difficulty obtaining the capital necessary to refocus their farm operations since lenders were reluctant to finance changes during the volatile economy of the 1980s. The state chose to assist these farmers through direct lending.

The initial $1 million appropriation from the state legislature was set up as a revolving fund. As loans are repaid, the funds are pooled and redistributed to other farmers in the form of new loans. Many farmers will benefit from this continuing program with no additional cost to the state.

Evaluation Criteria

Applications for the Loan Program are accepted throughout the year and are competitively evaluated. A review panel representing a cross-section of agricultural professionals from various regions of the state determines which loan projects to recommend to the Commissioner of Agriculture for funding.

The loan proposals are evaluated based on the following criteria:

a) **Long Term Plans for the Farm:** How does this investment fit the long-term plans for the farm?
b) **Effect on the Farming System:** How will this investment lead to a more sustainable farm system?
c) **Environmental Impact:** Is there an environmental benefit to the proposed project?
d) **Farm Income:** What is the added return to the farming operation from the proposed project?
e) **Input Reduction:** Does the project reduce or make more efficient use of inputs?

Each proposal is judged on its relative merits. A farming method considered to be highly innovative in one region of the state may be commonplace in another region.

Impact of Program

The loans have given Minnesota farmers added incentive to make changes toward more efficient use of inputs while enhancing profitability and protecting the environment. More than 325 farmers have borrowed over $3.5 million from the Sustainable Agriculture Loan Program.

As loans are repaid and the funds redistributed, approximately $250,000 is available each year for new loans. When farmers implement innovative changes, their neighbors have an opportunity to observe and decide whether to adapt changes to their farming system. In this way, the farmers are demonstrating new, innovative, and alternative ways of farming and are serving to accelerate the rate of adoption of sustainable agriculture in Minnesota.

Project Categories

Loan projects typically fall into six categories: energy savings and production, livestock management, conservation tillage, weed and nutrient management, on-farm processing, and alternative crops. Almost one-half of loans have been made for livestock management and this category continues to be the most common. Projects have included fencing, livestock handling equipment, milk parlor upgrades, and building improvements. Conservation tillage and weed management projects have accounted for about one-fourth of the loans and include the purchase of rotary hoes, flame cultivators, and ridge tillage equipment. Energy production and on-farm processing and handling equipment projects have been increasing in the past few years.

About the Staff…..

The Greenbook staff brings a broad range and many years of experience in sustainable agriculture areas. Each staff person focuses on individual topic areas where they have expertise and interest.

Linda Bougie – Office Manager, has been working for the program since it began in 1988. Linda provides administrative clerical support to the staff and the program.

Jean Ciborowski - Integrated Pest Management (IPM) Program Coordinator, has been part of the staff since 1997. During her tenure at the MDA, she has coordinated the Biological Control Laboratory (1989-91) and the Exotic Pest Program (1991-97). Jean works on development and implementation of statewide strategies for increasing the use of IPM on private and state managed lands.

Alison Fish - Secretary, does desktop publishing and word processing for the program, helps design program brochures, handles mail requests, and maintains the Sustainable Agriculture Loan and Grant files.

Mary Hanks - Program Supervisor, works with staff to develop project goals and implementation strategies. Mary's training is in plant pathology with a research focus. She came to the MDA in 1990 from private industry.

Wayne Monsen - Alternative Livestock Systems Specialist, provides rotational grazing planning services for livestock producers (in cooperation with NRCS), and cooperates with local, state and federal agencies on livestock and non-point source pollution issues. He began working for MDA in 1992 after farming for 12 years near St. James, MN.

Meg Moynihan - Organic and Diversification Specialist, joined the Minnesota Department of Agriculture in 2002. She educates about and promotes crop, livestock, management and marketing options, including organic. She has also worked professionally as an educator and evaluator, and as a community development extension specialist with the U.S. Peace Corps in northern Thailand.

Mark Zumwinkle - Sustainable Agriculture Specialist, provides hands-on experience to farmers working on soil quality and acts as a liaison with university researchers and farmers coordinating the use of the rainfall simulator. Mark uses soil and cropping system health as focal points for farmers exploring management issues and options and provides the non-farm community with access to soil health information. Mark is a vegetable grower from North Central MN with research experience in living mulches and plant nutrition. Mark joined the ESAP staff in 1993.

Staff Resource Directory

	Jean Ciborowski	Mary Hanks	Wayne Monsen	Meg Moynihan	Mark Zumwinkle
Agroforestry			•		
Alternative Crops & Livestock			•	•	•
Community Supported Agriculture (CSA)		•		•	
Composting		•			•
ESAP Grants	•	•			
ESAP Loans		•			
Farming Systems/Tillage, Weed Control, Crop Rotation	•		•		•
Integrated Pest Management (IPM)	•	•			
Livestock Production			•		
Living Mulch					•
Management Intensive Grazing		•	•		
Manure Management					•
Organic Production/Livestock,Vegetables, Grain, Fruit				•	•
Organic Rules and Certification		•		•	
Plant Diseases/Insects	•	•			
Rotational Grazing Planning			•		
Soil Quality and Soil Fertility, Composting					•
Vegetable Production					•

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www.mda.state.mn.us/protecting/sustainable/greenbook.htm