

# GREENBOOK 2005



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

# Greenbook 2005

## THE NEXT GENERATION OF SUSTAINABLE AGRICULTURE FARMERS

### *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.*



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# Introduction to the Greenbook 2005

I am pleased to introduce the 16<sup>th</sup> edition of the Greenbook, a publication of the Minnesota Department of Agriculture's Agricultural Resources Management and Development Division (ARMD). Our theme this year is "The Next Generation of Sustainable Agriculture Farmers." We highlight the project results of creative and innovative farmers and researchers involved with the Sustainable Agriculture On-farm Demonstration Grant Program.

Sustainable agriculture focuses on farming practices that reduce inputs and protect the environment. It also includes diversification of crops and alternative livestock systems, and it gives farmers increased access to alternative markets.

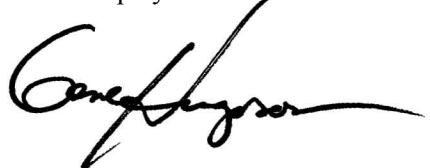
*Greenbook 2005* contains articles highlighting the results of the grantees' projects and provides practical and technical information. Each article includes personal observations and management tips from the participants. Additionally, these grantees are willing to share their knowledge and experiences with you. They are all dedicated to making Minnesota agriculture more profitable and environmentally friendly. Feel free to give them a call about their projects.

Our essays this year include: "Food as Community Power: A New Vision of Urban Agriculture in Community," "The Agrarian Skills of Minnesota's Newest Immigrants," "Time, Soil, and Children: Conversation with the Second Generation of Sustainable Farm Families in Minnesota," and "Why the Obsession with Succession?"

This year's Greenbook also includes nine articles on organic agriculture projects sponsored by the MDA with funding provided by the United States Department of Agriculture (USDA) – Risk Management Agency Community Outreach and Assistance Partnership Program. Additionally, there are six articles on sustainable agriculture provided by the Minnesota Institute for Sustainable Agriculture (MISA), a unique partnership between the College of Agricultural, Food and Environmental Sciences at the University of Minnesota and the Sustainers' Coalition, a group of individuals and non-profit organizations. MISA received funding from the Sustainable Agriculture Research and Education (SARE), a program of USDA's Cooperative State Research, Education, and Extension Service (CSREES) to help farmers implement sustainable agriculture practices. The articles in *Greenbook 2005* present the work done on these projects.

The Greenbook also includes updates on other ARMD projects such as activities at Big Woods Dairy at Nerstrand – Big Woods State Park, organics in Minnesota, integrated pest management, and a special section titled "Risk Management Agency – programs and partnerships for producers."

I hope you find *Greenbook 2005* interesting and full of new and useful ideas.



Gene Hugoson, Commissioner  
Minnesota Department of Agriculture



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By Gunnar  
Liden

Gunnar is the Program Director for the Youth Farm and Market Project in the Twin Cities. Most of his work over the past nine years has been focused on the West Side of St. Paul where he and his wife live. To find out more about the Youth Farm and Market Project, its programs and market venues, please visit: [www.youthfarm.net](http://www.youthfarm.net) and [www.laplacitamarket.org](http://www.laplacitamarket.org)

# Food as Community Power: A New Vision of Urban Agriculture in Community

## Experiencing Urban Agriculture

- In tucked away plots of land throughout the Twin Cities, there is a movement brewing.

You are with 11 other youth huddled around a harvesting table on a hot summer day. As you separate the heirloom tomatoes from the Habañero peppers, the pole beans from the summer squash, the cilantro from the chives, you relish these summertime experiences. If you were hanging out on a street corner, people might think you were up to no good by the way you are dressed, but your compadres are intently working, you realize the produce has to be to the food shelf by 10:30 a.m. so the group can set up for the share distribution in the afternoon.

- The kitchen is a place of action, education, and personal and cultural exploration.

The Cajun music blasting out of this church basement kitchen doesn't seem to fit the smell of East African food, but it all seems to make sense, it is this way three days a week. The mother and daughter team confer in their native language, then direct you, the three other youth, and adult cook around the kitchen -- food's got to be ready by noon to please the 50 hungry youth farmers' a ¼ mile away at their urban farm.

- The drums beat with the heartbeat of a community, sometimes rhythmic and beautiful, sometimes uncomfortably challenging, but always true and honest.

Sandwiched between a Mexican grocery store and a jewelry shop, you set up your produce tent in the tiny open-air marketplace. This is your favorite time of the week. As you sit behind your display of produce, you are drawn by the crowds watching the Mexican dance group, the methodical drum, the beautiful clothing, but it is the words of one of the members that get you to better understand this

community marketplace. "Sharing our culture, our produce, and our food is what brings us together in this community," the leader of the dance group yells out. Your first customer of the day comes to your stand, your fellow farmer proclaims, "It's organic, no pesticides here. We grew it right up the street on *our* farm!" They purchase some of the cilantro and pole beans that you harvested yesterday. You thank them for purchasing the produce and tell them to come again. As they leave you notice the marketplace is full today, people selling produce, Salvadorian and Soul food, displaying and creating art on site, and even registering people to vote. This is *your* neighborhood.

This is a week in the life of an urban youth farmer – Minnesota's next generation of sustainable farmers.

What is at the center of all of these experiences is food and the power it holds. Food has the power to bring a community together around issues of agriculture, but also push the





discussion and interaction between community members beyond agriculture, to issues of culture, identity, race and racism, class, and ultimately, community power. This is what the next generation of sustainable farmers is doing... and they are 11 years old!

### Youth Farm and Market Project's vision of the role sustainable agriculture plays in today's urban environment

Over the years, the Youth Farm and Market Project (YFMP) has evolved from an upstart urban farming program into a multicultural community gardening enterprise, which fights for environmental responsibility, youth empowerment, eradication of racism and poverty, and advancement of cultural expression. Building on a variety of traditions in working the land and growing and preparing food, our Youth Farmers build cross-cultural and intergenerational relationships, cultivate youth leadership, engage in microenterprise development, and organize neighbors to envision, realize, and activate neighborhood public space. It's an organic process of nurturing individuals' roots and sprouting new relationships. There are three core principles to our vision:

- **Urban Agriculture** - YFMP operates urban gardens in three neighborhoods in the Twin Cities – Lyndale and Powderhorn in Minneapolis and on the West Side of St. Paul. Youth are involved in planning their gardens as well as cultivating, harvesting, and selling their produce through participation in community farmers' markets. Much emphasis is placed on exploring sustainable and organic ways of farming, with a focus on local food systems.
- **Youth Organizing** - Project LEAD provides opportunities for 25 older youth (ages 14 to 18) to develop power and public leadership in their neighborhood, apply these skills through community-based social change projects, as well as supervise, mentor and create strong relationships with younger youth in our school year and summer program.
- **Cultural Nutrition** - The goal of the Cultural Farming and Nutrition Program is to strengthen support for new immigrants' traditional diets, and to increase both the capacity and willingness of immigrant youth to grow, eat, cook, and provide these foods to others in their communities. This provides a basis for much of the personal and cultural exploration that we do around food.

### Food as Community Power

What is food power?

The phrase, "Food Power," might conjure up some strange images, but we feel it is the essential and key element to the relevance of the work that we as youth workers and urban farmers do. Furthermore, in a society that is so quick to label youth as gang members, troublemakers, and thugs, the idea of youth having power through the food that they grow, cook, eat, sell, etc., forces people to recognize the role that food plays in their lives and how youth are contributing and shaping their community right before their eyes.

Why do we feel it is important to approach sustainable agriculture from a view of power? The complexity of working on sustainable agriculture, involving youth in their community and creating a positive urban environment is real. The work of the Youth Farm and Market Project is not just about individual behavior change of youth, but about how agriculture can play a key role in changing agricultural and non-agricultural systemic issues that impact people. For people to understand and embody concepts and issues like sustainable agriculture there must be some sort of personal investment in that idea or concept. Approaching the topic of sustainable agriculture with youth in a way that forces them to individually and collectively understand how their lives and community can be affected by sustainable agriculture, truly reveals the power of their work as urban farmers.

Where do the youth have power through their food?

**Access** - "The rich people have more healthy choices, so by doing the market, we give poor people and others more healthy choices." This is a quote from one of our Youth Project LEADers. While simplistic, it speaks volumes to what power these youth have created in their neighborhoods across the Twin Cities through the food that they grow. Food politics and the access to quality food by lower income people is a real issue that needs to be talked about more in urban environments.



**Relationships** - For many, the days of knowing the person who grew the food that we eat seem long gone. If this opportunity does still exist, we probably either still live in a rural area, or have made a point to make frequent trips to one of our many farmers' markets in the Twin Cities. What the Youth Farm and Market Project, along with other youth gardening and farming programs in the area, have done is allow people who live in urban environments to be able to experience having a relationship with the person that grew their food. What is unique to this is that that person may be their next door neighbor, the youth who cuts their lawn or plays with her friends in the alley behind their apartment. One of the themes that I often repeat throughout the year to the youth that are a part of the Youth Farm and Market Project, is that they are the only ones in their neighborhood that are growing food that their neighbors will eat. Recognizing this as an important and integral part of a healthy community is something we must all see and support. We must support this not for the same reason we buy a candy bar from our 10 year old next door neighbor for their schools field trips, but because a society that values those who provide sustenance for other community members is a healthy society. We must recognize these youth as agents of change in our community and understand this as an investment in sustainable agriculture.



**Knowledge and Choice** - By growing produce in an urban environment and distributing and selling it at community farmers' markets, local restaurants, CSA shares, and food shelves, these youth are not only providing access to quality produce, but knowledge of where produce is grown, how it is grown, why it is grown that way, and how that affects the community. When this knowledge can be presented not as a dogmatic viewpoint that is either right or wrong, but as a choice that people have and can make about what food they eat, where they get it, and how it is grown, farmers, community members, and consumers are all more powerful.

**The Future** – For our next generation of sustainable farmers to be successful and have an impact on our world, we as a community must understand the potential that the urban farming movement can have, that it is much more than agricultural practices and environmental responsibility. Sustainable farming for these urban youth farmers is about finding their way in the world, leaving their mark, owning a sense of place and purpose that is so often hard to find in our poorer urban environments. Ultimately for these youth, sustainable agriculture is their launching off point into the world. It is our job to support it in real and meaningful ways.

## By Yimeem Vu

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# The Agrarian Skills of Minnesota's Newest Immigrants

After resettling in a new country, many immigrants have typically found jobs in labor-intensive fields that utilize very little, if any, specialized skills. Assembly, manufacturing, and service work are a far stretch from working on farms in crop and livestock production, but they serve as a source of income. However mundane or tedious these jobs may be, there is a level of security that is provided by a weekly paycheck, a security that many of these immigrants are not yet ready to give up in order to follow a dream of one day returning to farming as a way of life.

Minnesota has historically been known as home to a very diverse group of people, including an eclectic group of immigrants. As a result of Minnesota's rich diversity, there has been a corresponding variety of farming tactics and production yield.

Walking through any Minnesota farmer's market is equivalent to walking through a virtual history book of immigrants that have relocated to Minnesota. The breads and potatoes of the rich European culture are accompanied by the colorful greens of Central America and the strong aroma of Asian spices. These cultures are strong and abundant, yielding to sights and smells evidenced in the thriving farming community in Minnesota.

Farming is not a new concept to many of these immigrants who have resettled in Minnesota. They come from a rich agrarian culture and most likely were subsistence farmers before coming to the United States. They have a love and passion for farming that is undeniable. Oftentimes having to resort to community gardening in busy urban areas, these new immigrants are always looking for more land to grow vegetables and farm not only for consumption and relaxation, but also as a way to pass down the farming traditions to their children. In a new country, they are making use of what is available to them.

Many of the Somalis, Southeast Asians, and Latinos now find themselves at home on the rolling hills of Minnesota after having to adjust to the extreme environmental changes. Although their environments have changed, they still have a knowledge of land usage and unique crops that appeal to many niche markets in the United States. For example, the growing Hmong population in Minnesota has created an incredible demand for chicken with "black feet." The few livestock producers near the metropolitan area who have these chickens often find lines extending past their parking lots before the sun rises on most Saturday mornings. Likewise, the demand for Halal, meat from sheep and goats that have been ritually slaughtered in Muslim traditions, is extremely high. Restaurant owners who serve this large population of Muslims often have to import large quantities of meat from Australia and New Zealand to meet the demands of their customers. Many people from these cultures know how to produce these special products and are looking for a way to do this. These new immigrants are capable of learning how to supply a product that traditional farmers just do not have the capacity to provide.

It would be easy to assume that many of these farmers would be able to break into the farming industry because of these growing niche markets. The perception is that with the existence of the Farm Service Agency, Small Business Association, and many other agencies that have been set up to help those looking to start a business, many of the hurdles would be removed. And although this may be true in the sense of traditional farming practices such as technological advances and farm training, there are barriers to farming that are unique to new immigrants. Even though Minnesota has traditionally been a very accepting state for new immigrants, there are cultural barriers that exist that have stymied the attempts of potential new immigrant farmers.

Language barriers have always been a major hurdle for many immigrants and continues to be a hurdle for new immigrants who wish to pursue farming as a means to sustainability. Legal documents are mostly in English and Spanish only. Also, experts in the agriculture industry that have the language capacity to work with these new immigrants are very rare. While state agencies are showing an increase in hiring of new employees that have the language capacity to work with new immigrants, the sheer volume of immigrants can be overwhelming for a single staff member in any one public assistance organization to bear.

Parallel to language barriers is an invisible barrier that exists in the views of many immigrants. This barrier lies in the cultural differences that exist between the immigrants and current rural Minnesotans. In the metropolitan area, many immigrants have easy access to a variety of networks that were created to minimize these racial tensions. The fear is that once they have moved into rural Minnesota, they may be too isolated and these local support systems will be too difficult to access on a regular basis. Living remotely and breaking into rural Minnesota communities is very difficult for many of these immigrants to fathom without examples of people from their cultural communities who have already made the switch successfully.

Other barriers include the general lack of information to these new immigrants in regards to farm production. The idea that farming is an actual business just like owning a grocery store or a restaurant is still hard for many of them to grasp. The development of a business plan, formal education in financing, marketing practices, and risk management are all foreign to these immigrants. Many of them see the commercial farming practices and realize that there are incredible costs involved in becoming

production farmers. However, they are unaware of the existence of “truck” farms, community supported agriculture, and co-ops. They are also unaware of official job training programs such as those provided by Hmong American Partnership and Culturally Appropriate Program Implementation, two nonprofit organizations based in the Twin Cities, to help facilitate the assimilation of New Immigrants into many specialized fields. The Minnesota Food Association is a nonprofit organization that developed a program specifically designed to help new immigrants break into the farming industry by teaching them about safe and efficient farming practices, risk management, and the business aspect of farming. Business planning, marketing, farm safety, and accounting practices are all covered in the *New Immigrant Agriculture Project*. The goal of the *New Immigrant Agriculture Project* is to provide training and documentation to would-be farmers that would qualify them for loans from the Farm Service Agency (FSA) and other traditional lending institutions for land purchase and farm production.

There are outreach projects that exist to assist these new immigrants in becoming the next generation of sustainable farmers. Culturally sensitive, formal training and education is now available through the Minnesota Food Association. Through the possible cooperation of many of the larger organizations that specifically serve these new immigrant communities, barriers can be removed to provide a more inviting environment for new producers. These environments will allow all Minnesotans to enjoy the variety of tastes that are offered by our diverse group of citizens as well as develop the relationships that have always defined the essence of “Minnesota Nice.”



By Beth E.  
Waterhouse

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## Time, Soil, and Children: Conversations with the Second Generation of Sustainable Farm Families in Minnesota

The blue eyes of a happy, muddy baby sparkle from the book's cover. Ariana Lentz Andres is playing in the soil of her Grampa's farm one warm summer day, and she looks to be enjoying every minute. "That's my little farmer," commented Ralph Lentz, when I borrowed the photo off the front of his refrigerator.

*Time, Soil, and Children* is a book that explores the relationship of child to land, farmer to family, or memory to awareness. What happened to the children of those farm families who made the switch to sustainable agriculture, I wondered. Then I had the great fortune to interview many of them and find out. I wondered about the impact of all the hard work on small, diversified farms. I wondered if that work spoiled it for them or motivated this generation to go farther in the field of agriculture. Were they ever so glad to leave the farm once and for all, or were they called to return to this lifestyle?

"I remember when I was quite young playing in the dirt near the garden while my parents worked. Later we weeded and we were always helping out," Brandon Rutter remembers. His childhood photo also graces the cover of *Time, Soil, and Children*. He remembers the joys and work of growing up in southeastern Minnesota where his dad studied hazelnut trees. Although Brandon now studies bio-robotics as a Ph.D. student, his heart is still connected to the soil and to his memories of growing up as his parents came back to the land.

In 2003/04, with support from the Endowed Chair in Agricultural Systems, I interviewed 15 young people, all second generation in those Minnesota farm families who made the shift from conventional practices to sustainable farming in the 1970s and 1980s—young men and women, ages 18-35, now in various locations, jobs, or capacities. Themes emerged from dynamic interviews,

and I explored such topics as the meaning of work, the importance of learning through hands-on experience, and the motivation that comes from one's own children.

"First things that come to mind about growing up in our family are all the chores we had to do," remembers Connie Carlson, daughter to Carmen Fernholz, grower of hogs and organic grains. Maybe it's not surprising that the first memory in nearly every interview had something to do with chores—putting up hay, feeding sows, weeding strawberries... Connie's brother, Craig, probably wins the prize in this book as the youngest boy to do daily barn chores. Craig remembers that he pretty much ran the barn the year he was nine when his dad took a year-long job in the Twin Cities. "The hardest thing was to guess when to bring the pregnant sows in... you had to closely watch them." And Craig admits, "I actually did come to hate it. I dreaded going out there every single day." Yet he also details ways in which this particular youth has left him the exact kind of person he is—a young man who loves to figure things out, loves to work with his hands, loves the wide open sky. Craig now builds sets at the Guthrie Theater, and has encouraged the Guthrie toward practices of recycling and re-use, reflecting values from his boyhood farm in Madison, Minnesota.

*Time, Soil, and Children* does not profess to have answers, but with the voices of 15 young people, you surely get to hear many good stories. I heard from young people who know what it's like to be rebels in farm country—not always easy. I recorded the stories of those who now clearly know their own desires and who will likely be leaders in their own fields—be they diverse farm fields or other diverse fields of interest. One theme was the power of leaving home.

“When I graduated, the last thing I ever wanted to do was anything with agriculture or the farm,” recalls Amanda Bilek. “It took being out of that (home) environment to appreciate the value of the farm. You come to college in St. Paul with all these kids who don’t even think about where their food is coming from.” It was natural for Amanda, after slaughtering chickens on Saturdays as a teenager, to want to know the source of her own chicken sandwich!

I think my biggest surprise as I sifted these stories, was the power of the *third* generation. I figured the parents (my generation) would have influenced their children, but what I didn’t fully understand is how the new baby, the child in arms, will motivate its parents even before it can talk or walk. In this book, you get to meet children of well-known and active sustainable farm families, but here you also meet some of *their* children. I met Madeline Carlson, Connie’s daughter and Carmen Fernholz’s granddaughter, as well as Ian MacKimm, grandson to Dwight Ault and son of Melissa. I have met Hazel and Arlo, children of Malena and Mike, little ones who call Audrey Arner ‘Grandma.’ And when I first heard the names of Jacob and Andrew Van Der Pol or Nicholas Minar, I knew of active boys growing up inside the same strong families, inside the same strong values.

It becomes apparent that each generation puts its hopes in the next one, and not so much on specific behaviors or dreams for that next generation, but simply on their presence. Even operational changes on their home farmsteads are made in the name of the next generation. In the Van Der Pol clan, this seems to be true. I remember Jim standing in St. Paul in the Minnesota Project office one day in 1997 or so, saying that if he hadn’t gone into diverse and more sustainable operations, Josh might not want to come back to the farm. There might not be a viable farm to share. Now Josh does not so much talk about the opportunity for himself as he speaks of the opportunity to have his own children with him. “When Jacob was born,” said Josh Van Der Pol, “I wanted to give him the life I’d had.”

When this book meets the public, it’s clear that its stories are about hope. And in the pages, I asked these young people what they hope for. This group of people have been handed a deeper-than-ordinary knowledge about the land and its ills and losses. This knowledge could have buckled the knees of these young lives, yet it did not. To a person, they faced their knowledge with enthusiasm and resolve. Some have stayed with farming, some have not. To a person, they love the land and can articulate its impact on their lives, vocations, and future families.

From their stated hopes, I summarized elements of life that this second generation calls for in their own hopes for the future. They hope for citizen awareness about food, a clean environment with a good mix of energy, children who can live without fear, land as a living entity that is free to heal itself—no small list. Clearly, they have named guiding principles behind a hundred potential policies in agriculture, education, and environmental protection. These are solid, sustainable hopes for a better world, spoken at a time when young people could very easily become hopeless. They have not become hopeless, and therefore we should not—their values are not dwindling; they are multiplying.

It is my own hope that this small book can be the beginning of many new conversations about families, motivation, parenting, or young people and their relationship to the land. I went into this work eager to meet a new generation, and I met two new generations, all sharing the familiar surname we’ve come to know. Let’s enliven what they are creating with our experience and encouragement.

## By John R. Baker

John is the Attorney for Iowa Concern Hotline and the creator and Administrator of the Beginning Farmer Center at Iowa State University. He has taught business succession planning throughout the United States and in Europe and Japan. He also coordinates the National Farm Transition Network. He can be contacted at 515-727-0656 or 800-447-1985 or at [jrbaker@iastate.edu](mailto:jrbaker@iastate.edu). Additional information is available at [www.extension.iastate.edu/bfc/](http://www.extension.iastate.edu/bfc/) and [www.extension.iastate.edu/nftn/](http://www.extension.iastate.edu/nftn/).

# Why the Obsession with Succession?

Who will farm the land? Why are there so few young farmers? Why are so many rural businesses closing? Why are rural schools closing? What is happening to our rural communities? How come there are no children attending our church? Why do we have to drive so far to see a Doctor? What does the term succession mean?

All good questions. These and many more are being asked by farmers, rural residents, policy makers and academicians, all with a desire to understand what is happening and to develop appropriate responses. It is obvious that we have fewer new farmers than in the past.

There are many factors that contribute to the decline in the number of new farmers. Farmers have adopted labor saving technology that, in addition to allowing them to farm larger farms, has also allowed them to extend their careers by delaying retirement. Life expectancy continues to increase and people are healthier longer than past generations, allowing them to postpone retirement.

The evidence of our aging farm population is well known. We currently have twice as many farmers over the age of 65 years as are below the age of 35. A majority of farmland and farm business assets are owned by individuals over the age of 65. Obviously, farming and rural America will experience a great deal of change during the next several decades.

With fewer young farmers entering farming, farms are getting larger. So what? Farms are getting bigger because they are more efficient. Right? Wrong! Farms reach their maximum efficiency at approximately 600 acres. After that, there is no increase in efficiency. Farms get bigger to make more money, not to become more efficient.

Well, more money is better than less money. Right? Right! More money is better than less money and obviously, to stay in the business of farming, farmers need to make a profit. However, the idea that every farmer can continue to get bigger and bigger, and thereby

continue to increase profits, is, on its face, ludicrous. No farm can be large enough to insure a profit and not every farm can be the largest farm in the county.

All of this leads us back to the question, “Why the obsession with succession?” There are many reasons for this “obsession” but, perhaps, the primary reason is that farm business succession planning is an integral facet of the continuation of the farm family business. Some individuals have argued that the farm family business is no longer relevant as a means of organizing agricultural production. Of course, the vast majority of the individuals making that argument are not farmers. I have often wondered how many times the imminent demise of the farm family business has been predicted and, yet, they are still here and still a vibrant and necessary part of society, albeit, a part that is under a great deal of stress.

The majority of farmland and farm business assets are owned by farm family businesses and a majority of the farms are organized as farm family businesses. It is axiomatic that prosperous rural towns and villages are surrounded by prosperous farms. The contribution of farm business to the rural economy, the environment, and, indeed, to society as a whole, should not be ignored. Those who live next to the land and toil upon it are more likely to be interested in their community, their environment, and their society than will an absentee landowner.

Another reason for the increasing interest in farm succession is to formulate public policy that will help the next generation start a new farm business or succeed to an existing farm business. It is obvious that the current farm policy is wanting when measured by its ability to foster a new generation of farmers and it needs to be changed. A policy that is truly sustainable is one that sustains the succession of farm family business to the next generation and aids new entrants in becoming established farmers. Current farm policy rewards larger commodity farms and works against the establishment of smaller farms that produce crops other than commodities.

A third reason for the interest in farm business succession is the identification of the best methods for the development and implementation of farm business succession planning and farm business succession plans. The identification and understanding of successful methods of transferring a farm business to the next generation will encourage farmers to develop a farm business succession plan for their farm by demonstrating that it is possible to transfer their farm business to the next generation.

This does not mean, nor is it meant to imply that it is a simple or easy matter to transfer a farm business to the next generation. There are barriers to both the entry of the younger party into farming and to the older party exiting farming. Among the barriers to entering farming are the following:

1. Ineffective entry strategies. The younger party needs to explore all the possibilities for entering farming. The most common approach is the “borrow and buy” method of getting started. The idea is to borrow as much money as you can, as young as you can, work as hard as you can, for as long as you can, pay back as much as you can, live as poor as you can, and die as rich as you can. The problem with this approach is the increased risk of failure of the business. The business is in debt to such an extent that it has little or no ability to survive a crop or market failure.
2. Inability to acquire initial capital investment. A majority of the loan program available through government agencies are for the purchase of land, which has the highest fixed cost and the lowest return. Also, it is sometimes difficult to obtain loans for nontraditional crops, livestock, or enterprises.
3. Identifying viable farm entry opportunities. Other than looking at realty listings for farms that are for sale, it is often very difficult to identify an existing farm owner who is interested in helping a young farmer gain entrance into farming. The National Farm Transition Network may be able to help locate a program in your area that works to link entering and exiting farmers.
4. Obtaining appropriate financial, managerial, and production skills. Operating a modern farm business involves more than growing a crop or raising livestock. This is especially true for many noncommodity types of production. It is essential to have financial management and marketing skills.

Farmers also face barriers in exiting farming. Among these are:

1. Lack of qualified help in formulating exit strategies. Developing a farm business succession plan involves more than merely forming a business entity or gifting assets to the successor. It involves four essential planning areas. The first is strategic business planning to insure that the business will not fail. The second is retirement planning for the older party. The third is the transfer of management, income, and assets to the younger party. And, the fourth is the estate plan of the older party.
2. Lack of farm business viability or refusal to invest in new technology, products, or methods. All too often the older party has failed to keep the farm business current with the modern trends.
3. Retirement funds are tied up in the business assets and the assets must be sold at a premium to generate sufficient retirement income. Many farmers are asset rich and cash poor. Most farm business assets are not cash or near cash items. Therefore, it may be difficult for the farm business to generate sufficient retirement income and income for the younger party.
4. Lack of knowledge of entrants who want to become farmers.
5. Unwilling to give up managerial responsibility and unwilling to transfer ownership of assets to the younger generation. It is often difficult to give up control of a business that has been built from a lifetime of hard work.

So, if you want to become a farmer, where do you begin the process? The following are questions that you should answer.

1. Why do you want to farm? Examine your values related to starting a career in farming. You should also consider the values of your family as your decision will affect more than just you. You should think about where you want to be and what you want to be doing in the future and you need to set specific goals and objectives.
2. What is agriculture? Modern agriculture involves far more than production. It also involves marketing, natural resource management, consideration of neighbors, and many other considerations not present just a few years ago. In addition, agriculture, especially for new entrants, is not simply production of raw commodities. Entering farmers must have a clear understanding of what they are aspiring to if they are to be successful.
3. What are some options available? Underlying this question is the need for keeping and using good records. All farming enterprises involve a mix of land, labor, capital,



and management. It is crucial for the beginning farmers to concentrate on selecting enterprises that accentuate their strengths. It is also imperative that beginning farmers know where they are financially and that they have the records necessary for a detailed examination of their position. Given these goals, they must be able to evaluate decisions to help foster achievement of what they want. Some examples of options would be banding vs. broadcasting, renting vs. ownership of intermediate and long term assets, labor sharing with neighbors, selecting alternative enterprises, utilizing alternative marketing strategies, finding off-farm employment, finding employment to compliment the farming operation, using contracts, and others. The purpose of this section would be to help identify options and more importantly to show a framework for evaluating other options.

4. Forming beginning farmer communities. Find others who share your desire to become a farmer and maintain that relationship once you enter farming. Beginning farmer communities offer an opportunity to share experiences and to form bonds that will help them. Such communities can lead to collaborative business relationships such as sharing equipment and labor sharing to reduce costs, etc.

Starting farming is not easy but it is possible! There are examples, perhaps not as many as in the past, but there are significant numbers of existing and beginning farmers who are finding mutually beneficial ways to move a farm business to the next generation. And, isn't that a significant part of the definition of a "sustainable" farm!

# Sustainable Agriculture Grant Program

Summary of Grant Funding (1989-2005)				
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	\$10,000	\$4,300 - 20,000
2003 *	—	—	—	—
2004 *	—	—	—	—
2005	10	\$70,000	\$10,000	\$2,000 - 11,600
<b>TOTAL</b>	<b>236</b>	<b>\$2,525,016</b>		

\* No grants were awarded in 2003 and 2004.

## Program Purpose

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

## Program Description

The Department has received over 980 grant applications and has approved over \$2.5 million in funding for 236 projects since the program began in 1989. Project categories include: Alternative Markets and Specialty Crops, Fruits and Vegetables, Cropping Systems and Soil Fertility, and Livestock. There are 18 grant projects throughout the state of Minnesota that are described in *Greenbook 2005*.

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

## Grant Summaries

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

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**Project Duration**

2004

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**Keywords**

greenhouse, hoop  
house, hydronic,  
season extension,

*This organic demonstration project was made possible by funding from the USDA Risk Management Agency Community Outreach and Assistance Partnership Program. USDA-RMA and the Minnesota Department of Agriculture are equal opportunity providers.*

# Exploration of Market Crop Season Extension Through Innovative Subsoil Heating – A Hydronic Hoop House

**Project Summary**

While Minnesotans are hungry for fresh vegetables year 'round, our growing season is a relatively short one. This project tested the idea of adding a wood-fueled subsoil heating system to a hoop house. Wood is a renewable source of energy and adding energy directly to the soil, as opposed to the air, should be an effective way to assist a variety of cold-loving vegetable crops.

Many cold hardy vegetables can handle temperatures below freezing, but like most crops, cold-hardy crops grow faster at higher soil temperatures. As winter approaches, a heated hoop house system can be used to overcome cold dips that would slow, or possibly even kill crops. In the early spring, the system should be able to inject extra heat into the soil and allow an even earlier start than a hoop house alone might permit.

This project assessed how well a subsoil hydronic heating system in a hoop house could extend the growing season. A wood boiler provided subsoil heat via a thermal mass system using tubing buried under low raised beds; hot water circulates through the tubing. Goals included: 1) increase the growing season for market crops in Minnesota; 2) develop a system that uses on-site resources as energy inputs; and 3) improve marketability through continued production into the winter holiday season.

***Sean lights the wood burner using a hand-held flame weeder.***

**Project Description**

The simplicity of the subsoil heating system fits well with the philosophy behind my farm's management. I grow vegetables and flowers for direct sale and a few crops for wholesale to local cooperatives and have been an organic grower for four years. I've been focusing on high value crops like garlic, artichokes, heirloom tomatoes, and peppers during the summer. For most crops, I start seeds in soil blocks that are transplanted into 36" wide raised beds. I rely on cover crops and green manure cycles rotated with intensive vegetable crop plantings. For fertility and soil health, I leave a number of plots in green manure cover crops for the entire growing season, building soil capital for future seasons. I use techniques like living mulches, interplanting, and companion planting to reduce pest problems and assist in weed management.

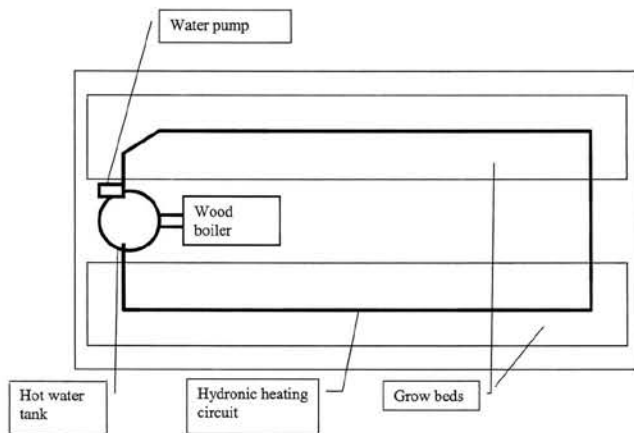
I added a wood-fired water heating system to a hoop house (or high tunnel) to extend the season beyond that of the ordinary Minnesota market crop season. The basis for the idea was that subsoil heat in the hoop house would provide added energy to the cropping system using a fuel source that is renewable and abundant in our state – wood.



Traditionally, greenhouses use fossil fuel heaters to raise ambient temperatures to protect crops from cold damage. This system works well for crops that require warmer overall temperatures for success. But for hardy, cold-loving crops, a system that directly heats the soil seemed like a good idea. Heating only the soil would require far less energy than heating the entire structure. Additionally, using subsoil heat fits well with the increasingly popular use of spun-bonded floating row covers for additional protection in hoop house microenvironments. When heat is radiated from tubing buried in the soil, some is reflected back by the floating row covers, giving crops extra protection from freeze damage. A few consecutive days below 0°F would likely result in crop failure, but elevating soil temperatures should offset any short-term dips.

The subsoil heating system consists of two parts: 1) a water heater made of a wood burner connected to a storage tank and 2) a series of underground hydronic tubing circuits with a pump for circulating hot water through the beds. Two pipes connect the wood burner and storage tank – one at the bottom of the tank and burner, and one at the top. Since cold water is heavier than hot water, the water naturally circulates in the tank as it is heated and does not require pumping (Figure 1).

**Figure 1. Schematic of Hydronic System**



The wood burner itself is a steel wood stove that has a 15-gallon water jacket surrounding it. The storage tank is a 30-gallon galvanized steel tank with fittings in the top, bottom, and sides. The hot water is tapped off the top of the tank and then pushed through two circuits of buried hydronic tubing that flow 10" under the beds. A total of 104' of 1" cross-linked polyethylene (PEX) tubing is buried in each 50' bed. The water is pumped using an open loop circulating pump designed specifically for hot water hydronic pumping applications. The pump circulates water through the hydronic tubing circuits at about 7 gal/minute. A list of material supplies I used when building my hydronic system is provided in Table 1.

**Table 1. List of materials and suppliers of components used in the construction of the hoop house.**

Hoop house kit – includes galvanized steel bows and purlins, plastic covering, endwall framing brackets, channel lock, wiggle wire, stakes, and assembly screws and fasteners.  
(Atlas Greenhouse Systems – Snow Arch 20' wide.)

Atlas Greenhouse Systems, Inc.  
PO Box 558, Hwy. 82 East  
Alapaha, GA 31622  
800-346-9902

Wood fueled jacket water heater. (Lehman's – part #26-845)  
Water storage tank (range boiler). (Lehman's – part #571-004)

Lehman's  
One Lehman Circle  
PO Box 41  
Kidron, OH 44636  
877-438-5346

Open loop circulating pump (Grainger – part #UP15-18-SU)

Grainger  
277 W. Lafayette Frontage Rd.  
St. Paul, MN 55107-1628  
763-531-0300

*Available locally from most hardware/lumber supply companies:*

Dimensional lumber for base and endwalls  
Storm door  
PEX hydronic tubing and fittings  
PTR (pressure temperature release) valves  
Galvanized pipe and fittings  
Steel chimney pipe

Over the course of the project I took temperature readings twice a day. Data were recorded for the following:

- outside and hoop house temperatures 8" and 4" below soil surface,
- inside and outside air temperature,
- hoop house high/low temperature, and
- hoop house bed surface temperature.

In addition, in order to emphasize the impact of using this kind of simple wood fired subsoil heating system, I fired the burner during a 36-hour cold dip in mid-November and measured its effects on soil temperature at various depths.

I held a public field day on October 30. About 20 people attended to see the system and discuss using wood fired subsoil heat in a hoop house. A number of market growers who attended showed interest in using hydronic heat for season extension on their own farms.



## Results

The weather in 2004 was, as always, variable and unpredictable. An unseasonably warm November reduced the need to provide additional subsoil heat. With only a minimal amount of energy from the hydronic system (for testing), we kept the soil temperatures near 60°F into the first week of November. It isn't often that I wish for colder weather, but I would have appreciated a few early dips below average in order to be able to test my system.

When it was cloudy for an extended period, the soil temperature dropped. Firing the wood boiler and pumping hot water through the hydronic tubing circuits pushed the soil temperature up over 60°F with very little fuel. With the addition of floating row covers, the soil warmed a bit faster. About half a cord of wood was used in the hoop house between the beginning of fall through November 30.

Figure 2 compares the average hoop house soil, outdoor soil, and outdoor air temperatures from October 1 to November 29. Starting on November 16, I fired the boiler every evening from sunset until about 9:00 p.m. As the graph shows, the temperature of the hoop house beds plateaued at around 64°F during the final two weeks of November. The spike before the plateau corresponds to the 36-hour firing, which occurred from November 9 at 6 p.m. to November 12 at 6 a.m.

Figure 3 shows the soil temperature in the hoop house at various depths between November 1 and November 29.

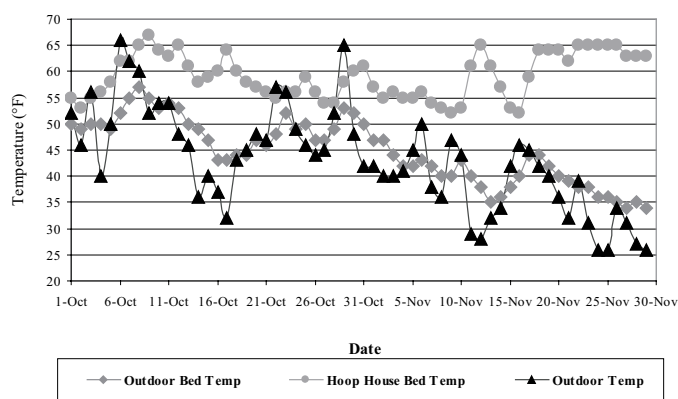
Since outdoor temperatures didn't drop below 20°F until the end of November, most of the crops could have been grown using more traditional season extension techniques such as cold frames or row covers this year. Even though

the subsoil heat wasn't needed to keep crops from freezing, increased growth rates were observed. The hydronic hoop house produced crops of mache (a mild-flavored edible green used in salads), spinach, and lettuce through the entire month of November and conditions seemed favorable for continued production going into December. The spinach and mache in the heated beds grew to marketable size far more quickly than those grown in a cold frame next to the hoop house. Two-week-old spinach starts transplanted into the hoop house on October 22 were harvestable on November 13, while spinach grown in the cold frame (planted the same day) was much smaller. Spinach starts planted in the hoop house on October 29 were harvested on November 24 at about the same size as those planted in the cold frame a week earlier. With favorable weather conditions and a couple of clear days a week, we anticipate that we could have continued production through the New Year.

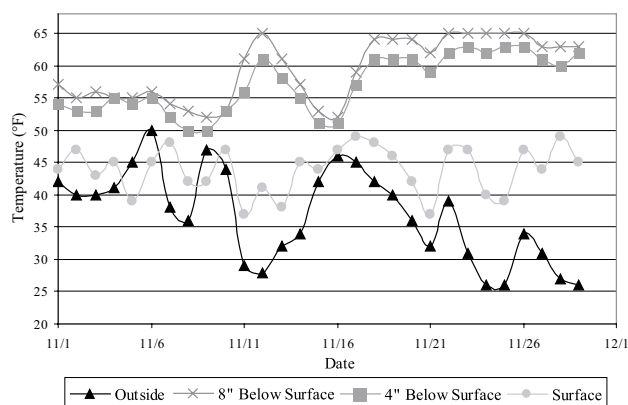
The costs involved with a subsoil heating system are fairly large compared to the value of the cold hardy crops that I produced. The high cost is partly offset by the fact that many of these low-value crops can be produced when no other crops can be grown. It is also important to note that the increased soil temperatures and protection afforded by the hoop house allow multiple generations of the lower value crops to be grown. Faster growth and higher quality is worth a lot. The system will likely allow for other higher value crops to be grown during early spring that will also benefit from the additional subsoil heat.

The possibility of using the subsoil heating system in the late winter and early spring will be interesting to assess. Injecting heat into the soil early in the year will allow growers to take advantage of the increasing day length.

**Figure 2. Average Outdoor Soil and Air Temperatures Compared to Hoop House Soil Temperatures October 1 - November 29**



**Figure 3. Average Soil Temperature Inside Hoop House at Two Depths Compared to Outdoor Soil and Air Temperatures November 1 - 29**



*Hearty loops outlet from the boiler and reservoir.*

Once the soil temperature rises and the hoop house becomes too warm for cold hardy crops, the added heat in the soil will make it possible to get higher value crops – such as tomatoes and peppers – off to an early start.

For a hydronic subsoil heating system to work on a larger scale and with less fuel and maintenance, it is likely that the reservoir of the system would need to be expanded to store a greater amount of thermal energy. Many commercially manufactured water boilers for home heating are available and could be used for subsoil heating in agricultural applications. As a rule, most commercially available boilers would require reservoirs and lengths of hydronic tubing that are far larger than the ones I used. Having a larger system would allow longer times between fueling the furnace and also create a system where the temperatures would be more stable.

Placing the hydronic burner and reservoir in a head house attached to the hoop house could also be beneficial. Having the burner and reservoir outside of the hoop house would allow the entire growing space to be used for crops. It would also separate the crops from the wood burner, reducing the chance that ash and smoke might contaminate some of the crops. Keeping the ambient heat of the burner and the reservoir away from the crops in a separate building would also permit more reliable management of temperature. Separating them would allow for temperature regulation of the system during days when cold night temperatures would suggest firing the system. Daytime sun creates conditions where the hoop house quickly heats up and you need to quickly decrease temperatures.

Another aspect of subsoil heat that merits further research would be installing the hydronic tubing closer to the bed surface to see if closer proximity to the heat source will provide better growing conditions. Having the hydronic tubing closer to the surface would result in higher temperatures closer to the plants' roots, but could create problematic conditions. The tubing might inhibit proper cultivation for bed preparation and might also lead to the soil drying too drastically in the root zone.

This project is important to me and other organic market farmers because it is a diversification strategy that allows vegetable crop producers to overcome the short Minnesota



growing season. It offers increased marketing opportunities and a potential for spreading the productivity of smaller farms over a longer period. Local fresh organic foods available for a greater part of the year will allow more people to appreciate what Minnesota has to offer. Being able to produce crops from October through November and from late February through March could offset potentially devastating weather in the traditional May to September growing season. In addition, providing customers with locally grown produce outside of the traditional growing season generates added consumer excitement about one's products and farm. The reliance on locally based energy resources is also an important aspect of the system

### Management Tips

1. Operating a wood-fired boiler in a hoop house raises some interesting issues that need to be worked out. Burning wood can at times create a messy situation. Improper chimney draft can create smoke, so make sure that the chimney allows proper suction and creates a positive draft quickly to keep smoke from filling the hoop house. Since the water boiler isn't completely sealed (to prevent unsafe pressure buildup), extra moisture in the closed hoop house environment can become an issue. At times, the added moisture must be counteracted by increasing air circulation in the hoop house, especially when it is closed for extended periods of high humidity. Installing fans might be necessary.
2. To make the subsoil heated hoop house better, I would suggest using a larger water boiler and reservoir. Increasing the amount of water in the system would allow it to store a greater amount of energy, making it better at keeping the temperature of the soil higher, while also requiring less maintenance and fueling. It might also be advisable to install the heating system in an auxiliary building that is insulated and has supplemental heat to serve as a safety

*Newly planted spinach starts next to a group of mature plants. Planting into a hog panel grid keeps the plantings orderly.*



check to prevent the system from freezing. Using an auxiliary building would also allow for fueling of the system during the coldest weather without disturbing the protection afforded by the hoop house.

### Cooperator

*Kevin Gahm, St. Paul, MN*

### Project Location

From Stillwater, go north on Cty. 15 (Manning Ave., which becomes Manning Tr.). Farm is about 8 miles north of Hwy. 36. Look for the blue roof.

### Other Resources

Coleman, Eliot. 1999. *Four-Season Harvest*. Chelsea Green Publishing. White River Junction, VT.

Lehman's. Hot water from your woodstove. Available from Lehman's, PO Box 321, Kidron, OH 44636, 877-438-5346. Web site: [www.lehmans.com](http://www.lehmans.com)

Plastic Pipe and Fittings Association. PEX Installation Guide – a guide for installing and technical specifications for PEX hydronic tubing. Glen Ellyn, IL. Available at: [www.ppfahome.org/publications.html](http://www.ppfahome.org/publications.html)

The following web sites sponsored by the Noble Foundation and the Rodale Institute have pictures and additional information on hoop house construction: [www.noble.org/Ag/Horticulture/HoopConstruct/Index.htm](http://www.noble.org/Ag/Horticulture/HoopConstruct/Index.htm)  
[www.newfarm.org/depts/beginning\\_farmers/0303/hoop-house.shtml](http://www.newfarm.org/depts/beginning_farmers/0303/hoop-house.shtml)

**Principal Investigator**

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**Project Duration**

2002 to 2003

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**Keywords**

American Indian, antioxidant, beans, heirloom, indigenous, Three Sisters method

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

# Dream of Wild Health, a Project of Peta Wakan Tipi

**Project Summary**

One of the goals of Dream of Wild Health is to address the dramatic rise of diet-related chronic diseases in today's society, especially for American Indian people. Many people within the Indian community believe that a return to traditional heirloom food crops could be an important part of a healthier lifestyle. Previous research indicated a high antioxidant level in heirloom crop varieties. The objective of this project was for Dream of Wild Health to grow and analyze the antioxidant activity of the eight varieties of indigenous beans in its possession. Dream of Wild Health grew the beans; the University of Minnesota Department of Food Science and Nutrition assessed their antioxidant activity.

**Project Description**

Over the past century, crop breeding and production strategies have been largely driven by agribusiness concerns over cost, improved yield, and processing qualities. On these fronts, tremendous gains have been made. But only recently has nutrition science advanced to the point where more subtle bioactive properties of food crops are recognized and investigated. The dramatic increase in prevalence of diet-related chronic diseases has refocused attention on the diversity (or lack thereof) in our cropping systems and germplasm. From the context of nutritional value and chronic disease prevention, what qualities might we have lost over the past 100 years? This small project offered a rare opportunity to gain some badly needed insight.

Age-adjusted mortality rates for diabetes and cardiovascular disease among American Indian people of the Upper Midwest are four-fold and two-fold higher, respectively, than their non-Indian neighbors, according to Indian Health Services data from 2000.

Many within the Indian community believe that part of the answer to these diet-related diseases involves a healthier lifestyle and healthier food selections, including a possible return to traditional heirloom food crops. Consistent with this notion is a growing body of scientific evidence that consumption of grains, fruits, and vegetables are related to lower risk of chronic disease. In previous research, three heirloom crop varieties – Oneida hominy corn, Potawatomi beans, and Arikara squash – were analyzed and found to contain a wide variety of phytonutrients, including antioxidants. The results suggested that indigenous beans have up to 20 times more antioxidant activity than market beans.

Five years ago, American Indian elders and community members started giving Peta Wakan Tipi with heirloom indigenous seeds. Word of our indigenous seed collection spread and we began receiving seeds from the academic world, too. For example, we received 800-year-old seeds from an archeological dig in the Southwest. Scientists from Iowa donated 2,000-year-old Hopewellian seeds – the oldest known culture in North America.



*Sally with samples of heirloom seed.*

To honor the seeds, Peta Wakan Tipi founded the Dream of Wild Health, a program dedicated to preserving and sharing the seeds in our collection, as well as to preserve the traditional Indian relationships between plants and people, and to educate across ages and cultures. When this project started, the Dream of Wild Health had been given the care for seed stock of almost 400 varieties/species of heirloom plants. Over the past four growing seasons, the Dream of Wild Health had begun the work of preserving, growing, and propagating our indigenous heirloom plant varieties.

Dream of Wild Health leased a small plot of land in Farmington, MN on a small, organically certified farm. The crops were grown according to traditional protocols of indigenous people and concepts of sustainable practice. These included Three Sisters gardening (intercropping of heirloom corn, beans, and squash), using traditionally made hand tools, and hand-pollinating corn to ensure varietal stability.

Dream of Wild Health assumed responsibility for growing the beans in accordance with appropriate indigenous protocols, and harvesting them. The beans were then given to Dr. Craig Hassel, who oversaw antioxidant analysis at the University of Minnesota. They assessed antioxidant activity by 2,2 diphenyl-1-picrylhydrazyl (DPPH) methodology. Two bean plants were sampled for each of eight varieties tested.

## Results

Bean samples from each of two plants per bean variety were dried and ground immediately prior to analysis. Dried bean samples from each plant were subdivided into six determination antioxidant assay sets. The results generally show that indigenous bean varieties contain high levels of total antioxidant activity (Table 1). As such, it is possible that these varieties may be a useful source of food in creating culturally acceptable, high nutrient food products to American Indian communities. It remains to be determined if this high antioxidant activity measured in a raw bean could be maintained in a finished product that American Indian consumers find acceptable based on taste. The health benefits of consuming such a product would require further study.

Based on the results of an earlier project that are not reported here, there is some variability in antioxidant

activity within bean varieties. The one variety common to both the earlier project and this one is the Potowatomi bean. In the first project, the Potowatomi bean tested at 22,470 TE/100 g, compared to 14,850 TE/100 g (average of two plants) reported in this project. The reasons for this variability are unclear. The DPPH assay was methodologically identical, however the assays were conducted in two different laboratories. The 22,470 figure was obtained using two assay determination sets per sample, while the 14,850 was derived using six sets per sample. It is possible that some of the difference could be accounted for by assay variation in the two different locations. It also remains possible that different growing years and climatic conditions could have contributed to these differences.

## Cooperators

*Dr. Craig Hassel, Department of Food Sciences and Nutrition, University of Minnesota, St. Paul, MN*  
*Dr. Len Marquart, Department of Food Sciences and Nutrition, University of Minnesota, St. Paul, MN*  
*Dr. Gary Fulcher, Department of Food Sciences and Nutrition, University of Minnesota, St. Paul, MN*

## Other Resources

Milan, Bruce and Diane. 2000. Dry Edible Beans as an Alternative Crop in a Direct Marketing Operation. Greenbook 2000. Available at: [www.mda.state.mn.us/esap/greenbook.html](http://www.mda.state.mn.us/esap/greenbook.html)

**Table 1. Total Antioxidant Equivalents for Heirloom Bean Varieties**

Bean Variety	Bean Accession Number	Plant Number	Total Antioxidant Activity*
Black Turtle Bean	00:100-1:72	2	15,300
		3	14,700
Cut Short Bean	00:100-1:76	4	10,000
		6	10,400
Potowatomi Bean	00:100-1:80	1	15,300
		5	14,400
Rabbit Bean	00:100-1:79	1	24,100
		3	24,000
Red Bean	00:100-1:80	1	15,400
		2	15,100
Seneca Bean	00:100-1:70	2	10,600
		3	10,800
“Unknown” Bean	00:100-1:74	1	13,600
		2	9,650
Women’s Yellow Bean	00:100-1:78	1	10,700
		3	11,000

\* Reported values represent the means of the six determination sets for each plant, expressed in Trolox equivalents (TE) per 100 g sample

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**Project Duration**

2003 to 2005

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**Keywords**

bees, honey, melissopalynology, pollen, varietal honey

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

# Adding Value to Honey Products Through the Use of Melissopalynology Techniques

**Project Summary**

Most honey in the U.S. is collected from multiple hives, blended, and sold in 55 gallon drums. In other parts of the world, a much greater share of the honey market is represented by small artisan honey producers who sell varietal honey, separated by the different flora sources. They have successfully differentiated their product from the blended, cooked product which the larger packers offer, and are able to command a premium for their varietal honey. In this research, I wanted to find out if we can create a successful model for adding increased economic value to Minnesota produced honey through the use of melissopalynology techniques. Melissopalynology is the term used to describe the science of pollen analysis using a microscope. I sought to incorporate melissopalynology techniques in the collection, segregation, and identification of the varietal honey in my honey operation.

**Project Description**

The roadside honey stand is mostly a forgotten relic of the past in American rural areas, but honey can play an important role in diversifying a farming enterprise. Domination by large honey producers in the U.S. makes it difficult for small beekeepers to run a profitable business. We need a more sustainable model for small beekeepers to stay in business.

Large honey producers offer a blended, cooked product, so most people think of honey as a generic product, which is far from the truth. Honey is as diverse a food source as the world's different geography and cultures. Honeybees collect nectar and pollen from a wide variety of flowers, trees, and shrubs. The season begins with the beginning of spring when the willows bud out and continues until the frost kills off the asters and remaining wildflowers in October. As the season progresses, the honey that is collected varies in flavor, color, and texture.

Honey business and production models found in New Zealand and parts of Europe differ markedly from our U.S. model. In those regions, a much greater share of the honey market is represented by small artisan honey producers who sell varietal honey, distinguished by the different flora sources. They have successfully differentiated their product from that of the larger packers and are able to command a premium price.

In New Zealand, national standards enforce a definition for what constitutes a varietal honey. The standard requires the use of melissopalynology methods to determine the origins of a particular honey sample. Melissopalynology is the term used to describe the science of pollen analysis using a microscope. A varietal honey must contain pollen in a minimum specified percent of the overall volume of pollen residue found in a sample. As a result of these approaches, New Zealand honey is considered to be some of the highest quality honey in the world and commands a premium price in North American markets.

My goals in this research were to:

- increase awareness about this approach to marketing honey;
- increase profits;
- share information with other interested beekeepers; and
- contribute to a more sustainable production model that small apiaries can follow.

I own a business, Ames Farm, in which I manage 150 beehives in ten different locations. Rather than blending my honey together by using more efficient equipment like the larger commercial operations, I work with very small amounts of honey using several small pieces of equipment. This allows greater attention to detail but is more labor intensive. I receive a premium for my

honey products and have gained a wide market share at the Minneapolis Farmers Market and at 20 stores and co-ops in the Twin Cities area.

I keep track of the time periods in which the supers (beehive boxes) are filled. I also keep a list of different plants I see in bloom and note when the bees are feeding on them. The labeling and marketing of my products provides information about the flora source of the honey. Each container has the individual hive number and location where the honey was produced printed on the label at the point of bottling; each jar is searchable on my online database. I cannot always be certain of the flora source and must sometimes make an educated guess. Many of the sources, like basswood, sweet clover, and goldenrod are fairly reliable year after year. Different weather patterns, however, can cause a plant like birdsfoot trefoil or blue vervain to produce enough nectar from which the bees are able to make a crop. I have 12 to 20 different nectar sources each season and the variety changes each year.

This variability is what led me to research melissopalynology. The first part of this project was assembling the necessary equipment to perform pollen analysis on honey samples as they were produced during the season. The main expenditure was the microscope used to document the pollen samples. Other supplies included slides, glassware, and utensils. I hired a biologist consultant to assist me in creating a procedure for identifying the main flora source of different honey samples.

## Results

During the first summer of the project (2003) I used a microscope in the Entomology Lab at the University of Minnesota to get started until I had a better understanding of what I needed in equipment. During that summer, Elaine Evans, my consultant, developed a procedure for analyzing the different pollens in a honey or bee pollen sample, and we created a report that provided information useful in determining the floral sources of the nectar or pollen.

Besides giving me a new tool, this pollen analysis added credibility to my claims concerning floral source names. During the first six months, several honeys like sweet clover, Dutch clover, basswood, goldenrod, and birdsfoot trefoil were verified. Several new nectar sources were “discovered” and included wild mustard, crown vetch, and buckthorn.

As a result of the ability to perform pollen analysis, I introduced a new bee pollen product which also had the floral source of the pollen noted on the jar label. Because of the complexity of overlapping colors and flavors of bee pollen, I would probably not have been able to introduce

this product without having the microscopic analysis to identify the pollen source.

During 2004, the second season, the pollen analysis was ongoing and we identified several “new” nectar sources including elderberry, horse chestnut, and purple loosestrife. I purchased an Olympus CX31 microscope with a high-quality 100X objective. Originally I had budgeted money for photographic equipment, intending to take photographs of the pollen shapes to use as a reference collection. However, I learned we need to be able to determine depth or texture in analyzing a sample; information that is not included in high-magnification photography. The high-quality magnification optics are more useful than having photographic equipment.

To take the place of having a photographic reference image, we are constructing our own pollen reference library which will require a substantial amount of effort in 2005. The sample library will be slides of pollen preserved under a glass cover. The University of Minnesota has an excellent pollen reference library, but I need to have my own easy-to-access library.

Overall, the information collected is being used in the labeling and marketing of different varietal honeys, enabling us to obtain a greater price for the product. I also believe I can educate others about these differences with the real data I collected from this project.

## Management Tips

1. Invest in high power magnification optics rather than photography equipment.
2. Use the information from melissopalynology in the labeling and marketing of honey products.

## Cooperators

*Don Hegreberg, Beekeeper, Jordan, MN*  
*Elaine Evans, Biologist, St Paul, MN*

## Other Resources

Louveaux, J., A. Maurizo, and G. Vorwhol. 1970. Methods of Melissopalynology. International Commission for Bee Botany of IUBS. *Bee World* 51: 125-128.

Minnesota Hobby Beekeepers Association, c/o Gary Reuter, 612-624-6740. [www.mnbeekeepers.com](http://www.mnbeekeepers.com)

Moar, N.T. 1985. Pollen Analysis of New Zealand Honey. *New Zealand Journal of Agricultural Research*, 28: 39-70.

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**Project Duration**

2002 to 2004

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**Keywords**

animal health,  
antibiotic  
alternatives,  
brand standards,  
consumer  
education, direct  
marketing,  
grass-based  
dairy products,  
management  
intensive rotational  
grazing

# 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

**Project Summary**

The three member farms of the PastureLand Cooperative are working to create public demand for dairy products produced on farms that use management intensive rotational grazing. This project resulted in more focused production methods and marketing techniques for our cooperative. Consumers in the Twin Cities metro area and in southern Minnesota are showing more awareness of pasture-based dairy methods and more demand for PastureLand dairy products. The project included three components: helping co-op members to comply with the cooperative’s Production and Quality Standards related to limiting antibiotic use; development of a formal business plan for the cooperative with emphasis on marketing and sales strategies; and an intensive consumer education drive in the Twin Cities area.

**Project Description**

The PastureLand Cooperative was incorporated in 1998 with the goal of creating a profitable marketing alternative for the milk of member farms. Each of the member farms of the cooperative uses management intensive rotational grazing. The members of PastureLand have watched commodity prices fluctuate and the dairy industry, both production and processing, become a big-business enterprise. Members have

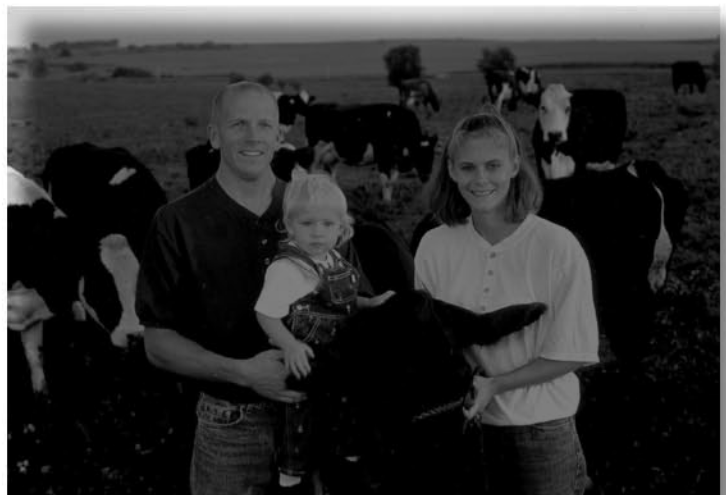
also tracked the emergence and success of the organic foods movement. The goal of the cooperative enterprise is to market the distinctive attributes of milk products from grass-fed herds in a way that enables it to return a high, stable price for milk to member farmers.

PastureLand hopes to create a market niche that can provide a profitable income for member farms and, in the long run, encourage more family farms to utilize management intensive rotational grazing. After the cooperative began to market cheese and butter in 2000, it became clear that “branding” dairy products from grass-fed cows would be among the biggest challenges in establishing a successful business. With the proliferation of organic and natural foods in the market, consumers are confused and skeptical about a new product that makes health and environmental claims.

This project was designed to help the cooperative address these challenges through three specific work areas:

- Part One of our project focused on helping member farmers develop methods for complying with the Quality and Production Standards established by

*Roger and Michelle  
Benrud with daughter,  
Emily.*





*Dan describes his grazing system.*

the cooperative. Members need reliable, effective alternatives to antibiotic treatment for common illnesses in their herds.

- Part Two of this project involved working with a marketing expert to develop a more focused marketing and sales plan for our products, followed by market testing and development of products/packaging to meet the demand of target markets.
- Part Three involved educating Twin Cities Natural Foods Co-op members and shoppers (now including Kowalski's Markets as well) about products and production methods. As we worked with customers face-to-face, we learned about their buying preferences and reactions to our products. This information was the foundation for all publicity material developed during this project. This part was completed in cooperation with the Food Alliance Midwest.

Though the specific goals and outcome measures for each of these work areas were slightly different, the overall goal of the project was to increase the cooperative's expertise in the complex world of food marketing in order to make "grass-fed" an understood, positive association in the minds of consumers. Product sales have been the primary measurement of the cooperative's success in this endeavor, however, other measurement tools, discussed below, were used as well.

## Results

*Alternatives to Antibiotic Use.* The first part of our project involved on-farm testing of alternatives to antibiotic use in PastureLand member herds. After a considerable amount of deliberation, PastureLand members adopted a policy strictly limiting the use of antibiotic treatments in member herds in early 2001. This policy was a direct response to negative consumer feedback about use of antibiotics in dairy animals. At the time the policy was adopted, the PastureLand cooperative also committed itself to assisting member farmers in meeting these standards.

Since early 2002, Roger and Michelle Benrud have kept illness and treatment records for each animal in their herd, with a specific emphasis on monitoring and recording the administration and outcomes of non-antibiotic treatments. They tested a number of treatments for common ailments and sought professional advice from holistic veterinarians. The illnesses, treatments, and outcomes of this effort can be found in Table 1 of our 2004 *Greenbook* article.



PastureLand members feel that they have benefited from the on-farm testing of alternative treatments, the information presented at workshops and field days, and the informal advice provided by the Benruds. Successful utilization of alternatives became even more important to PastureLand members as organic certification is becoming a reality or a distinct possibility on each farm (as of December 2004, Benruds were certified organic, French/Kaiser Farm was in transition, and the Stellings were actively considering certification). It seems likely that PastureLand will be marketing its products as grass-fed and organic within a year's time. Organic certification will open new markets for our products as well as for the by-products generated by our cheese and butter production.

*Business and Marketing Planning.* PastureLand made significant progress toward its goals of market analysis and business/marketing planning. In 2002, we secured the assistance of consultant Jeanne Quan, who designed a market analysis program and business planning process. By mid-year, much of the planning was complete, and late in 2002 we were working to secure new product placements and roll out new butter packaging as called for in the market analysis. John Seymour-Anderson, a graphic designer with a strong interest in sustainably produced products, worked as a team member to help conceptualize the images and language that will sell grass-fed products to customers. Our market research methods can be found in Table 2 of our 2003 *Greenbook* article.

Marketing plans were updated in 2003 and 2004. These annual plans were critical to our successes each year in the areas of growth, brand identity, and publicity. During the period of this grant, we have had steady, manageable sales growth. Sales of PastureLand branded products doubled from 2002 to 2003 with a projected almost 300% growth

from 2002 to 2004. We are now confident in our brand's attributes, appearance, and target market, and feel that our packaging, marketing materials, and publicity reflect this brand. PastureLand joined the American Cheese Society in 2004 and was able to enter some of our products in their annual competition in 2004. Our first entries into the competition, our salted and unsalted butters, each won first place in their divisions! Our herb Gouda cheese took a third place ribbon. The publicity from these prizes prompted a great deal of local, regional, and national interest in our butters and facilitated our entry into a major local grocery chain, Kowalski's.

Because of the growth in sales volume that we have experienced with accompanying increased complexity and volume of work, the marketing part of the business quickly outstripped the members' abilities to perform both marketing and production functions. The cooperative hired Jean Andreasen as our general manager in September, 2004. We are now ready to embark on a new phase of growth and development.

*Consumer Education.* The goal of this portion of our work was to engage consumers and retail partners in a focused way, to educate them about our pasture-based methods, and gauge their interest in and potential loyalty to grass-based dairy products.

The third part of the PastureLand project began in the spring of 2003. We had initially proposed working with the Food Alliance Midwest to conduct a consumer education campaign in the Rochester, MN area. Because of staffing changes and other considerations, the location of this campaign was moved to the Twin Cities metro area, with an emphasis on shoppers at the Twin Cities Natural Food Cooperatives (TCNFC). This effort expanded to include Twin Cities Kowalski's locations in 2004.

The focus of the consumer education campaign was threefold:

1. in-person product demonstrations in co-op stores;
2. placement of longer-format articles and other information about PastureLand in the newsletters of the food cooperatives; and
3. placement of advertisements or running product sales in order to attract attention and new consumers to our brand.

***Roger and Michelle Benrud at field day.***

To the degree possible, we tracked the sales outcomes of these efforts. In addition, we hope to conduct some in-store surveys with buyers and consumers early in 2004 to gauge how much of our grass-fed message and brand identity "stuck" with people who first encountered it in 2003.

In-store product demonstrations were very effective for reinforcing our brand identity and creating loyal customers. Product demonstrations were conducted in 11 retail locations during 2003 (ten of these locations were natural foods cooperatives). As an example of the impact of product demos and other consumer education efforts, during 2003, sales at one Twin Cities co-op increased from \$375 for the period of January through March to \$823 for April through June to \$1,462 for July through September. The growth trend continued in 2004 and this increased brand recognition helped PastureLand secure placement of our butter in most Twin Cities Kowalski stores.

We found that product demonstrations are an absolutely critical step in increasing brand recognition and building loyalty in the retail setting. This is true even in the smaller, more intimate setting of the food cooperative. There are enough brands of butter and premium cheese on the market that consumers rarely look past their favorite brand when shopping. We plan to aggressively pursue demonstrations in our new and existing accounts late in 2004. The timing for these demonstrations will be excellent because consumers are more likely to purchase butter and more willing to try something that they perceive to be a premium product during the holiday season. Also, both supplies of commodity and organic milk and butterfat are quite low nationwide, driving up prices on all brands of butter. This makes PastureLand's price very competitive.

Because this is our first placement in a conventional (non-natural food) grocery store, we are using demos in those stores to learn about Kowalski's shoppers' preferences and priorities. This chain has been an enthusiastic supporter of



the Food Alliance Midwest's program and we believe that our Food Alliance certification was one key component in getting our products into their stores. The American Cheese Society award also helped!

In addition to product demos, we have found that long-format articles are much more effective in reaching out to new consumers than product advertisements. This could be because of a very weak history in product advertisements in most co-op newsletters, but it also speaks to the willingness of natural foods consumers to learn more about the foods they purchase and consume. These articles are particularly helpful when combined with product demos.

A final aspect of our consumer education program is our presence on the internet. We have used our web site to reinforce our message with shoppers. We do not have an e-commerce site at this time but have a steady stream of visits from people who want to see pictures from the farms and learn about the grass-fed aspects of our production methods.

### Management Tips

1. Thoughtful (and successful!) marketing efforts must rely on good record keeping. We spent much of 2002-2003 refining our bookkeeping practices in order to better understand where we were gaining or losing ground with regard to marketing our products.
2. If we were starting today, we would try to place more emphasis on marketing. It is the part of this business that is most critical to our success, but the hardest to do without connections and knowledge of this field.
3. Modifying or customizing our business plan to take into account our current resources and strengths helped us continue to grow during this project. For example, we focused on sales and marketing (an area in which we have resources and growing expertise) instead of product and packaging development (an area which would have required us to purchase costly staff or consulting time, with less immediate financial gain).

4. While it was a good learning experience to design our own logo and labels, the help of marketing professionals was valuable. It would have been helpful to know these people and solicit their help in the first place.

5. In-store product demonstrations are critical to earning new customers in the retail setting. They must be held on a regular or at least cyclical basis in order to remind shoppers of your presence and to capture new consumers who might be unaware of our brand. These are a significant expense in either time or money and need to be figured into operation and promotional budgets. Demonstrators need to be knowledgeable about production methods.

### Cooperators

*Dan and Muriel French, DMJ Farms, Mantorville, MN*  
*Ralph and Phyllis Stelling, Dennis and Ronda Stelling,*  
*Ral-Den Dairy, Millville, MN*

*Roger and Michelle Benrud, Goodhue, MN*

*Jon Kaiser, DMJ Farms, Mantorville, MN*

*Food Alliance Midwest, St. Paul, MN*

*Kirsten Bansen Weigle, PastureLand Cooperative, St.*

*Michael, MN*

*Jean Andreasen, PastureLand Cooperative, St. Paul, MN*

*Jeanne Quan, Jeanne Quan Fine Food Marketing, St.*

*Paul, MN*

*John Seymour-Anderson, Minneapolis, MN*

*Dr. Paul Detloff, Arcadia, WI*

### Project Location

For DMJ Farm: From Hwy. 52 exit on Hwy. 57. Follow Hwy. 57 17 miles south. The Co-op's warehouse and office facilities are also located at DMJ Farm. Directions to other co-op members' farms can be obtained from Dan French.

### Other Resources

Food Alliance Midwest. 400 Sibley Ave., Ste. Y, St. Paul, MN 55102, 651-265-3682.

Available at: [www.thefoodalliance.org/midwest](http://www.thefoodalliance.org/midwest)

PastureLand information available at:  
[www.pastureland.coop](http://www.pastureland.coop)

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**Project Duration**

2002-2003

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**Keywords**

agroforestry, black walnuts, contour curbs

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

# Utilizing Water Conservation and Infiltration for Black Walnut Production

**Project Summary**

This project demonstrates agroforestry as a viable production system, with economic and environmental benefits. The goal was to develop and provide a model for the establishment of genetically superior black walnut trees primarily for wood production and secondarily for nut production. Innovative conservation features such as contour curbs and a rock weir system provide for irrigation and groundwater recharge and eliminate erosion.

**Project Description**

On the 212 acre farm I co-own with my parents, 45 acres have been in a corn and soybean rotation production system for the past eight years. This project demonstrates the opportunity to diversify the operation on a portion of the remaining acreage by establishing black walnut trees.

Farmland in south central Minnesota is rich and relatively flat, but also contains rolling hills with higher runoff and erosion potential. Many of the highly erodable portions are managed the same as the flatter fields. During storm runoff events, these portions have the potential to shed larger volumes of water causing lower areas of the field to flood and increase soil erosion. Agroforestry combined with other conservation measures, provides an alternative cropping system for those areas. It reduces nutrient runoff and soil erosion risks on those sloping fields that have the lighter, highly erodable soils. Black walnuts require minimal land and labor, and generate a long-term high value product which can be used for income after the farmer has retired from annual row crop production. Too often farmers in my area rely on the sale of their

farm for their retirement income, which limits their family's options to continue farming.

Many farmers in my area haven't considered agroforestry as a viable production system because of a lack of demonstration sites or local economic models. They are not aware of recent research advances to grow productive stands, or of products and techniques developed to assist in the early, more vulnerable and time consuming years of tree stand development.

For this project my goals were to establish a black walnut crop that would:

- offer a high-value long-term production crop as a retirement investment for farmers;
- offer a different labor time frame requirement;
- reduce nutrient runoff and soil erosion from susceptible fields;
- require a relatively small amount of acreage; and
- introduce and demonstrate production concepts of agroforestry.



***Black walnuts planted in tree tubes.***

To achieve these goals, I planted a stand of genetically superior black walnut trees primarily for wood production and secondarily for nut production. I selected a 2 acre site with silty clay loam soil and slopes of 6-15%. The seedlings were purchased from a few sources varying in genetics and price.

Because of the slopes and soil type, and to reduce labor and promote faster growth, I incorporated some unique features. The design of this system was a compilation of reading and research of agroforestry articles and information. It is a hybrid of research the Carver County Soil and Water Conservation District conducted on retrofitting open inlets with rock inlets (which itself was borrowed from Morriem Drainage of Freeborn County, MN). My system includes:

*Contour Curb System* - The contour curbs were installed on the contour approximately 20-25' apart. The curbs are about 1' in height and intercept hillside run-off. The intent of the contour curbs was also to capture any nutrient runoff and allow it to be incorporated into the root zone via the pea rock weirs. To provide additional nutrients to the seedlings, hog manure was injected into the sod hillside the previous fall. This was done due to previous Missouri research which showed increased black walnut seedlings growth during the first three years when fertilized with chicken manure.

The contour curbs were not engineered, as with compacted clay soils. This would have defeated the purpose. Instead, they were constructed with a road grader that turned the sod over and topped that with topsoil. The structural component of the curbs became reestablishment of the grasses.

*Pea Rock Weir System* - The pea rock weir system consists of a 9" diameter hole, 24-30" deep, placed on the uphill side of the curb. The holes were placed in between every other tree seedling. Each tree seedling then shares an infiltration hole with one other tree. The intent was to capture as much runoff as possible and infiltrate it into the hillside. Black walnuts prefer precipitation of about 35"/year. With this system of collection and infiltration, our average rainfall of 29" could be enhanced.

*Weed Barrier Tree Mats* - Placing weed barrier mats in between the trees reduced labor requirements in the summer. Between the rows, I intended to plant a legume (red clover) to provide for a higher value crop than the grasses currently grown on the hillside, as well as provide a nitrogen source for the walnuts.

*Vented Tree Tubes* - The vents provide the tree tubes with hardening off capabilities, encouraging faster growth.

## Results

The results of this project are in the long-term economics of harvesting black walnut timber. The short-term results include the harvestable material from between the rows of walnuts. Only one cutting was taken off the hillside the first year. This was partially due to the grading in the Spring, and a misunderstanding with the person harvesting the hay that they should harvest the hay between the seedlings. Again, I think this demonstrates a lack of familiarity with agroforestry practices.

I had intended to seed red clover between the rows to provide a higher value intercrop than the grasses currently growing on the hillside, as well as to provide a nitrogen source for the walnuts. Due to time constraints and consistent precipitation in May and June, I was not able to interplant the clover into the hillside. I will attempt to inter-seed next Spring.

The result I found the most interesting was the effect the contour curbs and pea rock weirs had on runoff. This was proven during a rainstorm in late May, when installation was partially completed. We had a short, intense rainstorm - in 15 minutes we received 1/2" of rainfall. After the rain stopped, I photographed the contours that had been completed and those under construction. Those that were completed had no surface ponding and those that were under construction showed the runoff that would have occurred, as well as water ponding. The photos clearly showed that the contour curbs and pea rock weirs were allowing far greater infiltration.

The precipitation that occurred during May, June, and early July was above normal and we experienced very little precipitation the rest of the summer. I believe the increased infiltration, especially during intense rainstorms, and the weed barrier fabric contributed to the lower drought stress on the seedlings.

In keeping with my goal of demonstrating an agroforestry model, the walnut stand is readily seen from the road, and this visual display generated interest from area farmers. This project also provides an avenue to sense the long-term impacts and benefits of agroforestry.

## Management Tips

1. If I were to do it over again, I would not change any of the major structural components of the project. The contour curbs did function as well as I had hoped and hopefully they will remain structurally intact.

2. Selecting tree genetics and suppliers were difficult decisions. I would recommend going with those suppliers with a long history.

3. Designing cropping systems that can literally go beyond one's lifespan is a humbling experience. A successful project depends on detailed planning and good decisions. This in itself may be a significant reason why a producer, or even a resident of a community, would hesitate to pursue agroforestry. This lesson provides me and the people I talk to with a deepened interest in seeking out the best available research, technology, and experience.

### Cooperators

*Vern and Myrtle Gieseke, Farmers, New Ulm, MN*  
*Gary Hachfield, Nicollet County Extension Educator,*  
*St. Peter, MN*

### Other Resources

Josiah, Scott. 2000. Discovering Profits in Unlikely Places: Agroforestry Opportunities for Added Income. Publication No. BU-07407. University of Minnesota Extension Service, St. Paul, MN, 612-625-8173 or 800-876-8636. Email: [order@extension.umn.edu](mailto:order@extension.umn.edu)  
 Available in full text online at: [www.extension.umn.edu/distribution/naturalresources/DD7407.html](http://www.extension.umn.edu/distribution/naturalresources/DD7407.html)

Josiah, Scott, et al. 2002. Agroforestry in Minnesota: A Guide to Resources and Demonstration Sites. University of Minnesota Extension Service, St. Paul, MN, 612-625-8173 or 800-876-8636. Email: [order@extension.umn.edu](mailto:order@extension.umn.edu)

National Agroforestry Center web site: [www.unl.edu/nac/](http://www.unl.edu/nac/)

University of Minnesota. Center for Integrated Natural Resources and Agricultural Management (CINRAM). 612-624-4299 / 7418 / 4296. Email: [CINRAM@umn.edu](mailto:CINRAM@umn.edu)  
 Web site: [www.cnr.umn.edu/fr/cinram/](http://www.cnr.umn.edu/fr/cinram/)

University of Missouri Center for Agroforestry web site: [agebb.missouri.edu/umca/research/pubs.asp#nut](http://agebb.missouri.edu/umca/research/pubs.asp#nut)

***Contour curbs with pea  
rock weir holes.***



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### Project Duration

2004

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### Keywords

organic, value-added, variety trial, wheat, yield

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# Adding Value to Organic Wheat

## Project Summary

Southern Minnesota has fallen out of favor as a small grains growing region. However, in organic systems, extended rotations improve soil tilth and quality and interrupt pest and disease cycles. Profitable marketing options for crops like small grains can be important to the success of organic operations. This project conducted variety trials to test yield and quality of several varieties of wheat suitable for southern Minnesota.

## Project Description

A sustainable system needs rotations that will improve soil quality and make money. I farm a 100 acre organic grain farm near Austin in southern Minnesota and small grains are an important part of my farm's diverse rotation. Small grains may be underseeded with a legume for forage or plowed down for contribution of nutrients and organic matter. Soils planted with small grains suffer less erosion. Tillage operations for small grains happen at different times of the season compared to tillage operations for row crops, offering an important strategy to reduce the soil weed seed bank. Small grains also cycle soil nutrients in ways that differ from row crops.

The number one small grain grown on organic farms in our area is oats, which can stay on the farm as feed or can be marketed for organic feed, seed, or food processing. Although being certified organic commands a premium in the marketplace, organic farmers could benefit further by producing not just an organic commodity, but more of a finished product.

*Joseph combines his plots.*

A farmer friend of mine who markets pork products to restaurants found that there was an interest in locally grown whole wheat flour and encouraged me to grow it for the Twin Cities restaurant market. This seemed like an idea that was worth trying. If wheat worked as a small grain it would increase the number of crops that I could use in my rotation. As with any new idea, it is best to try it out in a demonstration plot without committing the whole farm to it.

The challenge was to find a wheat variety that would produce good quality flour. My objective in this project was to grow several varieties of wheat and compare the yield, protein, and milling quality.

My plan was to grow six varieties of wheat in three plots each and to test the harvested grain for yield, protein, falling numbers, and vomitoxin (DON). If the wheat quality was good, then further flour and baking tests would be done.

We had a long winter and I planted on May 1, which was late in the planting season, but not that unusual in my part of the state. Another factor that delayed me was difficulty getting varieties that are not typically available in our area. I consulted with Hans Kandel (University of Minnesota Regional Extension Educator in Crookston), Joachim Wiersma (University of Minnesota Small Grains Specialist, Crookston), and the Albert Lea Seedhouse about varieties to plant. I decided to use Alsen, Ingot, Oxen, Briggs, Walworth,



**Table 1. Varieties Tested**

Variety	Characteristics
Alsen	Awned, midseason maturity, medium height. Resistant to stem rust and moderately resistant to leaf rust. Moderately resistant to other leaf diseases. Low to medium yield and high test weight. Strong straw. High protein percent. Released by N.D. AES in 2000.
Ingot	Awned, early, tall. Resistant to stem rust and moderately susceptible to leaf rust. Moderately susceptible to other leaf diseases. Low to medium yield and high test weight. Moderately strong straw. Medium to high protein percent. Released by S.D. AES in 1998.
Oxen	Awned, early-midseason, semidwarf. Resistant to stem rust and moderately susceptible to leaf rust. Moderately susceptible to other leaf diseases. High yield and low to medium test weight. Moderately strong straw. Medium protein percent. Released by S.D. AES in 1996.
Briggs*	Awned, early maturity, medium height. Resistant to stem rust and moderately resistant to leaf rust. Moderately resistant to other leaf diseases. Medium yield and high test weight. Medium straw strength. High protein percent. Released by S.D. AES in 2002.
Walworth*	Awned, early maturity, medium height. Resistant to stem rust and moderately susceptible to leaf rust. Moderately susceptible to other leaf diseases. Medium to high yield and low to medium test weight. Medium straw strength. Medium protein percent. Released by S.D. AES in 2001.
Knudson*	Awned, midseason-late maturity, semidwarf. Resistant to stem rust and to leaf rust. Moderately resistant to other leaf diseases. High yield and medium test weight. Moderately strong straw. Medium protein percent. Released by AgriPro in 2001.

\* not commonly grown in southeastern Minnesota

Table adapted from *Hard Red Spring Wheat Variety Trials 2004*.  
Minnesota Agricultural Experiment Station.

and Knudson. Their characteristics are described in Table 1. I planted a 33-acre field of Ingot wheat on April 6 and, although it was not part of the project, it made for an interesting comparison with the demonstration wheat that was planted several weeks later.

The growing season was unusually cool and wet. Austin was noted by Minnesota Public Radio for the amount of moisture it received during the summer – even before we had a flood in September. Rust and ergot were noted on almost all varieties. Ergot did not seem to affect the wheat much, but I observed that in the larger field of wheat not in the demonstration, volunteer rye left over from the previous year almost completely developed ergot. The wheat demonstration plots looked good throughout the summer until late July, when the weed pressure became intense. The larger field of Ingot (not in the project) showed some rust, but looked healthy throughout the season.

I held a field day at the end of June. By then, the wheat showed some rust as well as some ergot. I harvested the plots on August 15.

## Results

In general, the appearance of the different varieties of wheat was a good predictor of how they ended up yielding. The varieties that stood better appeared to have fewer weeds, thrashed out more completely, and had higher yields.

Quality testing was conducted at the Minnesota Department of Agriculture Grain Inspection Division and included test weight, protein, and vomitoxin (DON) (Table 2).

The next step after conducting basic yield and quality data would have been to conduct dough and baking tests. I consulted with the United States Department of Agriculture (USDA) Agricultural Research Service laboratory in Fargo, North Dakota. Because of the low test weight and protein content of the samples, this lab recommended I not conduct

**Table 2. Post Harvest Testing Data**

Variety	Yield (bu/A)	Test Weight (lb/bu)	Protein (%)	DON* (ppm)
Alsen	19.5	52.1	12.5	1.5
Ingot	19.5	50.6	11.6	2.9
Oxen	21.6	47.5	13.1	2.1
Briggs	25.9	54.7	11.3	2.1
Walworth	26.9	49.8	12.7	0.9
Knudson	36.8	55.4	11.8	1.3

\* DON indicates the level of deoxynivalenol (vomitoxin) present in the grain.



***Field day attendees talked about the project  
and their own experiences.***

further dough or baking tests. In addition, the high DON levels exceeded USDA Food and Drug Administration (FDA) allowances, prohibiting consumption of the flour. (The FDA allows up to 1 ppm in finished grain products.)

The larger field planted to Ingot wheat underseeded with clover looked good during the growing season, but like the variety test plots, developed Fusarium head blight. The DON on this grain was 7.2 ppm -- higher than the test plots of Ingot planted several weeks later.

Doing this demonstration project allowed me to compare different varieties under a stressful season. I was able to grow varieties like Briggs, Walworth, and Knudson that are not readily available or grown in our region. They compared well in regards to yield and test weight with the Oxen, Ingot, and Alsen, the varieties that are most commonly grown in south central Minnesota. Walworth and Knudson did well and are strong possibilities for being grown in our area.

Although the project's final results were inconclusive due to not being able to test for baking quality, I would like to continue these tests in future years to obtain more data and to test for milling characteristics. Doing this yearlong demonstration project also raised other interesting research questions such as:



1. How does underseeding legumes affect protein, test weight, and disease problems? Do previous rotations with crops planted into a rye cover crop increase disease pressures and negate the effect of rotations?
2. Wheat used to be grown for flour in our area. What wheat varieties were used in the past and are they still available?
3. Is the weather in our region too unstable to grow wheat? During this wet year there was little wheat within a hundred miles of our farm that did not have Fusarium head blight. In other years the heat and humidity also cause problems. Farmers and seed dealers report that the growing season is generally good three out of four seasons. Is this consistent enough to develop a steady market for wheat from southern Minnesota?

### **Management Tips**

1. Try different varieties and techniques on your farm to learn more about them. It is a lot of work setting out plots and harvesting them, so contact extension agents, University of Minnesota Research and Outreach Centers, and other cooperators early to get ideas and assistance.



***Joseph labeled all his plots carefully so he  
could observe them during the season.***

2. Appropriate Technology Transfer for Rural Areas (ATTRA) publishes good, free information about grain processing and adding value to farm products, as well as about organic production and marketing. The information is available at [www.attra.ncat.org](http://www.attra.ncat.org)

3. Milling quality wheats usually have high protein levels and generally yield less than lower protein varieties. A farmer who plants the higher milling quality wheat does not benefit if the grain does not meet the milling quality standards. They then end up sacrificing yield and the premium that would come with the quality. The question for the farmer becomes whether to produce a high quality milling wheat with lower expected yields but a higher anticipated premium, or to grow a lower milling quality that will have higher yields. A farmer needs to decide what will work on his or her farm based on soil fertility, rotation, yield, and quality history.

### Cooperators

*Mac Ehrhardt, Albert Lea Seed House, Albert Lea, MN*

*Tim Fisher, Pork Producer and Marketer, Waseca, MN*

*Gary Hareland, USDA/ARS, Fargo, ND*

*Doug Hilgendorf, Whole Grain Milling Company,  
Welcome, MN*

*Barry Kurtz, Riverland Technical College, Austin, MN*

### Project Location

From Austin, Take I-90 east to 28<sup>th</sup> St. exit. Cross over freeway. Take Cty. 46 west for 2 to 3 miles. Turn left at gravel road going north. Farm is first on right.

### Other Resources

Varietal Trials. 2004. Minnesota Agricultural Experiment Station. Regents of the University of Minnesota.

Minneapolis, MN. Available at: [www.maes.umn.edu](http://www.maes.umn.edu).

A variety trials bulletin is produced every year.



***Doug Hilgendorf, Mac Ehrhardt, and Joseph look over a test plot at the field day.***

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**Project Duration**

2004

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**Keywords**

consumers,  
market, organic,  
rural

*This organic demonstration project was made possible by funding from the USDA Risk Management Agency Community Outreach and Assistance Partnership Program. USDA-RMA and the Minnesota Department of Agriculture are equal opportunity providers.*

# Demonstrating and Publicizing Organic Agricultural Methods in Minnesota

**Project Summary**

While a wide selection of organic foods is readily available in urban areas, the same is not true for rural communities. This project introduced organic food and organic growing practices to food buyers and farmers in this farm's rural mid-Minnesota neighborhood. Various organic food demonstrations were held during the 2004 growing season. A midseason field day answered commonly asked questions about organic growing practices such as weed management, pest control, cover cropping, and soil issues. Retail and consumer surveys provided information about availability of and interest in organic food.

**Project Description**

Webster Farm Organics is an 80 acre wild place, owned and operated by partners Nett Hart and Tamarack in Benton County.

We grow 450 varieties of open-pollinated (mostly) heirloom vegetables and distribute our organic produce to a community supported agriculture (CSA) subscription service called "Salad Days." Planting every week from February to August is one of our primary risk management strategies.

We got the idea for this project from conversations with our Salad Days members who are, for the most part, urban Twin Cities residents accustomed to having ready access to organic food at many local co-ops. They are such committed organic eaters that they don't understand why all farmers aren't organic. We decided to explore whether increasing availability of organic food in a rural area might lead to more organic farmers and, at the same time, expand our customer base into our local community. Adding a second delivery to local communities would make the farm more financially sustainable and might provide opportunities for additional farmers or interns. The population is growing in our area and we felt this was a good time to develop a local market while increasing awareness of organic food.

With the Organic Demonstration Grant, we wanted to find out why there aren't more organic farmers or food in our area and to counter any perceptions that might be keeping farmers and consumers from pursuing organic.

Our project strategies included: surveying organic food availability in local stores (at beginning and end of project); surveying rural consumers about food sourcing attitudes and issues (at beginning and end of

*Nett is almost ready for visitors to arrive.*





project); a series of public samplings of organic food at the farm; and a field day highlighting organic techniques and resources.

#### Local food store surveys

In March, we surveyed 18 grocery stores within a 30 mile radius of the farm, reaching about an hour's drive in all directions and including the towns of Milaca, Mora, Isle, Sauk Rapids, Foley, Pierz, St. Cloud, Rice, Princeton, Zimmerman, Ogilvie, and Sartell. We did not survey convenience stores attached to gas stations. We visited each store to check availability of organic milk, apples, lettuce, eggs, and carrots – all organic products that might commonly be found in conventional groceries. We also noted any other organic products sold in these stores.

We provided store managers with results of the consumer survey in July and in October, repeated our survey of organic food ability in the same food stores (plus one additional store) to determine whether availability had changed.

#### Consumer surveys

Using a four-page questionnaire, we interviewed a random selection of 100 people in the communities listed above. The respondents were not shopping for food at the time they were interviewed. We asked a range of questions to ascertain preferences for organic products and what circumstances and beliefs might motivate consumers to buy (or avoid) organic food.

Because the randomly selected respondents to the initial consumer questionnaire were anonymous, we had no way to follow up and survey them again toward the end of the project to provide a “before and after” comparison. Therefore, our follow up survey questioned different individuals who demonstrated their

*Field day visitors  
withstand the drizzle to  
view one of the gardens.*

interest in organic by attending at least one of the events on our farm.

#### Outreach events

During the 20 weeks of our CSA delivery season, we hosted a two-hour open tasting at the farm each Friday evening. We offered two to four dishes for sampling, provided recipes and, on four occasions, had guest chefs or speakers. We publicized the events using community bulletin boards, press releases, road signs, and leafleting, and a red and white “Organic Demonstration Farm” sign we posted near the road. In early August, we hosted a field day offering field tours and presentations on CSA marketing, retailer motivations, basic organic production techniques, and resources for organic and transitional producers.

#### Results

##### Local food store surveys

Organic food availability in retail food stores increased during the lifetime of the project and is shown in Table 1. In October, we noted that three stores had added dedicated organic produce sections and carried produce items not surveyed – on average about 20 items. While we cannot directly attribute increases to the consumer interest information we supplied to managers, we believe that awareness of organic food has begun and organic product selection and sales at these stores will continue to increase.

**Table 1. Retail Survey Results**

	Number of stores selling these products	
	March	October
Organic milk	1	2
Organic apples	5	5
Organic lettuce	6	7
Organic eggs	1	2
Organic carrots	7	5*
Organic soy beverages	5	9
Organic frozen veg or processed foods	2	3
	n=18	n=19

\* Two stores that had organic carrots in March but not October did have other fresh organic vegetables in October, suggesting seasonal or supply variation.

Figure 1. Factors that Affect Food Choices

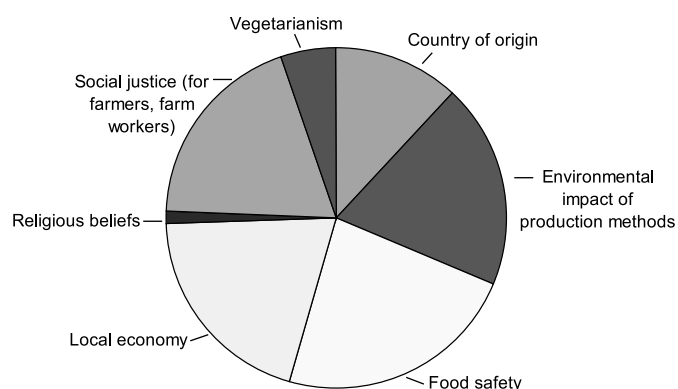
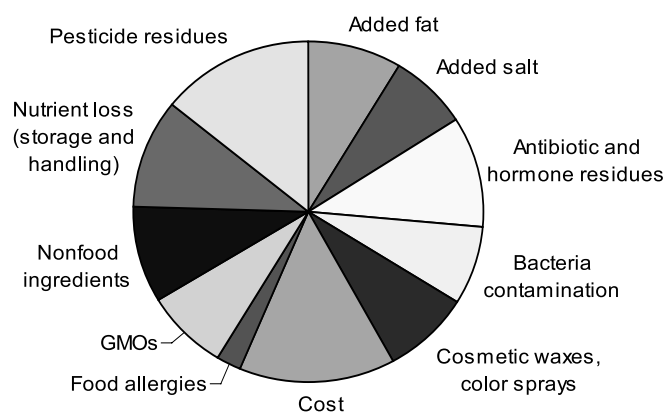


Figure 2. Respondents' Main Concerns about the Food they Buy



### Consumer surveys

Factors that survey respondents said affect their food choices are shown in Figure 1. Of great interest to us was the number of respondents who said they were interested in buying organic – more than half said they would buy organic if available. We also realize, however, that what people say they do or are interested in doing and what they actually do, don't always match up.

We noted that the respondents said their “food goals” (for themselves and their households) included: more fresh fruits and vegetables, less salt, sugars, additives, and added fats. Their main concerns included pesticide residue, nutrient loss, bacterial contamination, cosmetic waxes and color sprays, genetically modified organisms (GMOs), antibiotic and hormone residues (Figure 2). Eating more certified organic foods could help them manage all of these concerns, since organic production requirements prohibit the use of GMOs, antibiotics, hormones, and most synthetic pesticides, and pre-harvest timing requirements for manure application are strict. Fewer than half of respondents were aware of the federal organic program that regulates organic claims.

When we surveyed consumers that attended our events, we learned that they were twice as likely to garden and shop at a co-op grocery store than the random group of consumers we surveyed early in the project. More knew about the National Organic Program. The event goers were also twice as likely to cite environmental impact as a factor that contributed to their food choices. It was clear that the people who attended our events were already more knowledgeable about and predisposed to buy organic food.

While the surveys provided interesting numerical information, it would not be accurate to gauge the “success” of the project by these numbers. We have no way to measure the change in exposure to or adoption of organic

techniques. Nor could we credit our project alone for any changes, since there is growing publicity about and attention to organic and local foods.

### Outreach events

Weekly turnout varied from two attendees to 11; most weeks we had five or six. As the season progressed, we began to enjoy the time dedicated to sitting down to visit with neighbors in small groups. During the course of the season, we drew visitors from most of the communities in the survey area. Our midseason field day attracted 62 people. Most stayed – in the rain – for the entire event.

In addition, we have been looking for ways to encourage more organic farmers in our area, to develop a larger local market for organic food, and to create a more organic-friendly environment with some of the public agencies in our area as well as county road crews. This grant gave us the resources, credibility, and an excuse to engage groups like Extension, the Department of Natural Resources, and the Natural Resources Conservation Service in conversations about organic farming.

This project addressed risk management in several ways. First, it demonstrated the resources available to organic and transitional farmers. Secondly, it demonstrated how multiple plantings of diverse varieties can spread risk and increase the percentage of successful crops under varied conditions, such as are found on any farm. Third, it demonstrated how low-input techniques like living mulches, cover crops, organic waste by-product of reduced inputs can mean cost savings for growers. Fourth, by demonstrating how the CSA direct marketing model works, we demonstrated how buyers can and will share production risks with producers. Fifth, we demystified the process of organic certification, highlighted assistance and resources available, and presented certified organic production as an economically sustainable option for producers.

This project helped us try new ways to increase consumer and producer awareness of organic food by making it possible for us to organize, publicize, supply, and staff educational sessions during the growing season. We have already noticed that there seems to be more recognition of organic as a “viable” farming practice in our neighborhood, and that there seems to be more networking going on. We are getting more referrals of people who have questions about organic food or farming.

### Cooperators

*Les and Kathy Barry, Minneapolis/St. Paul, MN*  
*Xandra Coe, Minneapolis/St. Paul, MN*  
*Jill Davidson, Minneapolis, MN*  
*Rita Henning, Milaca, MN*  
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*Jane Levin, Minneapolis/St. Paul, MN*  
*Judy Meath, Minneapolis/St. Paul, MN*  
*Meg Moynihan, Minnesota Department of Agriculture, St. Paul, MN*  
*Donna Walters Nelson, Natural Resources Conservation Service, Milaca, MN*  
*Jamie Pekonnen, Minneapolis/St. Paul, MN*  
*Kate Rassier, St. Cloud, MN*  
*Judy Reisman, Minneapolis/St. Paul, MN*  
*Marjorie Ross, Land Stewardship Project, White Bear Lake, MN*  
*Cyndi Rudolph, St. Johns University, Collegeville, MN*  
*Rick Stevens, St. Cloud, MN*

### Project Location

From St. Cloud: Take Hwy. 23 east to Benton Cty. Rd. 9. Go north 4.5 miles to 145<sup>th</sup> St. NE. Go east 1 mile to 195<sup>th</sup> Ave. NE/170<sup>th</sup> Ave. Turn north 1 mile to driveway.

### Other Resources

Sustainable Agriculture and IPM Program, Minnesota Department of Agriculture, St. Paul, MN

International Certification Services d/b/a Farm Verified Organic, Medina, ND

Land Stewardship Project, White Bear Lake, MN

Organic Consumers Association, Little Marais, MN

University of Minnesota College of Agricultural, Food, and Environmental Sciences, St. Paul, MN

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**Project Duration**

2003 to 2004

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**Keywords**

heirloom varieties,  
indigenous  
plants, Three  
Sisters Gardening,  
traditional  
agricultural  
practices

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

# Restoration of Traditional Anishinaabeg Agricultural Practices

**Project Summary**

We have good land and we are intended to be healthy people. However, 35% of the White Earth Indian Reservation community over 40 suffers from type II diabetes. There is also a 60% increase in youth diabetes in the community. This is partially due to poor nutrition practices and food choices. We believe that an important part of improving the health of our people lies in increasing access to healthy traditional foods in the community. In order to increase the availability of local foods, we wish to reintroduce traditional Anishinaabeg agricultural methods, such as Three Sisters Gardening, preserving and increasing use of our indigenous varieties, and providing the tools and information necessary for community members to use these methods by expanding the gardening and farming systems on the White Earth Reservation.

**Project Description**

Our community has a high incidence of type II diabetes due largely to the rapid destruction of the traditional diet of Native people. The foundation of this problem is the loss of local production of traditional foods. Our traditional varieties of vegetables are highly nutritious. White flint corn contains 10% more protein than regular corn and is lower in fat. One serving has 47% of the recommended total daily fiber intake and it is also an excellent source of

magnesium and B vitamins such as thiamin. Arikara squash contains about half of the calories of market squash (38 calories vs. 82) and is an excellent source of the antioxidant beta-carotene. The squash also contains over twice the calcium and magnesium found in market squash. One serving of Potawatomi lima beans provides 1,005 grams of the fiber needed per day, and 1/3 of the recommended daily value for thiamin as well as other vitamins. These beans also contain higher levels of antioxidant activity than other grocery store market beans. Enhancing local consumption of our foods in our community will improve the health of our people.

Indigenous agriculture has been declining for almost 100 years, resulting in a massive loss of local seed stocks to Native communities - the communities from which much of the world's food stocks originated (i.e. corn, beans, squash, potatoes, and tomatoes). From 1981 to 1994 we lost almost 84% of all non-hybrid vegetable varieties in the country. It is necessary to increase the seed stock and diversity in this area of traditional agriculture, in particular corn, beans, and squash, while providing food, recovery of traditional knowledge, and nutrition. We are committed to increasing biodiversity in agriculture and recognize that restoring varieties of corn, beans, and squash will insure some diversity.

**Project meeting at  
White Earth.**



The goals of this project were: 1) to expand our activities in the area of traditional agriculture, in particular, corn, beans, and squash; and 2) to continue to provide food to those who most need it - the elders and youth who are often fed in our institutional programs. Our Mino-Mijim Program provides traditional foods through delivery to elderly, diabetics, and youth on the reservation. While hominy (white flint) corn is one of the food staples that they receive, we have been unable to produce enough for distribution to the community, as well as have it for sale. We also planned to increase the amount of other traditional foods distributed through these programs. Finally, as production of local foods increases and local needs are met, traditional foods can be sold through Native Harvest, a project of the White Earth Land Recovery Project (WELRP), securing the value added benefits of our native products.

Our objectives for this project were:

- to research and restore at least three different types of open-pollinated indigenous white flint corn with a 90-day or less growing season with the assistance of community groups;
- to reintroduce the “Three Sisters Gardening” method, utilizing indigenous varieties of corn, squash, and beans;
- to increase corn production using various options in fertilizer and cultivation techniques;
- to strengthen local agriculture production in the Native community by building a collaborative aimed at traditional and unique seed restoration, greenhouses, and local gardening, and to increase production of food for community use and for sale through Native Harvest; and
- to increase the consumption of traditional foods to benefit the health of our community and expand the knowledge base and community participation for traditional knowledge.

Three Sisters Gardening is a traditional Anishinaabeg practice where mutually beneficial plants (corn, beans, and squash) are planted together to maintain the health of the soil and to increase yields in the long and short-term. Corn is a nitrogen depleting crop and planted alone forces crop rotation in order to maintain soil quality. Beans are nitrogen fixing. They take nitrogen from the air and fix it back to the soil. When corn and beans are planted together, they maintain the balance of the soil. Beans are also a climbing plant and corn provides a natural trellis. Squash is a ground covering prickly plant vine that offers weed control and pest control. The prickles deter larger pests like rabbits and deer.

We worked to expand the use of traditional corn, bean, and squash varieties and traditional agricultural practices in our community gardening programs. We planned to supply access to tilled, fertile land, access to greenhouses and grow boxes, and seeds and information.

## Results

We were able to find a small amount of Bear Island flint corn through the University of Iowa. Bear Island is a 55-day, short-eared flint corn with white, purple, yellow, red, and sometimes blue kernels that was traditionally grown on an island in the middle of Leech Lake. Local organic farmers, Curt and Darlene Ballard, were able to increase the seed the first season, and in 2003 we were able to produce 1/2 acre of Bear Island flint corn which we saved for seed. We were able to plant 10 acres in 2004, however due to poor growing conditions and an August 20 frost, we were only able to harvest about 1.5 acres, which we again saved for seed. This year we have 10 acres planted again, and it seems that it will be a pretty good year. Also in 2004, we increased another 55-day white flint corn that originally came from Manitoba, however this seed did not germinate. In 2005 we are also growing out several other varieties of flint corn throughout the community to see which ones will do well in our area. Bringing back the traditional varieties of corn is important to our community, and we hope to plan a harvest festival and feast for this special corn in future years.

We have also reintroduced a few varieties of mainly Mandan and arikara varieties of squash and beans that we have been growing in the community. We are hoping to establish a Three Sisters Community Garden in each village on the reservation, and have each one include heirloom seeds which they will save from year to year. We received over 1,000 packets of seeds, many of them heirloom varieties, which we then distributed throughout the community. Over the last two years we have held seed saving workshops to educate people about saving seed. Seed saving is an integral part of saving heirloom varieties because these varieties are not available commercially. We will continue to try to locate and distribute heirloom seeds and plants to increase our local seed bank.

During the past two years, the Sustainable Communities program of the WELRP has built 15 greenhouses and 25 grow boxes, handed out thousands of seeds, and in 2003, tilled 120 community gardens. In 2005, over 180 people were involved in our community gardening workshops, tilling and seed distribution. We used aged horse manure, readily available from our local farm, to improve the fertility of the plots. Greenhouses were placed in Rice Lake, Naytahwaush, Ponsford, White Earth, Ogema, and Strawberry Lake.



Last year we were able to start our first Three Sisters Community Garden in Naytahwaush. Kathy Goodwin and Diane Roy were the main caretakers with many folks from the community involved in planting and weeding. We were unable to harvest anything, again because of bad weather. This garden is expanding with the help of local youth to help plant, cultivate, and water. We hope to expand to additional locations in the future.

Mino-Mijjim has continued to make monthly deliveries of traditional foods to diabetic families on the reservation. Margaret Smith, one of the elders, bags up wild rice, hominy, buffalo, maple syrup, chokecherry jam and other canned or fresh vegetables for the people in the program. We hope to get the fresh vegetables from the WELRP gardens in the future. The next step is expanding the Mino-Mijjim program into reservation school cafeterias.

The WELRP worked with Honor the Earth to publish “Food is Medicine - Recovering Traditional Foods to Heal the People.” This book presents the history of indigenous food production, the loss of traditional foods, and the current challenges to restoring traditional food systems to Native peoples. It celebrates the collective accomplishments of numerous groups that are working to restore traditional foods to their communities.

We continue to host our traditional foods stand at the White Earth Pow-wow to increase interest in traditional food production. We sell wild rice and buffalo soup, and hominy and buffalo soup as well as traditional niibish, or tea. Native Harvest, the marketing arm of WELRP which sells our traditional food and product, has expanded steadily. In 2001 it had \$100,000 worth of sales, and based on current trends and markets, is projected to be a \$1,000,000 endeavor by 2008.

As we continue to involve more people in our traditional foods programs, we see the interest in health and the traditional ways increasing. We hope to continue our programs to restore health and the seed to our communities, and increase the overall access to our traditional foods and to our culture.

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## Resources

Dream of Wild Health. Web site: [www.petawakantipi.org](http://www.petawakantipi.org)

Food as Medicine – Recovering Traditional Foods to Heal the People. Honor the Earth, 612-879-7529, [honorearth@earthlink.net](mailto:honorearth@earthlink.net)  
Web site: [www.honorearth.org](http://www.honorearth.org)

Native Harvest, 888-274-8318, [nativeharvest@welrp.org](mailto:nativeharvest@welrp.org)  
Web site: [welrp.org/nativeharvest/nativeharvest.html](http://welrp.org/nativeharvest/nativeharvest.html)

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## Project Duration

2003 to 2004

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## Keywords

pick-your-own  
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berry

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

# Developing a Saskatoon Berry Market in the Upper Midwest

## Project Summary

After seeing Saskatoon berries (*Amelanchier alnifolia*) at berry farms in Canada, we decided to pursue our plan of establishing a pick-your-own Saskatoon farm in Minnesota. Saskatoons are the most commonly cultivated species of Juneberry or Serviceberry and are native to the Great Plains area from Canada south to Nebraska. Our project involved preparing for and establishing a healthy patch of plants in preparation for berry sales once the plants start to produce in a couple of years.

## Project Description

My husband and I own 220 acres of land west of Randall, MN, where we raise beef cattle. We wanted to use some of our land to diversify our current farm operation. As we thought about diversifying, we wanted a crop that would:

- increase farm income;
- require minimal labor; and
- use less chemicals.

In the Canadian Prairie Provinces, Saskatoon berries are one of the most popular fruit crops. They are a healthy, naturally sweet fruit that can be used a lot like blueberries. Because the market is growing, and because they would make excellent jams, jellies,

and syrups, we believe there would be an excellent market in Minnesota. Pick-your-own berry farms are popular in our area, and the fact that we have a working farm with livestock and horses is attractive to u-pick visitors with younger children. We will also eventually include other berries, such as chokecherries, gooseberries, currants, lingonberries, and elderberries.

Being native to harsh climates, Saskatoons are adaptable to many soil types and climates and grow to a manageable height of 8 to 10'. An established orchard should be productive for 60 or more years with little maintenance. There should be little or no chemical use needed because Saskatoons have minimal disease and insect problems. We decided to plant the Saskatoons on the west side of our building site so that they can also serve as a windbreak and help reduce soil erosion (our land has a slight slope and is a lighter sandy loam soil).

Saskatoons are closely related to apples so we prepared the soil according to soil recommendations for pome fruit. We needed to increase the soil pH to 6.5 from the current pH of 5.1. In the fall of 2003 we applied marl at 4 tons/A to both increase calcium and raise the pH. We also applied 4 tons/A of composted manure on 10 acres then chisel plowed and disked.

## Ripe Saskatoon berries.



In May 2004 we planted 78 five-year old, 380 three-year old, and 190 two-year old Saskatoon plants on two acres. The plants need a lot of room to grow so the rows are 18' apart with 4' spacing between plants. Varieties planted were Pembina, Smokey, Honeywood, Northline, and Theisen. We used a mulch of sawdust obtained from a nearby Amish sawmill between plants within a row.

## Results

Throughout the growing season of 2004, we discovered that the plants were indeed tolerant of diverse weather conditions and that they were susceptible to a certain amount of damage from browsing deer. Our observations included:

**Weather:** At the end of June 2004, the plants seemed to be doing well despite having no rain for almost a month. In August there was a frost that hurt corn and beans in the area, but the berries weathered it well.

**Disease and Insects:** The plants looked very healthy overall with no signs of disease or insect damage.

**Weeds:** We did some spot spraying with Roundup within the rows in June and disked between rows to control weeds once in July and once in August. We discovered that not much maintenance was needed. In September 2004, we seeded grass to establish permanent cover between the rows.

**Deer:** The biggest problem was deer damage, which started in May and continued throughout the summer.

Overall, we lost 76 plants, a little over 10% of our first planting. Most of these were the smallest plants and it was usually traceable to deer damage. In the fall of 2004, we started fencing 12 acres to prevent deer predation.

Results relating to berry yield and profit will only be established once the berries have matured and are bearing fruit. In mid-July 2004, we had some berries ripening on the older bushes, but the berries were eaten by birds or animals. Saskatoons have a high establishment cost of over \$6,700/A. To give an idea of the income that could be associated, currently in Canada the average price is \$2/lb for pick-your-own and \$3 to \$4/lb for pre-picked fruit. A mature Saskatoon field produces an average of 3,000 to 4,000 lb of berries/A.

We plan to expand to three to four acres by planting 500 one-year-old plants and another 500 three-year-old transplants from our own nursery in the spring of 2005.

By the second or third year after planting we should be getting a small crop that I will use for a marketing survey. I plan to visit local flea and farmers' markets with samples and recipes to increase interest and advertise our Saskatoons pick-your-own operation. I will also gather information about consumer preferences.

## Management Tips

1. Plan for deer to disrupt and damage berry plants. Develop fencing or other methods to keep deer away from plants. We tried various repellent mixtures which used egg and other substances, but still had a lot of deer damage. We are currently establishing a 7' high fence around the entire Saskatoon acreage.

2. Plant berries far enough apart to ensure room to grow and to allow for easy picking.

## Cooperators

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## Other Resources

More information on Saskatoon berries can be found on the following websites:

Manitoba Agriculture, Food and Rural Initiatives.  
Web site: [www.gov.mb.ca/agriculture/index.shtml](http://www.gov.mb.ca/agriculture/index.shtml)

Ontario Ministry of Agriculture and Food.  
Web site: [www.gov.on.ca/omafra/](http://www.gov.on.ca/omafra/)

Saskatchewan Agriculture, Food and Rural Revitalization.  
Web site: [www.agr.gov.sk.ca/](http://www.agr.gov.sk.ca/)

The Saskatoon Farm, Okotoks, Alberta.  
Web site: [www.saskatoonfarm.com/](http://www.saskatoonfarm.com/)

University of Alberta Department of Agricultural, Food, and Nutritional Science. Web site: [www.afns.ualberta.ca/](http://www.afns.ualberta.ca/)

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**Keywords**

acetic acid, beets,  
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transplants

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# Weed Control in Organically Grown Vegetables: Techniques for the Small Acreage

**Project Summary**

Foxtail Farms is an owner operated community supported agriculture (CSA) farm that consists of 64 acres of which, 12 are used for rotational vegetable production.

Weed control in high value vegetable crops can present labor challenges to growers. This project tested the efficacy and economic return of two different weed control techniques: transplanting and acetic acid (vinegar). Transplanting was evaluated as a weed control strategy in sweet corn to compare whether there are advantages for stand establishment and ability to outcompete weeds and concomitantly reduce the need for cultivation. Various concentrations of vinegar were evaluated for their ability to control weeds in carrots, beets, and salad mix.

## *Part 1: The Effect of Seedling Age on Yield in Transplanted Sweet Corn*

**Project Description**

As CSA vegetable farmers, our marketing system dictates that we deliver a high quality box of 8 to 12 different vegetables to our 150 prepaid members each week. Like most CSA farmers, we grow smaller amounts of 40

to 50 different vegetable crops in numerous successive plantings throughout the growing season. For a number of reasons, sweet corn is a troublesome crop for many organic CSA farmers to grow and a good percentage of farmers decide to grow very little of it or none at all. The commitment of a relatively large percentage of land to sweet corn is often cited as an important reason not to grow it. In addition, for organic farmers, fertility, weed control, and seed germination can be problematic, resulting in a crop that is not dependable. At Foxtail Farm, we require dependable crops above all else because a shortfall directly affects our ability to fulfill our commitment to our prepaid members. Not surprisingly, we have learned that high quality sweet corn is incredibly popular with our members and our surveys have consistently shown that we cannot give our members too much. As a result, we look at our success in providing quality sweet corn in at least five weekly deliveries as an important goal in having a successful CSA season.

We first began to transplant sweet corn in search of an earlier and more dependable crop. Because we do not use treated seed, germination in cool spring weather is erratic at best. In addition, our heavy silt loam soils

## *Transplanted sweet corn.*



compact and crust easily, further inhibiting germination and stand establishment especially when using newer sugary enhanced and super sweet varieties. Fertility is also an issue. On organically managed soils, high organic matter is a primary source of nutrients. Unfortunately, release of nutrients from soil organic matter does not occur to any great extent until the soil begins to warm up, usually in June. As a result, direct seeded sweet corn that does manage to germinate in cool soils often lags behind both conventionally fertilized sweet corn and weeds. On our farm, direct seeded sweet corn is often smaller than the weeds growing with it, making cultivation very difficult. It has not been uncommon to have direct seeded sweet corn crops fail completely, leaving us several weeks behind and wasting valuable resources.

Transplanting sweet corn allows us to address all of the problems we encounter with direct seeded plantings. Germination in the greenhouse is close to 100% and occurs very uniformly. In addition, the organic starter fertilizer in the soil mix gets the plants off to a very rapid start. We can plant 10-day-old transplants into newly tilled soil and have a 3" plant with a two week jump on the weed competition as well as 100% stand establishment and the fertility of the soil mix in the plug. With a couple of timely cultivations, our sweet corn is often weed free at canopy. All of this allows us to limit the amount of land we dedicate to sweet corn which is very important considering the number of other crops we must grow. In addition, the hassle factor is greatly reduced when the corn plants are 12" tall when weeds are just getting going. We realize that there are some very good organic sweet corn growers out there who do not transplant their sweet corn and we take our hats off to them. As CSA farmers though, we want to know that the crop will be there every time and that it will not waste a lot of ground. We are willing to put the extra resources into transplanting in order to have a sure thing. Given that, our goal is to maximize the efficiency of the transplanting system so that the amount of extra resources required is minimized.

We were told by a number of people that corn does not transplant very well because it has a long tap root and will go reproductive very early if it is stressed or is too big at transplanting. As a result, we have always transplanted the smallest plants that we could handle in a plug. We found this to be 3 plants/cell in a 72 plug tray at 10 days.

Untreated corn seed was planted in our soil mix of compost, peat moss, and medium vermiculite with a fertilizer mix of blood meal, fish bone meal, and wood ash. Seventy-two cell plastic plug trays were used with three seeds planted/

**We were told  
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cell. This gives a possible total of 216 seedlings/tray at 100% germination. We do calculations assuming 200 plants/tray. Seeds are germinated in our greenhouse at 70-75°F. Ten-day-old seedlings were transplanted into the field after beds were prepared with an Imants rotary spader. Plugs were spaced at 14" in rows and 30" between rows. This spacing gives a field population of approximately 44,000 plants/A. This is a high population but we are looking for more ears, not necessarily the largest ears, and so we find this population to be effective. Cultivation depends on soil and weather conditions but normally includes harrowing with

a spring tine weeder and 1 to 2 cultivations with shanks and 6" shovels. Depending on the soil fertility, sweet corn was side dressed at the last cultivation with 8-2-6 soybean based fertilizer purchased from Renaissance Fertilizers in Minnetonka, MN.

The experiment we ran this past summer looked at the effect of the age of transplant on the yield of usable cobs of sweet corn. We would love to be able to plant an even larger plant into the field to shorten the time to harvest. Our experiment was designed to tell us if there would be a cost to using the larger and older transplants. In addition, we kept track of some of the costs and potential savings involved in transplanting under one acre of sweet corn.

We transplant approximately 3/4 acre of sweet corn per season. This year we used three bicolor, sugary enhanced varieties of differing maturities to give us five weeks of sweet corn. The varieties included: Temptation (69 day), Delectable (80 day) and Seneca Dancer (89 day). Untreated seed was purchased from Jordan Seed in Woodbury, MN. One planting of all three varieties on May 22, plus a small second planting of Seneca Dancer on June 5, yielded 960 dozen ears of marketable sweet corn for the CSA with extra to sell at our roadside stand.

The second planting of Seneca Dancer was used to determine the optimum age of transplant to use. We used 10, 15, and 22-day-old transplants in a randomized block arrangement. Two 360' beds were used for the experimental treatments. Each bed was divided into nine 40' sections. The sections were planted randomly with 10, 15, or 22-day-old corn seedlings giving six randomly planted sections for each treatment age. Between the two experimental beds as well as on each side of them were planted border beds with 10-day-old seedlings to eliminate edge effect. One bed of direct seeded sweet corn was also planted for comparison.

## Results

Increasing seedling age resulted in a dramatic decrease in yield of marketable cobs of sweet corn. Ten-day-old seedlings yielded an average of 78 cobs/section. Fifteen-day-old seedlings yielded an average of 59 cobs/section and 22-day-old seedlings yielded an average of only 42 cobs. Cobs were harvested by hand and marketability was determined based on cob size and tip fill. A single individual harvested all of the experimental beds.

The 22-day-old corn tasseled erratically beginning about one week earlier than the 10 and 15 day corn. Corn was harvested at one time although the 22-day old corn was slightly more mature. Although the number of large marketable ears with good tip fill did vary between treatments, the number of silks and small, stunted ears on the 22-day corn plants indicate that the problem is one of maturation of the cob instead of formation. Plant size was also inversely related to age of seedlings with the 22-day plants averaging almost 1' shorter than the 10-day-old plants.

We found that the major cost associated with transplanting sweet corn is the labor for planting and transplanting the plugs. We timed both operations at about 4.5 minutes for planting a flat and 4 minutes for transplanting. At \$8.00/hr this comes to approximately \$1.13/flat. Soil, flat, and heat for the greenhouse amounts to approximately \$.35/flat. Extrapolated to an acre, we estimate the cost to be about \$297.00. With a yield of 1,280 dozen/A, this represents an additional cost of \$.23/dozen.

Direct savings included a reduced use of seed. Even without accounting for failed plantings, we feel that we used approximately 2/3 of the seed when transplanting as we used for direct seeding. With the equipment we use, there is some waste associated with direct seeding. At 12 lb/A, we feel that we saved up to \$25.00/A on wasted seed. In addition, there was the ease of cultivation and at least one less cultivation associated with transplanting. We valued this at \$20.00 for the acre. These savings reduced the cost of transplanting to \$252.00/A or \$.20/dozen.

In addition, we considered the following to be indirect savings for which it was more difficult to calculate a cost. Poor stand establishment and failed seedlings required us to commit 1/3 to 1/2 more land to sweet corn with direct seeding. CSA's, such as our own, gross \$5,000 to \$10,000/A. An extra acre represents a large opportunity cost. In addition, failed direct seedlings put us several weeks behind in our sweet corn delivery. We feel that reduced customer satisfaction leads to greater turnover and very real costs

associated with increased marketing. Finally, we end up with more weeds going to seed in our direct seeded plantings. This shows up the next year as increased costs for hand weeding and cultivation of the following crop.

It is clear to us after this experiment that there is a definite cost associated with transplanting older and larger sweet corn transplants into the field. The 10-day-old seedlings yielded almost twice as many cobs of marketable corn compared to the 22-day-old seedlings. We are glad that we did this as part of a comparison as it would have been easy to write off the poor yield as due to fertility or pollination had we planted only 22-day-old seedlings. We could have done this for several years before we either stopped transplanting sweet corn or figured out the problem.

While we do not know why the age of the transplant would make so much difference, we think that the smaller plant size that resulted from the older seedlings would limit the resources available for cob production. Why the plants were so much smaller may be the real question here. In addition, could increased fertilization or a lower plant density increase the plant size and allow for larger, higher quality ears to form even with the older transplants?

## *Part 2: Using Acetic Acid on Small Seeded Vegetable Plantings*

### Project Description

We have been hearing quite a bit about using acetic acid in the form of vinegar (5.25%) or stronger concentrations of glacial acetic acid as an organic herbicide for vegetable crops. We wanted to look at the potential of using acetic acid on small seeded crops where we spend many hours per year hand weeding. These crops include carrots, beets and salad mix. We were especially interested in finding concentrations of acetic acid that would kill weeds but not kill the crop plants.

Glacial acetic acid was diluted with water to final concentrations of 5%, 10%, 15% and 20%. Our plan was to use these concentrations of acetic acid on small plots of carrots, beets, and salad mix to look for an effective range before moving to larger plot sizes. Six foot sections of a 3-week-old bed of carrots were marked and sprayed with each concentration. Weed populations of foxtail, crabgrass, velvet leaf, lambs quarter, and pigweed were observed throughout the bed. Before and after estimates of weed cover were made for both grasses and broadleaf weeds.

## Results

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Every concentration of acetic acid killed every carrot plant in each experimental plot. In addition, each concentration had the same effect on salad mix and 4 week old beets. The weed killing ability of acetic acid was less pronounced. All concentrations of acetic acid killed or severely damaged the broad-leaved weeds in the plots although older broadleaf weeds survived the 5% spraying. The 5% concentration of acetic acid (vinegar concentration) had little or no effect on grasses. Ten percent acetic acid and higher killed or severely damaged the grasses in the plots. After several weeks, most of the severely damaged grasses had recovered to the extent that they were once again a problem.

Acetic acid may be a useful natural herbicide for vegetable crops with enough research on the types and stages of crop development that would allow the crop to survive the spraying at concentrations that kill the weeds. We decided not to continue on to the large scale spraying project because acetic acid, at concentrations greater than those found in household vinegar, is a dangerous and really, really unpleasant substance to work with. As organic farmers, part of our objection to conventional herbicides and pesticides is the danger that these substances pose to the farmer. Why would we want to work with something that should really be mixed in a fume hood or with gloves, a coat, and a respirator? In addition, acetic acid seemed to be an excellent method of killing the crops we were trying to protect. Even the slightest drift from the higher concentrations of sprays was enough to severely damage plants in the next row or bed. With specialized, low drift, banding-type sprayer heads, we could see how acetic acid could be used, but, for our operation and for most farms of our scale, the investment of time, money and equipment would not be worth any benefit gained. After this initial unpleasant experience, we can see using the acetic acid on the poison ivy along the fence row but not in our vegetable fields.

## Management Tips

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1. Poor stand establishment and failed seedlings are greatly reduced when corn transplant seedlings are used rather than direct seeding.
2. Increasing seedling age resulted in a dramatic decrease in yield of marketable cobs of sweet corn. The best yield came from 10-day-old seedling which yielded almost twice as many marketable cobs as the 21-day-old seedlings.
3. More research is needed before acetic acid can possibly be used as a natural herbicide in vegetable crops. Research should focus on the types of crops and stages of crop development that would allow the crop to survive the spraying at concentrations that kill the weeds.

## Project Location

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Foxtail Farms was formerly located in Shafer, MN, on Hwy. 95, south of Taylor Falls, MN.

## Other Resources

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Grubinger, Vern. Ten Steps Toward Organic Weed Control. University of Vermont Extension. Web site: <http://www.uvm.edu/vtvegandberry/factsheets/orgweedconrtol.html>

Howell, Mary, and Klaas Martens. 2002. Organic Weed Control – Cultural and Mechanical Methods. Reprinted from Acres - USA. Vol. 32, No. 8. Aug. 2002. Web site: [http://www.acresusa.com/toolbox/reprints/Organic%20weed%20control\\_aug02.pdf](http://www.acresusa.com/toolbox/reprints/Organic%20weed%20control_aug02.pdf)

Organic Farming Resources Web Site. Appropriate Technology Transfer for Rural Areas (ATTRA), National Sustainable Agriculture Information Service, PO Box 3657, Fayetteville, AR 72702, 800-346-9140. Web site: <http://www.attra.org/organic.html>

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**Project Duration**

2002 to 2003

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**Keywords**

crop rotation,  
potato beetle

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

# Testing the Use of a Modified Crop Rotation System to Control Colorado Potato Beetle

**Project Summary**

Our objective was to reduce our reliance on our current methods for controlling the Colorado potato beetle by improving our crop rotation system. We had previously tested long distance crop rotation with a small plot of potatoes and, in 2003, we expanded the size of this planting.

**Project Description**

The Food Farm consists of 200 acres of cropland, pasture, and woods located 25 miles south of Duluth. Eight acres of certified organic vegetable cropland supply members in our community supported agriculture program (CSA). We are also the largest local wholesaler to the Whole Foods Co-op in Duluth. We have a 900 ft<sup>2</sup> root cellar that allows us to supply squash, cabbage, and root crops to the co-op and to CSA members through the winter. We also produce pasture-raised chickens, turkeys, and eggs for our CSA members.

Northeast Minnesota has a cool season and fertile soils, so the primary crops are cole crops and potatoes. We seem to have inherited the pest problems of our conventional farming predecessors whose large fields and low levels of diversity

supported high numbers of insect pests to these crops, most notably the Colorado potato beetle (CPB), the imported cabbageworm, and the cabbage root maggot. The latter two have minimal economic impact for us because of the use of floating row covers which help control root maggots, and the encouragement of bird predation by providing birdhouses, forest edge areas, and perches in key areas of cabbage, broccoli, and cauliflower fields which help a great deal in controlling imported cabbageworms.

Consequently, as with many organic vegetable producers in our area, the CPB is the main insect pest that we have difficulty controlling. We use a number of techniques to combat this problem, including crop rotations, flaming, *Bacillus thuringiensis* (*Bt*), and using eggplant as a trap crop. Despite the use of these methods, which are expensive and time-consuming on their own, none have ideal effectiveness and we still have to spend a significant amount of time hand-picking potato beetles off plants. For example, *Bt* treatments are effective only on small larvae, not on adult beetles or on larger larvae which do the greatest damage. *Bt* also degrades quickly and is washed off by rain or even heavy dew. Flaming is somewhat effective against adults, but can

**Janaki examining potatoes.**





only be performed when plants are small or yields will be diminished, and the foliage of larger plants protect the beetles from the flaming. Plastic-lined trenches also can trap the beetles, but require time and money to install and use a lot of resources. Faced with larger growers from outside our region being able to provide potatoes at a lower cost to our local wholesale market in Duluth, it is necessary that we be able to reduce these production costs.

While we have rotated our crops to different fields each year, the cropland we used was all conveniently (for us and the beetles) located in one part of the farm. Consequently, one year's potato ground was never more than 300 yd from where the previous year's crop was located. Even before temperatures were warm enough for flight, the adult beetles (which overwinter in the soil) could easily crawl to the new location in the spring.

Previous research results from Massachusetts and Ontario showed that increasing the distance between crop rotation fields could effectively decrease colonization. The beetles' ability to fly and thus colonize new fields is greatly affected by early spring temperatures, their ability to reproduce is affected by day length, and their ability to find rotated fields may be affected by topography or vegetation that they encounter. Potato beetles are not able to fly until their body temperature reaches 70°F in the springtime, requiring time and heat to develop flight muscles and reproductive organs. With our cool early summers we thought that making it necessary for the beetles to fly, rather than simply crawl, to their spring food source could be a critical factor for us to have effective control. We felt it would be of value to most growers in our area for us to test the effectiveness of this rotation system under our particular growing conditions.

In preparing for this project, we hoped to:

- reduce off-farm inputs to increase profitability and efficiency;
- decrease Bt, propane, and gasoline;
- reduce hours spent hand-picking;
- increase in the number of growers using organic or integrated pest management practices; and
- decrease beetle pressure.

This grant enabled us to open up new ground far away from our existing fields to test the effectiveness of long distance crop rotations. The new field lies over 1/2 mile to the east of our existing fields, with a 1 acre pond, woods, and pasture in-between.

In 2001 we had planted a small experimental plot of potatoes in a flat location in this new field. No beetles reached the plants, although we did not have a vigorous stand of plants because of drought. We believed that to have an effective experiment we would need to rotate our entire potato acreage. A small section in the original potato field was left to act as a trap crop to prevent beetles from migrating. Beetles will undertake migratory flight if they have not found host plants within five to seven days. The trap crop allowed us to pick the beetles easily from a concentrated area. We hand-picked the beetles daily early in the spring, then tilled the plants under before any of the next generation of larvae hatched.

An excavator was hired to prepare the new field for crop production for the summer of 2003. Heavy sod was broken using a spading machine (similar to a tractor-mounted rototiller). The ground was leveled and usable ditches were

**Table 1. Comparison of Potato Beetle Activity and Control Practices for 2002 and 2003.**

2002		2003	
Date	Activity	Date	Activity
6/15	First beetles found in 2001 field (volunteer plants)	6/16	First beetles in trap crop (2-5 adults per picking)
6/18	First beetles found in main field	7/22	Trap crop tilled under after emergence of larvae
7/6	First larvae found and first application of <i>Bt</i>	7/30	First beetles and larvae found in new field
7/13	Second application of <i>Bt</i>		
7/25	Third application of <i>Bt</i>		
7/29	Fourth application of <i>Bt</i>		
Time spent spraying and picking: 55 hr		Time spent spraying and picking: less than 20 hr	

created. As the new field was also out of reach of previous water sources, we purchased irrigation pipe to reach the new field from a pond. Soil amendments (composted cow manure or lime) were added based on soil test results. We scouted the fields three to five times per week in collecting our results. We also recorded dates of first colonization, first reproduction, emergence of summer adults, and approximate population levels. This ended up taking much more time than anticipated, especially since the new field was located quite a distance from the rest of the operation.

## Results

We clearly spent much less time on beetle control in 2003 vs. 2002 (Table 1). This time would likely have been reduced even more had we been able to spray *Bt* upon first seeing larvae in the new field, but it rained nearly every day that week, making *Bt* ineffective. Thus, we used no *Bt* in 2003, as compared to 2 gal plus 3 1/2 cups in 2002. Even after the beetles arrived, their numbers remained quite low and seemed to concentrate in a few areas of the field rather than populating the entire 2 acres as they had in 2002. Beetle pressure in the trap crop was surprisingly low, possibly because we had a cold winter with no snow cover. This in turn may have delayed and lessened the impact in this year's crop producing field.

The results of this project were for the most part as I had anticipated. In particular, beetle feeding and damage was delayed but not eliminated using the long distance rotation method. Time is needed to see whether these results will continue.

## Management Tips

1. This method will very likely reduce problems with potato beetles.
2. A field 1/2 mile from previous potato fields effectively reduced potato beetle feeding and damage.
3. Make sure that there are natural barriers between potato fields.
4. If the field can be brought into production easily, this is an ideal way to improve the operation.
5. If it would be very costly to bring the field into production (road-building, clearing timber, etc.), we recommend a more comprehensive analysis with longer-term information.

## Cooperators

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*Edward B. Radcliffe, Department of Entomology, University of Minnesota, St. Paul, MN*

*Jenifer Buckley, formerly with the Northeast Chapter of the Sustainable Farming Association of Minnesota, Duluth, MN*

## Other Resources

Fisher-Merritt, John. 2004. Root Cellaring and Computer-controlled Ventilation for Efficient Storage of Organic Vegetables in a Northern Market. Greenbook 2004. pp. 34-37. Available at: [www.mda.state.mn.us/esap/greenbook.html](http://www.mda.state.mn.us/esap/greenbook.html)

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**Project Duration**

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**Keywords**

calcium sprays,  
fertilizers, organic  
strawberries

# Organic Strawberry Production in Minnesota

**Project Summary**

We have a farm called 'Wilson's Organic Strawberries', which is a certified pick-your-own organic strawberry farm. Like most Minnesota berry growers, we have matted rows and we plan on keeping plants in for three years of production. However, we use no synthetic pesticides or fertilizers. This past year was our first year of selling. We had a very good crop with good quality berries and little disease or insect damage. Our customers were very pleased with the berry quality and the picking conditions. The organic strawberries have not made us rich, but we have been able to pay operating expenses and pay for our long hours of work.

**Project Description**

We own a 44 acre farm that we recently bought from Laura's father. We currently grow about five acres of organic strawberries. On the rest of the farm, we grow alfalfa, corn and oats, which usually are fed to the 5 to 10 head of cattle that we raise for our own beef and to sell locally. We will certify the entire farm next spring. We grow a large vegetable garden that we plan to expand to sell organic produce. All of the labor is done by us, with help from family and friends during the really busy times.

Our goal for the project was to show that organic strawberry production can be profitable. Growing strawberries without synthetic pesticides and fertilizers may seem difficult with all

the potential disease and insect problems, but we feel we are showing that it can be done successfully.

We have found that in order to have healthy, high yielding plants with good quality fruit, the first year of growing is critical. The location of the field and the soil type are important. Strawberries don't do well in clay soils. Weed control in the first year is very important. Weeding consumes a lot of time, but good weed control that first year makes controlling weeds the next year much easier. If the field is kept clean the first few months, the plants fill in the rows and, by the next year, the rows are so filled with strawberry plants that weeds cannot compete. Our biggest investment in growing organic strawberries was our time spent weeding, and we feel that it was time well spent. Our customers were happy with the clean rows for picking and the good quality of our fruit.

Another thing we found to be very important in organic strawberry production is applying plenty of straw. Finding a good source of weed-free straw is critical. With clean straw, there are fewer problems with weeds and disease. Customers really appreciate having plenty of straw between the rows so that they stay clean when picking. Straw also helps hold in moisture near the roots while keeping the berries and plants dry.

***Laura and Brian  
with their son Jack.***



Last year we experimented with foliar feeding of compost tea and we showed several promising results. This year, however, we were informed by our certification agency that we couldn't apply compost tea less than 90 days before harvest. We continued using calcium sprays for foliar feeding.

To fertilize our plants, we spread 2,000 lb manure/A. The plants also needed nitrogen and other nutrients after the first year, so we applied chicken feather meal that we purchased from Renaissance Fertilizers. We banded 400 lb of feather meal over the rows, or about half the area of the field, at renovation the past two years.

## Results

This summer turned out to be a great year for growing strawberries. We had just enough moisture and perfect temperatures for the plants. The milder temperatures brought out eager customers to pick our berries.

### Insects and Diseases:

In the first picking, the biggest problem was slugs. By the last picking, slug damage had disappeared (Table 1). We monitored on a regular basis for tarnished plant bug nymphs, but the number of nymphs was always under the threshold for spraying. Overall, tarnished plant bug damage became worse over the season. During the first picking,

**Table 1. Fruit Damage**

Variety	Tarnished plant bug		Gray mold		Anthracnose		Slugs	
	June 29*	July 14	June 29	July 14	June 29	July 14	June 29	July 14
Cavendish	12*	5	0	10	0	8	18	0
Honeoye*	0	---**	0	---	---	---	7	0
Annapolis	0	2	0	12	0	0	3	0
Jewel	0	0	0	20	0	0	0	0

\* % damaged fruit, \*\* Not rated

**Table 2. Fruit Quality**

Variety	Size (grams)		Sugars (°brix)		% Good Berries	
	June 29*	July 14	June 29	July 14	June 29	July 14
Cavendish	14.7	13.6	10.80	10.52	70	80
Honeoye	18.6	---	9.49	---	85	---
Annapolis	16.3	8.6	9.56	9.08	97	86
Jewel	23.0	11.7	10.00	8.45	100	80

\* All the fruit sampled on June 29 were second picking except Jewel. Jewel were king berries.

**Table 3. Comparison of Nutrients in 2002, 2003 and 2004**

	Soil (ppm)			Leaves (% dry wt)		
	2002	2003	2004	2002	2003	2004
Nitrogen (total Kjeldahl for soil)	2,211	2,010	2,205	2.67	2.28	2.11
Phosphorus (weak bray for soil)	42	37	49	0.33	0.23	0.34
Potassium	253	264	435	1.37	1.33	1.98
Sulfur	---	---	---	0.16	0.11	0.15

there was one small section of berries with tarnished plant bug damage in the Cavendish. We don't think that the Cavendish plants were more susceptible to tarnished plant bug, but that the bugs happened to be in that section of the field. Many of the berries with tarnished plant bug damage were marketable and we prefer a few misshapen fruit to insecticides. Gray mold became more of a problem later in the season with up to 20% of the berries in the last picking having some gray mold.

#### Fruit Quality:

Our early berries were large and very sweet (Table 2). All of the fruit averaged over 9.5 % sugar, which is considered quite sweet. Cavendish started out the smallest, but by the last picking it had the largest berries. The size of Annapolis during the last picking was half the size of those from the first picking. The sugar content in all the fruit, except Cavendish, decreased during the season. We did not sample Honeoye on July 14, because the berries were unmarketable due to a bitter flavor.

#### Soil Fertility:

One problem that all organic strawberry growers face is keeping soil nitrogen levels high from one year to the next. We tried to keep nitrogen levels high with an organically approved feather meal. In 2003, all nutrient levels dropped in soils and plant leaves, but by 2004, the nutrient levels had rebounded (Table 3). The low levels of phosphorus and sulfur in 2003 may have been worsened by the late summer drought. We have a drip system, and there was not enough rain to move nitrogen from the drip zone to the roots in August 2003.

#### Customer Surveys:

There is an increasing demand for organic produce and most of our customers were very enthusiastic about our farm. In the survey that 36 of our customers filled out, 97% of the respondents said that our being organic was important in their decision to come to our farm. A third of our customers traveled more than 30 miles to buy berries at our farm. Many of those were people in the Metro area driving specifically to an organic strawberry patch. See the customer survey questions with the responses.

#### Customer Survey Responses:

1. *How often do you buy locally grown strawberries?*  
 11% = Less than once a year  
 62% = 1-2 times a year  
 11% = 3-4 times a year  
 17% = More than 4 times a year
2. *How many farms have you bought strawberries from in the past two years?*  
 46% = Only this farm  
 46% = 2 farms  
 8% = 3 or more farms
3. *How far did you travel to visit this farm?*  
 37% = Less than 10 miles  
 23% = 10-20 miles  
 6% = 20-30 miles  
 34% = More than 30 miles
4. *How often do you buy organically grown fruits or vegetables?*  
 6% = Several times a week  
 11% = Several times a month  
 14% = Several times a year  
 63% = Unsure
5. *If you buy organically grown produce more than once a month, you buy because:*  
 11% = Organically grown produce tastes better  
 31% = Organically grown produce is healthier  
 17% = Organically grown produce is easier on the environment
6. *How important is the fact that we are organic play a role in your decision to come pick at our strawberry patch?*  
 48% = Very important  
 45% = Somewhat important  
 3% = Not important
7. *Would you be more likely to buy from a producer who has been certified as organic by a national certifier than one who states that they do not use pesticides?*  
 66% = Definitely  
 28% = Maybe  
 6% = No
8. *Would you buy more organically grown produce if there were more available?*  
 66% = Definitely  
 34% = Maybe  
 0% = No
9. *Would you pay more for organically grown produce than conventional produce?*  
 43% = Definitely  
 54% = Maybe  
 6% = No
10. *If you normally don't choose to buy organically grown produce is it because:*  
 40% = Organically grown is too expensive  
 68% = Organically grown is not available  
 3% = Organically grown is poorer quality  
 6% = Organically grown doesn't matter  
 (For this question, respondents could check more than 1 response.)

## Management Tips

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1. Choose a location with good air movement and water drainage. Start preparing the soil a year before you plant.
2. Plan so that you will always have adequate labor and you can keep up with the work.
3. Use plenty of straw.
4. In a small farm like ours, it is better to certify the entire farm rather than a few acres.

## Cooperator

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

## Project Location

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Six miles west of Alexandria on I-94. Take Garfield/Lowry exit, then take the first left off Cty. Rd. 40, .5 mile north of I-94.

## Other Resources

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Ames, G., and H. Bom. 2000. Strawberries: Organic and IPM options. Appropriate Technology Transfer for Rural Areas (ATTRA). Web site: [www.attra.org](http://www.attra.org)

Minnesota Department of Agriculture 2003 Strawberry Guides:

- Field Guide for Identification of Pest Insects, Diseases, and Beneficial Organisms in Minnesota Strawberry Fields.
- Integrated Pest Management Manual for Minnesota Strawberry Fields.

Web site: <http://www.mda.state.mn.us/ipm/fandvipm.html#fipm2>

Specialty Crops Management Course, Northland Community and Technical College, Thief River Falls, MN, 218-846-0741. Web site: [www.mgt.org](http://www.mgt.org)

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### Project Duration

2004

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### Keywords

biocontrol,  
invasive, spotted  
knapweed, weed

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# Tillage, Green Manure, and Cover Cropping to Control Spotted Knapweed

## Project Summary

Spotted knapweed is an invasive pasture weed. Organic growers must find alternatives to conventional chemical control methods. This project tested three combinations of tillage, green manure, and cover crops to see what is effective in destroying established plants, and in preventing establishment of new ones from the soil seed bank. Insect biological control was also begun with release of two knapweed-eating weevils provided by the Minnesota Department of Agriculture Weed Biocontrol Program.

## Project Description

Northern Light Farm is a 160 acre diversified farm. Our current cash crops are CSA vegetables, broiler chickens, eggs, and honey. We are also establishing an orchard and have 11 head of Highland cattle. Only five of our 70 acres of open land are planted to crops, with the rest designated as pasture or hay land. When we bought the farm in the fall of 2000, it had been heavily grazed and mowed. The farm has sandy soils with little organic matter, and when we let most of the open land grow out the following spring, we found that we had some major perennial weed problems, with spotted knapweed being the chief culprit.

Spotted knapweed is an aggressive, invasive, exotic weed that has destroyed thousands of acres of pasture in the western United States. It is quickly invading the sandy soils and roadside ditches in northern Minnesota. It is a perennial that can develop a large taproot in a few years. It kills competing vegetation with a chemical given off by its roots, and produces thousands of long-lived seeds each year. Left to its own devices, it will completely take over a pasture with its large rosettes of leaves and coarse, inedible flower stalks. Fallow fields such as CRP land are especially at risk.

We are committed to using organic techniques and rotational grazing to improve the health of our worn out soil, but it was clear that manure and grazing alone were not going to remove our knapweed problem, and a more aggressive approach was needed.

We have observed that, while knapweed is a tenacious plant, its seedlings do not compete well with a thick stand of tall grass. Ultimately, we want to see whether an economically feasible combination of tillage, fertilization, and cover cropping can improve the soil and wear down the knapweed seed bank to the point that pasture grasses can suppress knapweed. We hope to suppress

*Paul shows field day participants what a healthy clump of spotted knapweed looks like.*



the knapweed enough that it can be controlled with regular scouting and hand pulling.

In this one-year project, we tried three different tillage and planting plans (see Table 1). We selected nine large (1-2 acre) patches of fallow pasture that were heavily infested with spotted knapweed. Initial plant counts showed that an average square yard in the plots had about 50 knapweed plants, and that there were places with more than 300 knapweed plants in a square yard. One of the plots had been disked once the previous summer and still had an average of 24 plants/yard<sup>2</sup>. A soil test was done in each plot.

**Table 1. Treatments**

Treatment	Description
#1	Oats underseeded with white clover
#2	Buckwheat
#3	Oats incorporated after 1 month, followed by buckwheat
Control #1	Black fallow
Control #2	2002 chisel plow, buckwheat followed by winter rye; 2003-winter rye allowed to mature; 2004 fallow

Each of the nine plots was disked in late June, spread with fresh dairy manure at about 200 bu/A (7.5 tons/A and about 75 lb-N/A) and disked again two weeks later. Each plot was then randomly given one of three treatments (Table 1). Three plots were planted to oats underseeded with white clover. The oats were harvested for hay and the clover will be allowed to grow in the second season, a traditional method for establishing a perennial legume crop. Three other plots were planted with buckwheat. The final three plots were planted with oats, which were tilled under after a month and planted to buckwheat. The last two treatments were disked down at the beginning of September and planted with a mix of winter rye and hairy vetch.

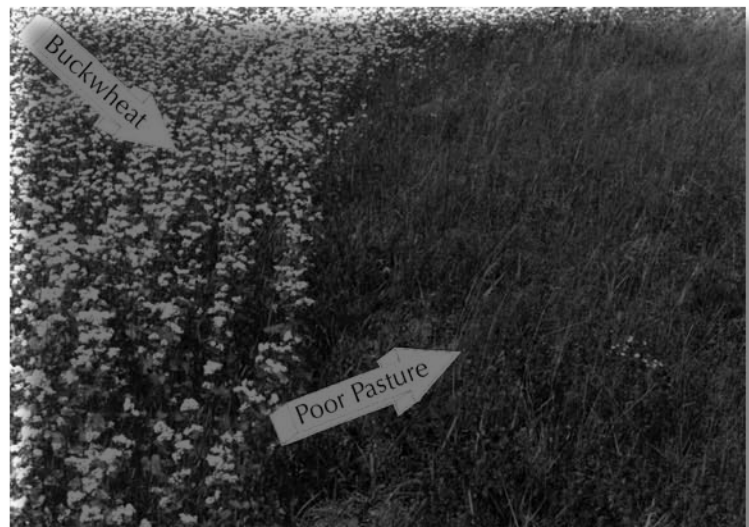
For comparison, several smaller plots of knapweed were simply disked down and were kept in black fallow for the duration of the experiment. We also had one test plot that was chisel plowed and disked in 2002 and planted to buckwheat followed by winter rye. The rye was allowed to mature in 2003 and the plot was left fallow in 2004.

***Buckwheat was one of the crops tested for potential to control spotted knapweed.***

We suspect that, despite our best efforts, we will always have some spotted knapweed hiding in our fence rows, or creeping in from neighbors' fields. Because of this, we contacted the Minnesota Department of Agriculture (MDA) Biological Control Program and asked to become a release site for several insects that are being tested for control of spotted knapweed. At a field day in early August, we released two species of weevils: one that eats knapweed seeds, and one that eats knapweed roots. The insects were released on a patch of knapweed that will not be treated in any other way, thus providing a home where the insects will hopefully increase in numbers and spread (either by themselves or with our help) to other areas of the farm. We hope to release additional species in 2005.

In addition, we noticed that spotted knapweed and goldenrod seldom grow together on our farm. While we don't expect a massive planting of goldenrod to be part of our knapweed control strategy, we wonder whether goldenrod is able to actively exclude knapweed, or if it just got to the best soil first and established itself before the knapweed invaded. To test this theory, we marked the boundary between knapweed and goldenrod in several patches and will watch them over the next several years to see if the boundary changes or if the two species intermix.

We discovered another problem this year as we scouted our fields to pull single invading knapweed plants that were many yards away from established patches. If the knapweed invader had been growing for more than one year, when we pulled the mature plant we would often find the ground carpeted with thousands of tiny knapweed seedlings for a foot or two surrounding the mature plant. For scouting and hand pulling to be effective, we need to have some way to quickly control these seedlings. We began experimenting with regular household vinegar this year and will test more concentrated vinegar as well as herbicidal soaps and other approved organic herbicides next year.





**Table 2. Results Summary and Plans for Subsequent Years**

Treatment/ Timing	Treatment #1: oats & clover	Treatment #2: buckwheat → rye & vetch	Treatment #3: oats → buckwheat → rye & vetch	Control #1: black fallow	Control #2: buckwheat → rye & vetch w/o manure in ‘02, fallow ‘03 and ‘04
late June (beginning of bloom)	-disk -manure 200 bu/A -disk	-disk -manure 200 bu/A -disk	-disk -manure 200 bu/A -disk		
early July	-oats 3 bu/ac -clover 2 lb/ac	buckwheat 60 lb/A	oats 3 bu/A	-disk before seed set	
early August			-disk -buckwheat 60 lb/A		
early September	cut for hay	-disk -rye 60 lb/ac -hairy vetch 20 lb/A	-disk -rye 60 lb/A -hairy vetch 20 lb/A	-disk	-disk -rye 60 lb/A -hairy vetch 20 lb/A
2004 results	-too little tillage, a few mature plants survived, many knapweed seedlings by fall -modest hay crop	-good control of existing knapweed -few seedlings at end of year	-good control of existing knapweed -two cover crops may be unnecessary	no vegetation	-blooming knapweed too thick for hand control in most of plot after 2 years fallow -little knapweed in dense volunteer red clover patch
2005 plans	-can clover establish well enough to slow knapweed? -may have to start over	Will monitor for knapweed in rye/vetch cover. If too many, will do another round of cover crops starting late June 2005. If knapweed is light, will add more manure and plant pasture mix late summer 2005.		disk 2-3 times to kill all sprouting seeds	-monitor for knapweed -apply manure to increase vigor of cover crops
2006+ plans	Establish pasture mix with annual scouting to pull flowering knapweed No hay and only light grazing for at least 2 years after pasture mix planted			plant pasture mix at same time as treated plots for comparison	

Our field day on August 5 was attended by about 14 people. Two-thirds were local agricultural professionals and one-third was area landowners. The program started with an overview of spotted knapweed identification and behavior. We toured an infested hayfield and the project's test plots. The last part of the event was an introduction to the knapweed biological control program of the MDA and featured the release of two species of weevils.

## Results

This is a long term project, and we will only be able to claim success when we have a healthy pasture or hayfield with fewer knapweed plants to pull each year. However, even in this first year, we can make a number of observations (see Table 2).

1. The two successive diskings at the beginning of the project were successful at killing most of the established knapweed plants. Out of the thousands of plants in each plot, no more than several dozen managed to regrow, and

most of these were destroyed when we tilled down the cover crops.

2. While seedling knapweed is difficult to distinguish from several other weeds, it appears that the oat/clover treatment had a pretty good stand of knapweed coming up with the clover. This treatment was the least expensive and provided a bit of oat hay as a bonus, so it would be nice if it provided decent knapweed control. However, we suspect that when the knapweed starts to flower, we will have to till these plots again and do another round of cover crops. We have observed that large patches of hop clover and red clover that have naturally seeded in our test field are also mostly knapweed free. It will be interesting to observe the progress of the planted clover to see if it can overcome the knapweed seed bank.

3. Treatment 4 (established in 2002 and left fallow in 2003 with no added nutrients and no planted cover crop) was covered with a haze of new purple spotted knapweed

flowers in 2004. We plowed these down again and planted rye and vetch this fall. The exception was a 100 yd<sup>2</sup> section of the plot that had self-seeded to red clover, where the few remaining knapweed plants could be pulled by hand. We expect that we may have to continue tillage and replanting for several years as the knapweed infested area gets smaller and smaller, until the remaining weeds can be controlled by hand.

4. The repeated tilling of the plots with successive cover crops killed many knapweed seedlings and plants that regrew from the roots. We expect tillage will shorten the time until we can declare the knapweed under control. This year, we planted late due to a cool spring and our need to let the knapweed grow up enough for its flower stalks to emerge so that we could mark the boundaries of the test plots. With this late start, there was probably little advantage to the double crop of oats and buckwheat in treatment #3 versus the single buckwheat crop in treatment #2. If we had managed to get the project underway at the normal planting time for oats in early May, the oat/buckwheat double crop might have been more useful in increasing the soil organic matter.

5. Plain white vinegar may be useful in killing newly emerged knapweed seedlings. It also kills the leaves of more established plants, but they appear to readily regrow from the roots.

### What's Next?

We will thoroughly evaluate all of our test plots in June of 2005, including soil tests and a count of knapweed plants in square yard sample plots. Depending on the results of these tests, we will either do another season of cover crops or plant a pasture mix. Even using herbicides, controlling knapweed is a multiyear proposition. We don't expect organic techniques to be any faster.

Finding an organic-approved herbicide that is effective for spot spraying would be a welcome addition to our knapweed control tool box. Young knapweed plants with a flower stalk are easy to pull from moist soil, but big plants and plants with just leaves require digging, and we have many small but well established knapweed patches that are too small and scattered to till, but with hundreds of plants, are too big to pull. We also need to see whether hand hoeing and replanting with a grass/legume pasture mix will be effective on these patches.

Finally, we hope that the biological control agents will be well enough established that we can start moving them to new areas of the farm in 2005.

### Management Tips

1. Learn to recognize spotted knapweed flowers. Pull them immediately whenever you see them, even if it means stopping the tractor in the middle of cutting hay. Grabbing those initial invaders is much easier than controlling an established patch.
2. Control of an established patch of spotted knapweed will probably require at least two years of tillage. A single pasture renovation is not likely to provide sufficient control.
3. Converting affected areas to annual crops for several years may be better than trying to rescue a badly infested pasture.
4. After replanting an area of pasture or hayfield that was infested with spotted knapweed, allow it to grow without harvest for at least a year, preferably two, to allow grasses to shade out knapweed seedlings. Even if they can't bloom because of mowing or heavy grazing, knapweed plants love the sunlight. Like dandelions, they will grow lower and flatter and eventually bloom right next to the ground.
5. Spotted knapweed loves poor, sandy soils. Unless soil quality is improved, knapweed will reinvade no matter what method you use to try to control it.

### Cooperators

*Anthony Cortilet, Minnesota Department of Agriculture  
Weed Biocontrol Program*

### Project Location

The farm is located 12 miles west of Bemidji. From U.S. Hwy. 2, go south 2.3 miles on Cty. 5 (Centerline Rd.) to Cty. 16 (Tren Grove Rd.) Go east on Cty. 16 for .3 miles. Go north on Agate Lane for 3 miles to its end.

### Other Resources

Story, J. 2002. Spotted knapweed. In Van Driesche, R., et al., 2002, Biological Control of Invasive Plants in the Eastern United States, USDA Forest Service Publication FHTET-2002-04 Available at: [www.invasiveplants.net/invasiveplants/biologicalcontrol/13Knapweed.html](http://www.invasiveplants.net/invasiveplants/biologicalcontrol/13Knapweed.html)

*Centaurea maculosa*, *C. diffusa*--spotted and diffuse knapweed. Web site: [www.wildflowers-and-weeds.com/weedsinfo/Centaurea\\_spp.htm](http://www.wildflowers-and-weeds.com/weedsinfo/Centaurea_spp.htm)

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**Project Duration**

2002 to 2004

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**Keywords**

black walnuts,  
contour curbs,  
diversification,  
erosion control,  
grapes, rock tile  
inlets

# Treating Field Runoff Through Storage and Gravity-fed Drip Irrigation System for Grape and Hardwood Production

**Project Summary**

We are in the initial stages of diversifying the labor, economic, and natural resource aspects of our farming operation through the establishment of genetically superior hardwoods and wine quality grape stock. Most of our soils and topography are not well suited for corn and soybean row crop production. We wanted to be able to farm the entire 300 acres of the farm in the future and provide a substantial amount of farm-derived income. Therefore, an increase in the diversity of the operation was needed.

We also appreciate the water resources created on farms, and understand the difficulties that occur when all the farmers in one area compete to remove excess runoff within 48 hours. We have installed contour curbs and rock tile inlets to improve runoff collection, infiltration, and water quality. The stored water is being used to provide for wildlife, groundwater recharge, and irrigation of grapes and hardwoods.

**Project Description**

The arable land on the farm operation is comprised of two annual crop fields. A 25 acre field and a 19 acre field are rotated with corn and soybeans. A neighboring hog operation provides nutrients through manure which is fall injected into the soybean field for the following corn crop. No other fall tillage is used on the bean stubble. A 3.5 acre field adjacent to a drainage ditch was enrolled in the USDA CCRP Buffer Strip Program in 2000 and planted to native grasses. This demonstration project is located on 2.5 acres where slopes average 6% with clay loam to gravelly soils.

The goals of this project were fivefold: 1) to demonstrate a rock inlet waterway weir system; 2) to demonstrate a contour curb system; 3) to promote water infiltration into the soil profile with rock inlets; 4) to demonstrate reduced labor techniques in the establishment of grape and black walnut trees; and, 5) to capture field tile drainage and excess surface runoff to be used for gravity-fed irrigation.

*Installing contour curbs on the Gieseke farm.*



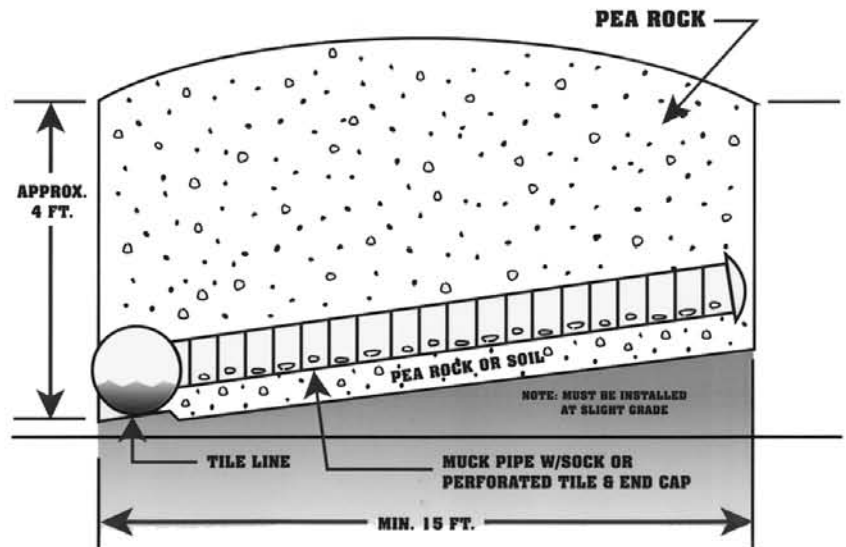
The rock inlet waterway weir system was installed to demonstrate its effectiveness in controlling erosion in fields with concentrated overland flow. Ideally, grassed waterways provide a protected conduit for excess runoff from fields, but due to the use of broad spectrum herbicides and wide application equipment, sod-forming grasses are often exterminated.

The rock inlet system has the potential to bring a new option to crop producers to address concentrated flows in their fields. We installed two rock inlets at 200' intervals along the waterway and perpendicular to the waterway. Installation consisted of digging a trench 2.5' wide and 20' long across the waterway bottom. A total of 20' of tile line was connected to the existing subsurface drainage and the trench was backfilled with pea rock. The excavated material was placed downstream of the rock inlet to act as a small berm to capture the runoff.

The contour curb system was installed on the section of the hillside where the black walnuts were planted. The curb system was not installed in the gently sloping vineyard. The contour curbs act as a mini-terrace system. Each curb was constructed at 20' widths with 30" deep holes dug on the upslope side of the curb at 12 to 24' intervals and filled with pea rock. The intent is to capture and infiltrate all precipitation into the hillside soil. The curbs were constructed with a 0.5% gradient toward a collection pond to route any runoff into the pond.

Fifty black walnut seedlings were planted in the fall of 2002. A 9" diameter auger was used to drill 30" deep holes to plant the seedlings. In the spring of 2003, 125 more black walnut seedlings were planted. Weed suppressing fabric and vented tree tube protectors were installed to reduce sod competition and moisture loss. A small section of a gravity-fed drip irrigation system was installed and tested. The intent was to provide sufficient moisture to the seedlings and reduce labor cost for several years after establishment.

The vineyard was laid out in parallel rows perpendicular to the slope. The site is near the top of a small hill with open space and good air movement and water drainage. Breezes are common on the site. Because of the taut trellis system to be installed, the grapes could not be planted exactly on the contour. The rows were planted on a slight slope, approximately 2%. We chose not to use contour curbs in the vineyard because they could not be contoured well on the landscape. A 9" diameter auger was used to drill holes to make sure the hardpan was removed for each of the grape



stock. The holes were then backfilled when the grapes were planted. The plants were spaced 8' apart in rows that were 12' apart. Wide rows were used to fit the size of the farm equipment available.

Peter Hemstad, horticultural scientist at the University of Minnesota Horticultural Research Center, recommended testing two types of trellis systems for the grapes. We installed both the more commonly used Hudson River Umbrella System (HRUS) and the relatively less used Vertical Shoot Position (VSP) trellis system.

The HRUS has a structure that encourages vine growth to 6' high and then allows the vines to grow out to mimic an umbrella shape. The VSP trellis encourages growth of the cordons (branches trained to grow horizontally) at a 3' height and then supports shoots to grow vertically to 6'. The VSP trellis may provide for a more uniform growth structure, more mechanized labor in pruning, and more ease in harvesting. These systems will be compared for growth characteristics and the labor requirements for maintenance.

The grapes were planted in mid-May, 2003. At planting, each hole was inoculated with commercially available mycorrhizal fungi and a small amount of compost. Five rows were inoculated and one row was left as a control. The plants were then staked, covered with vented growth tubes, and weed suppressing fabric was rolled out on the rows.

The runoff collection pond was installed in October, 2002 to collect surface and subsurface field drainage water, to encourage infiltration, and to store and use the water for irrigation. Runoff water quality and quantity is being collected and analyzed. Excess water is pumped into a 1,000 gallon tank to be used as gravity-fed drip irrigation.

Starting in 2003, we monitored the runoff collection and storage system for:

- rainfall amount;
- runoff volume (from a staff gauge measuring pond depth);
- runoff samples from the pond and collection well analyzed for total suspended solids (sediment), total phosphorus, and nitrate; and,
- weekly pond staff gauge readings for infiltration or evaporation losses.

## Results

We have successfully installed the collection pond, the rock inlet waterway weir system, and the contour curbs. Black walnuts and grapes have been successfully established.

*Rock Inlet Waterway Weirs.* The system was installed perpendicular to the waterway, and not parallel with the row crops. This caused an irregular angle to maneuver field equipment over. The inlets functioned well in spring runoff and normal rain events. However, they were overtopped during a late spring 2½"/hr rain. Two inlets were initially installed. It appears that we need more inlets with less distance between inlets to be able to handle these larger storms. The tile line below the waterway needs to be sized to accept the flows generated by larger storms.

The rock inlet waterway weir system did not function as well as standard basin rock inlets. The rock inlets we used are in a sloping, concentrated flow area making it difficult for the runoff to enter the rock inlet under significant rainfall. This system may prove more workable in a high-residue cropping system such as no-till. Under no-till or strip-till much less runoff occurs and it moves off the landscape in a slower manner. Less sediment is transported under these conditions, reducing deposition on the inlet during high load events. Our system will be monitored under high residue conditions in the coming years.

2003. Judging from the first year of use, it appears that the system can work on relatively small field subwatersheds of less than 20 acres. The fall field tillage was custom hired and both inlets were chisel plowed through. The inlets will provide drainage in 2004, but it remains to be seen if drainage will be

to the extent necessary to eliminate the need for a grassed waterway.

2004. Similar results occurred in 2004. Storm events that would be expected to occur every two years were handled well by the two rock inlets. However, larger and more intense events overtopped the berms. Still, a significant amount of the runoff did enter the inlets and very little rilling occurred downstream of the overtopped berms.

After two years of field experience, we feel that rock inlets installed in waterways can play a role in water management. Ideally, properly constructed and maintained grassed waterways would be installed to handle runoff, but rock inlets remain an option due to the relatively low cost of installation.

The rock inlets as a waterway weir system were more difficult to install and maintain than standard surface intake rock inlets (as used in field depressions). Such additional challenges include:

- proper spacing of rock inlets on the waterway to handle flows;
- proper size of subsurface tile to handle the larger runoff volumes; and,
- placement to manage planting, tillage and harvest with relative ease.

*Contour Curbs.* The contour curbs functioned well under the relatively wet spring in 2003. An intense ½" rain event in mid-May occurred during the construction of two contour curbs and rock inlets. The rain event highlighted the function of the contour curbs as well as the function of the rock inlets. The curbs under construction were built up and the holes were dug and filled with pea rock. The holes still had an auger berm around the top of the hole. The runoff was captured by the curb, but the runoff was not able to enter the hole because of the berm. The captured water ponded

***The grapes were staked, trellised, covered with vented tree tubes, and protected with a weed suppressing mat.***



but the completed curbs and inlets had no water standing, due to the rapid infiltration capabilities of the pea rock.

*Vented Tree Tubes and Weed Suppressing Mats.* The installation of the vented tree tubes went fairly well. Weed suppressing mats were placed around the tubed trees and five staples were used to secure the matting. The performance of the mats was promising. The vegetative growth of grasses and broadleaves surrounding the mats was intense during the summer but the mats kept root competition to a minimum.

A neighbor mowed and baled the grasses between the seedling rows, but a minimum amount of weed control was done in the row. This was due, in part, to the difficulty in working around the contour curbs. In hindsight, this was not all that bad. The grasses were thick, but they were kept off the trees by the mats. The grasses also captured snow and protected the seedlings as winter began.

Several walnut seedlings were left without the protection of the vented tree tubes as an experimental control. We have seen no difference between the trees with tubes and the control. Even with a large rabbit population, there has been no predation on the exposed saplings. The tree tubes were removed in the spring of 2004 as recommended by the manufacturer.

*Seedling Establishment.* Despite the fairly dry weather, with intermittent rain events during July, August, and September, the grape and black walnut seedlings fared well. The walnut seedlings had up to 20" of growth during the first season. The grapes grew well during the summer of 2003. Many of them reached 6' in height and branched down the trellises. Fifteen of the grape stock died and were replaced in mid-June. Some of these replacements also reached over 6' in height. Weed control was managed by mowing between the rows and occasionally pulling a weed from the hole cut in the fabric where the grape vine was planted.

The trellis systems were completed in the spring of 2004. No herbicides, pesticides, or fungicides have been used on the vineyards to this point. It is common for grape growers to get by the first year with no use of chemicals. We plan on pursuing an organic growing system as long as we can. There was no significant difference in the growth of the rows with or without inoculation of mycorrhizal fungi. It may be that our soils already have sufficient inoculum.

*Runoff Collection Pond.* The collection pond was constructed in October, 2002. The snowfall amounts for the winter were fairly low, but the pond did collect spring runoff. Spring rains filled the collection pond to approximately 60% capacity. Infiltration was noted between runoff events. After early July, very little rainfall occurred and the pond completely dried up. No runoff left

the 10 acre watershed during this project. Either the runoff infiltrated or, later in the summer, evaporated.

Runoff samples were collected and analyzed from 2003 through 2004 for total phosphorus and nitrate. The phosphorus levels were uniformly low so only the nitrate levels are presented here.

**Table 1: Tile Outlet and Pond Water Nitrate Levels**

Date	Sample Location	Nitrates (ppm)
July 2, 2003	Tile line	< 2.00
	Pond	< 2.00
May 23, 2004	Tile line	23.00
	Pond	3.50
Sept. 14, 2004	Tile line	0.36
	Pond	0.51
Sept. 21, 2004	Tile line	0.34
	Pond	29.80
Sept. 22, 2004	Tile line	31.40

Because of the limited testing regime, it is not possible to draw hard and fast conclusions about water quality benefits. However, the samples do provide a perspective on the variable levels of nutrients that passed through the tile lines and what was captured in the water to be used for irrigation. The variability in the tile line nitrate concentrations probably reflect the source of the runoff. For example, on Sept. 21, 2004, the tile line nitrate concentration was 0.34 ppm and increased to 31.4 ppm the next day. There are two rock inlets installed on this tile line. Therefore, the runoff collected on Sept. 21 probably originated as surface runoff entering the rock inlets, whereas the sample collected the next day probably originated as subsurface drainage well after the runoff event occurred. The infiltrated water likely increased in nitrate concentration as it percolated through the soil profile.

In mid-September, 2004, we received 4.25" of rain over a two day period. The pond held approximately 1½ acre-feet of water, or nearly 500,000 gallons. In addition to capturing this volume for irrigation, we also prevented it from running into an adjacent crop field. This volume can cover 16 acres with an inch of water. Under the September, 2004 scenario, assuming a cumulative nitrate concentration of 30 ppm, the pond captured 125 pounds of nitrate.

While this was not a scientific study, it does portray some aspects of nutrient transport and the potential for additional nutrient cycling on the farm. The pond also provides habitat for mammals, amphibians, and waterfowl. Subjectively, our visual assessment of water quality throughout the year was fair to good. In the latter part of the summer, a small mat of algae grew, encompassing less than 1% of the pond area.

**Conclusion.** We would recommend the contour curbs for agroforestry or silvaculture systems. The system seems to work well. The rock inlets in the waterways would only be recommended for strip-till or no-till systems at this point. It is too early to recommend the VSP over the HRUS trellis system. At this point, it appears that production may be increased and labor requirements may be lessened with the VSP. The runoff collection pond is a practice that offers many benefits to the farm and farm community. Each farm has its unique characteristics, but all farms can benefit from capturing and utilizing runoff for production, aesthetics, wildlife and water quality.

### Management Tips

1. When constructing a rock tile inlet, use the excavated material as a berm downstream to collect runoff.
2. Contour curbs are constructed so as not to compact the soil. This is contrary to the intentionally compacted construction of a field terrace system which captures runoff from a large area and routes it through a tile line. The contour curbs capture runoff from a relatively small area and infiltrate the runoff. The non-compacted curb is held in place by the vegetative growth around the trees as well as the tree roots. Pea rock infiltration inlets are required if a non-compacted curb is installed.
3. Fill each pea rock infiltration inlet hole with additional pea rock to create a mound to act as a catch berm for the water traveling down the contour. Each 9" by 30" hole with mound uses 3 ft<sup>3</sup> of pea rock. A wagon with a controlled chute reduces the labor needed to fill many holes.
4. Excessive buildup of crop residue from severe storms may affect the performance of the rock tile inlet.
5. Minimum tillage reduces the amount of soil brought into the rock inlet. Consider combining rock inlets with minimum tillage.
6. The contour curbs with rock infiltration inlets worked well on 6-15% slopes. Installation cost and increased field complexity may not warrant these structures on lesser slopes.
7. After several growing seasons, it may be advantageous to pull a chisel plow through the rock inlet to loosen up any tire compaction.
8. Soil that is mixed into the rock inlet does not significantly migrate below the tillage line.
9. Eventually, the top 1' of rock may have to be removed and replaced with clean rock.

10. The crucial factor in developing a runoff collection pond is determining the ratio of watershed size to pond size. An 8 to 1 ratio is adequate, but larger is preferable.

### Cooperators

*Vern and Myrt Gieseke, New Ulm, MN*  
*Ken Schneider, North Central Region SARE, Lincoln, NE*  
*Peter Hemstad, University of Minnesota Horticultural Research Center, Excelsior, MN*

### Project Location

From St. Peter, go west on Hwy. 5 until you reach Nicollet Cty. 12. Go north .25 mile until you reach the Brighton Township Church. Turn left down driveway. From New Ulm, go north on Hwy. 15. Turn east at Klossner on Hwy. 5. Go 4 miles to Nicollet Cty. 12 and travel north .25 mile until you reach the Brighton Township Church. Turn left (west) down driveway.

### Other Resources

Minnesota Grape Growers Association, John Marshall, Secretary. 35680 Hwy. 61 Blvd., Lake City, MN 55041. Email: grapes@rconnect.com  
 This is a membership organization and publishes the quarterly newsletter "Notes from the North" with information about grape production.

USDA Sustainable Agriculture Research and Education web site at: [www.sare.org](http://www.sare.org)

University of Minnesota Horticultural Research Center, 600 Arboretum Blvd., Excelsior, MN 55331. Web site at: [www.arboretum.umn.edu](http://www.arboretum.umn.edu)

Pirog, R. 2000. Grape Expectations: A Food System Perspective on Redeveloping the Iowa Grape Industry. Leopold Center for Sustainable Agriculture, 209 Curtiss Hall, Iowa State University, Ames IA 50011-1050, 515-294-1854.

Minnesota Department of Agriculture. Greenbook 2003. Viability of Wine Quality Grapes as an Alternative Crop for the Family Farm, pp. 43-46. St. Paul, MN.

Minnesota Department of Agriculture. Greenbook 2003. Replacing Open Tile Intakes with Rock Inlets in Faribault County, pp. 61-62. St. Paul, MN.

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**Project Duration**

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**Keywords**

percent protein,  
top dress, turkey  
manure, winter  
wheat, yield

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# Winter Wheat Fertilization Using Turkey Manure

**Project Summary**

Including small grains in an organic crop rotation can be important to pest management and soil structure. The small grain crop must also be profitable in the marketplace as well because it is difficult to sell low protein wheat for human consumption. In this project, I evaluated the use of purchased turkey manure on grain yield, grain quality, and straw yield of winter wheat as well as the effect on soil organic matter and overall fertility for the following crop.

**Project Description**

My farming operation consists of about 420 acres of cropland and pasture in south central MN. All but 34 acres is certified organic. I have 40 Angus beef cows and finish about 50 lambs per year. My cattle are rotationally grazed and the 2004 calf crop will be my first crop of organic calves. I am trying to use the cattle as a way to add value to small grains and low quality hay.

The land I farm is mainly gently to moderately sloping which gives me some management challenges. I have two crop rotations depending on the field terrain. The first rotation has been soybeans followed by winter wheat. The second rotation is corn, soybeans, corn, and then three years of alfalfa.

I wanted to do this project so that I could determine if it is profitable to top dress turkey manure on a young winter wheat stand in the spring. I hoped that applying the manure I

could increase grain yield, protein content, straw yield, and increase soil organic matter.

**Results**

The wheat was planted on October 8, 2003 into disked soybean stubble. The soil conditions were very dry and the wheat did not germinate until after a rain on October 20. The wheat only grew about 2" by freeze up, which was way behind preferred height.

The turkey manure was spread on May 3, 2004. The 30 acre field was divided into seven plots. One with no manure, two with 1 ton of manure, two with 2 tons, and two with 3 tons of manure. The field conditions were very dry until May 22, then it rained a lot and often throughout the summer.

Visual inspection of the plots during the growing season showed a darker green and somewhat denser stand in the 3 ton plots. The weed pressure was fair in all of the plots except one of the 3 ton plots where the pressure was extreme. This weedy plot was swathed; all of the other plots were harvested standing. The grain was harvested on August 13.

The yield, test weight, and protein content did not show any direct relationships between the plots. Yields were similar ranging from 37.9 to 45.9 bu/A. Test weight from 58.5 to 61 lb. Percent protein from 10 to 10.6. This similarity surprised me since during the growing it seemed that there was a distinguishable difference in the plants in the respective plots.

**Table 1. Test weight, protein, and yield results on winter wheat turkey manure test plots.**

Tons of Manure /acre	Test Weight	Protein (%)	Yield (bu/A)
0	61.0	10.2	45.9
1 Ton	59.0	10.5	41.8
2 Ton	58.5	10.6	39.6
3 Ton	59.0	10.0	37.9



The timing of the manure application seemed to fit into the initial spring growth of the wheat and it required little if any additional labor on my part. However, from an economic stand point it did not pay for itself. I think the weather had an overall impact on the wheat yield, but I do not know if the weather had any impact on the difference in yields throughout the plots.

It may be more beneficial to apply and incorporate the turkey manure before planting. The nitrogen in this year's plots may have been lost into the air because the manure was not incorporated and there was not a soaking rain shortly after it was applied.

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### Management Tips

1. Turkey manure is a very beneficial fertilizer for corn, but is questionable for small grains.
2. Incorporate turkey manure soon after application to capture the nitrogen.
3. Top dressing turkey manure onto a wheat crop does not show much fertilizer benefit to the crop.

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### Cooperators

*Greg Miller, Agronomist, Century Ag, Waseca, MN*  
*Jim Jirik, NRCS District Conservationist, Waseca, MN*

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### Project Location

Take Hwy. 14 east from Waseca about 1 mile. Turn left on Cty. Rd. 4 approximately 3.5 miles. Look for Gregors' Orchard sign.

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### Other Resources

Appropriate Technology Transfer for Rural Areas (ATTRA), PO Box 3657, Fayetteville, AR 72702, 800-346-9140. Web site: [www.attra.org](http://www.attra.org)

Provides assistance and resources free of charge to farmers and other agricultural professionals.

North Central Region SARE. University of Nebraska-Lincoln. 13A Activities Bldg., PO Box 830840, Lincoln, NE 68583-0840, 402-472-7081. Email: [ncrsare@unl.edu](mailto:ncrsare@unl.edu)  
Web site: [www.sare.org/ncrsare](http://www.sare.org/ncrsare)

Sustainable Agriculture Research and Education (SARE) program works to increase knowledge about and help farmers and ranchers adopt practices that are economically viable, environmentally sound, and socially responsible.

**Principal Investigator**

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**Project Duration**

2002 to 2004

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**Keywords**

acetic acid, Canada  
thistle, chickling  
vetch, green  
manure, legume,  
nitrogen, organic,  
vetch, vinegar

# Chickling Vetch – A New Green Manure Crop and Organic Control of Canada Thistle in Northwest Minnesota

**Project Summary**

Because of its reportedly high nitrogen fixation rate and vigorous growth, chickling vetch may be an attractive cropping system option for farmers. The purpose of this project was to estimate nitrogen and ground cover provided by chickling vetch in a Northwest Minnesota location. The first year of the project, heavy rains flooded out the experiment and generated a healthy crop of Canada thistle and, the project team turned their attention to evaluating thistle control with organic-permitted sprays including acetic acid. In 2003, the project returned to its original objective of evaluating chickling vetch in comparison with other legumes.

**Project Description**

Dan Juneau has farmed near Red Lake Falls since 1972. He transitioned 885 acres to certified organic status and uses rotations that include rye, spelt, soybean, wheat, barley, and chickling vetch. His soils are predominantly sandy loams and his most problematic weed species are pigweed, mustard, smartweed, pigeongrass, and wild oats. Dan says he

undertook this project to help other farmers learn about ways to fix nitrogen and believes chickling vetch will produce 200 to 250 lb N/A. He wanted to demonstrate how a farmer can save money by “growing” fertilizer right on the farm while obtaining better soil conservation from winter ground cover. “Blowing dust every spring across many states is very common,” Dan says. “More and more valuable topsoil is being lost every year to blowing. We can change this.” Dan is also a seed dealer for a commercially available variety of chickling vetch called ‘AC Greenfix.’

Green manures like alfalfa, clovers, and new legumes like chickling vetch are particularly important to organic farmers, because organic practices prohibit the use of synthetic fertilizer. According to Dan, many farmers in his area are looking for less expensive sources of nitrogen fertilizer and would benefit from research like these studies, and from learning opportunities like field days. Data that Dan collected and observed include biomass, crop residue, root nodules (which indicate activity

*The chickling vetch and wheat plots abutted on Dan's farm in 2003. Next year he'll solid seed all of the 2003 legume plots to wheat.*



of nitrogen-fixing bacteria), and observations about wind and rain erosion.

## Activities

### 2002

The 2002 growing season started out dry. Shortly after planting, seeds were blown away in 40 mph winds. After Dan re-planted in early June, his area received about 3.5" of rain before the chickling vetch had emerged. Although the field plot was on relatively high ground, it flooded out completely. Alfalfa, hairy vetch, and 60% of the chickling vetch did not recover. By the end of June, he had a test plot full of 18" tall Canada thistle. Ordinarily, he would have eliminated the thistle by letting the field lie in summer fallow and deep chisel plowing as necessary.

Since it was too late to plant the original experiment again, Dan contacted staff at MDA along with project cooperators, organic crop consultant Glen Borgerding, and Extension Educator Hans Kandel, to ask their advice. Since the weather conditions had left him with thistles, they concluded Dan could use this opportunity to test vinegar (acetic acid) for thistle control.

Dan and his collaborators decided to try a number of natural sprays that would not jeopardize his organic status. Treatments included several concentrations of vinegar (acetic acid) with and without two surfactants, Alldown™ (a non-selective herbicide approved for use in organic systems), and hydrogen peroxide. Plot size was 10' x 25' and treatments were replicated four times. Because the land was certified organic, it was not possible to include a chemical check similar to what a conventional farmer in the area might use.

### 2003

In 2003, things went a little more according to Dan's original plan for the experiment. He used a 3 acre test plot that had grown chickling vetch in 2002. In mid-May, he solid seeded approximately 1 acre each of spring wheat and soybean, and 1/3 acre each of chickling vetch, alfalfa, and hairy vetch using a John Deere 9300 press drill. He seeded hairy vetch at about 20 lb/A, alfalfa at 20 lb/A, and chickling vetch at about 60 lb/A. He seeded both soybeans and wheat at 2 bu/A. All treatments were seeded within about a week of each other. The hairy vetch had poor germination, so Dan ordered a different lot and reseeded it on May 30.

For weed control, Dan harrowed approximately every seven to ten days in all plots until the end of June. On June 21, Dan mowed a swath in each legume plot with a Toro lawnmower set to a stubble height of 4" to 5" because he wanted to see how the plots would perform in terms of

regrowth. Biomass of chickling vetch, soybean and hairy vetch was clipped by hand to ground level in 1-meter square quadrats (in previously unmowed portions of each plot) on July 11 and again on August 12 in two locations per plot. The material was bagged and dried, then separated into crop and weed fractions. Dried fractions were weighed and the data recorded. Wheat harvest occurred on August 11 and soybean harvest on October 5.

### 2004

Dan used a 3 acre test plot that had grown Chickling vetch. In mid-May, he solid seeded approximately 1 acre each of spring wheat and soybeans, and 1/3 acre each of Chickling vetch, alfalfa and hairy vetch using a John Deere 9300 press drill. He seeded hairy vetch at about 20 lbs/A, alfalfa at 20 lbs/A and Chickling vetch at about 60 lbs/A. In addition, he seeded both soybeans and wheat at 2 bu/A. All treatments were seeded within about a week of each other.

## Results

### 2002

According to Dan, results from all treatments were fairly consistent and disappointing. Dan and the collaborators speculated that solution strength and timing are very important to effective thistle control, and that acetic acid solution might provide effective control if the thistles were very small. Dan said if he had it to do over again, he might use a higher acetic acid rate or would douse the crop more, but would need more information about potential damage to the crop. It is unknown at this time which acetic acid concentration and volume would work best in that situation.

### 2003

During the early part of the season when Dan was harrowing approximately every seven to ten days, he observed more damage in the alfalfa plot than in the hairy vetch or chickling vetch plots. There was little harrow damage to soybean and wheat.

After mowing a swath in all of the legume plots on June 21, Dan observed that weeds came up vigorously in the mowed swath of the hairy vetch plot, but less so in the chickling vetch swath. He noticed that the mowed alfalfa swath regrew slowly, "If it got to 8" we were lucky," Dan said.

Biomass measurements were taken in the chickling vetch, soybean, and hairy vetch plots during the growing season (See Greenbook 2004). At the first sampling (July 11), chickling vetch had produced significantly more biomass growth than soybean or hairy vetch (it is unknown whether replanting of the hairy vetch two weeks after the other crops contributed to its inferior performance in biomass generation). This data did not surprise University of

Minnesota Extension Educator Hans Kandel, who says that chickling vetch is known as a sprinter that starts fast, while hairy vetch starts more slowly and typically produces tremendous growth in August and September, after chickling vetch growth slows as it matures and sets seed. In Dan's experiment, chickling vetch contained statistically fewer weeds by weight than hairy vetch at the first sampling, but more weeds than soybean. By the second sampling in mid-August, biomass production of chickling vetch and soybean were statistically similar. Both produced more biomass than hairy vetch. Again, this finding may be due to the fact that hairy vetch was seeded two weeks later than chickling vetch and soybean and thus got a later start. In mid-August, there was no significant difference among the plots in terms of weed biomass.

#### 2004

Dan observed that chickling vetch "flushes" weeds as it grows. The first four or five weeks he noticed flushes of weeds he had not seen before. While weeds need managing, Dan believes that the fields will become cleaner each year. By early June he had some thistles coming around the plot. He sprayed concentrated vinegar to kill them. Even though the chickling vetch was a few feet away they were also injured. In a few days, the chickling vetch was curling back but because of the cool weather. The

vinegar did not kill the plants. It only set them back about ten days.

The chickling vetch did better than he had hoped in some fields. One field for seed was better than 4' to 5' tall. In another field, this vetch grew about 25" tall at one end of the field. Biomass measurements are reported in Table 1. After six to eight weeks of growth, Dan worked the crop under for the best nitrogen release. Planting in August to generate fall soil cover and nitrogen for the following spring is also an option. The crop usually kills at 18°-22° F.

#### Management Tips

1. Be sure to select the right inoculum for legumes because it is critical to formation of the nodules that fix nitrogen. "If you're not going to inoculate, don't plant it!" says Dan.
2. Plant chickling vetch at least six weeks before a hard frost and do not frost seed.
3. If growing chickling vetch for a hay crop or green manure, cut it the first or second week of bloom to a 3" stubble. Seeds are poisonous to livestock.
4. Chickling vetch currently costs about \$.50/lb for

**Table 1. Biomass Components During the 2003 and 2004 Growing Season**

	Sampling 8/12/03			Sampling 8/13/04			Combined 2003-2004		
Crop	Legume Fraction (lb/a)	Weed Fraction (lb/a)	Total Biomass (lb/a)	Legume Fraction (lb/a)	Weed Fraction (lb/a)	Total Biomass (lb/a)	Legume Fraction (lb/a)	Weed Fraction (lb/a)	Total Biomass (lb/a)
Alfalfa				3,457	597	4,054			
Chickling vetch	4,648	1,556	6,204	3,051	1,255	4,306	3,850	1,405	5,255
Hairy vetch	1,850	2,010	3,859	2,654	1,235	3,888	2,252	1,622	3,874
Soybean	4,190	772	4,962	2,141	1,919	4,060	3,165	1,346	4,511
Wheat				6,874	615	7,489			
LSD 0.10	1,397	N.S.	N.S.	1,147	N.S.	1,355	N.S.	N.S.	950

non-organic and \$.60/lb for organic seed and is seeded at approximately 60 lb/A.

### Cooperators

*Glen Borgerding, Consultant, Albany, MN*

*Hans Kandel, Extension Educator, Red Lake Falls, MN*

*David and Ida Kruze, Farmers, Flasher, ND*

### Project Location

From Red Lake Falls, go south on State Hwy. 32 approximately 3 miles. Go east on State Hwy. 92 for 6 miles, then turn south on County Hwy. 12 for 1 mile. At County Road 117 (gravel road), go east 1.5 miles. Plots are on the south side of the road across from a grove of trees.

### Other Resources

Comis, Don. 2002. Spray weeds with vinegar? ARS News and Information. United States Department of Agriculture. May 15. Available at:  
[www.ars.usda.gov/is/pr/2002/020515.htm](http://www.ars.usda.gov/is/pr/2002/020515.htm)

Kandel, Hans, and Dave LeGare. 2004. Cover crop evaluation in NW Minnesota. In On-farm cropping trials - Northwest and West Central Minnesota. University of Minnesota Extension Service, St. Paul, MN.



*Dan observes growth in one of the vetch plots.*

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## Project Duration

2002 to 2005

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## Keywords

cover crops,  
nitrogen  
cycling, organic  
production, rye  
(*Secale cereale*),  
soil erosion

# Use of Rye as a Cover Crop Prior to Soybean

## Project Summary

Currently, most of our crops across the state are planted in the spring and harvested in the fall. This practice provides less than ideal ecosystem functioning from late fall until spring. There is inefficient use of rainfall, solar radiation, and nutrient cycling. The result is loss of nutrients through leaching (especially nitrogen), and wind and water erosion of our soils. This project evaluated the use of a fall-planted rye cover crop prior to soybeans or corn in various cropping systems at five on-farm locations across the state (Moorhead, Lamberton, St. Peter, and two near Crookston).

## Project Description

At the five locations in 2002 and 2003, rye was planted in the fall into corn or small grain residue. The rye survived the winter and quickly put on additional biomass the following spring. Then in 2003 and 2004, either soybeans or corn were planted into the rye which was later killed by shredding, chopping, or herbicide. We monitored rye growth and development, soybean and corn growth and yield, and weed pressure.

The studies at the Anthony and Runck farms evaluated the rye variety Homil21 at two seeding rates using herbicides to control the rye growth. The studies at the other three farms involved organic production techniques and each evaluated two of the following three rye varieties: Rymin, Homil21, or Prima. All studies included control plots without rye.

*Organic soybeans  
and rye on the Robin  
Brekken farm,  
August 13, 2003.*

## Results

### 2002-2003

Rye varieties and seeding rates had relatively little influence on weed suppression. On one of the two conventional operations, a sizable soybean yield reduction occurred where rye was employed as a cover crop. This was probably due to extremely dry conditions at that location. The other conventional operation achieved soybean yields using rye that were comparable to winter fallow.

The three organic operations had varying degrees of success with their use of rye as a cover crop and weed control method. Soybean yields were higher in the rye cover crop system on two of the three organic farms.

### 2003-2004

#### *Anthony farm: Conventional operation in Nicollet County in south central Minnesota*

In the fall of 2003, the Anthonys planted rye following wheat harvest and a manure application containing 160 lb/A nitrogen. The manure was disk injected. The rye was broadcast-seeded on September 10 with a fertilizer spreader and incorporated with a tine harrow in a block 1/4 mile long. Part of the rye received a spring application of 28% liquid nitrogen at a rate of 30 lb N/A. A control rye strip received no nitrogen. There was also a no-rye strip with and without spring N, giving a total of four unreplicated treatments.



In late March, 2004 the rye was sprayed with Roundup. On April 7 the field was disked to incorporate the 6" tall rye. Corn was planted on April 24. At planting, all treatments received 10 lb N/A as 28% liquid nitrogen applied in the furrow. Despite very dry spring conditions, spring disking produced a very cloddy seedbed. Corn germination in the rye strips was low and non-uniform.

**Table 1. 2004 Corn Yield on Anthony Farm.**

Treatment	Yield (bu)/A	Grain Moisture (%)
No Rye plus Nitrogen	218	20.1
Rye plus Nitrogen	214	21.3
No Rye, No Nitrogen	201	20.2
Rye, No Nitrogen	198	21.5

The corn was harvested with a yield on October 15. Overall, yields were very good. The rye killed very slowly when Roundup was applied in late March. Weed control was excellent in all portions of the field.

These results support earlier research findings that, with proper management, a fall-planted rye cover crop can have a minimal impact on subsequent corn yield. It is important to work the rye under early in the spring and a supplemental nitrogen application may be necessary.

The Anthonys did not plant any rye in the fall of 2004, partly because they tilled the site this fall and partly because they had an adequate stand of volunteer peas for ground cover. An article on the Anthony's experience with rye cover cropping can be found in the November, 2004 issue of *The Farmer*.

***Runck farm: Conventional operation in Redwood County in southwest Minnesota***

Rye was drilled directly into corn residue in late October, 2003 with a 15' JD750 no-till drill on 7.5" row widths. Treatments included two rye seeding rates (1.25 and 2.5 bu/A) and a no-rye control strip. Each strip was 60' wide by 560' long and replicated three times. Rye growth was better than a year ago, partly due to the earlier planting date.

Soybeans were planted on May 7, 2004 with a 15' JD750 no-till drill on 7.5" row widths. The rye was killed with Roundup. Half the plots received one herbicide application on June 1. The other half received two herbicide applications: one on June 1 and one on July 1. The soybeans were harvested on October 9, 2004. Yields of each strip were recorded with a yield monitor. In general, this area experienced below normal temperatures from May through August which adversely affected soybean growth.

The results from the soybean harvest are difficult to interpret due to the effects of patches of standing water and non-uniform frost damage on August 20. However, it appears there was a reduction in soybean yield where rye was grown. Overall, the trial averaged only 30 bu/A, reflecting the influence of the abnormally cold growing season and early frost.

Leonard Runk could feel a difference in how hard the chisel plow pulled following soybean harvest. Plots with rye seemed to pull easier than the no rye checks. Leonard sees this as an advantage to the rye cover crop system. He feels there will be a fuel savings and a major difference in the wear and tear on the chisel plow points. Perhaps it is something to monitor more closely next fall. The study will be repeated in 2004-2005. An article on the Runck farm can be found in the November, 2004 issue of *The Farmer*.

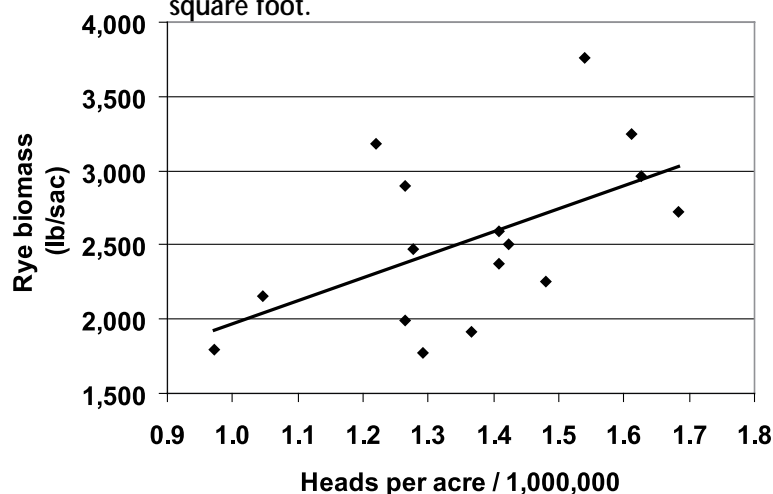
***Thomas farm: Organic operation in Clay County in west central Minnesota***

Lee Thomas planted two rye varieties (Homil21 and Prima) at 2 bu/A on September 16, 2003. Soybeans were planted on May 28, 2004 at 2.1 bu/A and a good rain immediately followed. The rye was 26" tall on that date. On June 13 the rye was sampled for aboveground biomass and for heads per acre. On that date the rye variety had no influence on biomass or heads per acre. The rye was at anthesis and had not yet been shredded. The Homil21 variety was slightly taller than Prima (44" vs. 42"). The soybean stand was not influenced by rye variety. However, overall soybean plant populations varied from under 100,000 plants/A to 220,000 plants/A. The rye was shredded on June 21. Field or hedge bindweed was an issue in poorly drained soil.

Lee's soybean yields were affected by an August 20 frost. Lee commented that there were very few 3-bean pods and the few pods present at the tops of plants were mostly empty. The soybeans yielded 15 bu/A and the rye yielded 2.0 bu/A at cleanout. Lee expressed surprise that the soybeans did as well as they did. He thought it looked like a greater percentage of rye than beans in the combine tank. Although initially not impressed with the soybean yield in rye, the 15 bu/A eventually proved respectable as the three fields planted on 22" rows without rye yielded 8, 10, and 20 bu/A.

One lesson Lee has learned is to make sure to be ready for fall rye planting. In fall 2004, Lee put off ordering seed until fall rains set in. Consequently he didn't plant any rye. However, Lee feels "it is definitely a good system that we will keep in our plan for future use." Lee is thinking of planting some rye in spring 2005, perhaps frost seeding it. He sees the fall-planted rye system working best on soils that are adequately drained, allowing for good rye and soybean growth.

**Figure 1.** Relationship between rye heads per acre and aboveground biomass. Samples were taken at the Thomas farm on June 13, 2004. One million heads per acre is approximately 23 heads per square foot.



***Brekken farm: Organic operation in Polk County in northwest Minnesota***

On September 1, 2003, Robin Brekken planted several fields to Prima variety rye at 2 bu/A. He planted seed he had saved from that summer's harvest. The spring of 2004 was generally cool, resulting in slow rye tillering and development. Robin started planting soybeans into the standing rye on June 8 and continued until June 16. This was later than desired due to inclement weather.

Robin was planning on cross-seeding the soybeans at 3 bu/A but on June 8, the rye growth stage was not yet at anthesis (pollen shed), and anthers were not present. In one field, Robin shredded the rye around a 120' border. When he began to drill the soybeans, it became obvious that the rye was not laying down as it had the previous year. He felt a second pass (cross-seeding) would not adequately cut up the rye residue. The reason for this was because the rye was less tillered, less lush, and shorter (40" tall at most).

The weather forecast for June 9 was for a 90% chance of rainfall over the next several days so Robin decided to try an alternative plan. Using a 60' floater, he broadcast seeded the soybeans at 3 bu/A on the soil surface into the standing rye. Then he came back across the field with a heavy duty, 60' Brandt harrow to work up the soil, lightly incorporate the soybeans, and set back the rye. The idea was that the soybeans would germinate with the coming rains. Of course, the predicted rains never came. The harrowing did not adequately set back the rye, so all of the rye was shredded. Robin decided he needed to guarantee a soybean stand, so on June 10 he drilled in an additional 1 bu/A.

At the June 23 field day, it was difficult to tell how well the soybean stand would turn out. By early August, it was evident the soybean stand was adequate for a good yield. The weed control in several rye cover crop fields was the cleanest Robin had ever experienced.

An unusual frost on August 20 severely impacted the soybean crop in the area. Robin's soybean yields averaged 6 bu/A and the rye screenings averaged 2 bu/A. His soybean yields were comparable to neighboring conventionally grown fields.

Robin has not given up on using rye as a cover crop. By mid-September, 2004 he had planted approximately 1,200 acres of rye. Robin and his wife Karen were named 2004 Outstanding Farm Conservationists for the State of Minnesota by the Minnesota Association of Soil and Water Conservation Districts. They received the award in part due to their cover crop work.

***Langlois farm: Organic operation in Red Lake and Polk Counties in northwest Minnesota***

In September, 2003, Bill Langlois seeded three fields (54, 40, and 19 acres) to the rye variety Prima at 2.5 bu/A. In June, 2004, he drilled 7.5" rows of soybean at 3 bu/A. Planting was delayed due to wet conditions. By June 24 the soybeans had imbibed moisture but had not yet germinated. The rye was past anthesis, but had not yet been mowed. The planter laid down 25% of the rye. In the 19 acre field, the rye plants averaged 58" tall and rye biomass was 5,040 lb/A.

Bill decided to shred the rye with a stalk chopper. It was a slow process due to the extensive rye biomass. Bill felt that the soybean growth and development was slow due to the large volume of shredded rye and wonders if he would have been better off just cutting the stems and laying them down.

The August 20 frost hit Bill's crops hard. Two of his three fields with rye and soybeans were 'zeroed-out' for insurance purposes and then worked down. The third field was on slightly lighter soil and was sheltered by adjacent trees. It produced a soybean yield of 13 bu/A. The rye harvested with the soybeans was not saved. A nearby organic field with the same soybean variety planted on 22" rows yielded 7 bu/A. It was perhaps hit worse by the frost "because the canopy wasn't there" compared to Bill's rye/soybean field.

After the 2004 experience, Bill still likes the system. In the fall of 2004, he planted 500 acres of rye. Half of this will be drilled with soybeans in the spring of 2005. The other half



will perhaps be allowed to grow to maturity both for seed and to sell. Bill will try to plant his soybeans in mid-May in the future, weather permitting.

Bill still has to deal with the issue of timing of 'rolling rocks' (packing the rocks back into the soil, usually done prior to planting rye or soybeans). Bill is unsure how rolling will impact the rye. Because of wet fall, 2004 conditions, he did not 'roll' the rye land.

## Summary

2004 was a difficult growing season because of the unusual weather. The wet cool spring and early summer resulted in slowed development and maturation of the rye, as well as slowed the development of the subsequent soybean or corn crop. In spite of this, when managed properly, the use of rye as a cover crop can be done with little to no yield reduction in the subsequent crop. The use of rye as a cover crop in both organic and conventional systems has numerous environmental benefits.

## Management Tips

1. Plant the rye as early in the fall as possible if maximum rye biomass is desired.
2. It is critical to have access to the proper equipment to drill soybeans into rye residue, to shred or mow the rye, and, if organic, to separate rye from soybean seeds. Narrow row, no-till drilling of soybeans is recommended over wide row soybeans.
3. When no-tilling soybeans into standing rye, increase the seeding rate to compensate for stand loss due to poor seed-to-soil contact.
4. For optimum weed control, do not incorporate the rye residue. Instead, plant no-till directly into rye or rye residue.
5. Mow the rye as close to pollen drop as possible. The later the rye is mowed, the less rye regrowth there will be.
6. Climatic conditions will determine the time of soybean planting and the management of the rye residue (both chemical and mechanical).
7. Early spring rye biomass is a function of fall weather conditions, fall planting date, soil fertility,

previous crop, and previous crop residue. Heading is largely influenced by day length and less dependent on fall planting date or early season biomass.

8. Cross seeding of soybeans appears to adequately chop up the rye residue, resulting in very little rye regrowth. This eliminates the need to shred the rye.
9. Rye variety selection and seeding rate are less important than the timeliness of the various agronomic operations.
10. When following a rye cover with corn, manage the rye with cultivation prior to elongation to reduce root clumps and rye regrowth.
11. The soybean seed harvested in this system was cleaner of dirt stains, an important consideration when growing food-grade soybeans.

## Project Locations

Contact Paul Porter for directions to cooperators' farms.

## Other Resources

Hyk, Deborah. September, 2003. Weed FREE! An ode to rye. New Farm. Available at: [www.newfarm.org](http://www.newfarm.org)

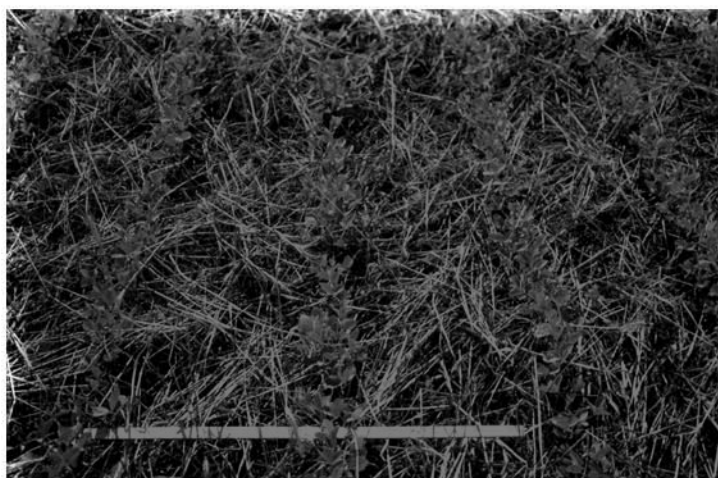
Hyk, Deborah. November, 2004. Study shows rye reduces nitrate loss. The Farmer, p. 14.

Minnesota Grown Opportunities web site:  
[www.mgo.umn.edu/crops/rye.htm](http://www.mgo.umn.edu/crops/rye.htm)

Purdue University – Dept. of Horticulture. Web site:  
[www.hort.purdue.edu/newcrop/afcm/rye.html](http://www.hort.purdue.edu/newcrop/afcm/rye.html)

University of California - Davis SAREP. General information on rye is available on the web at:  
[www.sarep.ucdavis.edu/cgi-bin/CCrop.exe/show\\_crop\\_12](http://www.sarep.ucdavis.edu/cgi-bin/CCrop.exe/show_crop_12)

*Soybeans in killed rye on the Anthony farm, July 1, 2003.*



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**Project Duration**

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**Keywords**

cattle, fertility,  
manure, weeds,  
wintering

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# How to Benefit from the Fertility of a Cattle Wintering Area Without Excessive Weed Pressure

**Project Summary**

In winter, livestock wintered on pasture spend much of their time close to water and shelter. The result can be compaction and weed pressure in these areas. This project tested the effects of tillage (conventional, deep, and rototilling) with and without 2,000 lb applied gypsum and biological mix, on the weediness of oat/legume ground following winter pasture.

**Project Description**

We have a 200 acre crop farm we converted to a legume/grass rotational grazing beef operation. We raise the animals from calving through finishing. Our farm is surrounded by land enrolled in the Conservation Reserve Program and windbreaks, and some acreage is fenced with 5-wire high tensile fence. We have a mile of 2" underground water line and ten water points, so by using energy-free fountains and portable windbreaks, we can have livestock anywhere on the farm in both summer and winter.

On 20 acres of pasture where we have been wintering about 100 animal units, the cattle have been very hard on the legume/grass mixture. The area gets covered with a great deal of manure and organic material. We

would like to use this area for organic crop production for two years before seeding it back to a legume grass pasture. We know we can expect heavy weed pressure in this high nutrient area while it is planted to crops.

We wanted to test several products approved for use in organic production – gypsum, which purports to neutralize the acid from the manure, and a biological mix of soil bacteria, Soil Restore<sup>1</sup>, liquid fish, molasses, and Chilean nitrate. This biological mix is supposed to stimulate soil bacteria to work on the organic nutrients and make them available to the plants. We believe the more good soil bacteria and the closer to a pH of 7 our soil is, the less negative weed germination and weed vigor we will have. We also wanted to try two different tillage techniques: deep tilling and rototilling.

We soil tested in the spring of 2004. The pH ranged from 6.6 in one field to 7.8 in the other (top 6"). Sulfur was 17 ppm and 16 ppm. We know that manure and urine are acidic and expect that the top inch of soil is much more acidic than the soil below, but we pulled a 6" soil test and did not test the top 1" separately. We plan to test the soils again in the spring of 2005.

*Don samples plots by hand at harvest time.*



**Table 1. Demonstration Treatments****Tillage Treatments**

1. Deep till (rip followed by rototill)
2. Rototill
3. Double disk (control)

**Product Treatments**

1. 2,000 lb/A gypsum
2. Biological mix (3 lb Chilean nitrate, 2 gal liquid fish, 2/3 gal molasses, 2 oz Soil Restore, and 2 oz soil bacteria per acre)
3. Control (no product added)

Treatments are summarized in Table 1.

We laid out our experiment in a split plot design (Figure 1). Main plots were tillage treatments. Sub plots were product treatments. For rototilling, we used a 100" Howard Rotovator at a depth of 4-5". For the deep till treatment, we used a seven shank ripper and removed three shanks, which left four shanks 30" apart. We used a 130 horsepower front wheel-assist tractor, ripping to a depth of 18-20" and followed with the Howard Rotovator.

We intended to plant corn for this demonstration, but due to delays in obtaining some of the products for testing, we changed to an oat/pea mixture that contained 60 lb/A organic "Jerry" oats and 15 lb/A forage peas.

We walked through the plots, randomly pausing in each area, to visually observe the number of weeds around our feet when the oats were 3" high, and repeated this procedure again when the oats were 12" tall.

At a public field day on September 25, we demonstrated making lacerated vacuum oat/pea silage and had the field divided up into the 30 plots for inspection. About 15 people attended the field day. We also made a short presentation about our demonstration at the Minnesota Organic and Grazing Conference.

At harvest, we took quality samples from the chopped forage in the wagon. We measured yield by hand sampling within the plots. We took samples from the gypsum, biological, and control treatments. Samples were analyzed by a laboratory in Sauk Centre, MN.

*Demonstration grantees like Don and Bev posted these signs on their farms.*

**Figure 1. Plot Layout**

NORTH					
Tillage Treatment 1 ↓	Tillage Treatment 2 ↓	Control Tillage ↓	Tillage Treatment 1 ↓	Tillage Treatment 2 ↓	
Deep Till	Rototill	Double Disk	Deep Till	Rototill	
<i>Gypsum</i>	<i>Gypsum</i>	<i>Gypsum</i>	<i>Gypsum</i>	<i>Gypsum</i>	
Deep Till	Rototill	Double Disk	Deep Till	Rototill	
<i>Biological</i>	<i>Biological</i>	<i>Biological</i>	<i>Biological</i>	<i>Biological</i>	
<b>W</b> Deep Till	Rototill	Double Disk	Deep Till	Rototill	<b>E</b>
<b>E</b> <i>Control</i>	<i>Control</i>	<i>Control</i>	<i>Control</i>	<i>Control</i>	<b>A</b>
<b>S</b> Deep Till	Rototill	Double Disk	Deep Till	Rototill	<b>S</b>
<b>T</b> <i>Gypsum</i>	<i>Gypsum</i>	<i>Gypsum</i>	<i>Gypsum</i>	<i>Gypsum</i>	<b>T</b>
Deep Till	Rototill	Double Disk	Deep Till	Rototill	
<i>Biological</i>	<i>Biological</i>	<i>Biological</i>	<i>Biological</i>	<i>Biological</i>	
Deep Till	Rototill	Double Disk	Deep Till	Rototill	
<i>Control</i>	<i>Control</i>	<i>Control</i>	<i>Control</i>	<i>Control</i>	
SOUTH					

**Table 2. Harvest Sample Data are from the Deep Till Plots**

	Moisture (%)	RFV	Weight (%) <sup>*</sup>	Yield (T/A)	Treatment Cost \$/A
Biological	81	94	140	8.4	\$10.00
Gypsum	72	85	120	7.2	\$68.00
Control	62	89	100	6	--

<sup>\*</sup> % of control treatment

## Results

Dry weather at and after planting resulted in a poor stand, especially in the disked (control) plots. Dry matter samples taken at harvest are summarized in Table 2.

We visually observed the biological activity in the soil. We estimated that there were 50% more earthworm castings in the biological amended areas than in the control, and 30% more earthworm castings in the gypsum areas than in the control. We anticipate those differences will grow in the gypsum areas over the next year or two.

When the oats were 3" tall, the weeds were very small and hard to find; many were just germinating, especially in the deep tillage and rototilled areas. At 12", there was no visual difference in weed pressure between the deep tillage and rototilled areas, but we observed about 25% more small weeds, such as lamb's-quarters, in the disked areas. Some of these weeds were competing with the oats.

At our field day, participants observed that there was less weed pressure in the biological treatment (perhaps due to denser foliage) and the most weed pressure in the control plots. Don wishes he had thought to walk diagonally through the plots using a "sward stick" that had a nail on the end. We would have noted the species of plant and its height closest to the nail every 10 to 20 paces. All in all, we were pleasantly surprised that even the control areas did not have the excessive weed pressure we expected from all that manure that had been deposited during the winter.

In general, the oats and peas looked very good over the whole field. There were no signs of N deficiency, but there was still much less lodging than in our neighbor's wheat (which we have noticed usually stands better) during some wind and rain. We didn't see any lines or lodging differences among our plots.

We will definitely use more of the biological mixture and believe that combining the biological mixture and gypsum might work even better. The gypsum could be applied at a lower rate and less often. We did three 2-3 acre paddocks that were not part of the demo plots that way, and they looked very good. The cattle loved the forage – both to graze and as silage. Palatability was not part of our demonstration, but may be something we will look at next.

We believe balancing the soil is important in effective weed control but still think that timely tillage is what really makes the field clean. We don't think we will use the deep till on a regular basis, but instead will use one rototill pass followed by several passes with a tine drag or a field cultivator. We will also continue to use the biological mixture.

## Management Tips

1. Lightly till a couple of weeks ahead of planting to stimulate weed germination.
2. Apply biological mixture.
3. Till before planting (must kill all weeds).
4. Lightly till after planting before weeds develop a competitive root system.

## Cooperator

*Doug Gunnink, Consultant, Gaylord, MN*

## Project Location

Farm is located 1.5 miles east of Milan on the north side of State Hwy. 40.

<sup>1</sup> Inclusion of a trade name does not imply endorsement of that product by the Minnesota Department of Agriculture, nor does exclusion imply nonapproval.

**Principal Investigator**

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**Project Duration**

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**Keywords**

gypsum, organic  
production, weed  
ecology

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# Gypsum Trial to Control Giant Ragweed

**Project Summary**

As organic farmers, we find weed control to be a continuing challenge. This is especially true for row crops. We plant corn after mid-May and soybeans the last week of May or the first week of June. We use a rotary hoe and/or a tine drag early after planting. We then use different types of row cultivators: a vibrashank, a Hiniker 5000 ridge-till cultivator, and a flame weeder in our corn. We rotate to alfalfa or forage sorghum so that weeds do not get the chance to set seed.

All of these tools are effective on many different weeds except giant ragweed. Due to its persistence in our cultivation system, we are forced to hand pull giant ragweed or, in some areas, mow the weeds and the crop. Consequently, we are always interested in new ideas on how to better control this weed.

I spoke with another organic grower who had used gypsum and felt that giant ragweed was not as dominant as it had been before he started using the product. Being organic, our weed control is cultural. If we can increase crop vigor and decrease weed vigor, we might better control the giant ragweed.

**Project Description**

My wife, Karen, and I operate a crop and dairy farm. We started by farming full-time with my parents, Ludwig and Julaine. Recently

our son, Wayne, joined us full-time after college graduation. Our son, Chris (a college Junior) and daughter, Jenny (a high school sophomore) along with my dad round out the work force. We started to farm organically in 1996 on about 60 acres. The rest of our land was certified in 2000. Our feed supply was organically certified for our dairy herd by September, 2002.

We decided to test for a gypsum effect on giant ragweed in a side by side trial for field corn production. We had several questions. What rates of gypsum could deliver the desired result? Could we measure changes in the soil? Is there an economic benefit to this treatment?

We chose a field that had been seeded the previous year to barley with an underseeding of red clover. We used a ripper with shanks spaced 30" apart to till on November 5, 2003. We then spread the gypsum on frozen ground in test strips on December 1 at two different rates (500 lb/A and 1,000 lb/A). The 40' wide test strips were replicated twice with an untreated 40' check between each treatment.

On April 15, soil tests were taken to see if any changes could be measured. We ran a standard test plus soil salts. The red clover had come on vigorously and was disked in on May 10. Primary tillage was done with a field cultivator on May 19 and field corn was planted on the

**Tom (center) explains his project design to visitors at a field day.**



same day. That is when our wet weather woes set in. We were able to drag the field on June 11 for weed control but weren't able to cultivate until June 21. In spite of the delay, weed control was acceptable. The field was cultivated again on July 9 with a Hiniker ridge-till cultivator. At that point in the season, the corn was tall, making it difficult to get through the rows.

On October 23, we hand picked the corn in the test strips for a yield comparison. We chose to use a hand picked comparison because of the extreme variability in the plots due to the wet conditions. The crop was harvested on November 14. Soil samples were taken again on November 18.

## Results

The growing season of 2004 was extremely wet. The main question we were interested in was if gypsum had an effect on giant ragweed. From our test I can't say yes or no. We had very good weed control throughout the plots. From our soil test in the spring we could see an increase in available calcium but that difference was less noticeable in the November test. Our corn yield results were also inconclusive.

One thing we learned is that the soil in a given field has great variability. The soil samples taken from our 38 acre field in April, 2003 contained low pH (5.9) and relatively low calcium levels. When we sampled the smaller area containing the test strips, within the same larger field, the pH (7.0) and calcium levels were much higher. Since the weed control was good in the test strips, for comparison I took soil samples from a different area of the same field that had more ragweed pressure and found much lower pH and calcium levels

We intend to continue experimenting with gypsum. In the future, we will try the comparison on low calcium, low pH, and low organic matter areas of the field.

## Management Tips

1. Try the comparison on a low calcium and or low organic matter area in the field.
2. Pay attention to patterns in weed pressure across the field and see if these patterns match up with differences in soil properties.

## Cooperators

*Jodi De Jong-Hughes, University of Minnesota, Marshall, MN*

*Brad Carlson, University of Minnesota Extension, Faribault, MN*

*Dee Miner, Minnesota Bio-Ag, Owatonna, MN*

## Project Location

From Owatonna, take Cty. Rd. 45 south to Cty. Rd. 26. Turn east and go 3.5 miles to the Dan Suchanek farm.

## Other Resources

M. Toma, M.E. Sumner, G. Weeks, and M. Saigusa. 1999. Long-term effects of gypsum on crop yield and subsoil chemical properties. *Soil Science Society of America Journal*. 63: 891-895.

**Table 1. Gypsum Trial: Corn Grain Yield on October 23, 2004**

Treatment	Moisture (%)	Yield (bu/A)	Avg. Yield (bu/A)
Control	29.9	95.5	91.8
	31.8	88.1	--
500 lb/A Gypsum	30.1	85.1	89.4
	32.7	93.8	--
1,000 lb/A Gypsum	29.8	89.3	93.8
	29.1	98.2	--

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**Project Duration**

2002 to 2004

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**Keywords**

forage yields,  
silvopasture,  
thinning,  
timber growth,  
understory,  
woodland grazing

# Raising Cattle and Timber for Profit: Making Informed Decisions about Woodland Grazing

**Project Summary**

Silvopasture is the intentional incorporation of trees into grazing systems. While grazing the woods is common, these woods can be degraded by the grazing and the timber is often unmanaged. We tested the effect of crop tree management (managing individual trees as a timber product) on the forage yields of grazed woodlands. We are not necessarily trying to encourage woodland grazing but instead to encourage management of grazed woodlands. We completed the project this year. During the first year, we quadrupled forage yield with no reduction in forage quality or protein levels by thinning the stand. During the second year, the forage production was nearly seven times as great from the thinned stands as from the unmanaged stands. We hope to follow-up on the trees in about ten years to see what impact this thinning had on tree value.

**Project Description**

Grazed woodlots are common in central Minnesota. Grazing can damage timber value, but this does not always appear to be the case. On Don Sirucek's farm in Cass County (a former dairy that is now a cow/calf operation), a demonstration/research project was established to see the impact of crop tree management of grazed woodlots on both forage yields and timber growth. During the two years after thinning, forage sampling

was conducted to assess the forage yields and quality. Because trees grow slowly, while initial conditions were assessed, the timber aspect will not be assessed for ten years. We are not specifically encouraging opening up new woodlots to grazing. Instead, we are determining if forest management can have the added benefit of higher forage yields and improved tree growth for stands that are already being grazed.

We initiated this project because over 800,000 acres of woodlands are being grazed in Minnesota (Loeffler et al. 2000). These grazed woodlands are often unmanaged for timber, resulting in both low yields of forage and reduced timber value. Management of grazed woodlots could potentially increase both forage and timber value. Economically, this can be beneficial, especially if the landowner has an outlet for the thinnings (like firewood or a small sawmill).

We compared forage yields and quality in woodlots managed under a crop tree system and woodlots that were unmanaged. We marked six plots: three as a crop tree thinning and three as controls. We took three forage samples from each plot in midsummer of 2002 (prior to treatment). The winter of 2002, the

*Mike marking  
woodland grazing plots.*



crop tree thinning was done. We took forage samples in July and September of 2003. Because the moisture coming into the season was low, early growth was somewhat delayed. However, we then received good moisture for a month followed by nearly no moisture for most of the remainder of the season. Weather is a very important factor in yield. In 2004, we were able to take samples three times (moisture conditions were better which resulted in more growth).

## Results

The first year (2002) we took initial forage samples as the plots were still being established. The yield of the standing crop of forage cut to 1" tall was an average of 292 lb/A with a range from 155 to 532 lb/A. This yield was significantly higher than expected. However, this included a significant amount of indigestible material such as ferns on two of the plots where there was very limited grass.

We observed that the sites that have not been grazed have a completely different group of plant species in the understory. While samples from the ungrazed area had higher yields, the forage was of limited palatability because of the presence of more ferns and woody vegetation. And, interestingly, it appeared to be less diverse (primarily hazel and ferns) than the grazed areas, although we cannot tell for sure because of the small number of samples we took in the ungrazed area.

Forage in the grazed plots primarily consisted of forbs and cool season grasses. The forbs varied, but included hog peanut (more than half of volume), some spring ephemerals (wild flowers), and small *Rubus* (raspberry and dewberry). The grasses/grass-like plants consisted of Canada blue-joint, Kentucky bluegrass, and some sedges. Ferns were a main component in both the thinned and control plots, but they were an overall minor component because they dry down to very low weights.

In 2003, the total forage yield for the year was 735 lb/A for the thinned plot and 172 lb/A for the control plot. The early season cutting was 473 lb/A for the thinned plot and 131 lb/A for the control plot. The late season cutting was 262 lb/A for thinned plot and 41 lb/A for the control plot.

*After crop tree management, canopy is more open, allowing more light for better forage.*

Early season relative feed value and protein levels were good but not significantly different between treatments. The relative feed value for the early season samples for the thinned plot was 140 and 114 for the control. Protein was 15% for the thinned and 10% for the control. The early season thinned forage made Grade 1 forage.

Fall relative feed value was different with 132 for the thinned plot and 62 for the control. Protein levels were similar to the early season results.

Because the moisture coming into the season was low, early growth was somewhat delayed. However, we received good moisture for a month followed by nearly no moisture for most of the remainder of the season.

Due to a very small sample size for the control woods, the samples had to be pooled to get enough to do forage analysis. These numbers must be understood to be just for this year which was very dry.

The first cutting in 2004 was on June 24. The thinned plots produced 733 lb/A of forage while the unthinned plots produced only 97 lb/A. Protein (13% for both) and feed value (145 and 154, respectively) were both high and not significantly different. For the second cutting (August 28), the thinned plots produced 457 lb/A of forage while the unthinned plots produced only 77 lb/A. Once again the protein (13% for both) and feed value (121 and 128, respectively) were similar. For the last cutting (October 16), the thinned plots produced 75 lb/A of forage while the unthinned plots produced less than 11 lb/A. Protein (10% and 7%, respectively) and feed value (104 and 113, respectively) were similar and obviously low. For 2004, overall production was 1,266 lb/A for the thinned plots and 185 lb/A for the unthinned plots.





This data can be looked at in two ways. Either it does not yield much to graze an unthinned woodlot or that you should thin the woodlot if you are going to graze it. By thinning the overstory, the amount of forage available for grazing is greatly increased.

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## Management Tips

1. BUGS - As most people know, Minnesota has more than its share of biting insects. However, while cattle seem to enjoy a few trees around, a woodlot that is dense with trees can be pretty dense with biting insects. Opening the site up might reduce the vengefulness of the insect attack. The cattle seem to shy away from the woods during the periods that are heavy with biting insects.
2. Thinning the overstory more than quadrupled yield of forage.
3. Removing some trees from the stand increases the growth of the ones that remain. If you leave really good ones (crop trees) and take out the bad ones (culls), the wood that is growing on the site is going onto the best trees. These trees get more and more valuable each year.

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## Cooperators

*Rick Schossow, Soil Conservation Technician, Natural Resources Conservation Service, Walker, MN*  
*Howard Moechnig, Grazing Lands Conservationist, Natural Resources Conservation Service, Rochester, MN*  
*Don Sirucek, Farmer, Staples, MN*

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## Project Location

Plots are located off of State Route 64 north of Motley. For more information on specific locations, call the Brainerd Regional Extension Center at 218-828-2273.

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## Other Resources

Agroforestry Center in Missouri has a video and several publications on silvopasture.  
Available at: <http://agebb.missouri.edu/umca/>

National Agroforestry Center web site has information on silvopasture.  
Available at: [www.unl.edu/nac/silvopasture.html](http://www.unl.edu/nac/silvopasture.html)

Raising Cattle and Timber for Profit: Making Informed Decisions about Woodland Grazing. 2004. Minnesota Extension Service Bulletin FO-08128.  
Order at:  
[www.extension.umn.edu/catalog/item.html?item=08128](http://www.extension.umn.edu/catalog/item.html?item=08128)  
Call 612-625-8173 or 800-876-8636.

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**Project Duration**

2002 to 2004

**Staff Contact**

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**Keywords**

annualized profits,  
carcass data, feed  
consumption,  
finishing hogs,  
hoop barns, rate of  
gain, rate of return  
on investment,  
slatted barns

# Performance Comparison of Hoop Barns vs. Slatted Barns

**Project Summary**

There is a lack of information about performance of hogs in hoop barns vs. slatted finishing barns in northern climates. This project split groups of finisher pigs into two groups, about half going into hoops and the other half into slatted finishing barns. Each group was weighed going into the finishing units. Feed consumption and days on feed were tracked. The feed conversion, rate of gain, and carcass data of the two groups were compared. By comparing the dollars received in each system with the dollars spent to build each building, we computed the profit of each building and dollars returned to the operator.

**Project Description**

My wife, Judith, and I farm 500 acres nine miles southwest of Preston in southeast Minnesota. We live in country that has rolling terrain that is dominated by Fayette soil. We rotate corn, soybeans, and alfalfa in a minimum tillage system. We finish 2,600 hogs and have 20 beef cows. Jud and I are the main labor source; we do hire part-time help during spring planting and fall harvest seasons.

We have information from Iowa State University about the performance of hogs in hoop barns vs. slatted barns but our winters are more severe here than in central Iowa. We need hard data on performance of pigs split into two groups; one in

hoops and one in slats. We know that hoop barns cost less to build but we need to see if the savings transfer this far north.

We planned to divide groups of about 500 single source pigs into two groups – one subgroup into the hoop barn and the other into the slatted barn. This was an attempt to limit as many variables as possible from the study. We had a three-year contract for a single source of early weaned pigs prior to entering this study. The person on the other side of the contract decided to break the contract, so the first group was a different source than later groups but with the same genetics. After the problem with our source, eight neighbors formed a limited liability partnership and we purchased sows of the same genetics to supply all of us from the same farrowing unit. Since we now own the sows, there will be no change in the source.

Each group was weighed going into the barns with food consumption and days on feed tracked for the time they were in the barns. After slaughter, we calculated feed conversion and rate of gain, and also compared carcass data. At the end of the three year project, we calculated three year averages for rate of gain, feed conversion, days on feed, value of carcass in each system, and dollars returned per dollars spent in each system.

***Kent with pigs in slatted barn.***



**Table 1. Comparison of Five Groups of Finishing Hogs in a Hoop Barn and in a Slatted Barn**

	Hoop Barn					Slatted Barn				
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 1	Group 2	Group 3	Group 4	Group 5
Date In	3//02	9//02	5//03	12/03	5/04	3/02	9/02	5/03	12/03	5/04
Avg. Daily Gain (lb)	1.50	1.67	1.46	1.53	1.84	1.65	1.54	1.58	1.52	1.68
Lb Feed/Lb Gain (lb)	2.90	2.61	3.26	3.12	2.60	2.53	2.61	2.98	3.11	2.98
Feed Costs/Head (\$)	29.46	35.58	39.04	38.17	41.42	27.88	36.05	33.75	40.96	49.66
Profit/Head (\$)	13.66	15.22	( 1.31)	23.53	26.51	26.99	17.56	2.85	31.13	19.24
% Death Loss	3.4	4.4	5.2	5.7	3.0*	2.1	5.5	5.6	10.4	13.6*
Avg. Carcass Wt (lb)	192	199	190	189	207	196	204	189	193	209
Avg. Backfat	0.97	0.96	0.87	0.89	1.0	1.01	0.89	0.93	0.83	0.97
Rate of Return on Investment (%)	NA	59.13	(4.16)	31.39	132.8	NA	18.63	3.70	33.58	18.53

\* Pigs in Group 5 had about 14% death loss when losses in the nursery and finishers were combined. Pigs in the slatted barn group were moved to the finisher early and death loss continued from the nursery. Those pigs in the hoop finisher experienced most death losses in the nursery, which were not reported in this table.

## Results

We have had five turns of the finishers at this point. Even after three years, it might still be too early to make any definitive conclusions about the two systems. A flare up of PRRS (Porcine Reproductive and Respiratory Syndrome) in the sow herd that supplies our finishing barns could have affected the pigs in the study. The close-outs from the comparison of finishers from the five groups showed that the pigs in the slatted barn outperformed the pigs in the hoop barn for two groups, the hoops outperformed the slatted barn for two groups, and performance was poor in both barns for one group. Some of the close-out data is shown in Table 1. The rate of return on investment calculation is another way of comparing financial performance of the two systems.

After the first group, we refined the software program that we use to track pig performance. We added rate of return on investment, annualized profits, and barn turn over rate.

The hoop structure is a good place to use the straw created from the nurse crop for alfalfa. Prior to construction of the hoop barn, using the straw was a problem. We are very happy that we decided to pour concrete side walls instead of using tongue and groove lumber. These are much more durable when you clean the barn and pigs cannot damage concrete by chewing on it the way they might damage wood. We made our own forms which made the cost comparable to wood walls.

We encountered a number of health issues during this project. With the disease problems we experienced in 2003, I wondered if I was leaving disease behind when I

cleaned the bedding out of the hoop barns in the winter, or if the manure pack heated up enough to kill disease organisms. With the slatted floor finisher, we power wash when we move a group of pigs out, leaving little chance that disease organisms survive. In 2004, the last group of pigs we put in the nursery in March arrived with Strep. They responded well to antibiotics but all the pigs became sick again a few weeks later when PRRS showed up. We began to experience large death losses in the nursery so we moved half of the pigs to the slatted finishing barn earlier than planned to give all the pigs more room. Death losses continued there totaling about 14% between the nursery and the finisher. The rest of the pigs were moved to the hoop finisher two weeks later. This group also experienced about a 14% death loss with most of that occurring in the nursery which was not reported in Table 1.

Another possible disadvantage to the hoop barns is the stress put on animals being moved from the nursery to the hoop barn when there are wide temperature differences. We had a 30°F temperature swing in 24 hr when one group was scheduled to move to the hoop barn. We delayed moving them until the temperature had moderated. I have also decided not to use “cold confinement” systems in January and February because of gates freezing down and the stress on small pigs started during the coldest part of the winter.

One problem to be aware of is that slatted finisher barns are fully insurable for wind and fire damage. Hoop barns are not insurable for wind but are insurable for fire. There is, however, greater risk of suffocation in slatted finishers and it can be costly to insure against that.

## Management Tips

1. The hoop barn is a good place to use up the oat straw created from the nurse crop for alfalfa.
2. To avoid stressing the pigs, consider waiting to move pigs from the nursery to hoop barns if the weather is bad and there are wide temperature differences.
3. Consider pouring concrete for the side walls. It is much more durable when you clean the barn.
4. Make the notch at the top of the wall 2" by 8" at a minimum but 3" by 10" would be best for air flow. We used a 2" by 6" and found that the tarp covered too much of the slot, reducing airflow.
5. I am convinced that I could have saved money on the hoop structure by not putting in the side rollup vents. I didn't need them where I have the barn. You may want to include them if you are in a valley or surrounded by trees where airflow is a problem.
6. Use 5' round bales or 6'square bales for bedding. One person can roll these sizes without using a loader in the hoop barn. This size square bale rolls just as easily as the round bale.

*Consider poured  
concrete side walls for  
hoop buildings.*



## Cooperators

*Wayne Pike, Riverland Community College, Leroy, MN*  
*Doug Frodl, Riverland Community College, Austin, MN*

## Project Location

From Harmony go west on Hwy. 44 for 7 miles. Turn right on Cty. Rd. 15 and go 2.25 miles. Turn left on Cty. Rd. 20 and the farm is the first farm on the left.

## Other Resources

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

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

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**Project  
Duration**  
  
2004

**Staff Contact**

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**Keywords**

Boer goats, goats,  
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parasite

*This organic  
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Assistance  
Partnership  
Program.  
USDA-RMA and  
the Minnesota  
Department of  
Agriculture are  
equal opportunity  
providers.*

# Natural/Organic Alternatives for Parasite Control in Meat Goats

**Project Summary**

This project tested the effectiveness of various organically approved methods to control parasites in meat goats, including herbal, microbial, and nutritional strategies. Goals included: 1) boosting natural immunity to minimize parasite loads; 2) recording overall health condition during testing to verify changes; and 3) determining what effect parasite load has on reproduction.

**Project Description**

We farm 80 acres organically in Western Minnesota growing corn, soybeans, small grains, and alfalfa. We also raise South African Boer goats and Omega-3 laying hens, and operate a certified organic flour mill on our farm. Mark works off the farm as a tool and die maker. Wendy manages the farm full time.

Internal parasites are a major problem in raising goats. We wanted to do this project because in searching for ways to reduce chemicals on our land and chemical exposure for ourselves and our neighbors, we found few natural or organic-approved synthetic parasite control alternatives for goats. We don't like working with chemical wormer – it burns our eyes and we're afraid that if we get it on us, we may absorb it into our own skin. Plus, the animals don't like it and we've always felt bad forcing them to consume it. Alternatives to chemical parasite control

would be a great benefit to our environment, to other producers interested in maintaining healthful and chemical-free products, and to the organic community in general by giving producers a method of parasite control that has been tested in our area.

Our goal was to research ways we can boost the natural immunity of our herd to minimize the parasite load to a level that is no longer a health threat to our animals and to test the effectiveness of herbal and/or natural products on reducing parasite loads. Chemical dewormers are expensive and only control parasites. If we could find a natural way to control parasites and bring our animals to optimum health at the same time, it would be a great economic benefit to producers like us.

We began the study in March, 2004 and continued it until December, 2004. An initial consultation with Kathleen Head, DVM was done at the beginning of the project to evaluate our herd. At this time we took fecal samples to determine base parasite levels. During the course of our yearlong demonstration grant project, we attempted to keep our herd in optimum nutritional condition, rotate pastures to minimize parasite infestation, and use herbal and/or natural products to see their effects on Strongyle (an intestinal worm) and Coccidia (a protozoan) parasite loads. The goats were all on a sound nutritional program with hay and grain fed at appropriate times as needed and as the seasons changed. In order

**Table 1. Experimental Treatments**

Treatment group	Description
A) Control	No additional treatments other than hay, pasture, and minerals
B) Microbials Fastrack® by Conklin Company Inc.	Oral microbials, hay, pasture, and minerals
C) Hoegger Herbal Wormer and Hoegger Tonic by Hoegger Goat Supply	Herbal wormer and tonic, hay, pasture, and minerals
D) Intestinal Cleanser by Crystal Creek*	Intestinal cleanser, hay, pasture and minerals

*\* Discontinued by the manufacturer.  
Note: Inclusion of a trade name does not imply endorsement of that product by the Minnesota Department of Agriculture, nor does exclusion imply nonapproval*

**Table 2. Test Results**

Date	Group	Run 1 Results	Run 2 Results
4/5/04	(Quick run to check the loads before the experimental groups were separated)		
	1	+2 Strongyle +1 Coccidia	+1 Strongyle
	2	+1 Strongyle	Negative
5/28/04	A	+1 Coccidia	+1 Coccidia
	B	Negative	+1 Strongyle +1 Coccidia
	C	+2 Strongyle	+2 Strongyle +1 Coccidia
	D	+1 Strongyle	+1 Strongyle
6/18/04	A	+1 Coccidia +1 Strongyle	Negative
	B	+1 Coccidia	+2 Coccidia
	C	+1 Coccidia +1 Strongyle	Negative
	D	+1 Coccidia +1 Strongyle	Negative
7/15/04	A	+1 Coccidia +1 Strongyle	+1 Coccidia +1 Strongyle
	B	+2 Strongyle +1 Coccidia	+1 Strongyle +1 Coccidia
	C	+1 Coccidia +1 Strongyle	+1 Coccidia +1 Strongyle
	D	+2 Strongyle	+2 Strongyle
	D-1	+1 Coccidia +1 Strongyle	+1 Strongyle
8/23/04	A	+1 Coccidia +1 Strongyle	+1 Coccidia
	B	+2 Coccidia +1 Strongyle	+1 Coccidia +1 Strongyle
	C	+1 Coccidia +1 Strongyle	+1 Coccidia
	D	+1 Coccidia +1 Strongyle	+1 Coccidia
9/17/04	A	+1 Strongyle	+1 Strongyle +1 Coccidia
	B	+1 Strongyle +1 Coccidia	+1 Strongyle
	C	+1 Strongyle +1 Coccidia	+1 Strongyle +1 Coccidia
	D	+1 Strongyle +1 Coccidia	+2 Strongyle +1 Coccidia
11/9/04	A	+1 Strongyle	+1 Strongyle +1 Coccidia
	B	+1 Strongyle	+1 Strongyle
	C	+1 Strongyle	+1 Strongyle
	D	+1 Strongyle +1 Coccidia	+1 Strongyle

+1= 1-10 eggs per slide low power - considered safe and normal

+2= 5-10 eggs per field low power - careful monitoring indicated

+3= 10-50 eggs per field low power - treatment indicated

+4= too numerous to count per field

\* Test repeated on Group D one week later

**Table 3. Product Cost**

Product	Per dose cost	Doses/animal/year	Cost/animal/year
Fastrack®	\$0.15	365	\$54.75
Herbal Wormer*	\$0.07	52	\$3.64
Herbal Tonic*	\$0.14	52	\$7.28
Para-Tack**	\$0.36	4	\$1.44
Ivomec® Drench	\$0.66	4	\$2.64

\* Herbal Wormer and Herbal Tonic may be used together or separately.

\*\* Although not tested in the study, this product is manufactured by the same company as Intestinal Cleanser.  
Note: Dose price can be affected by the quantity of product purchased.

to minimize parasite infestation, we planned to rotationally graze all does during the summer months, resting each pasture section for 30-days after it had been grazed.

The does were split into four treatment groups of 25 animals each (Table 1). Microbials were chosen as one of the treatments because of their claim to increase overall general health of the intestinal tract. Herbal wormer was chosen for its claim to control and keep parasite loads down to safe numbers. Intestinal Cleanser<sup>1</sup> was also chosen for its claim to support optimum performance in goats and to keep parasite levels at safe loads.

To administer the treatments, we measured the same amount of grain for each of the test groups in a five gallon pail, then added the treatment product along with 1/3 cup liquid molasses. We mixed each pail with a stirring stick and fed the mixture to the goats in feed bunks. We used plenty of bunk space so they all could have room to eat.

Fecal samples were tested monthly for all four groups of does. We kept detailed records of fecal sample results and our own visual observations throughout the testing period. We were committed to using conventional chemical de-wormer if at any time during this project time frame testing showed parasite levels were dangerous for any does.

We held a fall field day to share the findings of our study up to that point. Dr. Kathleen Head gave participants a hands-on look at how fecal samples are prepared and participants viewed different parasites under the microscope. Parasite topics and questions were discussed and answered by Dr. Head. The group then took a pasture walk with Bill Head, also with the veterinary service, leading the discussion. A lot of useful information was exchanged at the field day event.

## Results

During our testing period, a number of factors affected our results. All of our test groups remained at relatively low parasite loads throughout the testing period, therefore, no one treatment seemed to stand out as working better than the others (Table 2). We speculate that the low levels may have been due to factors such as cooler than average weather (cooler year keeps parasite larvae counts down). Constant patrolling by the free-ranging chickens in the barnyard may also have kept the parasite egg and larvae numbers down. Additionally, our goat herd may have had a stronger resistance already built up to parasites since the herd had very low parasite levels at the beginning of our study.

Although fecal testing indicated little to no difference in parasite load among groups, we did notice visual differences in the test groups. Group A (control group) lost

weight, so we had to supplement this group with additional grain/hay starting in mid-August. All of the other test groups gained weight and we observed that they looked very healthy with improved body condition and healthier hair coat starting as soon as the second month of testing. Also, the groups receiving treatments showed better growth and general appearance in their kids. We treated two goats (one from Group A and one from Group B) with Ivomec® Drench once each during the project with a chemical de-wormer because they showed strong visual evidence of having high parasite loads and the risk to them appeared to be quite high. We may weigh the goats in April, 2005 (a year after the study began) to see if there are differences among the treatment groups.

While we grazed all four groups on pasture, it was not in a true rotational grazing fashion. We found it very hard to get the animals in our four groups to stay separated, so we had to alter that part of our demonstration plan. Omitting the 30-day rest between grazing cycles should have actually increased the parasite loads because not breaking the larval cycle should have increased the possibility of larval infestation in the pastures.

This demonstration had an environmental benefit for our farm, as all but two animals in our herd have not received a synthetic chemical de-wormer since December, 2003. We were still very pleased with the study and even though we had to use chemical treatment on two goats, we feel that is a dramatic improvement over past chemical treatment. We also learned more about sampling and detecting parasites and can now use these skills to make treatment decisions that reduce our risk of losing animals.

The costs of various treatment options are detailed in Table 3. Chemical wormers can range from \$1.00 to \$2.64 or more per goat per year. Natural products cost from \$1.00/goat/year and up, depending on volume and number of goats you are treating. Other factors that we find very important are the benefits to us and our environment that are hard to put a price on. Also, labor involved in administering natural vs. chemical products varies greatly. There is no need to handle each goat with the natural products because they are put into their grain ration mixed with liquid molasses. By contrast, with chemical treatment, a producer has to physically handle each goat approximately four times each year to administer the product.

Dr. Head was surprised that the level of parasites stayed relatively the same throughout the test groups. The weather was a huge factor that helped keep the load levels low because it was not hot and humid. Dr. Head also thought the herd's resistance was higher than is typical. She would like to have seen us carry out the testing for another year to compare with some different circumstances such as the

weather, longer term effects, and better overall statistics from a longer testing period.

## What's Next?

There is a need for studies like ours. We have encountered many producers who are also interested in finding alternatives to parasite control. We will continue to do work in this area and share what we have learned with anyone interested in our findings.

More research is definitely needed in this area to further develop data that is relevant to our region. We have been encouraged to continue this project for another year by repeating the study with goats put into another randomly selected group. In this case, the rotational grazing aspect of this study would have to be altered to be more practical. We plan to divide our goats into two groups for ease of management and will continue using one of the natural products. We will conduct fecal sampling every three months and observe goats carefully for any visible signs of heavy parasite loads.

We will keep reproduction records on the herd during the May, 2005 kidding season to evaluate whether the supplements or parasite levels had any effect on the does' conception/reproductive rates for the different test groups. If results show any indications that parasites in goats can be controlled or altered by any of the methods we've used in this study, we have achieved what we set out to do. Further testing can then be done to enhance or improve what we have started with this project. We will continue using alternative methods on our farm because we observe them to be a health benefit to us and our livestock.

We intend to share information and work with other producers and organizations throughout this project and beyond. There is little information on alternative parasite control in meat goats done in the Upper Midwest Region. We feel that with the major emphasis being the overall nutritional health of goats along with natural supplements to enhance their internal operations, this project could bring some interesting results that could benefit many. Receiving this organic demonstration grant enabled us to lessen the economic risk involved in testing the efficacy of different strategies and products.

## Management Tips

1. Use a calendar to schedule treatments and fecal testing – it will help you stay on a routine program.
2. Be observant to the visual condition of your goats at all times – they speak loud and clear to you if you are listening.

## Cooperators

*Amy Bacigalupo, Farm Beginnings/Land Stewardship Project, Montevideo, MN*

*Bill Head, H & H Veterinary Service, Benson, MN*

*Kathleen Head, DVM, H & H Veterinary Service, Benson, MN*

*Guy Jodarski, DVM, Crystal Creek, Inc., Trego, WI*

## Project Location

From Montevideo, go 9 miles north on Hwy. 29, then 3 miles west on Chippewa Cty. Rd. 12. Farm site is on north side of Cty. Rd. 12.

<sup>1</sup> *Intestinal Cleanser has been discontinued by the manufacturer and is no longer available.*



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**Project Duration**

2002 to 2004

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**Keywords**

daily rate of gain,  
deep bedding,  
feed consumption,  
hoop barn  
nursery, one-pen  
system

# Using a 24' x 48' Deep Bedded Hoop Barn for Nursery Age Pigs

**Project Summary**

This project was an on-farm study to see how nursery age pigs gain and interact in a deep bedded hoop barn. The amount of bedding, the temperatures inside and outside of the hoop barn, the manure pack temperatures, the feed consumed, and daily rate of gain were monitored.

**Project Description**

We currently farm over 700 acres with Trent's parents. The majority of the acres is in a corn and soybean rotation with some alfalfa acreage and occasionally oats for feed and bedding. We practice conservation tillage. We raise butcher chickens, cattle, bull calves, and had raised Berkshire-cross hogs in a farrow-to-finish operation. During this project we had 42 sows divided into three groups of 16, 14, and 12. We will no longer be raising pigs because of allergies the entire family developed.

Our initial nursery building was a self-contained liquid manure confinement barn. With this building deteriorating, we decided to move away from a liquid manure system and built a 24' by 48' nursery hoop barn with a deep bedded system. We made some modifications to better control drafts when the barn is used as a nursery. We replaced the tarp ends with steel salvaged from the confinement nursery barn we tore down. We enclosed the "half moons" at the top of the barn that are traditionally left open in a finisher hoop barn. In the nursery setting, these could cause drafts on nursery age pigs. We also put an Accutrack door on the barn instead of the traditional roll-up tarp door because this door can be dropped from the top down to provide fresh air but keep a direct breeze off of the pigs.

The move to hoop buildings provided several advantages. Our whole family has allergies and we wanted to get away from the dust that was associated with our old nursery building and move to a more natural ventilation building. The hoop building also helps us to be a more environment- and neighbor-friendly hog farm. With non-farming neighbors and East Sunburg Lake within 500' of our building site, we wanted to get away from liquid manure. A hoop barn has many uses: farrowing, nursery, grower, or as a finisher building.

We did notice a big improvement in our allergies when working in this type of building compared to our old confinement barn. Unfortunately, we just cannot tolerate the dust associated with pigs any longer. The hoop barn still fits into our farm's future because it can be used for many other purposes. We plan to use it for hay and machinery storage, for cattle, and for a training arena to prepare show animals for the local fair.

In this project we studied how nursery age pigs gained weight and interacted in a deep bedded hoop barn. We used the hoop barn as a nursery in all seasons of the year. The amount of bedding, temperatures inside and outside of the building, manure pack temperatures, feed consumption, and daily rate of gain were monitored.

*Trent and son, Jonah  
in front of hoop barn.*



**Table 1. Results from Two Groups of Pigs in Hoop Barn, 2002**

	<b>Group 1</b>	<b>Group 2</b>
Date Entered Barn	May 11	July 16-20
Number of Pigs In	84	97
Initial Pig Wt Range	10 to 50 lb	23 to 51 lb
Days in Barn	41	96
Daily Wt Gain - Range	.73 to 1.58 lb/day	.99 to 1.74 lb/day
Final Pig Wt Range	40 to 115 lb	118 to 218 lb
Number of Pigs Out	84	97
Feed/Head	150 lb	354 lb
Bedding Used (Bales)	3 – 1,000 lb round 5 – 40 lb square	7 – 1,000 lb round 30 – 40 lb square
Labor	23.25 hr	54.5 hr

## Results

### 2002

Two groups of hogs were put in the hoop barn in 2002. Table 1 shows the dates, numbers, weights, feed, and labor involved with both groups. Before moving the first group of hogs into the nursery, we spread out one and a half round bales, leaving the other half for the hogs to explore. Approximately two weeks later, another round bale was added and we manually bedded when and where needed, leaving the rest of the bale for them to forage/destroy themselves. All pigs in the first group were brought into the hoop on the same day. We did a little experiment with the second group, putting hogs in the building over three different days to see how they behaved with split mingling. We were very pleased as they did not fight or single out any pig to pick on. The natural environment of foraging, digging, and burrowing seems to keep them quite active and content.

During the hotter months, the temperatures inside the hoop barn were 5°F warmer than the outside temperatures. When the outside temperatures became cooler, the inside temperatures averaged 11°F warmer than the outside temperatures. The manure pack temperatures usually ranged 40 to 60°F warmer than the barn temperature.

We were quite pleased with the hoop barn after our first year. We did not have a single death among either of the two groups that used the barn. The one-pen system is a nice change.

### 2003

Three groups of pigs used the hoop barns beginning in February. Table 2 shows the dates, numbers, weights, feed, bedding, and labor involved with all three groups. We followed the same routine of spreading bedding as we used last year.

Table 2 shows the rate of gain and feed efficiency was better when the weather was warmer outside. Smaller pigs in particular had a better rate of gain in the July group (.98 lb/day) than in either the February (.73 lb/day) or May (.82 lb/day) groups.

When the first group was moved out of the barn in late March, we did not clean out the barn before moving the next group in. We wanted to see if leaving the manure pack affected the next batch of pigs. We did clean the cement slab and any heavily manured spots. As a precaution, the second group of pigs received a water soluble wormer after they were moved in. We did not experience any problems with doing this except, of course, there was more manure to remove after the second group!

We had problems with the second and third groups digging through the bedding into the gravel and dirt. The digging mixed the gravel/clay into the bedding material and a lot of gravel was hauled out when we removed the manure pack. Gravel was added to the floor of the barn after each of these groups. We don't know why the pigs did this because there was plenty of straw bedding each time. The addition of "toys" such as barrels and old tires reduced the digging a bit.

Differences between indoor and outdoor temperatures were the same as last year. With the manure pack being 40 to 60°F warmer than the barn air temperature, the pigs keeping their sleeping areas dry and cuddling together or up against the round bales, we have not used supplemental heat, calf hutches or extra tarps during either year of our project. We

**Table 2. Results from Three Groups of Pigs in Hoop Barn, 2003**

	<b>Group 1</b>	<b>Group 2</b>	<b>Group 3</b>
Date Entered Barn	February 16	May 6	August 17
Number of Pigs In	76	80	103
Initial Pig Wt Range	18 to 59 lb	7.5 to 30 lb	7.5 to 33 lb
Days in Barn	36	51	50
Daily Wt Gain Range	.75 to 1.58 lb/day	.82 to 1.6 lb/day	.98 to 1.69 lb/day
Final Pig Wt Range	45 to 116 lb	49.5 to 112 lb	56.5 to 117.5 lb
Number of Pigs Out	75	80	101
Feed/Head	153 lb	217 lb	142 lb
Bedding Used (Bales)	5 – 1,000 lb round 6 – 40 lb square	6 – 1,000 lb round 0 – 40 lb square	1 – 1,000 lb round 84 – 40 lb square
Labor	22 hr	29 hr	37.5 hr

**Table 3. Results from Two Groups of Pigs in Hoop Barn, 2004**

	<b>Group 1</b>	<b>Group 2</b>
Date Entered Barn	November 19	February 27
Number of Pigs In	71	101
Initial Pig Wt Range	15 to 48 lb	9 to 35 lb
Days in Barn	32	56
Daily Wt Gain - Range	.78 to 1.56 lb/day	.71 to 1.25 lb/day
Final Pig Wt Range	40 to 101 lb	49 to 111 lb
Number of Pigs Out	69	
Feed/Head	156 lb	159 lb
Bedding Used (Bales)	4 – 1,000 lb round	7 – 1,000 lb round
Labor	19 hr	35 hr

kept the doors closed during the coldest days but opened doors from the top to allow more air circulation on average days. During warm weather, doors are opened from the bottom and left open most of the time.

## 2004

Three groups of pigs used the hoop barns beginning in November, 2003. Table 3 shows the dates, numbers, weights, feed, bedding, and labor involved for two of the groups. When we decided that we were getting out of pigs because of our allergies, we began culling the sow herd. Our final group of 41 pigs was put in the barn on July 7. They were sold in separate groups to Hmong customers who liked pigs at lighter weights. These pigs gained well with a range of 1.11 to 1.82 lb/day.

There was a lot of digging into the clay pack with Group 1. We cleaned the cement slab often and leveled the high spots of the manure pack as needed. We did not clean out the barn between Groups 1 and 2, worming Group 2 twice as a prevention strategy. We ordered a load of clay after both Groups 2 and 3.

Overall, we were very pleased with the hoop barn as a nursery. With the modifications we made, we never had to supplement heat during the cold weather. The pigs would burrow into the bedding where it was warm. During hot weather, they laid on the cool cement slab or in the dirtier parts of the manure pack. Death losses were minimal. We did not set up a separate pen for the runts and, even though the runts did not catch up to the larger pigs, they seemed to be much more active and healthy than what we used to see in our old confinement barn. The more natural environment of the straw bedded system provided opportunity for the

pigs to forage, dig, and explore. Fighting was also reduced compared to our old confinement barn. Because we used a hoop building for a nursery, the pigs adjusted more easily to the finishing hoop barn because it was the same layout only bigger.

There were several challenges and things we would change. Loading pigs out of a hoop barn was always a challenge. We used as many gates as possible to limit the amount of maneuvering rooms the pigs had. If we had this to do over, we would change the vent doors on the barn. We made hinged, treated plywood doors with latches along both sides, thinking that we would open these doors for better air circulation on hot and humid days. With the manure pack and nosy pigs, opening the doors wasn't a good idea and we never used them.

While we will not continue raising pigs, we would recommend this system to others. Hoops are very economical and healthy for animals and people.

## Management Tips

1. During the winter, bed the floor of the barn immediately after cleaning to maintain ground heat. If the weather is warm, let the wet spots dry out first before moving bedding into the barn and moving the next group in.
2. Use plenty of bedding so the pigs can burrow without digging in the ground. If they still dig, add "toys" such as old tires or plastic barrels.
3. Do not use corn stalk bales for bedding in a nursery hoop in the winter. Corn stalks do not provide heat. They work fine the rest of the year.
4. Do not be afraid to keep the current manure pack if it is not too dirty or hasn't gotten too deep. You might want to worm as a precaution.
5. Bi-fold doors are a good investment. You can drop the doors from the top to provide fresh air without allowing a direct breeze on the pigs. Also, use steel for the end walls and enclose the "half moons" for a nursery facility.

## Cooperators

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

*Steve Stassen, Farmer, Kerkhoven, MN*

## Project Location

Farm is located 2 miles south of Sunburg on Hwy. 104 in the northeast corner of the intersection with Cty. Rd. 40.

## Other Resources

Appropriate Technology Transfer for Rural Areas (ATTRA). PO Box 3657, Fayetteville, AR 72702, 800-346-9140. Available at: [www.attra.org](http://www.attra.org)  
Provides assistance and resources free of charge to farmers and other ag professionals.

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

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

*Small nursery pigs in August.*



# New Demonstration Grant Projects - 2005

## Alternative Markets and Specialty Crops

### ***Gardening with the Three Sisters: Sustainable Production of Traditional Foods***

Winona LaDuke  
White Earth Land Recovery Project  
32033 East Round Lake Rd.  
Ponsford, MN 56575  
218-573-3448  
welrp@unitelc.com  
Becker County  
2 years

The objectives of this project are to establish Three Sisters gardens in communities throughout the White Earth Reservation; increase production and availability of our traditional foods for members of our community and for regional markets; educate our community in traditional, sustainable agriculture; and weatherize our existing community greenhouses and equip them with passive solar water heaters.

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

Dean Current – Center for Integration of Natural Resources and Agricultural Management  
University of Minnesota  
115 Green Hall  
1530 Cleveland Ave.  
St. Paul, MN 55108-6112  
612-624-4299  
curre002@umn.edu  
St. Louis County  
3 years

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

## Fruits and Vegetables

### ***Apple Scab Control Project***

Rick Kluzak  
Wild Fruits Farm, LLC  
34432 Teal Ave.  
Taylors Falls, MN 55084  
651-583-3411  
sales@wild-fruits.com  
Chisago County  
3 years

The objectives of this project are to reduce apple scab; reduce potential ascospore dose; reduce applications of fungicide sulphur; and improve organic business profitability. We will track degree days and leaf wetness for timed application of sulphur sprays for apple scab control.

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

Patrick Lynch  
3944 Iresfeld Ave. NW  
Maple Lake, MN 55358  
320-963-6554  
OrganicBreezyHill@Yahoo.Com  
Wright County  
3 years

We will compare three types of weed barriers against traditional hand weeding while maintaining an emphasis on organic practices and soil nutrition. We will also focus on developing commercial organic asparagus production while maintaining a healthy soil and environment.

### ***Developing a Saskatoon Berry Market in Minnesota***

Patricia Altrichter and Judy Heiling  
4176 - 230<sup>th</sup> St.  
Randall, MN 56475  
320-749-2154  
ronpat@littlefalls.net  
Morrison County  
3 years

We will establish a permanent Saskatoon berry patch for additional farm profit with minimal labor and chemical inputs. Our project will determine if Saskatoon berries could be profitably grown in MN; determine which varieties are best suited to MN markets and growing conditions; determine the sustainability of Saskatoons as a crop that requires low inputs of chemicals, fertilizer and labor; and develop a market in MN for fresh and/or processed Saskatoon berries.

### ***Four Season Production in a Northern Climate Greenhouse***

Charles Knierim  
7073 Nickel Rd.  
Breezy Point, MN 56472  
218-562-4864  
info@wildrosefarm.com  
Crow Wing County  
3 years

Organic fresh herbs and produce will be grown in a permanent, energy efficient greenhouse. It will share the heat from a biomass heat source with the farmhouse, and carbon dioxide from a flock of chickens. Greenhouses have not been economically feasible in cold climates because of the high cost of heat. Our proposal is to run a greenhouse built to use heat efficiently, and grow produce year-round for local use.

### ***Cropping Systems and Soil Fertility***

#### ***Feasibility of Winter Wheat Following Soybeans in Northwest Minnesota***

Dr. J. Wiersma  
University of Minnesota  
Northwest Research and Outreach Center  
2900 University Ave.  
Crookston, MN 56716  
218-281-8629  
wiers002@umn.edu  
Polk and Red Lake Counties  
1 year

The project will evaluate the feasibility of a soybean-winter wheat rotation in northwest Minnesota and determine the effect of a no-till drill system on the potential for winterkill of varieties that differ in winter hardiness in winter wheat following soybeans.

#### ***Field Windbreak/Living Snow Fence Yield Assessment***

Gary Wyatt  
University of Minnesota - Extension Regional Center  
1961 Premeir Dr., Ste. 148  
Mankato, MN 56001-5901  
507-389-6748  
wyatt@umn.edu  
Watonwan County  
3 years

This project will use modern technology (yield monitors/GPS) to update 1960 USDA research on the crop yield effects of field windbreaks and living snow fences established as conservation practices in crop fields; analyze woody plantings such as shrubs and trees as well as native

grass plantings in the field; record yields on both sides of the plantings; and look at whether yield data may vary over the three year period based on winter snows and summer rains.

### ***Livestock***

#### ***Managing Hoops and Bedding and Sorting Without Extra Labor***

Steve Stassen  
1105 - 140<sup>th</sup> Ave. SE  
Kerkhoven, MN 56252  
320-264-5932  
SteveStassen@tds.net  
Swift County  
2 years

The objectives of this project are to bed hogs in hoop barns using only one person; sort hogs in a hoop barn with two people or less; minimize stress on hogs; and develop a self-sorting system for the hogs.

#### ***Comparison of Alternate Breeds of Laying Hens***

Suzanne Peterson  
35294 Nature Rd.  
Foley, MN 56329  
320-355-2980  
azariahsue@yahoo.com  
Morrison County  
3 years

This project will compare cost of production of eggs among breeds of laying hens; compare customer preferences for egg color, shape, and size; and determine the feasibility of alternate breeds based on their longevity.

# Completed Grant Projects...

Final Greenbook Article	Title of Project	Grantee
<b>Livestock Grants</b>		
<b>2005</b>	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
<b>2004</b>	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
<b>2003</b>	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
	Programmable Approach to Pasture Renovation for Cell Grazing . . . . .	Daniel Persons
	Adding Value for the Small Producers via Natural Production Methods and Direct Marketing. . . . .	Pete Schilling
	Grazing Beef Cattle as a Sustainable Agriculture Product in Riparian Areas. . . . .	Frank & Cathy Schiefelbein
<b>2002</b>	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
	First and Second year Grazers in a Year Round Pasture Setting Served by a Frost Free Water System . . . . .	Don & Dan Struxness
<b>2001</b>	Low Input Conversion of CRP Land to a High Profitability Management Intensive Grazing and Haying System . . . . .	Dan & Cara Miller

Final Greenbook Article	Title of Project	Grantee
	Reviving and Enhancing Soils for Maximizing Performance of Pastures and Livestock . . . . .	Doug Rathke & Connie Karstens
	Whole System Management vs. Enterprise Management. . . . .	Dennis Rabe
	Working Prairie – Roots of the Past Sustaining the Future . . . . .	John & Leila Arndt
<b>2000</b>	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
<b>1999</b>	Deep Straw Bedding Swine Finishing System Utilizing Hoop Buildings . . . . .	Mark & Nancy Moulton
	Extending the Grazing Season with the use of Forage Brassicas, Grazing Corn and Silage Clamps. . . . .	Jon Luhman
	Home on the Range Chicken Collaborative Project . . . . .	Sustainable Farming Association of SE MN
	Hoop Houses and Pastures for Mainstream Hog Producers . . . . .	Josh & Cindy Van Der Pol
	Management Intensive Grazing Groups . . . . .	Dave Stish
	Renovation of River Bottom Pasture . . . . .	Jon Peterson
	The Values Added Graziers: Building Relationships, Community and Soil. . . . .	Values Added Graziers
<b>1998</b>	Buffalo: Animal From the Past, Key to the Future . . . . .	Richard & Carolyn Brobjerg
	Marketing Development - Small Farm Strategies Project . . . . .	Sustainable Farming Association of NE MN
	Pastured Poultry Production and Riparian Area Management . . . . .	Todd Lein
<b>1997</b>	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



Final Greenbook Article	Title of Project	Grantee
<b>1996</b>	Dairy Waste Management Through Intensive Cell Grazing of Dairy Cattle . . . . .	Scott Gaudette
	Establishing Trees in Paddocks . . . . .	Dave & Diane Serfling
	Evaluating Pasture Quality and Quantity to Improve Management Skills . . . . .	Land Stewardship Project
	Expanding into Outdoor Hog Production . . . . .	James Van Der Pol
	Grazing Length: Season Length and Productivity . . . . .	Doug & Ann Balow
<b>1995</b>	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
<b>1994</b>	Economics of Rotational Grazing vs. Row Crops. . . . .	Harold Tilstra
<b>1993</b>	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 Rodgers
<b>1992</b>	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

## Cropping Systems

<b>2005</b>	Chickling Vetch – A New Green Manure Crop and Organic Control of Canada Thistle in NW MN . . . . .	Dan Juneau
	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
<b>2004</b>	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

Final Greenbook Article	Title of Project	Grantee
	Native Perennial Grass – Illinois Bundleflower Mixtures for Forage and Biofuel . . . . .	Craig Sheaffer
	Woolly Cupgrass Research . . . . .	Leo Seykora
	Yield and Feeding Value of Annual Crops Planted for Emergency Forage . . . . .	Marcia Endres
<b>2003</b>	Aerial Seeding of Winter Rye into No-till Corn and Soybeans . . . . .	Ray Rauenhorst
	Replacing Open Tile Intakes with Rock Inlets in Faribault County . . . . .	Faribault County SWCD/Shane Johnson
	Soil Conservation of Canning Crop Fields . . . . .	Andy Hart
	Northwest Minnesota Compost Demonstration . . . . .	John Schmidt & Russ Severson
	Potassium Rate Trial on an Established Grass/Legume Pasture: Determining Economic Rates for Grazing/Haying Systems. . . . .	Dan & Cara Miller
<b>2002</b>	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
	Increased Forage Production Through Control of Water Runoff and Nutrient Recycling . . . . .	James Sovell
<b>2001</b>	Biological Control of Alfalfa Blotch Leafminer . . . . .	George Heimpel
	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
	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
<b>2000</b>	Forage Mixture Performance . . . . .	Itasca County SWCD
	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
<b>1999</b>	CRP in a Crop Rotation Program . . . . .	Jaime DeRosier
	Evaluating Kura Clover for Long-term Persistence . . . . .	Bob & Patty Durovec
	Inter-seeding Hairy Vetch in Sunflower and Corn . . . . .	Red Lake County Extension
	Timing Cultivation to Reduce Herbicide Use in Ridge-till Soybeans. . . . .	Ed Huseby

Final Greenbook Article	Title of Project	Grantee
1998	Sustainable Agriculture in Schools . . . . .	Toivola-Meadowlands School
1996	Biological vs. Conventional Crop Systems Demonstration . . . . .	Gary Wyatt
	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 Vosejпка
1995	Annual Medics: Cover Crops for Nitrogen Sources. . . . .	Craig C. 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
	Reducing Soil Insecticide Use on Corn Through Integrated Pest Management . . . . .	Ken Ostlie
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
	Early Tall Oat and Soybean Double Crop . . . . .	Charles D. Weber
	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
	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
	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

## Manure & Nutrient Management

2003	Dairy Manure Application Methods and Nutrient Loss From Alfalfa . . . . .	Neil C. Hansen
	Manure Spreader Calibration Demonstration and Nutrient Management. . . . .	Jim Straskowski
	Using Liquid Hog Manure as Starter Fertilizer and Maximizing Nutrients from Heavily Bedded Swine Manure . . . . .	Dakota County SWCD/Brad Becker
2002	Agricultural Use of Rock Fines as a Sustainable Soil Amendment. . . . .	Carl Rosen

Final Greenbook Article	Title of Project	Grantee
	Evaluation of Dairy Manure Application Methods and Nutrient Loss from Alfalfa . . . . .	Stearns County SWCD
	Turkey Litter: More is Not Always Better . . . . .	Meierhofer Farms
	Land Application of Mortality Compost to Improve Soil and Water Quality . . . . .	Neil C. Hansen
<b>2001</b>	Applying Manure to Corn at Agronomic Rates . . . . .	Tim Becket & Jeremy Geske/Dakota County Extension & SWCD
	Managing Dairy Manure Nutrients in a Recycling Compost Program . . . . .	Norman & Sallie Volkmann
	Using Nutrient Balances to Benefit Farmers and the Environment . . . . .	Mark Muller/IATP
<b>1999</b>	The Winona Farm Compost Strategies . . . . .	Richard J. Gallien
<b>1998</b>	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
<b>1997</b>	Converting from a Corn-Soybean to a Corn-Soybean-Oat-Alfalfa Rotation . . . . .	Eugene Bakko
	Manure Application on Ridge-till: Fall vs. Spring . . . . .	Dwight Ault
<b>1996</b>	Building Soil Humus Without Animal Manures . . . . .	Gerry Wass
	Controlled Microbial Composting to Improve Soil Fertility . . . . .	Howard & Mable Brelje
<b>1995</b>	Manure Management/Utilization Demonstration . . . . .	Timothy Arlt
	Taconite as a Soil Amendment . . . . .	Donald E. Anderson
<b>1993</b>	Cooperative Manure Composting Demonstration and Experiment . . . . .	Rich Vander Ziel
	NITRO Alfalfa, Hog Manure, and Urea as Nitrogen Sources in a Small Grain, Corn, Soybean Crop Rotation . . . . .	Carmen M. Fernholz
<b>1992</b>	Economically and Environmentally Sound Management of Livestock Waste . . . . .	Fred G. Bergsrud
	Soil Building and Maintenance . . . . .	Larry H. Olson
	Strip-cropping Legumes with Specialty Crops for Low-cost Mulching and Reduced Fertilizer/Herbicide Inputs . . . . .	Mark Zumwinkle

## Alternative Markets & Specialty Crops

<b>2005</b>	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
	Organic Strawberry Production in Minnesota . . . . .	Brian Wilson & Laura Kangas
<b>2004</b>	Collaborative Character Wood Production and Marketing Project . . . . .	Cooperative Development Services/Isaac Nadeau
	Creating Consumer Demand for Sustainable Squash with Labels and Education . . . . .	Gary Pahl

Final Greenbook Article	Title of Project	Grantee
	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
	Research and Demonstration Gardens for New Immigrant Farmers . . . . .	Nigatu Tadesse
<b>2003</b>	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
	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
<b>2002</b>	Development and Continuation of a Community Based Sustainable Organic Grower's Cooperative and Marketing System . . . . .	Patty Dease
	Flame Burning for Weed Control and Renovation with Strawberries. . . . .	David Wildung
	Increasing Red Clover Seed Production by Saturation of Pollinators. . . . .	Leland Buchholz
	Integrating Livestock Profitably into a Fruit and Vegetable Operation . . . . .	David & Lise Abazs
	Propagation of Native Grasses and Wildflowers for Seed Production . . . . .	Joshua Zeithamer
	Soil Ecology and Managed Soil Surfaces . . . . .	Peter Seim & Bruce Bacon
	Value Adding to Small Farms Through Processing Excess Production . . . . .	Jeffrey & Mary Adelman
<b>2001</b>	Bio-based Weed Control in Strawberries Using Sheep Wool Mulch, Canola Mulch and Canola Green Manure. . . . .	Emily Hoover
	Cover Crops and Living Mulch for Strawberry Establishment. . . . .	Joe Riehle
	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
	Sustainable Weed Control in a Commercial Vineyard . . . . .	Catherine Friend & Melissa Peteler
<b>2000</b>	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
<b>1999</b>	An Alternative Management System in an Organic, Community Supported Market. . . . .	Candace Mullen
	Cultural and Management Techniques for Buckwheat Production and Marketing . . . . .	Tom Bilek

Final Greenbook Article	Title of Project	Grantee
	Development of Mating Disruption and Mass Trapping Strategy for Apple Leafminer . . . . .	Bernard & Rosanne Buehler
	Pond Production of Yellow Perch . . . . .	John Reynolds
<b>1998</b>	Alternative Point Sources of Water . . . . .	Joseph & Mary Routh
	Comparison of Alternative and Conventional Management of Carrot Aster Leafhoppers . . . . .	MN Fruit & Vegetable Growers Association
	Establishing and Maintaining Warm Season Grasses (Native Grasses) . . . .	Pope County SWCD
	Jessenland Organic Fruits Project . . . . .	MN New Country School
	On-farm Forest Utilization & Processing Demonstrations . . . . .	Hiawatha Valley RC&D
	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
<b>1997</b>	Community Shared Agriculture and Season Extension for Northern MN . . .	John Fisher-Merritt
	Living Mulch, Organic Mulch, Bare Ground Comparison . . . . .	Dan & Gilda Gieske
<b>1995</b>	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
<b>1992</b>	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 Guenther
	Mechanical Mulching of Tree Seedlings . . . . .	Timothy & Susan Gossman
	Minnesota Integrated Pest Management Apple Project . . . . .	John Jacobson

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# Reflections from the Big Woods Dairy

## *Written by the Brossard Family*

“Mom!” said four year old Seth from behind the handlebars of his two-wheeler. “When we move, can we take the driveway with us?”

It seems that as we near the end of the ten year lease we signed with the State of Minnesota and the Nerstrand Big Woods State Park everything is focusing on the end. The end of the demonstration farm we started here. The end of the tours we’ve become semi-famous for. The end of the newspaper publicity. But this also seems like an appropriate time to talk about the beginnings we’ve had here and the beginnings we’re taking with us. When we started here, in the winter of 1996, we had a new baby and a kindergartner. Now we have a teenager, Amber, a nine year old, Trent, a four year old, Seth, and Evan, a two year old. But more than a growing family, we’ve learned so much from this farm. And, I suppose, we’ve made many mistakes.

We use an intensive rotational grazing system on our farm. We have 80 acres that we rent from the State Park and we have another 40 that we rent from neighbors. On that 120 acres, we have a system of paddocks set up that range in size between about 3 and 5 acres each. Every day from sometime in April to sometime in November, we send the cows out to a different paddock. All 60 milk cows leave the barn after being milked and go out to a different section of grass each time. There they eat about 120 lb of the special grasses, drink a whole bathtub of water from our watering system, and spread the fertilizer for us. Our calves are raised in an individual calf hutch for two months, then put out to graze also. We have about 60 head of young stock to come into our herd when they calve at about two years old.

Our farm is a demonstration farm. Because of that fact, we have put a lot of time and energy, as have many of the experts from the Department of Natural Resources, the Department of Agriculture, and the Nature Conservancy, into trying to learn from this ten year experiment. We wanted to learn what the environmental impacts of our grazing set-up were besides what grazing had to offer in terms of family and economic health. We set-up our lease to include the monitoring of many things, public tours, and to set-up a base that made us like any other farmer paying rent and trying to make a living as farmers. That made it an open-ended experiment with the opportunity to learn so much.

## Monitoring

1. Our family had to learn to become **Birdwatchers**. We would go out in the morning two times each summer to monitor the numbers and kinds of birds we have on our farm. With lots of help of course from people who actually knew what they were doing, we would stand in the same spots on the farm to listen and watch for birds. We

## *Phil and Dawn in front of the Five Star Dairy Award sign.*



*Amber, Trent, Seth, and Evan*

would record how many of each species we heard each time. Because we grazed our cattle, we have a continuous groundcover to offer the grassland birds. And the cattle periodically walk through the grazing grounds to stir up plenty of bugs to feed them. The theory is that we will have a significantly larger number of birds on our farm at the end of this ten year period than we had at the beginning.

2. The next thing our family was to learn about was **Frogs and Toads**. As anyone who watches the news is aware, frogs and toads are a good environmental indicator because they absorb water through their skin. That being said, the frogs and toads feel the effects of the ground and water pollution quickly. We used frog and toad counts from the neighboring Big Woods State Park to help us prove the theory that having continuous ground cover and using no chemicals on our land will benefit the populations of these species. As a bonus, our kids would catch a tank full of eggs and watch the amazing transformation from egg to frog every spring.

3. Who would have ever thought that we could simulate the rain? A rainfall simulator was brought on our farm and placed to measure how much **Soil Erosion** there was on our grazing land. A similar experiment was done on neighboring row cropland and results were compared. As expected, there was considerably less rain erosion from our grazing system than there was in the row crop system.

4. As part of cow feed management, Phil closely monitors **Pasture Health**. Daily, we walk through our rotational grazing paddocks to determine how much area to give the cows to eat. The amounts and kinds of grasses are also monitored to determine if the cows are getting the right feed to produce milk. We plant a new pasture mix as needed. At the present time, we are using a mix that includes perennial ryegrass, Alice white clover, annual ryegrass, orchardgrass, alfalfa, red clover, and timothy. This fall, we received an award qualifying us as a “Five Star Dairy.” We had to meet specifications in five environmental areas including air, water, and soil quality. It was an honor to be one of 50 Five Star Dairies in the state of Minnesota.

5. We have many resources that we utilize to help us monitor the **Economics** of our farm. With the help of the Farm Business classes available through South Central Technical College, we learned each year what our mistakes were and where we made money. This was a prosperous year, as far as farming goes. This meant that we were able to update a few things on our farm to try to make things a bit more time efficient and maybe to allow for more family time off of the farm.

6. **Herd Health** is a big one for us. Again, we use many resources to help us monitor this. Our veterinary bills are very minimal because our cows are under a minimum amount of stress in this grazing system. They spend their days through most of three seasons outside laying on the soft grasses where they have a constant feed supply. They have to walk to the barn and back twice each day and they don’t need to lay on the hard cement. We do not use any hormones (BST) and expect our cows to have a longer life expectancy than most. We have successful pregnancy rates and our average cow gave us 18,000 pounds of milk last year.

7. **Lifestyle and Family Living** is a more difficult thing to measure. Dairy farming, even with a grazing system, is a 24 hour a day job. The cows need to be milked and fed twice a day, at the same times each day. There are no weekends away without extensive pre-planning and much worry. However, on the other side of that, we never have to send our kids to day care. We’re always together. Our family works together each day and we all have responsibilities. Farming is not just a job; it’s a lifestyle that the entire family must be willing to accept.



## Public Tours and Open Houses

We've worked hard to "perfect" our **Tours**. We went from rainy afternoon tours to what seems to be the most informative and best learning opportunity available. Our open house tours now take place during the summer starting at Chore Time. Visitors are invited to come to help us get the cows from the pasture, move the fence for the night's grazing, feed calves, milk the cows, and learn about the technical aspects of the dairy farm. We try to offer a petting zoo with as many animals as we can get and free milkshakes from Hastings Creamery, where we sell our milk. This year's open house was June 4, 2005 at evening milking time.

We have two growing seasons left on our lease and will leave this farm with the knowledge of what has worked for us here. We will continue to dairy in a rotational grazing system supplementing feed as necessary with a Total Mixed Ration of corn silage, hay, and a grain mix. But we're ready to milk in a parlor set-up instead of in a tie stall barn for the efficiency because we will need to increase our herd size to afford to buy land at the prices they are at now. We've found the pasture mix that works well for us and have perfected the sizes of paddocks we need.

And while we have to leave the picturesque creeks and the beautiful woods in our extended backyard, we take the memories of the kids all muddy from playing in those creeks and wandering through the woods. So we prepare to take our cows and milking equipment and move on. But a part of our hearts will remain at the Big Woods where we got our start.



*Amber, Trent, Seth, and Evan  
playing with a new calf.*

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# Integrated Pest Management (IPM) Program

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

## Fruit and Vegetable IPM

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

The newsletter is a multi-disciplinary approach to disseminating IPM strategies, educating producers, communicating timely pest pressure and control information to growers, and providing feedback information for use in prioritizing basic research. The newsletter is published weekly from May through August. Reports are posted on the U of MN and MDA web sites on Fridays. The newsletter can be found at:  
[www.mda.state.mn.us/biocon/fruitreports](http://www.mda.state.mn.us/biocon/fruitreports)

In 2003, the United States Environmental Protection Agency (US EPA) funded the production of four MDA fruit publications. These include: *Field Guide for Identification of Pest Insects, Diseases, and Beneficial Organisms in MN Apple Orchard*; *Integrated Pest Management Manual for MN Apple Orchard*; *Field Guide for Identification of Pest Insects, Diseases, and Beneficial Organisms*

*in MN Strawberry Field*; and, *Integrated Pest Management Manual for MN Strawberry Fields*. The *Minnesota Fruit and Vegetable IPM News*, the manuals, and other fruit IPM information can be found at:  
[www.mda.state.mn.us/biocon/fruitipm.html](http://www.mda.state.mn.us/biocon/fruitipm.html)

In 2004 and 2005, using the previously funded fruit publications listed above, the US EPA provided follow up funding to implement an Apple and Strawberry IPM Project. The MDA has consultants working with five apple and five strawberry growers on the identification of major fruit pests and the use of IPM techniques to enhance pest management practices.

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## School IPM and IPM for Kids

The MDA has a set of IPM fact sheets for schools. They include: School Integrated Pest Management - What Is It?; Ant Management in Schools; Cockroach Management in Schools; Head Lice Management in Schools and Home; Landscape Insect Management on School Grounds; Nuisance Invader Management in Schools; Silverfish and Firebrat Management in Schools; Small Fly Management in Schools; Wasp and Bee Management Around Schools; Broadleaf Weed Management on School Grounds and Athletic Fields; Grassy Weed Management on School Grounds and Athletic Fields; Weed Management on School Grounds and Athletic Fields; Diagnosing Plant Disease on School Grounds; Preventing Plant Disease on School Grounds; Rat and Mouse Management in Schools; and, Management of Pesticides. A fact sheet, "Cockroaches in Your Home," is also available. All fact sheets are available at:  
[www.mda.state.mn.us/ipm/ipmpubs.html](http://www.mda.state.mn.us/ipm/ipmpubs.html)

Another item is "Join Our Pest Patrol - A Backyard Activity Book for Kids - An Adventure in IPM." The book and the

companion “Teacher Guide” are for use by third and fourth grade teachers. It includes many fun activities and is available at: [www.mda.state.mn.us/ipm/IPMPubs.html](http://www.mda.state.mn.us/ipm/IPMPubs.html)

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### Weed IPM Program

The MDA Weed IPM Program staff performs statewide weed surveys of cropland and noncropland weeds as a tool to assist land managers with the control of economically and ecologically damaging weeds. In addition, staff members work with local cooperators to release weed biological control agents and evaluate the impacts of weed biological control on leafy spurge and spotted knapweed.

To improve the methodologies for tracking and recording weed distribution, emergence, and shifts in weed types over time, staff members have developed a mobile global positioning system/geographic information system (GPS/GIS) procedure for mapping important weeds throughout the state. The Weed IPM Program’s goal is to have a system that will effectively update existing weed databases with survey data on noxious and problematic weed species. Both the cropland and noncropland surveys are intended to provide more insight for land managers into where major weed infestations occur and the abundance of weeds in those areas. More information on the survey will be available in the near future. Additional information on weed IPM can be found at: [www.mda.state.mn.us/weedcontrol](http://www.mda.state.mn.us/weedcontrol)

In addition to the very successful leafy spurge biocontrol program, the Weed IPM staff is increasing activity in the spotted knapweed program. Staff will be conducting intensive research studies at spotted knapweed biological control sites to assess the impacts that biological control agents are having on this aggressive weed species. Both leafy spurge and spotted knapweed release sites, along with site characteristics, are being mapped using GIS technology. This information will allow both state and local cooperators to better manage future biocontrol agent harvests and releases, as well as to monitor control effectiveness.

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### Weed IPM Working Group

A multi-agency Weed IPM Working Group was formed as a result of the 1996 IPM on State Lands Plan. The MDA works cooperatively with the MN Department of Natural Resources as co-chairs of the group. The Working Group developed the “*Thicket!*”, a newsletter for integrated weed management in Minnesota. It is published in the late fall and early spring of each year. “*Thicket!*” is available at the MDA’s web site: [www.mda.state.mn.us/ipm/thicket](http://www.mda.state.mn.us/ipm/thicket)

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

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### Biological Control Program (General)

Indoor Plantscape and Urban Biocontrol Project (IPUBP)  
The Indoor Plantscape and Urban Biocontrol Project (IPUBP) consists of two content areas - product information and insect identification. Both of these areas function as outreach sections of the Biological Control Program. Since 1999, staff members have given over 350 public presentations on insects, insect identification, biological control and IPM, and the effective use of biological control products.

In addition, staff involved with this project provide ongoing technical support to growers adopting biological control and other compatible methods for managing plant pests in greenhouses, conservatories, atriums, gardens, and homes.

Specific examples of individuals and groups most often served by this project in 2004-2005 include:

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

## Biological Control Product Information

Located on Metropolitan State University's main St. Paul campus, the MDA Biological Control Facility (BCF) serves as a "greenhouse-classroom" where living biological control agents and other forms of pest management are shown to and discussed with learners of all ages, interests, and backgrounds.

The main thrust of the IPUBP's "product-oriented" outreach activities is to describe insects and other arthropods in ways that enhance people's appreciation of them - and also show people that while some insects can be harmful and/or nuisances, that other live organisms can actually be used in practical ways to help manage real-world problems. This program tries to accomplish this through customized materials that include living organism displays, pinned insect specimens, slide presentations, digital videos, factsheets, posters, web pages, and other handouts.

While not traditionally used as a research facility, this year Biocontrol Program staff began a study at the BCF to investigate the effect of a whitefly parasitoid, *Eretmocerus eremicus*, against silverleaf whiteflies on tomatoes. As of June 2005, data are still being collected. The results from this study will be published in the fall of 2005 on the Greenhouse, Garden, and Indoor Plantscape web page [www.mda.state.mn.us/biocon/plantscape](http://www.mda.state.mn.us/biocon/plantscape). Other teaching materials produced by this program are located on this same web page.

### ***Insect Identification and Entomology Outreach***

Plant Pest Survey and Biological Control Outreach staff members give talks with displays of entomology to schools, science centers, environmental fairs, and similar groups - with particular emphasis on the aspects of insect classification, identification, and morphology. School presentations are typically in classrooms to students and their teachers in grades K - 12, although most are grades 3 - 5. Over a dozen display drawers and riker mounts of insects are used to show insect diversity, classification, and insect types used in biological control or encountered during surveys.

Topics of presentations include general information on insects and spiders, how to tell the difference between helpful or harmful insects, biological control concepts and how to apply them, IPM tools and how to use them, and collecting and/or mounting insects. Presentations have been made annually for the past ten years, reaching between 400 and 600 people each year.

In addition, staff have created a downloadable color poster "Major Insect Orders," an alphabetical description of 21 major insect orders and three digital videos – *The Field Crop Insect Database*, *Using Technology for Efficient Field Work*, and *Putting Ladybeetles to Work!*

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## Biological Control Laboratory

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

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# Organic Agriculture in Minnesota

The Minnesota Department of Agriculture (MDA) recognizes organics as a choice that a growing number of farmers and consumers find appealing. This is a rapidly growing sector of the food industry, both domestically and abroad. The United States Department of Agriculture (USDA), the Organic Trade Association, and other groups have been tracking the growth of organic food sales at about 20% per year during the last decade, and predict organic sales will continue to grow at this pace.

The MDA provides information and technical assistance on organic production methods, conversion to organic methods, certification, and marketing of crops and livestock.

Our Organic web site offers publications, notices of special programs, links to other helpful organizations, and a list of USDA-accredited certifying agents that do business in Minnesota.

Visit [www.mda.state.mn.us/esap/organic](http://www.mda.state.mn.us/esap/organic)

Organic is a guarantee to consumers about how an agricultural food or fiber product was grown and handled. Since 2002, a federal rule has governed how farmers grow organic plants and raise organic animals, and processors and handlers turn it into the organic food or clothing product we buy. Products that make organic claims must be grown and processed according to the national organic standards. There are stiff penalties for fraud, which means representing a non-organic product as organic.

In general, organic crops are grown on land that is managed to reduce erosion and improve soil quality, and fertilized with non-synthetic nutrients for three years before crops grown on the land can be considered organic. There are strict manuring and compost guidelines. Most synthetic herbicides and pesticides are prohibited. A few synthetic nutrients and soil additives that appear on a special National List are allowed. Weeds, insects, and other pests are typically controlled using ecologically-sound practices like crop rotation, cover cropping, variety selection, biological control, mulching, and tillage.

Organic livestock must eat feed that is organically grown and handled. The animals must be raised in conditions that allow them access to the outdoors (as appropriate to the species) and appropriate exercise. Ruminants must have access to pasture. Physical alterations like dehorning, castration, and tail docking must be done for reasons that promote the animal's welfare and must be done in ways that minimize pain and stress. Organic animals must never be given growth hormones, treated with vaccines or antibiotics (unless they are ill), fed urea, manure, or animal by-products. It is forbidden to withhold medical attention from a sick animal in an effort to "keep it organic."

Strict regulations govern how crops and animals that are grown organically must be processed and handled in order to preserve their organic status. Ingredients, processing aids, pest management in the processing facility, and labeling must all follow the organic standards. There must be no opportunity for organic products to mix (or "commingle") with similar non-organic products.

The USDA National Organic Program (NOP) oversees the national organic standards. You can get a copy of the standards and information about organic production, processing, handling, labeling, marketing, and sales from the NOP at its web site: [www.ams.usda.gov/nop](http://www.ams.usda.gov/nop) or by calling 202-720-3252.

If you are a grower or processor who generates more than \$5,000 in gross organic sales, you will have to meet the standards of whichever certifying agency you contract with. If your receipts are less than \$5,000, you can still identify your products as "organic" as long as you follow the Rule and can prove it if asked.

*Other sources of information include:*

**Alternative Farming Systems Information Center -**  
a section of the National Agriculture Library that offers a variety of publications on organic farming, gardening, and marketing. Call 301-504-6559 or visit [www.nal.usda.gov/afsic](http://www.nal.usda.gov/afsic)

**Appropriate Technology Transfer for Rural Areas -**  
an organization that offers a wide variety of free publications about production, marketing, and supplier topics. Reach ATTRA at: 800-346-9140 or [www.attra.ncat.org](http://www.attra.ncat.org)  
See especially “Organic Farm Certification & the National Organic Program.”

**Midwest Organic and Sustainable Education Services -**  
a nonprofit organization that educates about organics and sponsors an enormous Upper Midwest Organic Farming Conference each winter. MOSES publishes the Upper Midwest Organic Resource Directory. Call 715-772-3153 or visit [www.mosesorganic.org/](http://www.mosesorganic.org/)

**Minnesota Organic Farmers Information Exchange -**  
a network of 29 experienced Minnesota organic farmers who are willing to visit with farmers interested in learning to grow organically. You can contact the mentors via telephone or email. Visit <http://mofie.coafes.umn.edu/>

**Organic Farming Research Foundation -**  
a national nonprofit organization that sponsors organic research and education. You can reach them by calling 831-426-6606 or at [www.ofrf.org/general/about\\_organic/index.html](http://www.ofrf.org/general/about_organic/index.html)  
See especially the brief overview, “About Organic.”

**Organic Materials Review Institute -**  
an independent, nonprofit organization that reviews agricultural products for compliance with the NOP National List of Allowed and Prohibited Substances. OMRI publishes generic and brand name input lists. Call 541-343-7600 or visit [www.omri.org](http://www.omri.org).

For more information, call Meg Moynihan at 651-297-8916.

## Loan Technical Review Panel for 2005

Gregg Bongard  
Ag Lender

Robin Brekken  
Farmer

Ralph Lentz  
Farmer

Thaddeus McCamant  
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# Sustainable Agriculture Loan Program

## Program Purpose

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

## Background

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

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

## Evaluation Criteria

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

The loan proposals are evaluated based on the following criteria:

- Long Term Plans for the Farm: How does this investment fit the long-term plans for the farm?
- Effect on the Farming System: How will this investment lead to a more sustainable farm system?

- Environmental Impact: Is there an environmental benefit to the proposed project?
- Farm Income: What is the added return to the farming operation from the proposed project?
- Input Reduction: Does the project reduce or make more efficient use of inputs?

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

## Impact of Program

The loans have given Minnesota farmers added incentive to make changes toward more efficient use of inputs while enhancing profitability and protecting the environment. More than 315 farmers have borrowed over \$3.5 million from the Sustainable Agriculture Loan Program.

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

## Project Categories

Loan projects typically fall into six categories: energy savings, livestock management, conservation tillage, weed management, nutrient management, and alternative crops. About one-third of loans have been made for livestock management and this category continues to be the most common. Projects have included fencing, livestock handling equipment, milk parlor upgrades, and breeding livestock. Conservation tillage projects account for about one-fourth of the loans and include the purchase of rotary hoes, precision ag equipment, no-till planters, and ridge tillage equipment.

# About the Staff.....

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

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

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

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

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

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

**Meg Moynihan** - Organic and Diversification Specialist, joined the Minnesota Department of Agriculture in 2002. She educates about and promotes crop, livestock, management and marketing options, including organic. Meg came to MDA from Michigan, where she directed a community-based integrated farming systems program. She has also worked professionally as an educator and evaluator, and as a community development extension specialist with the U.S. Peace Corps in northern Thailand.

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

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



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## Risk Management Agency – Programs and Partnerships for Producers

Risk Management Agency (RMA) is part of the United States Department of Agriculture (USDA). Our role is to help producers manage their business risk through effective, market-based risk management solutions. RMA's mission is to promote, support, and regulate sound risk management solutions to preserve and strengthen the economic stability of America's agricultural producers. As part of this mission, RMA operates and manages the Federal Crop Insurance Corporation (FCIC). RMA was created in 1996; the FCIC was founded in 1938.

The RMA develops USDA's crop insurance policies and underwriting terms. The FCIC provides subsidization and reinsurance. Private-sector insurance companies sell and service the policies. A list of crop insurance agents is available at all USDA Service Centers or at:

[www3.rma.usda.gov/tools/agents/](http://www3.rma.usda.gov/tools/agents/)

The size of the program has grown to more than 130 crops. In FY 2002, RMA managed more than \$40 billion worth of insurance liabilities.

RMA also coordinates a risk management education program to help producers and agribusinesses understand and manage increased risks associated with production, marketing, financial, legal, and human resources. On October 22, 2004, USDA awarded \$19.8 million in partnership agreements to develop risk management tools and education. Funding for these agreements is available under the Federal Crop Insurance Act provisions for risk management and implementation of research and development, community outreach and assistance, and crop insurance education in targeted states.

RMA is committed to ensuring that all farmers and ranchers, including women, minorities, and other traditionally under-served groups, can equally access and participate in all RMA programs and activities.

"Through these partnerships, women, minority, limited resource, and other underserved agricultural producers will receive assistance in understanding and using risk management tools to improve their economic viability," said RMA Administrator Ross J. Davidson, Jr. "We're striving to expand the risk management options and educational possibilities for all producers," he added.

Administrator Davidson was appointed in March 2002. He also serves as the manager of the FCIC. Located within the Office of the Administrator are the Director of External Affairs, the Director of Civil Rights and Outreach, the Director of Program Support and Chief Information Officer, the Chief Financial Officer, and the Secretary to the Board of Directors of the FCIC.

RMA employs approximately 530 people in offices around the country. The St. Paul regional office covers Iowa, Minnesota, and Wisconsin and has 17 employees. You can contact outreach coordinator Laurie Fredricks at 651-290-3304 x 232.

Additional information about RMA – including agency news, state profiles and other publications, summaries of insurance sales, information on pilot programs, downloadable crop policies, and agency-sponsored events – can be found at:

[www.rma.usda.gov](http://www.rma.usda.gov)

The site also features online tools, calculator, and applications.

This article is based on excerpts from: USDA/Risk Management Agency 2004 Outreach Programs Fact Sheet, 2003 Civil Rights and Equal Opportunity Fact Sheet, About the Risk Management Agency: Program Aid Number 1667-02, June 2003 Fact Sheet and USDA News Release No. 0457.04