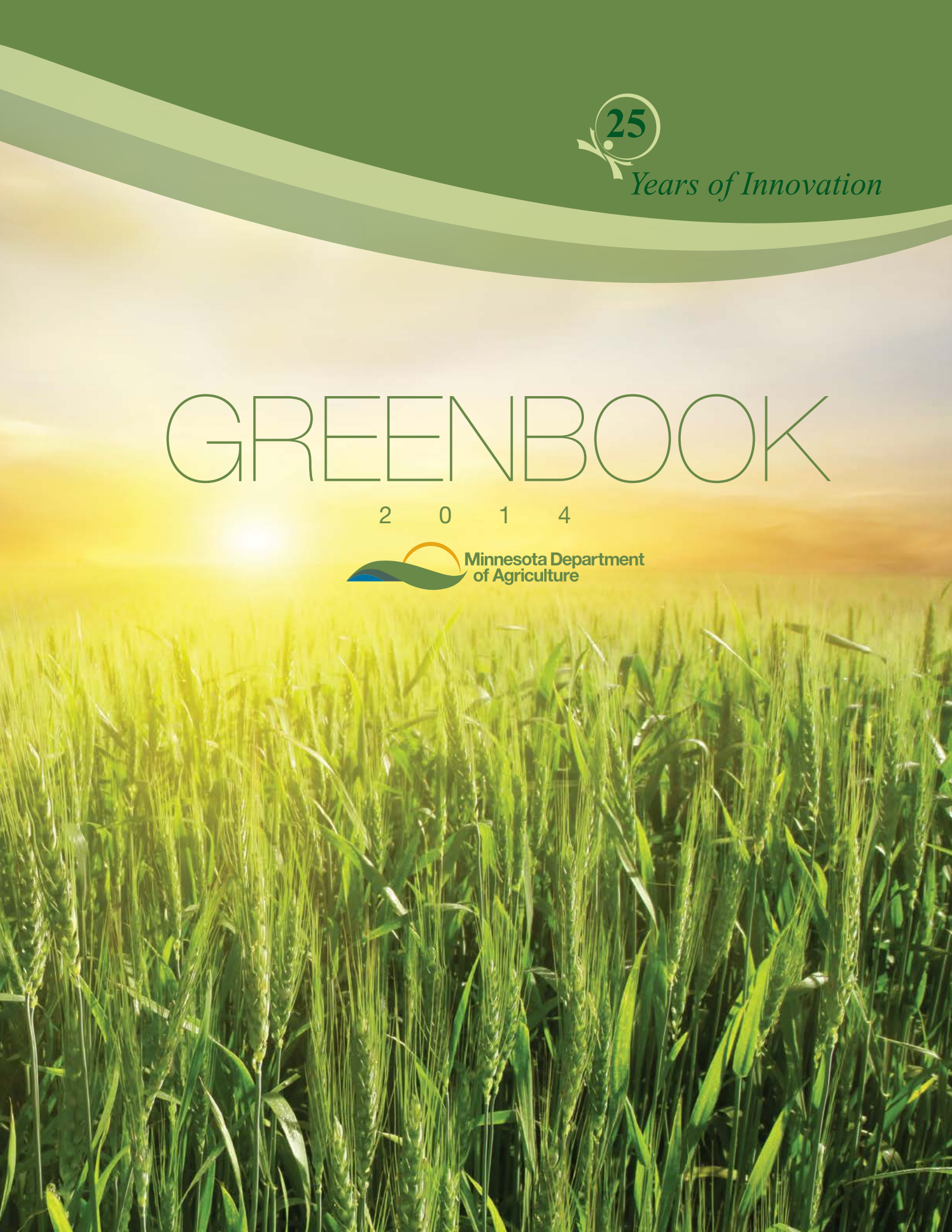
25 Years of Innovation

GREENBOOK

2014

Minnesota Department of Agriculture



Greenbook 2014

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.

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

MINNESOTA DEPARTMENT OF AGRICULTURE

June 2014

Thank you to the MDA's Agricultural Marketing and Development Division Staff who helped to make Greenbook 2014 a reality. They include: Jean Ciborowski, Alison Fish, Stephen Moser, Meg Moynihan, and Mark Zumwinkle.

Minnesota Department of Agriculture
625 Robert Street North, St. Paul, MN 55155
651-201-6012

Introduction to the Greenbook 2014

I'm excited to present the 25th annual edition of the Minnesota Department of Agriculture's Greenbook. In it, we highlight new and ongoing Sustainable Agriculture Demonstration Grant projects by Minnesota farmers, ranchers, and researchers. These dedicated people use the funding to pursue research and innovations that might have wilted away without our support.

The Greenbook shares what farmers learn, including on-farm demonstration results and research projects testing new approaches to raising crops and livestock as well as marketing agricultural products. These farmers help make Minnesota agriculture more environmentally friendly and profitable with their creative ideas and solutions.

In the course of the last quarter century, the Greenbook has showcased hundreds of innovative and creative grant projects contributing to important advances in Minnesota agriculture. In the early 90's projects explored rotational grazing, diversification, and soil quality. Now, projects demonstrate cover crops, season extension for vegetable production, perennial crops, and marketing. Farmers are showing a dedicated and sustained effort to help Minnesota farms thrive.

Greenbook 2014 details current projects with observations, technical information, management tips and practical proof from participants. I think you will enjoy these reports and the farmers behind them. Please feel free to contact any of the grantees about their projects. They are eager to discuss their successes and challenges.

Dave Frederickson, Commissioner

Table of Contents

Sustainable Agriculture Grant Program

Cropping Systems and Soil Fertility

Energy

Program Information

Sustainable Agriculture Grant Program

Program Purpose

The Grant Program provides a unique opportunity for farmers, educational institutions, individuals at educational institutions, or nonprofit organizations residing or located in the state for research or demonstrations on farms 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 1,100 grant applications and approved over $3 million in funding for 300 projects since the program began in 1989. Project categories include: Alternative Markets and Specialty Crops, Cropping Systems and Soil Fertility, Energy, Fruits and Vegetables, and Livestock. The grant projects, located throughout the state of Minnesota, are described in Greenbook 2014.

Grants provide a maximum of $25,000 for on-farm demonstrations that last up to 3 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 includes farmers, university agricultural researchers, extension agents, and educators with assistance from the Agricultural Marketing and Development staff.

Grant Summaries

The project summaries that follow are descriptions of objectives, methods, and findings of individual grant projects funded in 2013. 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 (1989-2014)

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
2008	10	148,400	14,800	4,500-25,000
2009	7	103,000	14,700	5,000-20,000
2010	11	77,000	7,000	3,600-10,000
2011*/2012*	---	---	---	---
2013	6	66,000	11,000	5,300-20,300
2014	13	205,000	15,770	7,800-25,000
Total Funded	**300**	**$3,059,416**		

**No grants were awarded in 2003, 2004, 2011 and 2012.*

Reducing Chemical Use and Inputs in a Cold Climate Grape Harvest by Creating New Uses Other than Wine

Principal Investigator

Chad Stoltenberg
Locust Lane Vineyards
1301 - 130th Ave.
Holland, MN 56139
612-770-3182
stoltenbergstone@gmail.com
Pipestone County

Project Duration

2013 to 2015

Award Amount

$10,950

Staff Contact

Jean Ciborowski
651-201-6217

Keywords

grape products, verjus (verjuice), vineyard, wine

Project Summary

We want to maintain overall vineyard health and yield while spraying less and making fewer passes through the vineyard. We do not want to see significant production loss but need to compare the difference in value of grapes produced, and the cost of more sprays and bird control.

By managing the vineyard for verjus (green grape juice) production, fewer trips across the vineyard is possible due to less need for insecticides. Bird protection is not necessary due to picking the grapes in an under-ripe state, before the birds are interested. This verjus can be used as an acid in production of food products available in stores and to chefs. Development of these products and recipes using verjus is a main goal of this project.

Grapes on the vine.

Project Description

The farm had been used for a diverse crop and livestock operation but has moved more toward a corn and soybean rotation for the last 15 years. We planted a small vineyard in land that was rarely used for anything other than grass hay. The farm is located along Buffalo Ridge in SW Minnesota just south of Holland and is the highest elevation vineyard in the state. Prior to this project our grapes had been sold to a winery. We want to make more dollars/lb for our grapes but don't wish to run a retail farm winery ourselves. We also have a greater interest in culinary applications than wine production.

We have generally found we have lower disease pressure than much of the state (possibly due to the wind on Buffalo Ridge) but, we still need to spray insecticide more than we would like. By producing grapes that are "green" and harvested earlier, we can eliminate more spraying across the vineyard and reduce bird netting.

There are many vineyards in Minnesota and more are being planted all the time. There are also many existing and new wineries opening to utilize these grapes. However, as with any "new" industry there are wild fluctuations in the supply and demand of the production. By developing verjus and products made from verjus we give greater value to our grape.

Our family is trying to decide how best to pass the family farm into the next generation so it can remain a family farm. This project helps us diversify the production of the farm and is our first venture into the "direct to consumer/ food service" wholesale business. In terms of juice produced from ripe vs. under-ripe grapes there was very little difference (which surprised us). We anticipated a lower yield of juice in the under-ripe grapes. In reality, by picking the grapes with the desired sugar levels, a similar amount of juice was found as would be found in wine grape production. This is based on data from only one year.

Results

Input costs were considerably reduced (40% in 2013). In a year with management for wine grapes, we usually spray five times for diseases and one time for insects and then net the grapes for bird protection. With managing for verjus, we eliminated two disease sprays, one or two insecticide sprays (none were necessary in 2013), and did not need bird netting as the birds are not interested in the grapes when harvested this early. This left us with no need to replace and/or repair netting or maintain other forms of bird control (usually $50.00/A in our system). This time and money savings allowed more time for the culinary applications of the project. Fewer trips spraying the grapes uses less gas and less sprays into the environment.

2013 had an extremely late spring in southwestern Minnesota. We had snows into May and freezing temperatures well into June. From the growing grapes perspective this delayed bud break and therefore had no ill effect on the grape crop. Since it had remained cold the plants had not broke dormancy and therefore there was no late frost that impeded the grape crop.

The late Spring did cause a problem by pushing back the harvest considerably – as much as three weeks. While not a problem in terms of the plants, it did make for a reduced labor force available at harvest time in terms of community volunteers and school groups to help pick.

Number of pesticide sprays used on verjus vs. wine grapes

Vine health and production will be more fully seen in subsequent years thereby allowing an evaluation of overall vine health. The reduced spray format did lower yield by as much as 8% but that profit loss was easily made back on lower input costs and labor savings.

The food products have had a positive impact on our income from the grapes produced. We made 70% more than marketing the grapes to a winery. This is based on $1,300/ton grape price and yield of juice worth $6.50/gal. This is partially skewed however due to the added costs of making the food products. Kitchen rental, licensing, and packaging costs must be figured in which lowered the 70% but still we netted a 27% increase when considering these costs.

The grape products have been met with a positive response when being sold to consumers at food shows and demonstration tables at specialty markets. When we sample out the items to customers, sales increase as opposed to simply having the items on shelves in stores. We were short on the number of markets we were able to get the products into in 2013, 43 markets rather than the 50 we'd hoped for. With more time in the colder winter months, we plan to gain back some ground there. Repeat sales have been strongest at the twin cities co-ops with three of the five having made multiple orders of the stand alone verjus product. All restaurants using our verjus have reordered at least twice but have started buying in bulk so no greater income has been seen there.

Management Tips

1. Get a clear picture of harvesting help – changes in harvest dates may not allow groups to help pick. With a late spring causing a later harvest, school groups were not able to help due to already being in school.

2. A new product is still a new product and consumers must be showed how to use it.

3. Picking grapes earlier than for wine production means that it's early in summer and therefore hotter, just be aware. If harvesting earlier works with other crops this is a good thing but it could be happening about the same time as the third cutting hay for instance and the grapes have to be picked – if the acids begin to lower they are no longer useful for verjus/products. They can however, be harvested for wine grapes but then they must be sprayed and bird control used. Also, finding a buyer at a late date (August) could be a challenge.

Cooperators

Nick Smith, Department of Horticultural Science, University of Minnesota, St. Paul, MN
Jennifer Anderson, Minnesota Small Business Development Center, Marshall, MN
Paul Bertolli, Fra'Mani, San Francisco, CA

Project Location

Locust Lane Vineyards physical vineyard is located at:
1301 - 130th Ave, Holland, MN 56139

From the Twin Cities metro:
Take MN Hwy. 23 South to Holland, turn left (south) on 140th go 2.5 mile turn right (west), go one mile to 130th Ave., turn left. 1371 is the farmstead, the grapes vineyards are just south of the farmstead on the west side of the road. Smaller vineyard is at farmstead on east side of road ½ mile further south.

The commercial kitchen space we rent for production of our food products is located at:
GIA, 955 Mackubin, St. Paul, MN, 55117.

Other Resources

Cooking With Verjuice. 2003. Maggie Beer. Penguin Books. ISBN: 10-14-300091-8 (pbk)

Maggie's Verjuice Cookbook. 2012. Maggie Beer. Penguin Books. ISBN-13:9781921382628

Maggie Beer's website: www.maggiebeer.com.au/

The Cooking of Southwest France. 2005. Paula Wolfert. John Wiley and Sons. ISBN: 10-7645-7602X

Correcting Soil Structure to Reduce Erosion by Using a Cover Crop Mix with Diverse Root Systems

Principal Investigator

Beth Markhart
Bois de Sioux
Watershed District
704 Hwy. 75 South
Wheaton, MN 56296
320-563-4185

Project Duration

2013 to 2015

Award Amount

$9,277

Staff Contact

Mark Zumwinkle
651-201-6240

Keywords

cover crops, compaction, soil health

Project Summary

Brian Rinke is doing a 3-year test adding a diverse cover crop mix to his row crops that will hopefully lead to reduced input costs, better water management, and higher row crop yields. The cover crop mix is being designed specifically to improve soil physical, chemical, and biological characteristics. The only expectation after 3 years is a measured improvement in soil physical structure. Showing a real improvement in biology and fertility will likely take longer.

Brian farms 1,800 acres of field corn and soybeans on silty to clayey textured soils in the Red River Valley. Slopes are 0-5% and soils are mapped at somewhat poorly to very poorly drained.

It is widely accepted in the Red River Valley that deep fall tillage and residue incorporation is needed to obtain a dark soil surface color to increase early spring soil temperature. This practice goes against the principle of disturbing the soil as little as possible to start building structure and biology.

Brian has already started working to improve water management on his farm. He is using conservation drainage on some fields and wants to assess whether spring drainage can be even further improved with cover crops, leading to a soil profile that has better structure and water infiltration.

Project Description

In this first year of the project, we aerially seeded a diverse cover crop mix into standing corn on 10 acres. The 3 year plan is to experiment with soil improvement practices while maintaining the cash crop cycle.

In order to track changes in soil structure, the following soil measurements are being made:

- water infiltration bulk density;
- aggregate stability;
- slake test (a measure of soil stability);
- and spring soil temperatures.

Organic matter is also being tested in the laboratory at the beginning of Year 1 and at the end of Year 3.

Results

In year 1, the initial soil evaluation showed a soil organic matter level of 1.9% at the 0-6" depth and 3% at the 6-12" depth. This suggests a plow layer with a potentially negative impact on soil physical structure.

The information was used to choose between two commercially available ten and nine way cover crop seed mixes. The consultant explained cover crop functional differences to assist in the choice of a cover crop mix. The nine way mix described in Table 1 was chosen specifically to enhance soil structure.

(see photo). We had intended on determining the extent of root biomass in the field at the end of the fall cover crop growth but this was not possible due to the herbicide damage.

Brian spent $250 on seed for 10 acres and $150 for application. Farm-wide implementation would have cost Brian $475 for seed and application.

Pilots in the area are getting more requests for aerial seed application as a new part of their business. The timing of next year's aerial seeding is being planned after the pilots finish their rounds of bug spraying. They will then switch the applicator for the purpose of seeding.

Nine Ways Cover Crop Mix for Imroved Soil Structure on Brian Rinke Farm, 2013

Cover Crop	% of Overall Mix	Functionality
Forage oats	54%	Cool season, deep fibrous root system
Forage peas	15%	Cool season, nitrogen
Hairy vetch	7%	Cool season, nitrogen
Foxtail millet	7%	Warm season, shallow fibrous root system
BMR sorghum/sudan	7%	Warm season, deep fibrous root system
Berseem clover	3%	Warm season nitrogen
Sunflower	2%	Micorhizal stimulant
Forage radish	3%	Taproot
Pasja Brassica (a forage turnip)	2%	Taproot

The cover crop mix was aerially seeded in early September into a standing corn crop in a level field without tile drainage. The seeding resulted in 95% of the seed contacting soil. On the same day, the pilot seeded the same mix into another farmer's corn field and adjacent wheat field 20 miles north of the Rinke farm.

An early October evaluation of the cover crops showed negligible establishment in both corn fields and high success in the wheat field (see photo of root growth in wheat field during September). The poor establishment in the corn was explained by residual activity of a moisture activated herbicide applied in August. In early October, soil samples were taken and a 'Dixie cup' germination test showed no residual herbicide effect. After germination, the seedlings were observed for 1 week without water which demonstrated a distinct difference in seedling vigor

August has been dry for two years and would not have been a good time to aerially seed. We have learned from the good stand of cover crop in the wheat this year that an early September seeding might not be too late for our northern area.

The land will be grazed in late fall or winter in cooperation with nearby animal producers if the cover crop yield is adequate next year. This would provide a low cost nitrogen application to the field through manure. The cash crop residue would be partially incorporated through animal impact instead of being tilled so as to begin working on a system with minimal soil disruption. As of this report, the plan for Year 2 is to drill seed soybean cash crop into Year 1 corn residue. Planning for Year 2 and 3 will be accomplished by adapting each decision to the outcome of the previous practice.

Management Tips

1. Avoid herbicide carry-over by tracking recent rainfall.

2. Start with a soil health goal and use cover crop functional groups to plan a cover crop mix.

3. Sufficient rainfall is necessary for a successful cover crop catch when aerial seeding.

Cooperator

Brian Rinke, Farmer, Wheaton, MN
Jon Roeschlein, Bois de Sioux Watershed Manager, Wheaton, MN
Matt Waterworth, NRCS Area Office Staff and District conservationist, Wheaton, MN

Project Location

The Brian Rinke farm is located 9 miles SE of Wheaton. From Wheaton, go south on US Hwy. 75 for 6 miles to Cty. Rd. 6. Go East 3 miles to the farm on the north side of the road.

Other Resources

Sustainable Agriculture Network. Managing Cover Crops Profitably: Third Edition. Beltsville, MD. 301-504-5236. Website: http://www.sare.org/publications/covercrops/covercrops.pdf

Midwest Cover Crops Council. Midwest Cover Crops Field Guide. 2012.
Website: ag.purdue.edu/agry/dtc/Pages/CCFG.aspx

USDA ARS. Cover Crop Chart.
Website: www.ars.usda.gov/SP2UserFiles/Place/54452000/CCC/CCC_v13_5_2012.pdf

Seedling vigor after one week without water. The rinke soil is on the left. Potting soil is on the right.

A Demonstration of Biological Primers on Drought Prone Soils

Principal Investigator

Kent Solberg
Sustainable Farming Association of Minnesota
18618 Cty. Rd. 23
Verndale, MN 56481
218-445-7580

Project Duration

2013 to 2015

Award Amount

$20,300

Staff Contact

Mark Zumwinkle
651-201-6240

Keywords

cover crops, biological primers, grazing, water holding capacity, soil health

Project Summary

A large number of demonstration projects in Minnesota have evaluated the use of cover crops using one, two, or three cover crop species such as annual ryegrass, oats, and turnips. Recent work in central North Dakota has focused on cover crop "cocktail" mixes that include eight or more species. These cocktails (also known as "biological primers") have demonstrated their efficacy in improving soil health. They have the potential to increase producer profitability by:

- reducing soil erosion;
- conserving soil moisture;
- reducing cropping input costs; and
- reducing livestock feed costs by providing forage during droughts.

The potential for biological primers to impart drought tolerance has been particularly evident in recent research. Trials in Ohio and North Dakota indicate that biological primers have tremendous potential even under adverse cropping conditions. Biological primers dramatically outperformed cover crops made up of one, two, or three species in side by side trials in North Dakota during the drought year of 2006. Corn grain trials during the 2012 drought in Ohio showed a 30 bu/A advantage using biological primers when compared to a two species cover crop blend.

Many producers in central Minnesota who farm on drought prone sandy soils have added irrigation systems to minimize drought risk. Biological primers have demonstrated efficacy during drought or in drought prone soils and may prove to be an alternative to capital intensive irrigation systems. Sandy soils also have high rates of nutrient leaching. Biological primers can be designed to sequester soil nutrients, thus reducing crop inputs by holding surplus nutrients for subsequent crop use. Producer profitability may be increased through lower fertilizer cost, while reducing the potential for high nitrates in the ground water.

Work in North Dakota indicates that biological primers appear to be most cost effective when crop and livestock systems are integrated, and when included as part of a broad crop rotation program.

Our goal is to demonstrate the efficacy and versatility of biological primers in integrated crop and livestock systems. We hope to show their capacity to improve soil health, produce forage, and reduce producer input costs in drought prone soils in central Minnesota. We want to introduce producers to biological primers and develop a core group of experienced producers that can serve as a resource to others.

A cover crop mix of turnips, white millet, BMR corn, soybean, cow pea, red clover, buckwheat, and sunflower on the Dan Middendorf farm.

Project Description

No two farming operations are the same. This project was developed to demonstrate the adaptability of biological primers based on individual farm needs and goals. Four integrated crop and livestock farms in central Minnesota were identified: Two dairy related operations (one dairy and one custom dairy heifer grazier) and two beef operations. All farms are dominated by sandy soils. One farm has irrigation. Two farms are certified organic.

The design of individual biological primer mixes was customized to each farm and field. Each farm intends to plant between 5 and 20 acres of biological primers each year as an extension of their current crop rotation. Each producer developed a biological primer mix comprised of eight or more species of annual crops customized to meet the needs of their operation.

The cover crops were harvested for livestock feed via managed grazing and/or mechanical harvest depending upon farm needs and goals. Each producer will plant the biological primers on a different field each year as the cover crops are incorporated into a broader crop rotation. We will follow planting, management, harvest methods, yields, soil health, crop rotations, and costs on the sites over the course of the 3 year project.

Results

The 2013 growing season provided interesting weather as we tracked the response of the cover crop demonstration plantings. The year began with low soil moisture and the spring was late. Snow was still on the ground on May 1. Rains in June and early July kept central Minnesota just ahead of severe drought status. There was a 6 week window without rain from early July until September 8. Several inches of rain fell in the area in September, and October had above average precipitation.

Due to extremely dry conditions on his farm in the spring of 2013, one of the beef operators did not feel it worth the risk or expense of planting his cover crop mix. This producer plans to participate in future years. Therefore, the results from the first year of the project reported here are from the remaining three farms.

Larry Heitkamp was looking for added high protein feed for his grazing replacement heifers. He also wanted maximum diversity to jump-start his soil biology. He planted his cover crop mix on June 12, 2013 into 25 acres after the heifers had grazed down a cereal rye and hairy vetch mix planted in the fall of 2012. The diverse cover crop mix included turnips, oilseed radish, mustard, white millet, sorghum-

sudan, soybean, cowpea, red clover, flax, buckwheat, sunflower, and phacelia. This field was harvested as baleage on August 13, 2013 yielding 1,700 pounds of dry matter. In addition, the field was grazed before and after mechanical harvest.

On August 24, a cool season cover crop mix was no-till planted in this field. The mix consisted of field peas, oilseed radish, turnips, lentils, hairy vetch, flax, buckwheat, barley, oats, and emmer wheat. After planting the cover crop, a second crop of the warm season mix was put up for baleage on September 4. The cool season mix did not grow well and fifty head of dairy heifers were allowed to graze the field for 1 week in the fall to glean what growth was there.

Dan Middendorf planted a 30 acre field to his cover crop mix on June 29, 2013. Dan runs an organic dairy. Unfortunately, organic cover crop seed choices were limited this year which limited the diversity of the mix. Dan's field had been in cool season grasses for many years. Dan's mix included significant warm season cover crops in an attempt to diversify his soil biology. The mix consisted of turnips, white millet, BMR (high digestibility) corn, soybean, cowpea, red clover, buckwheat, and sunflower. The field was harvested as baleage on August 31, yielding approximately 1 ton/A dry matter. This field was then no-till planted to an alfalfa-grass mix on September 7.

Marcus Edin planted 10 acres to a cover crop mix on July 10, 2013 after taking a first crop of hay. The field was sprayed with herbicide prior to planting due to a heavy thistle infestation. The field was then plowed and disked to level pocket gopher mounds. Marcus planted a cover crop mix of turnips, oilseed radish, rape, pearl millet, sorghum-sudan, cowpea, red clover, winter pea, buckwheat, and sunflower. Sixteen beef cows were allowed access to this planting on November 13 after grazing other fields planted to oats, oilseed radish, and turnips. As of December 19, the cattle were still utilizing this field. The cattle were offered free choice grass/alfalfa hay in addition to the cover cropped field. Marcus estimates that the cattle were getting about 90% of their feed from the cover cropped field until 12" of snow fell on December 3-4. Since December 4, Marcus estimates that the cattle have gotten about 50% of their feed off this field. The cover crop mix germinated and grew with little rain. The majority of growth, however, came after rains began in September. Marcus feels he could have put the cattle into the field 2 weeks sooner than he did.

Several soil measurements are being tracked to document the effect of the cover crop mixes on soil health. Measurements include water infiltration, bulk density, and respiration (Solvita test).

Management Tips

1. Secure a cover crop seed source well in advance. Cover crops are increasing in popularity and seed supplies may be limited. This is particularly true of organic cover crop seed.

2. Taylor your cover crop mix to compliment the crops that have dominated your rotations in the past.

Cooperators

Larry Heitkamp, Organic Farmer, Sebeka, MN
Dan Middendorf, Organic Dairy Farmer, Verndale, MN
Marcus Edin, Beef Farmer, Verndale, MN

Location

Contact Kent Solberg for directions to specific cooperating farm locations.

Other Resources

ATTRA. No-Till Case Study, Miller Farm: Restoring Grazing Land with Cover Crops. November 2012.

Sustainable Agriculture Network. Managing Cover Crops Profitably: Third Edition. Beltsville, MD. 301-504-5236. Website: www.sare.org/publications/covercrops/covercrops.pdf

Late Grazing Cover Crops. John Dhuyvetter, 2011. NDSU North Central Research Extension Center. Website: www.ag.ndsu.edu/northcentralrec/livestock-extention/articles/late-grazing-cover-crops

Comparing the Production and Profitability of Heat-loving Crops

Principal Investigator

Robin Major
Stone's Throw
Urban Farm
3217 – 17th Ave. S. #2
Minneapolis, MN 55407
802-380-5156
majorrobin1@gmail.com
Hennepin County

Project Duration

2013 to 2014

Award Amount

$10,292

Staff Contact

Jean Ciborowski
651-201-6217

Keywords

basil, cucumber, high tunnel, quick hoops, row cover, tomato

Project Summary

Unheated structures such as high tunnels or quick hoops are commonly used to extend vegetable production. However, for many beginning vegetable farmers season extension structures, such as a high tunnel, are a cumbersome investment. This project is an attempt to compare the interaction of production and profitability differences between two unheated season extension systems, a high tunnel, and quick hoops.

We want to determine if quick hoops; cheap and portable, are more profitable than high tunnels, costly yet highly productive. As vegetable farming operates on such tight margins, a quick hoops system that is inexpensive yet lower-yielding may in fact be more desirable due to lower overhead cost. If the project is successful, it will provide Stone's Throw Urban Farm and other vegetable farms an understanding of profitability expectations for high tunnel and quick hoop season extension systems.

Project Description

Stone's Throw Urban Farm is a 3-acre urban vegetable operation located on 14 rented lots in South Minneapolis, and the North End and Frogtown neighborhoods in Saint Paul. The farm sells food through its 100 CSA shareholders, at one farmers' market, and to restaurants in the Twin Cities. As beginning farmers with no land permanency, we strive to identify investments that will directly increase income or decrease expenses.

Season extension systems offer many benefits for increasing production earlier and later in the season. However, beginning farmers need more information to discern the best way to improve low-input season extension systems. With little start-up capital, many beginning vegetable farmers need to know how much additional income high tunnel crops will bring compared to working with quick hoops. Quick hoops are impermanent structures made by placing row covers or plastic over lightweight metal wickets three feet in height. This project aims to explore the following questions: At what point do high tunnels become more profitable than quick hoops? What are the production differences between systems? How much time will high tunnels extend the season compared to quick hoops?

We compared the profitability and productivity of three crops, tomatoes (var. Cherokee Purple), cucumbers (var. Bushy), and basil (var. Genovese), in three treatments: high tunnel, quick hoops, and outdoors (control). The demonstration size differed by crop but is consistent between the high tunnel, quick hoops, and outdoor treatments. Tomatoes and cucumbers were planted in 55' long beds per treatment, while the basil was transplanted in 30' long beds per treatment. The quick hoop protective row cover was removed when the crops outgrew the 3' quick hoops (June 15 for cucumbers and June 24 for tomatoes and the row cover was not removed from the basil). We kept track of all costs associated with the investments for the season extension systems

as well as the growing costs (seeds, soils, etc) and the labor required for production. We recorded first harvest dates and harvest amounts for each crop, and took pictures routinely through the season to keep track of differences in quality and growth. We also recorded differences in soil quality and temperature across treatments.

To evaluate the profitability for each treatment we used the following formula:

(Yield in Pounds * Price per Pound) minus Input Costs (materials, labor, tunnel/hoop maintenance, crop requirement costs) equals Net Return.

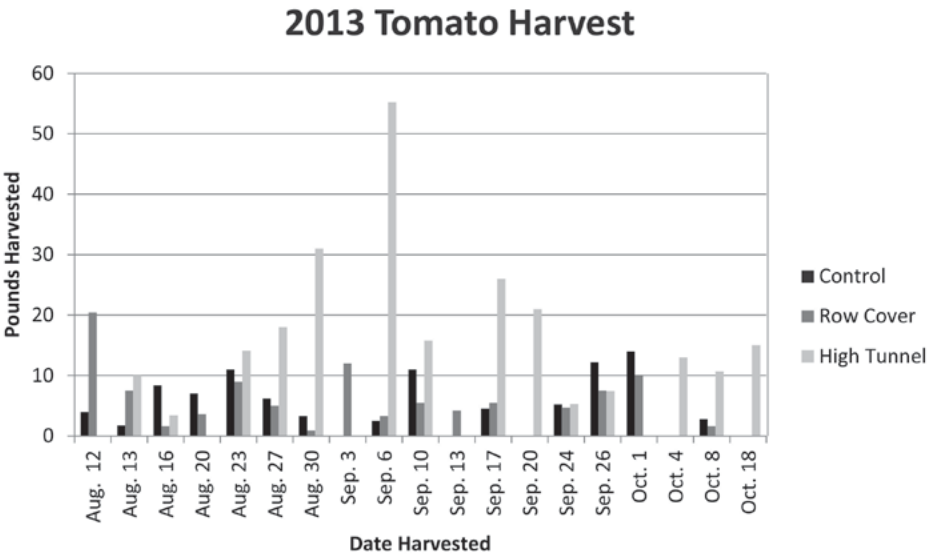
Results

Tomato, Cherokee Purple: The high tunnel treatment grew a noticeably higher quantity and better quality tomato, while the quick hoop treatment grew more quantity at the beginning of the season than the high tunnel or control. The high tunnel harvest started slow; it produced 10 days later into the season than the control or quick hoops. The row cover and high tunnel plants were transplanted on May 9 while the control tomatoes were transplanted seven days after on May 16. Out of 30 tomato plants per treatment, ten control tomato plants died, three quick hoop tomatoes died, and zero high tunnel plants died. The row cover tomatoes started the season looking much stronger with more growth than the control tomatoes.

However, by the end of the season the control produced, on average, more tomatoes per plant (4.9 lb/plant) than the quick hoop tomatoes (3.7 lb/plant). The high tunnel yielded twice as much fruit per plant than the quick hoop tomatoes (8.1 lb/plant). The high tunnel tomatoes grew to over 7' tall while the control and quick hoop treatments did not grow over 4'. The high tunnel yielded a season total of 245 lb, 2.3 times more than the quick hoop treatment (102 lb) and 2.5 times more than the control treatment (94 lb).

The high tunnel tomatoes were of a higher quality with fewer splits than either the quick hoop or control treatments (Photos 1, 2, & 3). It should be noted the high tunnel soil tested contained nitrogen levels six times higher (before compost and fertilizer application) than the quick hoop or control treatment areas, which likely affected the yield amount. This factor applies for all of the high tunnel crops. We believe this may have been a result of a compost application for growing salad mix in the high tunnel earlier in the spring. Next season we will consult with a soil expert in order to figure out ways to better balance our soil conditions between experimental treatments.

Control Tomatoes



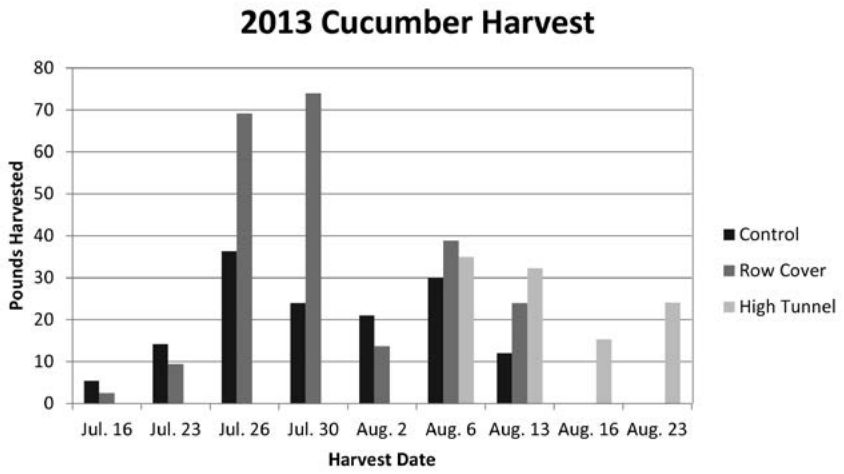
Row Cover Grown Tomatoes

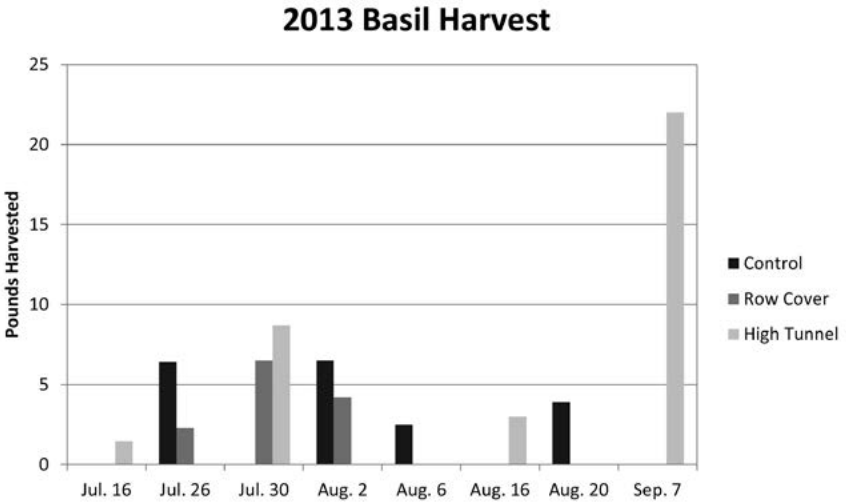
High Tunnel Grown Tomatoes

Cucumber, Bushy: The high tunnel cucumbers suffered from a 60% germination failure from cutworm damage, which greatly affected the total high tunnel yield. All treatments were planted on May 23 and the quick hoop and control cucumbers started to produce 16 days before the high tunnel, July 16 and August 6, respectively. While the quick hoop treatment produced 1/3 more than the control and two times more than the high tunnel, the quick hoop cucumbers yielded much less at the beginning of the harvest even though the quick hoop plants seemed to be growing faster than the control cucumbers. This may have been a result of keeping the protective row cover on while some of the plants were flowering, which may have blocked pollinators. The high tunnel cucumbers produced an average of 5.3 lb of cucumbers per plant, the quick hoops produced an average of 4 lb of cucumbers per plant, and the control produced an average of 2.7 lb of cucumbers per plant.

Basil, Genovese: The high tunnel treatment grew a noticeably higher quantity and better quality of basil. We started harvest in the high tunnel 12 days earlier (July 14) than the control and quick hoop treatments (July 26). The high tunnel yielded a season total of 35 lb of basil, three times more than the row cover harvest (13 lb) and almost two times more than the control harvest (19 lb). Basil was our most difficult crop to analyze in this experiment because we did not have the market to harvest all of the available growth. We sold basil at the farmers' market and to restaurants but we produced more that we could sell. We also noticed that the row cover was growing in more shade than either the control or the high tunnel.

Profitability: The crop with the highest net profitability was tomatoes. It was the only crop that we made a profit on in the high tunnel. Tomatoes in the high tunnel made a greater net profit than the row cover even though the high tunnel required eight times the up front investment cost in materials and labor than quick hoop materials.





Tomato Budget for Year 1

	Control	Quick Hoops	High Tunnel
Expenses (in dollars, $)			
High tunnel, construction labor + materials (for % of tomato space and time)			659
Row Cover		88	
Soil	25	25	25
Fertilizer	3	3	3
Irrigation	5	5	8
Trellis	25	25	25
Seedling labor + materials	8	8	8
Mulch	12	12	12
Labor (excluding harvest)	49	71	57
Income			
Income			
Market Price @ $4/lb	375	409	983
Total Funded	**$284**	**$172**	**$185**

Conclusion

We did not lose any money on plants grown under the row cover or the control. Overall, in year one we netted $519 in growing our crops as the control, $323 under the row cover and lost minus $520 on the high tunnel. In the first year of owning a high tunnel we suggest maximizing space in which high-value crops, like tomatoes, are grown.

We spent an average of 1.3 more hours per crop on the quick hoop treatment than the control and high tunnel treatments. This was a result of the time it took to take off the row cover and put it back on. In early summer, the weeds under the row cover would also grow faster due to the increased heat and weeding would take longer.

Cooperators

Courtney Tchida, University of Minnesota, St. Paul, MN

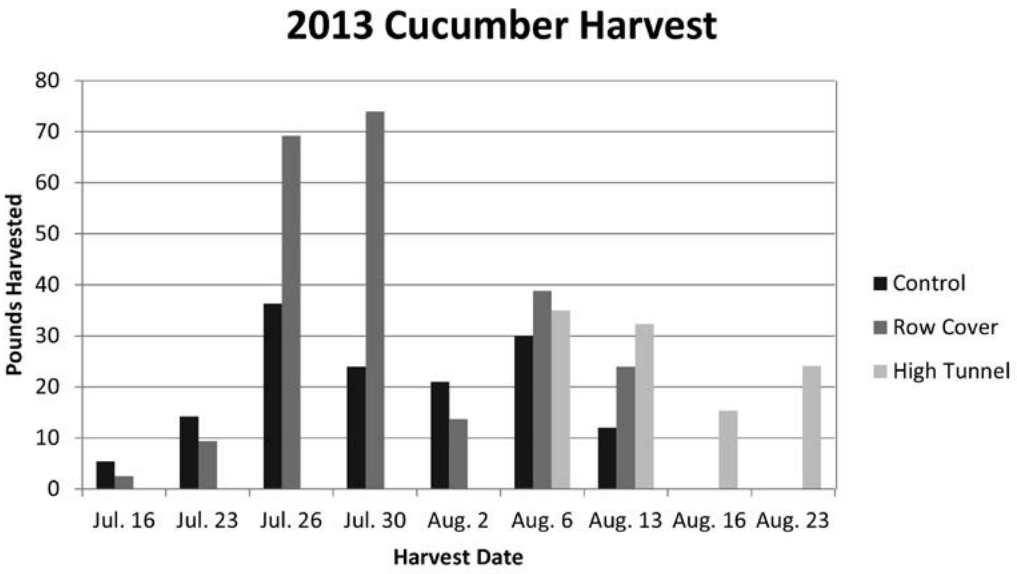
Project Location

The project is located on 15th Ave S. between 28th and 29th St. in South Minneapolis. Our farm address is 3217 17th Ave S. Minneapolis, MN 55407

Other Resources

The Winter Harvest Handbook. March, 2009. Elliot Coleman. Chelsea Green Publishing Company. ISBN: 978-1-60358-081-6

Cornell High Tunnel Website: www.hort.cornell.edu/hightunnel/



Management Tips

1. Create a set system for calculating labor for yourself and other people working on the farm when working with the experiment treatments.

2. Do not use row cover when cucumber plants start to flower. I think the row cover blocked pollinators, which caused a delay in production.

3. Have a reliable market and harvest schedule for experiment crops. We did not have one for basil and we did not harvest everything that we grew, and thus did not have accurate yields that accurately reflected the plant growth.

Using Spring-planted Winter Cereals to Control Weeds in Organic Soybeans

Principal Investigator

Floyd Hardy
18055 Woodrow Rd.
Brainerd MN 56401
218-764-3122
Crow Wing County

Project Duration

2013 to 2014

Award Amount

$5,331

Staff Contact

Meg Moynihan
651-201-6616

Keywords

cereals, organic, rocks, soybeans, triticale, vernalization, weeds, winter triticale

Project Summary

Raising soybeans on my North Central Minnesota farm has been difficult because of the many small rocks in my fields. Even if I pack the fields at planting time, cultivation disturbs the rocks, and they play havoc with my equipment when I combine the crop.

I am testing a strategy of planting winter triticale in the spring of the year (when planted in spring, winter triticale stays vegetative and does not produce grain). I want to see if the triticale will control weeds until the beans shade the ground, so that I don't have to cultivate and can reduce the risk of rock damage to my combine.

Floyd drills winter triticale in the spring.

Project Description

I have farmed organically for 13 years – mainly small grains, clover for hay and seed, hairy vetch for seed. I use hairy vetch as the legume to fix nitrogen, and buckwheat to control quack grass in my crop rotations. I am interested in putting soybeans back into my crop rotation, but because my fields have small rocks, cultivation of a row crop like soybeans moves the rocks into the crop row and makes for a difficult harvesting situation.

In 2007, I visited another organic farmer who had planted soybeans in a rye field. I noticed how clean (weed-free) his field was. He told me later that he did end up with some rye grain in his beans when he harvested them.

His experience got me to wondering if I could try something similar, but my idea was to use winter triticale as a smother crop that I would plant in the spring, instead of the fall. When you plant a winter cereal like winter triticale, winter wheat, or winter rye in the fall, it goes through a process called vernalization (exposure to cold temperatures), which triggers it to produce grain the next spring. However, when you plant winter grains in the spring, vernalization does not occur, and the plant stays vegetative; it never produces grain. My idea was that the triticale would control broadleaf weeds (just like that farmer that I visited who controlled weeds with rye), but would not produce any triticale grain that would end up in my soybeans. I wouldn't have to cultivate (and stir up rocks), and combining would also be much cleaner and easier.

The field I used had been in red clover for two years. I plowed, disked and multiweeded the field in the spring. Then, I planted the winter triticale at different seeding rates: 1, 1.5, and 2 bu/A on May 13.

The triticale was about 2" tall when it was time to seed the soybeans. However, it had been raining almost every day and a third of my field was underwater – to where geese and swans had taken up residence! After a 10 day delay, I drilled the soybeans in 12" rows on the high ground on May 23, using a seeding rate of 190,000/A. Then I packed the field to suppress the rocks. The triticale looked awful, and I wondered if it would survive, but it did! About a week later, I planted beans on some of the acres that had been flooded. The triticale there was in very poor condition. This area did not have to be packed because there are no rocks on this lower land.

Results

On July 12, my advisor Glen Borgerding and I walked the field. Just a few of the beans were starting to bloom. They were about 10" high and nodules were starting to form on the roots. The triticale was about 14" high and turning brown. Glen and I walked for some time before we found a broadleaf weed. However, we found a lot of quack grass on the low ground because of all the rain.

Then things dried up, and from July 4 on, not a drop of rain fell. By August 30, when I held a field day, the soybeans were in very poor shape. The low ground that I never planted was armpit high with volunteer grass. Where I did plant beans, they didn't grow big enough to shade the ground, and common ragweed was everywhere! A neighbor volunteered to cut and bale everything as he needed hay for his beef cattle.

Management Tips

Even though things didn't go the way I planned in this first year of my demonstration, I did learn a lot about my idea:

1. Don't try this on sod ground.
2. Drill the triticale right before planting the beans.
3. Drill the soybeans in 6" rows.

This is the strategy I will use in the second year of this grant. I truly believe it is going to work as a way to raise soybeans in rocky soil. Hopefully, in 2014, the weather will cooperate!

Cooperators

Glen Borgerding, Consultant, Ag Resource Consulting, Albany, MN

Project Location

From Brainerd, go east on State Hwy. 18. Continue east for 2.5 miles. Turn right onto Cty. Rd. 144 Go south 3.5 miles, turn left on Narrow Lane Rd. Look for fire number 14743.

Optimizing Alfalfa Fertilization

Principal Investigator

Doug Holen
University of Minnesota Extension
WCROC
46352 State Hwy. 329
Morris, MN 56267
320-589-1711
holen009@umn.edu
Project Location: Otter Tail County

Project Duration

2010 to 2012

Award Amount

$7,926

Staff Contact

Meg Moynihan
651-201-6616

Keywords

alfalfa, boron, forage, persistence, potassium, sulfur, yield

Project Summary

Alfalfa is a key component of sustainable cropping systems in Minnesota. It is a perennial crop that fixes its own nitrogen, improves soil health, reduces soil erosion, and provides high-quality forage for ruminant livestock. Economic analyses have consistently shown alfalfa to be a profitable crop for haying and grazing. In many years, it has been more profitable than subsidy-supported corn or soybean production. We were interested in identifying fertilization strategies that economically optimize alfalfa production , and after a four-year study, conclude that sulfur has a beneficial effect on alfalfa production.

Project Description and Results

Good soil fertility is known to be important to productive and persistent alfalfa. Potassium has generally been the nutrient recommended in greatest quantities due to the large amount of potassium removed when alfalfa is harvested as hay or haylage. Boron and sulfur have been recommended when alfalfa is grown on sandy soils, but there is increasing evidence that these nutrients may benefit alfalfa and other crops more than previously thought. Our specific objectives were to test alfalfa's response to various levels of:

1. Potassium fertilization
2. Boron fertilization
3. Sulfur fertilization
4. The interactions of these three nutrients, observed with timing of application

We designed the study to replicate a typical, intensively-managed forage production system, in which farmers maintain an alfalfa stand for three years of production after the establishment year. Some fields can persist and well for longer than that, and some producers continue production beyond the fourth year if stands and tonnage are adequate.

2010 Project Design and Establishment

In the first year, we set up the study, prepared the site, applied treatments, and documented existing soil fertility. On May 17, we planted a replicated small plot experiment on the Paul Beckman farm in Otter Tail County. We used a split-split plot restriction of a factorial arrangement of treatments to evaluate fall and spring applications of potassium, sulfur, and boron at different rates (Table 1). The total of all timings, fertilizers, and rates combined made for 48 different treatments, and replicating them three times required 144 plots. We seeded 'Rebound 5.0' alfalfa in 3' x 20' plots with a special small plot research planter, choosing this variety because it has performed well in recent University of Minnesota alfalfa variety testing. The seeding rate was 16 lb/A.

Table 1. Timing, Fertilizer, and Rate Treatments

Main Plot	Subplot	Sub-Subplot	Sub-sub-subplot
Sprint	Potassium at 0, 150, 300, 450 lb/A	Boron at 0 or 4 lb/A	Sulfur at 0,30,60 lb/A
Fall	Potassium at 0, 150, 300, 450 lb/A	Boron at 0 or 4 lb/A	Sulfur at 0,30,60 lb/A

In the first year, we set up the study, prepared the site, applied treatments, and documented existing soil fertility. On May 17, we planted a replicated small plot experiment on the Paul Beckman farm in Otter Tail County. We used a split-split plot restriction of a factorial arrangement of treatments to evaluate fall and spring applications of potassium, sulfur, and boron at different rates (Table 1). The total of all timings, fertilizers, and rates combined made for 48 different treatments, and replicating them three times required 144 plots. We seeded 'Rebound 5.0' alfalfa in 3' x 20' plots with a special small plot research planter, choosing this variety because it has performed well in recent University of Minnesota alfalfa variety testing. The seeding rate was 16 lb/A.

2011–2013 Data Collection

In spring and fall 2011 we took soil samples from all 48 treatment combinations conducted to determine costs, returns, and profitability potential of the various fertility treatments. We soil sampled again in Fall 2012. It is important for producers to know that soil tests are not a reliable way to determine sulfur needs. Traditionally, soil type has been the best predictor of sulfur need . Researchers like us are currently trying to learn more about different crops' sulfur requirements .

In our experiment, we applied fertilizer treatments on July 6 and October 4 in 2011; on July 3 and October 29 in 2012; and on June 10 in 2013. In all three years, we harvested the alfalfa four times using a small plot research flail harvester and documenting maturity, height, and weed content data at all harvests. The 2011 cutting dates were June 3, June 30, August 4, and October 4. The 2012 cutting dates were May 31, July 3, August 3, and October 8. The 2013 cutting dates were June 7, July 11, August 14, and October 10. We took representative forage samples to determine dry matter content. Fresh weights of harvested material were measured on site, and then adjusted to a dry matter basis based on content of the representative samples (Table 2).

This is our research site just after its 144 individual plots freshly were harvested.

Results

Yields for the four treatments are summarized in tables 2-5. In all three years, we observed significant yield increases with higher sulfur applications and we found significant differences for Timing x Sulfur (our statistical approach used a confidence level of 95% probability.) In 2012 only, we also found significant interaction for Potassium x Boron. In 2013, we found significant differences in potassium rates, but only at the 90% confidence level.

We conclude that fall-applied sulfur results significantly increases alfalfa yields.

Project Location

1. If alfalfa isn't producing the way you think it should and weather hasn't been extreme, start troubleshooting by taking soil and tissue samples. Nutrient availability and/or pH are often factors that limit production.

2. Matching the nutrient needs to the expected tonnage harvested is important. Deficiencies lead to underproduction, while excess fertility means lost money and risk to environmental quality.

3. Continually monitor alfalfa and forage fields for insect and disease pests. Properly identifying pests allows for timely management decisions if problems warrant action.

Table 2. Dry Matter Yield (T/A) by Fertilizer Application Timing

Forage Yield				
Timing	2011	2012	2013	Total
Fall	6.4	7.2	6.8	9.1
Sprint	6.3	7.2	6.7	9.0
LSD 0.05	NS	NS	NS	NS

Table 3. Dry Matter Yield (TA) for Four Potassium (K) Rates

Forage Yield				
K (lb/A)	**2011**	**2012**	**2013**	**Total**
0	6.3	6.9	7.1	8.7
150	6.1	7.0	7.3	8.8
300	6.5	7.4	7.6	9.3
450	6.6	7.5	7.9	9.4
LSD 0.05	NS	NS	0.56	NS

Table 4. Dry Matter Yields (T/A) for Two Boron (B) Rates

Forage Yield				
B (lb/A)	2011	2012	2013	Total
0	6.4	7.2	2.9	9.1
4	6.4	7.2	2.9	9.1
LSD 0.05	NS	NS	NS	NS

Table 5. Dry Matter Yields (T/A) for Three Sulfur (S) Rates

Forage Yield				
S (lb/A)	2011	2012	2013	Total
0	6.2	6.7	6.9	12.9
30	6.4	7.3	7.7	13.8
60	6.5	7.6	7.8	14.0
LSD 0.05	0.11	0.14	0.21	0.09

4. Pound for pound, not all agricultural lime is created equal. Check the label for "effective neutralizing power (ENP)" to figure out the correct application rate.

5. Retired alfalfa fields can be a tremendous nutrient provider for succeeding grass crops, such as corn and small grains.

Cooperators

Paul Beckman, Crop Farmer/Retired Dairy Producer, Underwood, MN
Phil Glogoza, University of Minnesota Extension Educator - Crops, Moorhead, MN
Paul Peterson, University of Minnesota Extension Forage Specialist, St. Paul, MN

Note: The University of Minnesota directly contributed to this project by underwriting an additional year of data collection and a summer intern. Cooperating producer Paul Beckman invested time, equipment, and site preparation for the study and throughout the four years. Researchers contributed in-kind labor to the project.

Project Location

Minnesota Agricultural Experiment Station. 2014. Alfalfa variety trials and resources. www.maes.umn.edu/Research/Crop_Variety_Trials

Other Resources

Minnesota Agricultural Experiment Station. 2014. Alfalfa variety trials and resources. www.maes.umn.edu/Research/Crop_Variety_Trials

Increasing Dairy Farm Profitability with Energy Efficiency Improvements

Principal Investigator

Fritz Ebinger
The Minnesota Project
1885 University Ave.,
Ste. 315
Saint Paul MN 55104
651-789-3330
febinger@mnproject.org
Carver, Dakota, Goodhue,
Rice, and Scott Counties

Project Duration

2013 to 2016

Award Amount

$9,999

Staff Contact

Meg Moynihan
651-201-6616

Keywords

dairy, conservation,
efficiency, energy,
profitability, savings

Project Summary

The Minnesota Project and Hastings Cooperative Creamery Company (HCCC) are collaborating to develop and deliver a program that helps dairy farmers learn about and adopt energy efficiency technologies on their farms. On average, Minnesota dairy farms use between 800 to 1,200 kWh/cow each year. This is a significant amount of energy consumption, and reducing it would help achieve two goals: 1) increase dairy farm profitability by reducing energy costs, and 2) help electric cooperatives make progress toward their energy conservation goals. We hope the approach we develop in this project will be used to promote energy efficiency for other types of livestock operations as well.

Project Description - 2013

This year, we consulted with certified energy managers and professional engineers from GDS Associates. They helped us develop a baseline survey to learn what kinds of dairy equipment producers are currently using and to capture a basic understanding of individual farm energy usage. Milk haulers and HCCC field staff distributed the survey to 57 of HCCC's dairy farms in Dakota, Goodhue, Scott, Rice, and Carver counties – and every operation responded!

We reviewed the completed surveys and created a scoring sheet to rank each farm's potential for energy cost reductions, considering things like equipment (vacuum pumps, milk pumps, plate coolers, heat recovery units, energy efficient lighting, etc.) and behavioral systems associated with how and when that equipment is used (for example, what time of day lights are on and for how long, length of time and speed at which vacuum or milk pumps run, use of tractor block heaters, etc.). We then contacted 38 of the 57 farms that we believed could reduce their energy cost substantially. All but eight of these farms agreed to participate (those that declined were either nearing retirement or considered selling their farm in the foreseeable future). A team of farm energy auditors from GDS associates and program graduates from The Minnesota Project's farm energy auditor program visited the 30 participating farms to gather data and write energy audit reports. The team created individualized recommendations about equipment changes and upgrades, including simple payback calculations based on energy dollars that could be saved per year. For the majority of farms, they were able to recommend four or five changes with reasonable payback timelines. The most common recommendations were lighting upgrades (e.g., replace incandescent bulbs with compact fluorescent or LED fixtures), and installation of refrigeration heat recovery units, refrigeration compressors, and/or water heaters. Though each participant farm was unique, electric water heaters and energy efficient lighting tended to provide the best energy savings opportunities.

A team of energy auditors training at Howe Holsteins.

The auditors discuss energy savings that could result from replacing a standard vacuum pump with a more efficient, variable speed design. Photos by Shaun Daniel

We expect that in 2014, many of the farmers will begin to adopt some of the changes that our audit teams recommended. We will help the farmers identify which are the "best" (lowest cost and/or fastest payback) equipment choices and will help them take advantage of electric cooperative Conservation Improvement Program (CIP) rebates and the USDA-NRCS Agricultural Energy Management Plan (AgEMP) cost-share program.

In the final year of the project (2015), we expect we will make changes in the program, based on recommendations from participating farmers and electric utility personnel. We will also quantify the energy savings across participating farms so that HCCC can use this information in branding and marketing its dairy products. We will share what we learned and accomplished in a presentation at the Minnesota Dairy Expo. We also plan to present our program at the Minnesota Clean Energy Resource Teams conference in early 2015, so rural electric cooperatives can learn about and use the approach we developed.

In the meantime, we have developed an online Dairy Farm Energy Benchmarking Tool so dairy farmers across Minnesota can compare their energy consumption to that of similar dairies in the Upper Midwest (see Other Resources). The tool estimates dairy cooling energy usage normalized by milk production. It considers equipment such as well water pre-coolers, refrigeration heat recovery units, scroll refrigeration compressors, variable speed vacuum pump controls, water heaters, and variable speed milk pumps. Energy usage calculations are based on hundreds of Midwest dairy farm energy audits completed by project partner GDS Associates. The cooling energy usage calculations in the benchmarking tool determine where a dairy falls on the spectrum of energy efficiency.

Management Tips

1. Use existing networks. Much of this project's success to date is due to help from Hastings Cooperative Creamery Company's field staff and milk haulers.

2. Communicate frequently and be patient. Writing letters to farmers and following up with phone calls worked well for us. Farmers are busy people; waiting for several days for a return phone call is normal.

3. Be courteous. Showing up on time and wearing booties demonstrates respect to the farmer you are visiting. Taking some time at the beginning of the visit to explain how an energy audit is conducted and sharing a few preliminary energy savings at the end of the visit built trust.

4. Respect confidentiality. Tell farmers how information will be used and who will see it.

Cooperators

Jennifer Brinker, Agricultural Energy Specialist, GDS Associates, Madison, WI
David Zwart, President, Hastings Cooperative Creamery Company, Hastings, MN
Meghan Romo, Field Officer, Hastings Cooperative Creamery Company, Hastings, MN

Project Location

This project is taking place on farms in Carver, Dakota, Goodhue, Rice, and Scott Counties.

Other Resources

The Minnesota Project Energy Benchmarking Tool
www.mnproject.org/e-BenchMarkingTool-Form.html

Dairy Farm Energy Efficiency Initiative Resources
www.mnproject.org/e-EE_DairyEnergyEfficiencyInitiative.html

USDA-NRCS Minnesota – Environmental Quality Incentives Program
www.nrcs.usda.gov/wps/portal/nrcs/detail/mn/programs/financial/?cid=nrcs142p2_023506

New Demonstration Grant Projects - 2014

Alternative Markets and Specialty Crops

Creating Beneficial Habitat for Weed Management & Wildlife Enhancement on Farm Wasteland

Grantee: Melissa Nelson
Project duration: 3 years
Award amount: $12,572
County: Big Stone

Project objectives:

1. Test various methods to transition various typical types of agricultural wasteland into pollinator habitat.

2. Document the number of pollinators attracted to the habitats before, during, and after habitat establishment. Document the types and varieties of beneficial plants.

3. Document the best practices to establish and maintain the pollinator oases from encroachment by undesirable plant species, and to disseminate this information to other landowners.

Preserving and Attracting Natives Bees

Grantee: Noreen Thomas
Project duration: 3 years
Award amount: $13,257
County: Clay

Project objectives:

1. Once native bees are released and populated determine what keeps them in the area? Which homes work better: wood, clay, or mud? Which direction and set up works better for the bee habitat?

2. Determine what plant vegetation retains the highest numbers of bees throughout the growing season? What about the second and third years? What produces revenue from plant habitat and what is the yield per acre?

3. Determine what is the most effective bee habitat for changing weather patterns such as rain, drought, etc?

Cropping Systems & Soil Fertility

Nitrogen Capture Using Cover Crops in a Cash Grain Rotation

Grantee: Sherburne Soil and Water Conservation District (Bill Bronder)
Project duration: 3 years
Award amount: $19,570
County: Sherburne

Project objectives:

1. Show that cover crops can be an effective nitrogen scavenger in a typical cash crop rotation.

2. Reduce leaching of nitrate-nitrogen below the root zone.

No-till Cover Crop Rotation vs. Intensive Tillage in Corn/Soybean Rotation

Grantee: Chad Rollofson
Project duration: 3 years
Award amount: $15,809
County: Grant

Project objectives:

1. Show that cover crops can be a viable part of a northern plains cropping system.

2. Prove that soil health is improved and soil erosion is controlled in a no-till cover crop system compared to the normal intensive tillage corn-soybean rotation.

3. Determine that a three crop rotation that includes wheat can compete economically with the corn-soybean rotation that is the normal rotation in west central Minnesota.

Developing Low-cost Planting Materials and Establishment Methods to Accelerate Agroforestry Adoption for Function & Profit

Grantee: Happy Dancing Turtle (Jim Chamberlin)
Project duration: 3 years
Award amount: $20,185
County: Cass

Project objectives:

1. Test propagation techniques in the establishment of low-cost agroforestry systems.

2. Demonstrate the use of ecological classification and succession in establishing agroforestry systems that can provide early return on investment and diversify farm income as the systems mature.

The Effects of Cover Crops on Water & Soil Quality

Grantee: Hmong American Farmers Association (Pakou Hang)
Project duration: 2 years
Award amount: $24,990
County: Dakota

Project objectives:

1. Determine if soil and water quality improve as a result of combining mixed vegetable production and cover crops (where improvement means more microbial activity, more stable aggregates, less soil compaction, increase water retention, and less erosion).

2. Determine which teaching tactics best convey the merits and methodology of using cover crops for a population of low-literacy farmers who often use multiple plantings in one growing season to grow fresh, mixed vegetables.

3. Determine if the use of cover crops will increase a farmer's income through greater yield per acre and less cost of inputs.

Legume Cover Crops

Grantee: Paul Kruger
Project duration: 3 years
Award amount: $15,006
County: Wabasha

Project objectives:

1. Reduce commercial nitrogen, replace with legumes, and measure by yield results.

2. Improve soil health including organic matter, biological-activity, and natural tilth, measurable by soil samples.

3. Determine applicability for commercial corn for grain operations, measurable by project outcome.

Using Compost Tea in Organic Farming

Grantee: Seeds Farms, Becca Carlson (and six other farmers)
Project duration: 3 years
Award amount: $24,152
County: Rice

Project objectives:

1. Develop consistent compost tea recipes and build cost effective compost tea brewers – at a farm scale level.

2. Measure yield, brix levels, plant health (plant tissue analysis), soil health (micro-organisms living in the soil); labor to make and apply compost tea.

3. Compare the profitability of compost tea vs. our current fertility inputs and methods (including labor): test plot vs. control plot.

Developing an Integrated Perennial System

Grantee: White Earth Land Recovery Project
Project duration: 3 years
Award amount: $17,663
County: Becker

Project objective:

1. Determine the viability of an integrated perennial system featuring hybrid hazelnuts, native berry plants, and a cover crop system of red clover, cowpeas, vetch, and rye for hardiness zone 3b.

Energy

Solar-powered Rainwater Catchment & Distribution System Using Drip Irrigation

Grantee: Hammer Green Acres (Sharon Utke)
Project duration: 2 years
Award amount: $7,568
County: Fillmore

Project objectives:

1. Demonstrate a low-cost, solar-powered, sustainable, easy-to build and use rainwater harvesting and drip-tape distribution system.

2. Reduce and/or eliminate dependence on household well water for irrigation, washing produce, and watering livestock.

3. Save the $25,000 cost of drilling a new well and thereby eliminating salt and other mineral build-up normally found in well water irrigation systems.

Fruits and Vegetables

Developing Profitable Apple Production along Lake Superior's North Shore of MN

Grantee: Clover Valley Farms (Cindy Hale)
Project duration: 3 years
Award amount: $18,074
County: St. Louis

Project objectives:

1. Develop high-density trial and demonstration orchards using modern and heritage apple varieties, including collection of baseline data on production, climate, and pest/disease monitoring along the north shore of Lake Superior to maximize production and profitability of apples for fresh eating and value-added products.

2. Identify, describe and distribute historic, cold-hardy apple varieties well suited for high-density production along Lake Superior that might serve local niche markets for fresh fruit, cider, jelly, sauce, and other value-added products.

Controlling Canada Thistle in Organic Blueberry Production

Grantee: Little Hill Berry Farm (Aaron Wills)
Project duration: 3 years
Award amount: $8,412
County: Rice

Project objectives:

1. Compare three different control strategies for Canada thistles, to determine which control strategy give the most control for the amount of labor and supply costs.

2. Use new methods of monitoring Canada thistles in the field to measure the efficacy of different control strategies.

3. Compare the effectiveness of organic controls for Canada thistle with standard conventional treatments on a nearby conventional farm.

Evaluating Different Depths and Types of Mulches in Blueberry Production

Grantee: Redfern Gardens (Kathleen Connell)
Project duration: 3 years
Award amount: $7,781
County: Wadena

Project objectives:

1. Determine the best depth of wood chip mulch for healthiest plant growth to optimize the effect of the chips.

2. Determine how mulch can affect the need for outside inputs, hopefully decreasing the need for water, fertilizer, and pH adjusting material.

3. Determine which of the mulches will best obtain the above objectives with the least outside inputs under organic growing techniques.

Completed Grant Projects...

Final Greenbook Article	Title of Project	Grantee
Alternative Markets and Specialty Crops		
2012	Growing Cherries in Central Minnesota	Pat Altrichter
	Organic Mushroom Cultivation and Marketing in a Northern Climate	Jill Jacoby
	Feasibility of Small Farm Commercial Hop Production in Central Minnesota	Robert Jones
2009	Hardwood Reforestation in a Creek Valley Dominated by Reed Canarygrass	Timothy Gossman
	Introducing Cold-hardy Kiwifruit to Minnesota	James Luby
	Growing the Goji Berry in Minnesota	Koua Vang & Cingie Kong
2008	Dream of Wild Health Farm Indigenous Corn Propagation Project	Peta Wakan Tipi (Sally Auger)
2007	Developing a Saskatoon Berry Market in the Upper Midwest	Patricia Altrichter & Judy Heiling
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

Final Greenbook Article	Title of Project	Grantee
1998	Establishing and Maintaining Warm Season Grasses (Native Grasses)	Pope County SWCD
	On-farm Forest Utilization and Processing Demonstrations	Hiawatha Valley RC&D
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		
2012	Fertilizing with Alfalfa Mulches in Field Crops	Carmen Fernholz
	McNamara Filter Strip Demonstration	Goodhue SWCD, Beau Kennedy/Kelly Smith
	Optimizing Alfalfa Fertilization for Sustainable Production	Doug Holen
2009	Environmentally and Economically Sound Ways to Improve Low Phosphorus Levels in Various Cropping Systems Including Organic with or without Livestock Enterprises	Carmen Fernholz
2008	Establishing Beneficial Bug Habitats in a Field Crop Setting	Noreen Thomas
	Keeping It Green and Growing: An Aerial Seeding Concept	Andy Hart
	Rotational Use of High-quality Land: A Three Year Rotation of Pastured Pigs, Vegetable Production, and Annual Forage	Gale Woods Farm – Three Rivers Park District (Tim Reese)
2007	Field Windbreak/Living Snow Fence Yield Assessment	Gary Wyatt
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 NW MN	Dan Juneau
	Feasibility of Winter Wheat Following Soybeans in NW MN	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

Final Greenbook Article	Title of Project	Grantee
2004	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
	Soil Conservation of Canning Crop Fields	Shane Johnson
	Using Liquid Hog Manure as Starter Fertilizer and Maximizing Nutrients from Heavily Bedded Swine Manure	Andy Hart
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

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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-Meadowland 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
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 MN 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 M. Fernholz
	Nitrogen Utilization from Legume Residue in Western MN	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 SE MN	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 MN	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

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1992	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
Energy		
2009	Evaluation of the Potential of Hybrid Willow as a Sustainable Biomass Energy Alternative in West Central Minnesota	Diomides Zamora
2008	On-farm Biodiesel Production from Canola	Steve Dahl
2007	Testing the Potential of Hybrid Willow as a Sustainable Biomass Energy Alternative in Northern Minnesota	Dean Current
Fruits and Vegetables		
2012	Extended Season Marketing of Asian and Latino Ethnic Vegetables Grown in Quick Hoops and a Moveable Greenhouse	Judy & Steve Harder
2011	Comparison of Strawberries Grown in a High Tunnel and Outside for Quality and Profitability	Debbie Ornquist
	Solar Energy Storage and Heated Raised Beds	Diane & Charles Webb
	Growing Blackberries Organically under High Tunnels for Winter Protection and Increased Production	Erik Gundacker
	High Tunnel Primocane Blackberry Production in Minnesota	Terrance Nennich
	Minimizing the Environmental Impact and Extending the Season of Locally Grown Raspberries	Steve Poppe
	Growing Fresh Cabbage for Markets Using Integrated Pest Management Strategies	Vang, Ly (American Association for Hmong Women in Minnesota)
2010	Using Solar Energy to Heat the Soil and Extend the Growing Season in High Tunnel Vegetable Production	Dallas Flynn
	Extended Growing Season for Lettuce	Michael Hamp
	Organic Day-neutral Strawberry Production in Southeast Minnesota	Sam Kedem
	Winter Plant Protection of Blueberries in Northern Minnesota	Al Ringer
2009	Intercropping within a High Tunnel to Achieve Maximum Production	Mark Boen
2008	Chokecherry (Prunus virginiana) Production in Western Minnesota	Todd & Michelle Andresen
	Insect and Disease Pressure in Unsprayed Apple Orchards in Central and Northern Minnesota	Thaddeus McCamant
2007	Apple Scab Control Project	Rick Kluzak
	Controlling Western Striped Cucumber Beetles Using Organic Methods: Perimeter Trap Crops and Baited Sticky Traps	Peter Hemberger
	Establishing Healthy Organic Asparagus While Utilizing Minimal Labor and Maintaining Proper Soil Nutrition	Patrick & Wendy Lynch
	Novel Preplant Strategies for Successful Strawberry Production	Steven Poppe
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

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2002	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 MN	John Fisher-Merritt
	Living Mulch, Organic Mulch, Bare Ground Comparison	Dan & Gilda Gieske
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2010	Using Solar Energy to Heat the Soil and Extend the Growing Season in High Tunnel Vegetable Production	Dallas Flynn
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	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
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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 MN	John Fisher-Merritt
	Living Mulch, Organic Mulch, Bare Ground Comparison	Dan & Gilda Gieske
Livestock		
2012	Determining the Cost of Raising Pastured Pork on a Diet Including Whey and Finishing on a Diet Including Acorns	Lori Brinkman
	Determining the Pasture Restoration Potential and Financial Viability of Cornish Cross vs. Red Broilers for a Small Pastured Poultry Operation in Northeast Minnesota	Cindy Hale & Jeff Hall
	Fall Forage Mixture for Grass Finishing Livestock Late in the Fall	Troy Salzer
2010	Increasing the Profitability of Raising Livestock: An Evaluation of Two Methods to Extend the Grazing Season	Dean Thomas
	Methods to Establish Grazing of Annual Forages for Beef Cows on Winter Feeding Areas	Walker/Mathison

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2009	A Comparison between Cornstalk and Soybean Straw for Bedding Used for Hogs and Their Relative Nutrient Value for Fertilizer	John Dieball
2008	Demonstration of How Feeding In-line Wrapped High Moisture Alfalfa/ Grass Bales Will Eliminate Our Fall and Winter "Flat Spot" in Grass-fed Beef Production	Donald Struxness
2007	Comparing Alternative Laying Hen Breeds	Suzanne Peterson
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
	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	Peter 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

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2001	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
	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 Value 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 SW MN	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 Limits: Season Length and Productivity	Doug & Ann Balow
1995	Evaluating Diatomaceous Earth as a Wormer for Sheep and Cattle	David Deutschlander
	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

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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 SW MN	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

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.

Jean Ciborowski, Quarantine Officer and Sustainable Agriculture. Jean provides oversight to the Plant Containment Facility operated by the U of MN/MDA on the U of MN St. Paul campus. In addition, Jean coordinates the Sustainable Agriculture Demonstration Grant program and is the *Greenbook* editor. She has worked in sustainable agriculture and integrated pest management at the MDA since 1997.

Alison Fish and Stephen Moser, Administrative Support. Alison and Stephen provide administrative support to the staff and the program.

Meg Moynihan, Principal Administrator, Organic/ Diversification. Meg helps farmers and rural communities learn about crop, livestock, management, and marketing options, including organic. She has worked professionally as an educator and evaluator and as a community development extension specialist with the U.S. Peace Corps in northern Thailand. She is also a certified organic dairy farmer. Meg joined the Minnesota Department of Agriculture in 2002.

Mark Zumwinkle, Sustainable Agriculture Specialist. Mark 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 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 MDA staff in 1993.

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