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# Greenbook 2003

## *Caring for the Land*



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

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# Greenbook 2003

## *Caring for the Land*



### **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.*

*July 2003*

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# Introduction to the Greenbook 2003

**I am** pleased to introduce the 14<sup>th</sup> edition of the *Greenbook*. The *Greenbook* is an annual publication of the Minnesota Department of Agriculture's Agricultural Resources Management and Development Division (ARMD). The *Greenbook* highlights the results of creative and innovative farmers and researchers involved with the Sustainable Agriculture On-Farm Demonstration Grant Program. These people are dedicated to doing their part to ensure that Minnesota agriculture is profitable and environmentally friendly.

Sustainable agriculture continues to evolve and expand. In the early days of our Sustainable Agriculture Grant Program, the focus was mainly on farming practices that reduced inputs and enhanced the environment. As time went on, the program evolved to include diversification of crops and alternative livestock systems. Today, sustainable agriculture includes all these things and it gives farmers increased access to alternative markets such as organic, sustainable, eco-labels, and locally produced. Farmers are incorporating marketing into their businesses as a way to capture more of the food dollar to keep their farms viable.

*Greenbook 2003* contains articles that highlight the results of the grantees' projects and provide 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. Feel free to give them a call about their projects.

Our essayists this year include Bill Hunt, State Conservationist for the USDA Natural Resources Conservation Service (NRCS) in Minnesota, and Art Thicke, who operates a grass-based dairy farm in La Crescent, Minnesota.

Bill's essay addresses the relationship of the NRCS with farmers and the role it plays in assisting farmers to care for and maintain Minnesota's natural resources. Incidentally, the MDA recently signed an agreement with NRCS and other federal and state organizations to cooperate more closely in serving the state's organic agriculture sector. Art's essay describes how and why he addresses natural resource issues on his farm and his observations on the impacts of his actions. I think you will find both informative and interesting.

The *Greenbook* also includes updates on other ARMD projects such as monitoring at Big Woods Dairy at Nerstrand – Big Woods State Park, organic growth in Minnesota, integrated pest management (IPM), Minnesota grown opportunities, research on soil quality and the rainfall simulator.

I hope you find *Greenbook 2003* interesting and full of new and useful ideas.

Gene Hugoson, Commissioner  
Minnesota Department of Agriculture

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**By: William  
Hunt**

Bill Hunt is the State Conservationist for the USDA Natural Resources Conservation Service (NRCS) in Minnesota, named to that post in 1995. He has held numerous positions with NRCS since he began his career with the agency in 1965. He earned a Bachelor of Science degree in agriculture economics from the University of Oklahoma, a Master of Science degree in agricultural economics from the University of Arizona, and a Master of Arts degree in public administration from Harvard University. He grew up on a cotton and grain farm in Oklahoma.

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# The Natural Resources Conservation Service - Protecting Minnesota's Natural Resources and Providing Conservation Technical Assistance to Minnesota's Agricultural Producers and Landowners

Agriculture and the quality of Minnesota's soil and water resources are vital to the State's welfare. About 84 percent (43.7 million acres) of the state is non-Federal land, and almost 90 percent of these acres are cropland, pastureland, and private non-industrial forestland. The care of these lands is in the hands of thousands of individual landowners.

The Natural Resources Conservation Service (NRCS) is the lead Federal agency for conservation on America's private land. It is part of the U.S. Department of Agriculture (USDA) and serves the United States, its territories, commonwealths, and Tribal governments. In 1935, Congress established the Soil Conservation Service (SCS) to carry out a continuing program of soil and water conservation on the Nation's private and non-Federal land. The SCS was transformed into the NRCS through Congressional legislation in the 1994 Federal Crop Insurance Reform and Department of Agriculture Reorganization Act. Since 1994 NRCS has functioned by combining the authorities of SCS and directing the establishment of financial and technical assistance programs for natural resource conservation and rural development.

NRCS provides conservation technical assistance through local Soil and Water Conservation Districts (SWCD), which are units of government created by state law. NRCS, SWCDs, state conservation agencies, and Resource Conservation & Development (RC&D) councils represent a unique federal, state, and local partnership dedicated to natural resource conservation. NRCS staff at the local level works in partnership with state and local SWCD staff and volunteers to assist individuals and communities to care for natural resources. NRCS also develops technical information and provides guidance for conservation planning and assistance. This

technical guidance is based on sound science, tailored to local natural resource conditions. This partnership helps conserve Minnesota's natural resources, increases agricultural productivity, improves the environment, sustains local rural communities, and enhances our quality of life.

NRCS serves all of the people of Minnesota. We respect the dignity and worth of every person we serve, and strive to treat each individual fairly and equitably. NRCS county-based staff interacts with and listens to the state's farmers and landowners. We hear their perspectives and views for conserving natural resources, and respond with advice that is tailored to their needs and is technically accurate. We will continue to improve our service and measure our efforts against the highest professional standards. Our appreciation of the needs of the agricultural producers and landowners is as important to successful conservation efforts as is our understanding of natural resources. We recognize the important contributions made by the stewards of privately owned, Tribal, and other non-Federal lands to the Nation's economy and quality of life. We consistently find that the majority of private land users do make responsible resource management decisions when equipped with appropriate data, technical assistance, and incentives.

We value our relationships with other federal, state, and local resource agencies that share common objectives, although our missions may sometimes differ. NRCS, SWCDs, state agencies, and RC&D councils represent a unique federal-state-local partnership dedicated to conservation of natural resources and environmental protection. NRCS is committed to keeping this core partnership



### Figure 1. Overview of USDA Conservation Programs

**Conservation Reserve Program (CRP)** - USDA's largest environmental improvement program on private lands, and one of the most effective. CRP encourages farmers to convert highly erodible and other sensitive land to protective vegetative cover such as native grass, wildlife plantings, trees, filter strips or riparian forest buffers. Currently 1.65 million acres are enrolled in CRP in Minnesota. In 2002, Minnesota's landowners also signed up 36,785 new acres in the Continuous CRP, established 53,500 acres of land in buffers, and 11,500 acres of grass filter strips on their farms.

**Environmental Quality Incentives Program (EQIP)** - Financial and technical assistance to producers to install structural, vegetative and management practices on their farms and working lands. In 2002 this program funded 340 applications (\$9.26 million) in Minnesota for practices including terraces, grassed waterways, sediment control basins, rotational grazing systems, nutrient management and animal waste storage structures. For the first time the EQIP program offered incentive payments to help farmers convert from conventional to organic production systems. A total of \$1.6 million dollars in EQIP financial assistance was obligated to agricultural producers to protect their natural resources through the resource conserving production of organically produced crops and livestock.

**Wildlife Habitat Incentive Program (WHIP)** - Funds for landowners to develop or improve fish and wildlife habitat on private and tribal lands. In 2002, 59 contracts were funded on 1,612 acres to do native grass plantings, timber stand improvement, and tree and shrub plantings.

**Minnesota Grazing Lands Conservation Initiative (GLCI)** - Voluntary effort designed to enhance the state's privately owned grazing lands by supporting demonstration projects and educational programs throughout the state. In 2002, 15,377 acres of conservation plans with prescribed grazing practices were planned and applied.

strong. NRCS also works in consultation with American Indian Nations to provide appropriate services at their request. We will seek to strengthen this partnership by enhancing the technical capacity of SWCDs and RC&D councils and by bringing in new partners to work toward common conservation goals.

We have confidence that a locally led, watershed-based, voluntary, incentive-based approach to resource management on private lands is key to maintaining healthy watersheds. Local action and leadership – neighbors working together – are the foundation for effective land stewardship. NRCS and our partners will work to foster the discussion needed to bring people together in a shared vision for healthy and sustainable land and communities. We will help achieve agreement based on sound science, sensible economics, appropriate technology, respect for diverse cultures, and current information.

NRCS employees recognize that the state's agricultural producers and private landowners are on the front lines of natural resource protection. The primary weapon we have in the battle for conservation use and protection of natural resources is education. The fundamental educational tool NRCS uses is accomplished through the systematic development with producers of individual farm-specific conservation plans. Conservation plans identify the current resource concerns and conditions on a farm or in a watershed and provide sound alternatives to

correct them. Due to the diversity of our state the typical resource concerns can and do vary. In most locations these concerns include soil erosion, surface and ground water contamination, excessive water runoff and flooding, management of manure, and the need for enhancing wildlife habitat. The USDA has a number of programs that provide technical and financial assistance to producers for implementing science-based conservation plans and practices. These USDA conservation programs, listed in Figure 1, protect and conserve our natural resources while assisting agricultural producers to continue to farm profitably. I strongly suggest that all Minnesota agricultural producers visit their local USDA Service Center to find out how our ongoing conservation technical assistance and these programs could work on their land.

NRCS' success depends upon the technical expertise of its employees and volunteers and upon their ability to work effectively with a diverse customer base. The agency will continue to strengthen its management, technical, and other training activities to ensure that all employees, partners, and private sector Technical Service Providers acquire the skills to be successful. This commitment to our employees and others is also a commitment to help private landowners protect the natural resources in our state. We look forward to the many future opportunities for continuing the conservation partnerships that lead to assisting Minnesota's producers in protecting our resources.

## ESAP Author

Mark Zumwinkle  
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Art and Jean Thicke operate a grass-based dairy farm with their nephew Dan in La Crescent, MN. They have 85 head of Ayrshire milking cows. The farm is perched on the ridge of very hilly bluff country overlooking the Mississippi River. There are 85 acres of permanent pasture divided into 42 paddocks with a permanent water system. They have 392 wooded acres. They also have an adjacent farm with 50 acres of forages which are grazed by the dairy replacement heifers with the excess forage harvested mechanically.

Art can be reached at 507-643-6246.

# Managed Grazing, a Mossy Hollow, and Binoculars Behind the Barn

## An Interview with Art Thicke, Winter 2003

My father began farming this land in the mid 1920's, when he was 17 years old. When he took it on, the farm was one of the poorest in the area. There were signs of long-term erosion throughout the farm. My father filled in extensive gullies with horses and a blade. He was always conservation minded and, in the late 1940s, he became one of the first farmers to install contour strips. In fact, a picture of our farm was on the cover of the USDA Yearbook of Agriculture in 1950 and again in 1957. At that time, our government was trying to reward farmers for practicing conservation, in contrast to today's farm programs.

So, I grew up with strip-cropping. Although the intentions of the conservation movement were good, I have found the benefits of managed grazing to be far more beneficial to the soil and the entire farm. With strip-cropping, there was still a lot of erosion. Along with the strips, we had continuous grazing. There were always gullies running from the row crops right into the pasture. But now, with our switch to managed grazing, we have eliminated the progression of the gullies. When I walk through the ditches, it is encouraging to see how they are healing. I now see a carpet of mosses covering the rocks and soil that had been exposed by erosion years ago. Water rarely even runs through these low areas anymore. I love to walk here - the mosses are so beautiful!

I believe the greatest change we have seen since we have switched to managed grazing is the tremendous increase in the capacity for the land to hold water. When we get really big rains, our pond doesn't run over. In 1993, we had 7" of rain in one day and the pond did not run over. This means there was little runoff from the land above the pond. Again, in 2001, we had 4" of rain in 2 hours. The U.S. Geological Survey measuring stick in the pond registered a rise of 4", showing that there had been little runoff.

We have a shallow silt loam soil. It is very productive but vulnerable to erosion because our land is so steep. I think, with managed grazing, we have really improved our soil structure. You can even feel it through your feet when you walk across the fields. The land is softer. I have land that I rent from the neighbors. I can feel that it is not as soft as our land. There's something good going on in our soil. The manure on our land doesn't last very long at the surface because the life in the soil completely cleans it up.

I don't use soil tests. The plants that I am growing on the farm can be supported by my soil. The last time I imported chemical fertilizers onto the farm was 1976. This includes no phosphorus, potassium, or lime. The only fertility we supply to the plants is in the manure. I feel that the way we have been encouraged to fertilize is wrong. Fertility programs derived from standard soil tests don't take into consideration the life in the soil. I think soil that doesn't have life in it shouldn't be called healthy soil.

We have learned from the chemical companies how to manipulate the soil to make it produce more but that doesn't mean it is balanced. Since I have slowed my rotations down over the last six years and directed my focus on manure, my pastures have become very productive without chemical inputs. If you look at the number of cattle we have (we are running about a cow per acre during the grazing period), that's a lot of manure we're putting on the land. We shouldn't have to put a lot of fertilizer down. I'm bringing nutrients onto the farm when I buy corn and hay. I like to do it that way rather than fertilize because then I can use it twice - once when I feed it to the cows and once when I use the manure. That way I'm feeding the soil and the life in the soil instead of spoon-feeding the plants.

It is really important to keep the water on the land. We live on top of the watershed. It seems that people working with water quality often focus their work right next to the river but I think it is just as important to improve environmental practices at the top of the watershed. A neighbor who lives directly below me told me just recently, “Since you’ve been grazing on top of the hill, we no longer have erosion problems.” He said this was so for both row crops and permanent pasture at the bottom of the hill. So what we do at the top of the hill has a far-reaching effect. Just think how well we could protect our water if everyone in the watershed practiced managed grazing!

I am doing things a little different than most grazers. I’m using a longer rest period between grazing. When I first started grazing 17 years ago, I saw the benefit of a longer rest period when I would put the cattle out on my hay land to graze the taller grasses. It worked just fine. Since then, the grazing experts have recommended that we speed up the rotation and feed the lush young vegetation to the milk cows. So I took their advice and went to faster rotations. But over a period of three or four years the pastures got worse and worse. There was less overall grass production. I don’t think our cool season grasses can tolerate fast rotations.

After five years, I decided to go back to the longer rotations. Now, I am running a more mature pasture and I think it is better for the land. Bare patches are healing. I get through droughts better. I think it’s better for the water cycle. The longer rotations pan out economically because I have healthier cattle. I have 150 head of cattle on the farm. I milk 85 cows and our vet bill has been zero. I no longer have to renovate my pastures. Most of my pastures have not been tilled for 20 years or more, and I don’t plan on doing it in the future. I do occasionally frost seed clover and grasses and lightly reseed the wintering areas. This is where long-term economics comes in. If I have healthier cattle from feeding the more mature hay, they have more longevity. I don’t have to raise as many replacements.

When we used fast rotations and fed the cows the shorter grass, I could tell there was something wrong. The cows weren’t as calm. I think their stomachs were out of whack. With fast rotations, it was as if we were feeding concentrate to the cows. Now we’re feeding grass with more fiber.

Grazing, particularly with long rest periods, is good for meadow birds and wildlife. Our pasture land is saturated with birds. We have goldfinch, bluebirds, bobolinks, meadowlarks, horned larks, killdeer, and eastern kingbirds. Today, with so many acres in corn and soybeans, these meadow birds don’t have a place to nest. The grazing farms attract the meadow birds. But it is just as important

for these birds to have a place where they can raise their fledglings. Our longer rest periods give the birds a longer time to hatch their fledglings. I have seen fledglings of all the species I mentioned here on the farm so I know some fledglings are making it. The cattle are more forgiving than the haybine which takes all the birds out. After grazing, I have seen young birds in their nests that have made it through. Often, with longer rest periods, the young birds are only exposed to one grazing cycle. If they come through the grazing cycle, then they will likely survive altogether.

The best part about the way we are farming is the enjoyment that it brings. The way we live is like living in the middle of a park but without park rangers. The wildlife is everywhere. We don’t have to buy lawn ornaments. We have the real thing right outside our window. For recreation, we have 300 acres of woods with the most beautiful hiking you could possibly imagine.

In the back of the barn, we keep a set of binoculars just for watching wildlife. We watch the big bucks, wild turkeys, and meadow birds while we’re milking. How many people have that where they work? We have a healthy environment, no chemicals, and we almost never use the tractors. This is truly the best job I’ve found so far.

So the long rotations are a win-win situation. It’s healthier for the cattle, the land, and the soil. My pastures have deeper root systems and more diversity. Healthier root systems hold the soil in place. Plant diversity allows different species to compliment each other. There is more complete nutrition for the cows with the diversity of forage, multiple sources of protein and energy. I will never go back to fast rotations. Even if there are occasionally times when my system limits production, I always have low inputs and few animal health problems.

Another tool we are using to improve our soil is our wintering system. We use the cattle wintering site to improve the pasture. We space the bales to distribute the manure on parts of the farm that are less productive. We are in a climate that does not allow us to graze year-round. We have to get the cattle through the winter somehow. I have a good barn but I don’t use it. Wintering the cattle outside keeps them much healthier when they are out in the fresh air.

I don’t balance my rations. I focus on the health of my cows and watch the texture of the cow pies to make sure the animals are getting enough fiber. I don’t shoot for maximum milk production. We get 13,000 pounds of milk per cow per year and we feel that is adequate. We have supported two families on this farm with no off-farm income for the last eight years. That pretty well says it right there. There are a lot of farms that could be doing this.

One thing we are trying to do on our farm is to just keep it simple. It is human nature to complicate things. If you observe nature, you will see that nature does everything as simply as it possibly can. Nature requires activity and rest. That is why it is important to find a balance between rest and animal impact. That is why my longer rotations are working so well.

# Sustainable Agriculture Grant Program

Summary of Grant Funding (1989-2003)				
Year	Number of Grants Funded	Total Funding	Average Grant Size	Range
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	—	—	—	—
<b>TOTAL</b>	<b>226</b>	<b>\$2,405,066</b>		

## Program Purpose

The Grant Program provides a unique opportunity for farmers, non-profit 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 950 grant applications and has approved over \$2.4 million in funding for 226 projects since the program began in 1989. Fifteen new demonstration grant projects proposed by farmers, educators, and researchers were funded in 2002. Project categories include: Alternative Crops, Fruits and Vegetables, Cropping Systems and Soil Fertility, and Livestock. This year there are 44 active grant projects throughout the state of Minnesota.

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 Energy and Sustainable Agriculture Program staff.

## Field Days

The grant project participants hold public field tours every year to share what they have learned and accomplished in their demonstrations. Typically, there are approximately 35 field days each year with funding from ESAP. Many of these projects were sponsored in cooperation with county extension services, Sustainable Farming Association, Land Stewardship Project, State Technical Colleges, the University of Minnesota, local units of government, private colleges, and agribusinesses.

## Grant Summaries

The project summaries that follow are brief 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.

**Principal Investigator**

Buckwheat Growers Association  
Lynda Converse  
34640 – 247 Ave.  
Browerville, MN 56438  
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**Project Duration**

2000 to 2002

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**Keywords**

alternative crop,  
corn flour, flour  
corn, gluten-free  
flour, open-  
pollinated, 'Painted  
Mountain' corn

# Flour Corn as an Alternative Crop – The Benefits of Using Corn Flour

**Project Summary**

Flour corn offers potential as a viable alternative and value added crop. Milled into gluten-free flour for people with gluten allergies or as a decorative seed crop, flour corn may provide a source of income for the small farmer. Our project goal was to investigate and demonstrate crop rotations, harvesting options, processing and marketing strategies to determine the potential for profit on both large and small-scale farms, and determine which areas need further development in order to make flour corn an attractive alternative crop to farmers.

**Project Description**

Flour corn (*Z. mays amylacea*) is one of the oldest types of corn known. It is primarily composed of soft starch that breaks apart easily. It is open-pollinated by pollen carried on wind, a process that ensures extensive mixing of genetic material. Unlike hybrids, seeds of open-pollinated varieties breed true. 'Painted Mountain' is an 80-90 day multi-colored variety originally developed in Northern Montana, where it was selected for hardiness and early maturity. In selection, farmers or researchers simply identify ('select') plants that have the most desirable characteristics and plant that seed in order to keep the desirable characteristics in subsequent generations.

Inspired by five years of experience by former master gardener Kathy Connell, several members of the Buckwheat Growers Association of Minnesota and the Sustainable Farming Association of Central Minnesota decided to find out whether 'Painted Mountain' flour corn could be grown, harvested, and marketed by central Minnesota growers as a crop for flour, decoration, and seed.

According to Dave Christensen, who selected the variety in Montana, "'Painted Mountain' is usually 3 to 5' tall. On good soil and (with) lots of water it gets 7' tall. Plants are thick and sturdy and often produce three cobs per plant." Kathy continued selection of 'Painted Mountain' at her farm, which gets one of the earliest frosts in the fall and continues to have damaging frosts into the very late spring.

The initial information that led us to pursue the project indicated there was a market for flour corn flour. Specifically, there is a demand for a gluten-free, good-tasting alternative to flour that has a flour-like texture and works well for quick breads. Since corn flour tends to be gray-blue in color because of the multi-colored kernels, we thought that using plant selection to develop a white seed would provide a white flour more desirable to buyers. Whiter flour would offer special appeal to

*Kathy holds a  
white-kernel ear  
selected by grower  
Joel Middendorf.*



several ethnic populations. Members of the Hispanic community who attended a project field day expressed a great deal of interest in the corn flour and their desire for a lighter-colored corn flour is driving the white corn flour selection project. In addition to flour, some project members believed growing flour corn as a seed crop or decorative crop offered other opportunities.

Early in the project, the members partnered to design trial sites in five counties (Table 1). Each location had different soil types and weather conditions. Growers documented field history, temperature, rain, rotation, ease/difficulty of maintenance, and harvesting procedure. The original cropping plan included a three-year rotation: Buckwheat → ‘Painted Mountain’ flour corn inter-seeded with Hairy Vetch → potatoes planted in mulch → edible beans. While the project started on three farms, by the end there were eight in the group. Production challenges we addressed included weed management, how to improve yields, causes for random mold and smut, machine planting and harvesting, seed selection, and central Minnesota hardness.

## Results

After three years of research and comparisons, we have successfully kept our crops free from chemicals by using livestock and green manures with a crop rotation including buckwheat and a legume. Several of the growers say that yields vary greatly according to location, but estimate a range of 25 to 35 bu/A. Hand weeding seems to be the most effective weed control to date. We found a double-sided hoe that works in two directions and is very helpful in the smaller plots. Continued research for weed control could include flame weeding and inter-seeding a smother crop like hairy vetch.

The original rotation concept of buckwheat followed by corn inter-seeded with vetch, then potatoes in mulch, and then edible beans was changed. The growers were not as concerned as was originally thought about having interim cash crops of potatoes and edible beans. Most were more interested in the best way to get the ‘Painted Mountain’ flour corn crop developed to its potential.

We faced weather typical of the challenges of farming during the three years of the project: drought, heavy rain, early and late cold weather, frost, and high winds. Each county had its own dilemma, which gave us opportunity to document a variety of effects. We found that ‘Painted Mountain’ flour corn is very hardy. It survived several killing frosts and drought in northern Wadena County. Growers in Wadena and Todd Counties experienced high winds, which totally lodged the corn crop. Fortunately, it stood back up without goosenecking and these growers had a good yield. Too much rain delayed planting in Douglas County the third year, resulting in low yields.

We have determined that, weather permitting, this variety of flour corn should be planted by, or as close as possible to, May 15 to provide maximum yield and minimal cross-pollination from hybrid corn varieties in neighboring fields. Location of the fields is important, too. In the third year, Grower 6 experienced poor pollination in a low plot that did not get enough wind.

While too much rain did not seem to cause problems, severe drought in Crow Wing County was a major problem the first and second year for Grower 2. By the third year the soil had improved through the rotational planting of buckwheat, and the drought was less intense.

**Table 1. Flour Corn Project Grower Profiles**

Grower No.	County	Soil/fertility	Other
1	Douglas	sandy loam	buckwheat rotation
2	Crow Wing	rocky, sandy; rotted pig manure	mechanical harvest trial site
3	Wadena	sandy loam to sandy	selected for white seed; 2-row corn planter
4	Wadena	sandy loam, 5 year-old cow manure, 300 lb organic chicken manure	selected for white seed
5	Wadena	sandy loam to sandy	buckwheat rotation, air planter
6	Todd	sandy loam, commercial fertilizer, goat and steer manure	poor pollination low ground
7	Chippewa	rich sandy loam	inter-seeded squash
8	Wadena	sandy, dry, amended with horse manure, buckwheat, rye, blood meal	selected for white seed

**Table 2. Nutritional analysis, measured in grams per 100g sample**

Nutrient	Grower 3	Grower 5	Grower 6	Grower 8
Protein	7.37	9.55	9.98	8.59
Saturated fat, total	0.69	0.59	0.66	0.62
Monounsaturated fat, total	2.20	1.70	2.04	1.91
Polyunsaturated fat, total	2.67	2.13	2.07	1.97

*Nutritional analysis performed by Agricultural Utilization Research Institute (AURI)*

We also learned that determining whether or not machine harvesting is viable will require more research. At the machine harvest trial site (Crow Wing County), the use of a corn picker was unsuccessful in 2002 because the ears would not release from the stalks and were mashed. It will take more time to select seed to get the required stalk height, uniform maturity, and stalk strength. We need to get the ears higher up on the stalk to be more accessible to a corn picker and to determine if higher ear placement will prevent mold. We also observed that the ears do not release from the stalk easy enough to use a corn picker – a problem that needs to be addressed as well. We have discussed doing further research using a two row stripper as is used for harvesting sweet corn.

By the final year of the project, we achieved improved stalk strength and height as well as white seed produced by the selection process. The three growers in Wadena County planted only white seed this year, resulting in excellent yields of beautiful ears of predominantly white corn. We had the corn flour tested for nutritional values, i.e., calories, total fat, saturated fat, cholesterol, sodium, total carbohydrates, dietary fiber, sugars, protein, vitamins A and C, calcium, and iron. Differences among the samples have led us to wonder whether production practices and seed selection impact the nutritional quality of the flour (Table 2). We intend to continue investigating this question and will start by comparing location differences in nutritional profile with differences in soil test results.

Todd, Douglas and Crow Wing County growers planted colored seed, and through selection, improved stalk strength, height, and uniform maturity. In Todd County, Grower 6 found that planting his corn closer together gave him increased stalk height and provided better weed suppression. According to Dave Christensen, “If plants are spaced too close, it would push them to be extra tall – seeking sunlight – and they would be correspondingly thin and spindly. A crowding situation reduces cob production in any corn. It not only slows cob formation, but stunts the size from lack of sunlight.” Dave Christensen recommends 1’ between plants.

Each farmer has varying opinions about the flour corn based on his or her own experiences and observations. While Grower 6 is excited about the crop for seed, flour, and decoration, Growers 3, 4, and 8 are more focused on selecting white seed in order to produce a lighter-colored flour. Grower 2 is committed to pursuing other machine harvesting possibilities. Machine planting has been successful for Growers 2 and 5. Grower 5 used an air planter with 36” spacing and achieved a good harvest on stalks over 6’ tall. In Chippewa County, Grower 7 learned that spacing could be significantly closer than his 3’ between rows and 10” between plants. The thin canopy of the corn did not prevent weed growth. However, squash grew well under the light canopy of the corn. Perhaps a companion crop could be planted without significant competition and help reduce the number of cultivations needed.

Most of the cooperating growers say they intend to continue raising ‘Painted Mountain’ flour corn, and agree that it is important to keep working on selection for yield, color, vigor, and uniform maturity. They recommend the crop to other farmers with the caveat that right now, small acreages are most manageable. Better methods of weed control, mechanical planting, and machine harvesting will be necessary before large scale cultivation makes sense.

Numerous news and newspaper articles, yearly field days, and exhibits at many sustainable or organic events generated grower interest in the project and more than doubled the number of participants during the three years of the project. In addition, project members think that consumer interest in gluten-free flour is growing. They recognize that grinding processes and marketing channels need further development. The project has been contacted by a farmer in Wisconsin who wants to experiment with the crop and a baker in Nebraska who wants to experiment with the flour.



## Management Tips

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1. Plant flour corn no later than May 15. The plants need to get an early start to produce strong stalks and, hopefully, more height for easier harvesting.
2. Don't plant the crop in hollows or other sheltered areas. Open-pollinated corn like 'Painted Mountain' needs wind to carry pollen. Balance the risk of contamination from other varieties by paying careful attention to planting and tasseling dates.
3. If inter-seeding a cover/smother crop like hairy vetch, plant when corn is 3 to 4" tall.
4. The best fertilizer is the farmer's feet. Get out into the field while corn is growing. Walk at least 10 rows into the field before making observations. Use flagging tape to tag attractive plants whose seeds you will want to save (select).
5. Harvest early, then dry down in a rodent-proof crib, especially in rainy falls. Field dry down has been somewhat successful but flour corn tends to mold easily.
6. Keep a lookout for and take action against striped gophers and other pests.

## Cooperators

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*DeEtta and Tom Bilek, Farmers, Buckwheat Growers Association, Aldrich, MN*  
*Dave Christensen, Consultant, Big Timber, MT*  
*Kathy Connell, Farmer, Sebeka, MN*  
*Clint Converse, Farmer, Browerville, MN*  
*Marvin Duhn, Farmer, Carlos, MN*  
*Floyd Hardy, Farmer, Brainerd, MN*  
*Joel Middendorf, Farmer, Verndale, MN*  
*Sandy Restine, Farmer, Sebeka, MN*  
*Paul Wymar, Farmer and Watershed Technician, Montevideo, MN*

## Project Location

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Contact Lynda Converse for locations of cooperators' farms. Project brochure, including recipes, and videotape of research sites are available from Lynda or from MDA.

## Other Resources

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Agricultural Utilization Research Institute, Oils Laboratory. 1501 State St., Marshall, MN 56258, 507-537-7440.

Glen Borgerding, Agriculture Resources Consulting, 131 - 5th Street, Albany, MN 56307, 320-845-6321.

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**Project Duration**

2002 to 2003

**ESAP Contact**

Mark Zumwinkle  
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**Keywords**

alternative markets,  
cooperative  
development,  
sustainable forestry

# Collaborative Character Wood Production and Marketing Project

**Project Summary**

Most of Minnesota's non-industrial private woodlots have suffered from high-grading (harvesting the high value trees and leaving behind the degraded material) and other logging practices that have left them in various states of degradation. In spite of this, these woodlands can still afford farmers and other landowners with economic opportunity. This project seeks to show how these woodlands can be improved ecologically *and at the same time* contribute to the total on-farm income. One way this can be done is through processing and marketing of specialty wood pieces – or character wood – for sale to woodworkers.

Based on early market research, there appears to be a demand for character wood that far exceeds anything a collaborative character wood processing and marketing project could meet in the near future. This project is working toward helping Minnesota's woodland owners learn to identify character wood on their own lands and find ways to work together to successfully and profitably market this untapped on-farm resource.

**Project Description**

The recently incorporated Woodlands Cooperative is a group of 10 steering committee members who own a total of 700 wooded acres in eastern Minnesota. The co-op is beginning to bring in new members. The woodlands owned by members of the co-op are made up mostly of mixed hardwoods including maple, oak, ash, cherry and other species. As with most of Minnesota's forests, much of the members' woodlands are, to

some degree, degraded by high-yield and unsustainable logging practices of the past.

The mission of the Woodlands Cooperative is to “assist one another in creating and enhancing healthy forest environments and facilitating beneficial interactions among local landowners, private and state forest workers, wood processors, and outlets for wood products.” Among the co-op's stated goals is the desire “to contribute to the environmental health of our area while assuring the highest return possible for the forest products being produced on private lands. We also want to have a positive impact on the local economy by encouraging the use of locally based forest and wood product workers.”

Character wood is generally considered to be of little or no value in the traditional



*Character Wood:  
Harvested, sawn, and photographed by  
Mark Adams, Cook County Forestry  
Cooperative.*

timber industry. As a result, a disproportionately high percentage of the timber that remains in today's degraded woodlots consists of character wood. Character wood includes burls, crotches, and wood with interesting graining.

How is character wood related to sustainable forestry? For many Minnesota woodland owners, one of the first steps toward improving the health of their forests is undertaking some kind of timber stand improvement, the equivalent of weeding an overgrown garden. In many cases, neglected or degraded woodlots have experienced one or more high grade harvests and are left damaged by the heavy equipment and the removal of the harvested trees. In order to bring the forest back to a state of ecological health and economic potential, it is important to remove weedy or undesirable species and make way for the desired species and composition to grow.

Through the course of timber stand improvement and the restoration harvests that are a critical part of improving a forest stand, many of the character wood pieces can be set aside for processing and marketing to woodworkers. In the long term, the forests will be improved ecologically while contributing to the bottom line.

The term character wood encompasses a tremendous variation in species, growth forms, grades, and anatomical parts of a tree. Character wood can be generally defined as a given piece of wood with unusual graining or other qualities that make it unusual.

The traditional lumber industry looks for straight-grained wood with few or no knots. The grain of wood is influenced by a variety of factors. A few of these include how fast the tree grew each year of its life; the degree to which the branch or trunk the board was derived from was straight or curved; whether the piece was cut at an intersection of branches, such as a crotch; any diseases the tree may have been afflicted with, such as spalted wood that has been infected with a fungus; deformities such as burls; and the presence of other patterns such as birds-eye maple. All of these "defects" create qualities coveted by furniture makers and other woodworkers.

Other types of character or specialty wood include pieces that are cut to the specifications of a woodworker, such as pieces with the bark left on the edges; cut to a greater thickness than typical boards; or boards cut from the same log and sold together, thus retaining the same grain pattern as one another.

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## Results

Most of the work done to date has involved planning and development of three on-farm character wood demonstrations to be held in the late winter and early spring of 2003. These demonstrations are being designed to provide farmers and other woodland owners with detailed information about how to identify and harvest character wood on their own lands. Logging and woodworking professionals in Minnesota will be present at the demonstrations to walk landowners step-by-step through the process of identifying and harvesting character wood, and information on marketing will be provided.

In addition, a test marketing project will provide added insight into the demand for character wood pieces available from Minnesota's woodlots. Some preliminary work has been completed regarding the character wood supply potential. Results of feasibility work will be presented at the March meeting of the Sustainable Forestry Improvement Collaborative.

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## Management Tips

1. Contact a local forester literate in sustainable forestry practices to begin planning for timber stand improvement.
2. Assess your local woodworking community for possible outlets for character wood.

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## Cooperators

*Jack Lewiston, Woodlands Cooperative, Milaca, MN*  
*Shelly Larson, Woodlands Cooperative, Milaca, MN*  
*Chuck Oiumette, Custom Wood Products, Hazelhurst, WI*  
*Lon Crosby, character wood market research, Webster City, IA*

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## Project Location

Contact Isaac Nadeau at: 651-228-0213 for locations of demonstrations this coming spring and summer in central MN.

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## Other Resources

Community Forestry Resource Center web site:  
[www.forestrycenter.org](http://www.forestrycenter.org)

Cooperative Development Services. 2002. Balancing Ecology and Economics: A Start-up Guide for Forest Owner Cooperation. 400 Selby Avenue, Suite Y, St. Paul, MN, 651-287-0184.

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**Project Duration**

2002 to 2003

**ESAP Contact**

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**Keywords**

identity preserved,  
locally grown,  
marketing

# Pride of the Prairie: Charting the Course from Sustainable Farms to Local Dinner Plates

**Project Summary**

Pride of the Prairie is a collaborative effort of western Minnesota farmers, the Land Stewardship Project (LSP), the University of Minnesota, Morris, the West Central Regional Sustainable Development Board, Prairie Renaissance, the West Central Research and Outreach Center (WCROC), and citizens. Our purpose is to promote the production and consumption of locally grown food in our region. We are working to develop a sustainable and secure community based food system in the Upper Minnesota River Valley that will provide good, safe, and nutritious food, nurture a healthy environment, and develop real economic opportunity for area citizens.

The Pride of the Prairie producer group's vision for their future, summarized by Mary Jo Forbord, describes the philosophy of the group:

*We are a strong community at work to transform our landscape and redevelop our culture in the Upper Minnesota River Valley. The foods that we locally and sustainably produce and consume bring nutritional, environmental, social, economic, and spiritual benefits to our entire region. We are an inclusive and growing network of*

*individuals and families that aim to live healthy, meaningful lives by producing, consuming and marketing the foods grown in our region. Through hard work, pricing transparency, and healthy communication we will uphold the economic and spiritual advantages of cooperation. We value diversity and strive for economic justice. We celebrate our connection with the land and we dedicate our efforts to all future generations.*

**Project Description**

The project began by connecting with established and beginning farmers in the region who are interested in producing food and marketing it directly to consumers, retail, and institutional food service establishments. Farmers' names were solicited at meetings and conferences and a press release was sent out locally encouraging farmers to call and participate. The response was overwhelming. During a six month period of time, over 150 farmers were interviewed about their farm products, distinguishing production characteristics, pricing and marketing strategies, future plans, the values they brought to their work, and marketing challenges for which they could use information and assistance.

*Grains grown in the upper Minnesota River watershed "fed the village first" at the University of Minnesota, Morris.*



In addition to gathering and sharing information in learning circle tradition, the group also wants to develop some kind of marketing association to serve the following purposes.

- Get locally produced food into homes, restaurants, grocery stores and institutions.
- Inform the community about local food and sustainable agriculture.
- Encourage and facilitate the development of better local processing and transportation systems.
- Weave local food through a strong sense of community that celebrates attachment to the land and to each other.
- Continually improve our ability as farmers to produce food, generate wealth, and sustain a natural environment that is characterized by diversity, healthy nutrient cycles, clean water and healthy soil.

## Results

As a result of the interviews and discussions, several activities that directly demonstrate the philosophy and course of the Pride of the Prairie group have occurred.

First, Pride of the Prairie and the University of Minnesota at Morris are working to build a stronger connection between the campus community and the Morris area. An obvious strategy is providing locally produced food in the University's on-campus dining service. Sodexo, an international company providing food service to the University of Minnesota in Morris, is partnering to make this a reality. A group of farmers involved in the Pride of the Prairie have begun organizing themselves to help develop and serve this local, rural market with food from their farms.

Secondly, Pride of the Prairie producers have provided products to many special events among which are two community dinners (each serving over 130 meals), a University of Minnesota Alternative Swine Task Force Open House at WCROC (serving over 100 meals), an on-campus meal (serving over 550 meals) as well as various community and church events. There is another on campus meal scheduled for this coming spring along with more community and church events.

And finally in 2002, a subgroup of the identified producers began meeting to discuss ways to organize themselves as "Pride of the Prairie" producers. Eighty-three farm families want to stay informed of this process and about 25 regularly meet to plan and strategize. The group produces a "market basket" of food products including bison, beef, chicken, pork, lamb, goat, eggs, honey, berries, flowers, grains, vegetables, and fruit. It is the group's intention to work together to supply retailers and institutions with diverse products with farm identity preserved. The

group has also discussed producing "Pride of the Prairie" signature products such as gift baskets, convenience products, and seasonal "local food box lunches."

The group is learning as it goes. They recognize there is much to learn from the experience of other farmers and groups of farmers. They are eager to share what they learn.

In June 2003, we will be part of a public forum and expo with a working title, "From the Soil to the Table." It will bring together farmers, chefs, cooks, institutional food purchasers, extension educators, and nutritionists.

## Management Tips

1. Having different types of farmers helps to ensure that the product line is diverse.
2. Having a diverse product line puts the group in a position to offer convenience and variety to retail/institutional purchasers.
3. Getting local products into an area food system is a complex task. Farmers can team up with community groups promoting and organizing for a local food system to accomplish more.
4. It is harder (and more important) to learn how to cooperate than to form a cooperative.

## Cooperators

*Craig Murphy, Farmer, Morris, MN*  
*Larry Olson, Farmer, Granite Falls, MN*  
*Richard Handeen, Farmer, Montevideo, MN*  
*Dan and Bev Struxness, Farmers, Milan, MN*  
*Gerard and Mary Radermacher, Farmers, Bellingham, MN*  
*Annette Fernholz, Farmer, Madison, MN*  
*University of Minnesota – West Central Research and Outreach Center, Morris, MN*  
*Land Stewardship Project (LSP), Montevideo, MN*  
*Midwest Food Alliance, St. Paul, MN*  
*Brad Beal, private chef, St. Paul, MN*

## Project Location

Contact Terry VanDerPol, LSP, 320-269-2105.

## Other Resources

Agricultural Marketing Resource Center, 1111  
 NSRIC, Iowa State University, Ames, IA 50011-3310,  
 866-277-5567, fax: 515-294-9496,  
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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 Dairy Cooperative are working to create public demand for dairy products produced from farms that use management intensive rotational grazing. It is our hope that this project will result in the development of stronger consumer recognition of and demand for dairy products that are made from the milk of grass-fed dairy herds, specifically those marketed under the brand name of the PastureLand Dairy Cooperative. The project includes 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 Dairy 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 have tracked with interest the emergence and success of the organic foods movement. The goal of the Cooperative enterprise is to sell dairy products from grass-fed herds at a premium price, returning more of the dairy dollar to co-op members.

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 without the need to become certified organic producers. 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.

*Roger and Michelle  
Benrud with  
daughter, Emily*





**Table 1.**  
**Dairy Herd Illness, Treatments and Treatment Outcomes on the Benrud Farm, 2002**

Illness	Treatment	Treatment Outcome
Metritis (failure to clean after calving)	Tincture of garlic and homeopathic supplements containing caulophyllum and pulsatilla	Very high success rate
Static (non-cycling) cows	Tincture of comfrey and homeopathic supplements containing pulsatilla and sepia	Very high success rate
Pinkeye	Concentrated hydrogen peroxide wash in eye	Successful in isolated cases. After an outbreak of pinkeye, veterinarian recommended vaccination for IBR.
Pneumonia/croup in calves and heifers	Natural “respiratory purge” of wild cherry bark, mullein, horehound, and coltsfoot Tribiotic tincture of garlic, eucalyptus, and goldenseal	Successfully treated one calf in spring of 2002. In the late fall, several calves have developed a croupy cough and will be treated with the same herbal compound.
Milk Fever	Change mineral ration in feed early in 2002 to one that contains kelp, hemocell 100 (a probiotic), Redmond salt, GSM mineral, and Solmin	No incidence of milk fever in 2002
Foot Rot	Concentrated hydrogen peroxide foot bath	Very high success rate

This project is designed to help the Cooperative address these challenges through three specific work areas:

- Part One of our project focuses on helping member farmers develop methods for complying with the Quality and Production Standards established by the Cooperative. Members need reliable, effective alternatives to antibiotic treatment for common illnesses in their herds.
- Part Two of this project involves 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 involves testing the buying preferences of consumers in one locality after they have received information about our farming practices and tasted our products. This part will be completed in cooperation with the Midwest Food Alliance.

Though the specific goals and outcome measures for each of these work areas are slightly different, the overall goal of the project is 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 will be the primary measurement of the Cooperative’s success in this endeavor, but other measurement tools, discussed in Table 2, will be used, as well.

## Results

*Alternatives to Antibiotic Use.* This first part of our project involves 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 is in direct response to negative consumer feedback about use of antibiotics in dairy animals. At the time the policy was adopted, the PastureLand Dairy 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. The Benruds attended informational sessions sponsored by Crystal Creek, a natural farm supply company based in Arcadia, Wisconsin, in February of 2002. They have since consulted with Dr. Paul Detloff and Crystal Creek founder, Dan Leiterman, about holistic and alternative treatments for their animals. Table 1 provides details about specific treatments and outcomes on the Benrud farm.

The Benruds and the other members of PastureLand are pleased with the outcome of the on-farm testing to date. The Benruds and other members of the Cooperative will

seek additional training from Crystal Creek in 2003 and more specific numerical results of the treatments tested will be compiled later in the year.

*Business and Marketing Planning.* PastureLand was able to make significant progress toward its goals of market analysis and business/marketing planning this year. Early in the year, 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. Table 2 outlines elements of our market research and business planning.

We believe that we have made significant progress in identifying our target market and working to appeal to them with the development of new packaging for our existing

products. Sales through December 15 of this year increased 15% over 2001. This is a satisfactory increase in sales, considering the progress made toward market positioning. Our business and marketing planning has also helped the Cooperative to secure a line of credit to be used primarily to build product inventory.

*Consumer education.* This third part of the PastureLand project got off to a slow start in 2002. Preliminary meetings were held between PastureLand and the Midwest Food Alliance (MFA) to discuss consumer research on the issue of grass-based agriculture. At that time, MFA was working with the Kellogg Foundation's Fires of Hope project to formulate research, and PastureLand was working to design its own market research program. The planned launch of the Rochester-area program was delayed, and MFA and PastureLand decided to re-group to focus 2003 efforts in the Twin Cities area where both organizations have strong relationships with retailers.

**Table 2. PastureLand Market Research Methods, 2002**

Market Research Method	Time Line	Participants
Review of competing products, pricing, and availability	Spring 2002	Jeanne Quan, John Seymour-Anderson, and PastureLand members
Focus Group reviews PastureLand's message and product list and completes blind taste-testing Moderated by Jeanne Quan PastureLand members observed focus group	Spring 2002	Sara Hill (VP of Classic Provisions, TC specialty foods distributor); Ruth Murphy (Director of Community Design Center); John Seymour-Anderson; Linn Veltema (savvy consumer); Michael Hochhalter (manager, France 44 Specialty Shop); Tim Tesch (Executive Chef, Lund's Food Holdings, Inc.); Kim Osell (owner, Maud Borup Chocolates)
Visit stores to better understand buying of target consumers in Twin Cities and to talk to store buyers; completion of "Strengths, Weaknesses, Opportunities, Threats" exercise	Spring 2002	Jeanne Quan and PastureLand members
Sales meetings with buyers at various existing and desired placements to better understand the sales process and the desires of buyers and consumers	Spring and Summer 2002	Jeanne Quan and Dan French (PastureLand Board Chair and Sales Manager)
Ongoing discussion with co-packers about possibility of expanding product line	Spring and Winter 2002	PastureLand members, Jeanne Quan
Design new "product identity" to be used on packaging of existing and new products	Summer 2002	PastureLand members, John Seymour-Anderson, and Jeanne Quan
Production of new butter and cheese wrappers	Fall 2002	John Seymour-Anderson and contractors



## Management Tips

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1. Natural and homeopathic treatments seem to work well but can be labor-intensive. Repeated, consistent treatment may be required and early detection and treatment seem to be very important to the success of these alternative therapies.
2. It has been very helpful to have a staff member with organizational, communications, and writing skills.
3. While it was a good learning experience to design our own logo and labels, we have just finished revising our “look” with the help of marketing professionals. It would have been helpful to know these people and solicit their help in the first place.
4. 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.

## Cooperators

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*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*

*Midwest Food Alliance, St. Paul, MN*

*Kirsten Bansen Weigle, PastureLand Dairy Cooperative,*

*St. Michael, MN*

*Jeanne Quan, Jeanne Quan Fine Food*

*Marketing, St. Paul, MN*

*John Seymour-Anderson, Minneapolis, MN*

*Crystal Creek Veterinary, Arcadia, WI*

## Project Location

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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.

**Principal Investigator**

Gary Pahl  
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55124  
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Dakota County

**Project Duration**

2002 to 2003

**ESAP Contact**

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**Keywords**

labeling, marketing,  
sustainable growing  
practices, winter  
squash

# Creating Consumer Demand for Sustainable Squash with Labels and Education

**Project Summary**

Our main reason for starting this project was to increase consumer demand and awareness of sustainably produced winter squash. Using the Midwest Food Alliance (MWFA) seal of approval, we hope to create new market share, increase profitability, and raise awareness of sustainable agriculture at a commercial food retail level. (The MWFA is an independent third party. They endorse farms that meet their strict requirements and allow the growers' products to carry their seal of approval. Farmers whose products bear the MWFA seal meet strict standards in the areas of pest and disease management, soil and water conservation, and human resources development). We need to educate consumers on new crops as well as existing crops that are grown more efficiently and with environmentally sound, sustainable growing practices such as integrated pest management and soil conservation practices.

**Project Description**

A product can fetch a premium price if it offers the consumer the "little extras" that let them know how the product is good for them. These extras can come in many forms. Nutritional content and ease of preparation

are benefits as is having a product produced locally. Environmentally friendly growing practices can also be beneficial. If all of these benefits are combined and marketed to the consumer, they also benefit the farm and community. At Pahl's, we strive for a premium product with a larger market share and one that is produced with reduced farm inputs. We are starting our project with one product – winter squash – and hope to create demand for this product, and eventually others, using the above philosophy.

Winter squash demand has been declining for the past ten years. As a grower that produces 100 acres of assorted squashes, we continually ask ourselves, "Is there anything we can be doing to increase our market share of winter squash?" This past fall, we coordinated our efforts with MWFA in labeling winter squash designated to certain markets to try and increase not only our market share but to increase the consumer's knowledge of winter squash. Our goal was to label squash with cooking instructions, nutritional values, and PLU (Price Look Up code) numbers. By doing so, we were hoping to create better demand from the younger generation that no longer likes to cook; make it easier for the cashiers at the

*Squash with labels*



*Gary at work.*

checkout counters with our PLU's; and lastly, we hoped to command a higher price for a superior product.

Achieving a higher price for any product is always a difficult task. When we started, we thought that our extra service and attention to this product as compared to other Minnesota growers would give us an advantage with the produce buyers. In-store demonstrations and one-on-one customer relations proved to be very fruitful. However, a grocer is looking to maximize his sales floor to the "highest volume product multiplied by the best margin which achieves the best profit scenario." By providing the labels, we convinced the grocer that there would be fewer mistakes at the checkout lane, the checkout process would be faster, and, ultimately, more money would be made. We also convinced them that the labels would encourage more impulse buying and create a larger demand from a more diverse group of people. Lastly, with the MWFA seal of approval, we were able to promote sustainable agriculture to consumers and command a higher price from the wholesaler.

This past year, we started our marketing effort in the metro area and northern Minnesota. In the years to come, we will expand it to our other customers in the Upper Midwest. Our goal, in the first two years, is to monitor the labeling so we can see how much of an increase in sales and profit the labeling will cause. Every aspect of our project can be measured directly through the addition of labels on the squash. Our goal is to increase the amount of winter squash sold per retail outlet where we market. With an original goal of 66,000 labels targeted to our stores during the first year, we figured to get a good assessment on how well the customer perceived our squash labels with the MWFA seal of approval on them. It took off with astounding success!

## Results

Three things happened that were of significant value. By putting on labels, we created more consumer awareness of winter squash and sold our product faster. We created demand that was not there in previous years because the consumer did not know enough about the product. Our average customer buying winter squash in the past five years has been 60+ years old. With the labeling and the increase of store demonstrations, we were able to target a younger customer, thus making them aware of how to prepare it and what to prepare it with. We expanded our customer base to include a younger clientele.

Secondly, we created more demand for our wholesalers. They were able to sell and market more winter squash. They specifically requested that the squash be labeled because they felt it fueled sales. It put our labeled product at a distinct advantage in the beginning of the year. However, as more squash became available during the fall, they were reluctant to keep paying a premium for the labeled squash.

Lastly, with the increase in sales and extended effort put into marketing, the retailer was more willing to run more fall specials featuring winter squash. Their receptiveness towards labels with PLU's and cooking instructions, in store demonstrations, and increased customer service proved to push demand faster.

The fact that we promoted a Minnesota Grown product grown under the MWFA seal with PLU's and cooking instructions increased our sales to the test market customers by 50%. At seasons end, we ended up placing 90,000 labels on winter squash versus the 60,000 originally estimated.

During the course of our first year, we only came upon one distinct problem. After the first month, the buyers tried to get the product for the old pre-label price versus the extra \$.50 per carton that we charged. We would have to constantly remind them of the extra service and value that they were receiving. Hopefully, in the second year of this trial, we will be able to further improve the demand for a great vegetable that has been losing its luster these past years.

### Management Tips

1. You must have a quality product; people buy with their eyes.
2. Be an aggressive marketer who is willing to spend time with the consumer by means of product demonstrations and other promotions.
3. Be efficient on the packing line; this is your largest cost incurred in the form of labor.
4. Track who is getting the labeled product and who is not. Is there any increase in sales due to the labels?

### Cooperators

*Midwest Food Alliance, St. Paul, MN*

*H. Brooks and Company, New Brighton, MN*

*Wholesale Produce and Supply Company, Minneapolis, MN*

*Hy-Vee, Rochester, MN*

### Project Location

Pahl Farms is located 4 miles east of I-35 on Cty. Rd. 46 in Apple Valley.

### Other Resources

Barco Labels, 1530 Glenlake Ave., Itasca, IL 60143-1173.  
Custom label makers. Web site: [www.barcolabels.com](http://www.barcolabels.com)

US Food and Drug Administration – Center for Food Safety and Applied Nutrition. 2000. Guidance on how to understand and use the nutrition fact panels on food labels.  
Web site: [www.cfsan.fda.gov/~dms/foodlab.html](http://www.cfsan.fda.gov/~dms/foodlab.html)

The Packer, 10901 W. 84<sup>th</sup> Terrace, Lenexa, KS 66214.  
Produce industry publication.  
Web site: [www.thepacker.com](http://www.thepacker.com)

### Principal Investigator

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### Project Duration

2000 to 2002

### ESAP Contact

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### Keywords

consumer demand,  
eco-label, grocery  
store, Midwest  
Food Alliance,  
natural meat, pork

# Demonstrating the Market Potential for Sustainable Pork

## Project Summary

This project was developed to demonstrate sustainable pork production practices and test the use of an eco-label on sustainable pork products in both mainstream grocery stores and natural foods cooperatives. It will also look at what price consumers, retailers, and distributors are willing to pay.

## Project Description

Prairie Farmers Cooperative (PFC) was founded in 1995 by a group of small, independent pork producers seeking to preserve what we value about a family farm: animals raised naturally and with concern for their well-being, respect for the land and the environment, and the entrepreneurial dedication to make a good living for our families. By 2002, PFC had grown to a membership of 81 diverse, hog-producing farms in western Minnesota, constructed a processing facility, and was ready to begin processing hogs. We see our farmer-owned cooperative as an alternative to the corporate philosophy dominating the pork industry.

In creating a co-op, our goal was to develop high quality pork products from local family farms that would garner a premium in the marketplace and return the processing profits to the producer-members. Members would receive a larger share of the retail food dollar. The processing plant was specifically designed to allow traceability of product back to the producer – a flow of information that would allow for consumer-driven changes at the production level. Consumers are reportedly willing to pay more for products raised according to sustainable standards. The

traceability aspects of the plant were designed to allow the members who were using sustainable practices to earn these premium prices.

The specific goal of this demonstration project was to develop an eco-label consistent with and supported by the Midwest Food Alliance (MWFA) seal of approval and to test market our product through two retail outlets consisting of a larger chain-type conventional grocery outlet and a natural foods cooperative. Based in St. Paul, MN, the Midwest Food Alliance is an eco-labeling project that promotes the use of sustainable farming systems with a long-term goal of helping farmers become more economically viable, environmentally sound, and socially responsible. The MWFA has created sustainable production standards for a number of foods, including pork. Growers who want to participate in the program and use the MWFA “seal of approval” undergo an independent inspection and certification process. The seal and consumer education campaigns in retail stores offer education to the public about sustainable farming practices and what the MWFA seal of approval means. Three PFC members are “Midwest Food Alliance-Approved” and their pork was the test product for this project.



*Special labels help consumers identify  
“Midwest Food Alliance-approved”  
products.*

## Results

As a precursor to the Midwest Food Alliance label, PFC developed a “natural” label in an effort to discover the nuances involved in the development and salability of this related product. The natural label was test marketed in three stores located in Willmar, Hutchinson and the Twin Cities metropolitan area. The product was displayed fresh and unwrapped at the specialty meat counter with point of purchase sales brochures depicting the PFC’s family farm base and locally processed attributes. The product was priced the same as the corresponding products located in the self-service meat case.

Personal observations on Friday, May 24 (payday for most people and Memorial Day weekend) and again prior to the July 4 holiday revealed an acute lack of consumer interest in the product at the retail level at the Willmar outlet. Although the store was very busy with shoppers buying supplies for the upcoming holiday weekends, during a one-hour observation, only two people stopped by the specialty meat case in the May observance, and only three during the July observance. The display of our pork products included loin eye chops, butterfly chops and stuffed pork chops – generally one-inch thick cuts openly displayed in a glass-faced counter with the point of purchase brochures located on the top of the case. Identification labeling was also placed in front of the displayed product. None of the people purchasing products through the specialty meat case during the observance bought pork; they all bought beef steaks. This trial run lasted through July and resulted in insignificant sales to justify continued effort.

This experiment probably offered more insight into consumer perceptions of specialty meat vs. self-serve meat cases, or beef vs. pork, instead of testing shopper response to a “natural” pork label and product. We believe this trial failed due to the perception by the general consumer that products in a specialty meat case are automatically more expensive than meat in the self-serve case. The average consumer in a rural area seems not to look at the specialty meat case because of this assumption. Even on holidays that might justify an extra expense for a special occasion, consumers did not respond to the marketing of a natural, fresher, premium product priced exactly the same as the commodity pork offered by the same store because they never went to the specialty meat counter to even compare other products to ours. Customer behavior may be different in food co-ops or in higher-status Lund’s or Byerly’s-type stores, since those consumers seem to prefer high-end product anyway.

Developing, establishing, and proving specific quality specifications on a consistent basis is a prerequisite to asking and getting premium prices. If you expect to receive premiums that will allow for improved margins and profit, you have to use objective testing techniques and documentation to prove, day in and day out, the unique quality aspects of your product. For us, further market exploration was hindered by the fact that during the plant’s startup year, staff and board members were busy with the many time-consuming aspects of starting a processing facility. Other issues were priority concerns, and the plant did not develop basic marketing specifications for the quality characteristics of hogs coming into the plant – specifications that are necessary to develop the quality product specifications of pork product coming out of the processing plant. While the board identified quality characteristics as a necessary attribute to develop specific end product, standards for consistent weight and yield characteristics, premium and deduction incentives, and equipment and processes required to monitor and manage the quality aspects concerning pH, color, and tenderness ratings of the producers’ hogs have not yet been established. The plant was therefore not able to use documentation in order to distinguish different quality aspects of each producer’s hogs – differentiation that was necessary for the identification and development of quality specifications.

The food industry is a highly competitive business. In order to justify added processing and production costs of a specialty product, you need to identify, up-front, the specifications that will achieve the premiums you want consumers to pay. This work needs to be done before you start dumping product on the market. You need to start slow and small, and develop the market in conjunction with the processing capabilities so you simultaneously build a good reputation and brand name recognition.

The PFC producer base is all across the board in terms of production practices and genetics. One of the original concepts behind developing the PFC was that we would discover marketing niches and use the collective finances of the PFC to hire the expertise that would enable us to market our products into those specialty markets. We have not accomplished this goal yet because the primary evaluation of available niche markets was not done, and the primary evaluation of the producer base of PFC was not completed. We had no way to distinguish our product from the commodity pork broker’s product. Being a new and untested player in the business made it increasingly difficult to establish any kind of premium market. Although the three MWFA-approved producers did have specific marketable attributes concerning the hogs coming into the plant, they could not deliver enough hogs on a regular basis to establish a consistent supply of end product for this test.

Principals in the processing venture are currently exploring alternate business structures. Plans for year two of this grant project will depend on the directions that partners wish the enterprise to take.

## Management Tips

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1. Know what products consumers want and what price they are willing to pay for them.
2. Be able to meet and document product specifications on a consistent basis and produce raw product at a price that will allow for adequate margin to make a profit.
3. Know what product you have, what product you are selling (are you selling pork, the concept of a sustainable food system, locally produced, safe, traceable product?), and to whom.
4. Make the product available in a form people can use, at a location where they can get it easily, and at a price they are willing to pay.
5. Monitor consumer trends and competition, and make adjustments to create marketability and consumer perceived value.

## Cooperators

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*Jim Ennis, Midwest Food Alliance, St. Paul, MN*  
*Lyle Haroldson, Farmer, Minneota, MN*  
*Nolan Junclaus, Farmer, Lake Lillian, MN*  
*Ann Ramey, Farmer, Redwood Falls, MN*

## Project Location

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Prairie Farmers Cooperative members live in a number of counties in Western Minnesota. Contact Dennis Timmerman for member information. The Prairie Farmers Cooperative plant is located in Dawson.



**Principal Investigator**

Michael Reese  
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**Project Duration**

2001 to 2003

**ESAP Contact**

Jean Ciborowski  
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**Keywords**

narrow leaf  
coneflower, native  
forb seed, prairie  
land restoration,  
purple prairie  
clover, seed  
production

# Integrated Demonstration of Native Forb Seed Production Systems and Prairie Land Restoration

**Project Summary**

I would like to find new crops to diversify my operation and reduce crop inputs. I am interested in maintaining and increasing native prairie species. Unfortunately, native forb seed, which is what I would like to plant, is very expensive. I believe that producing native forb seed could potentially allow family farms to diversify into a new crop, provide a stable market for native forb seed, and allow for more native prairie to be seeded. Additionally, native plants grow best on marginal soils and once established, can be harvested for up to 20 years, limiting the amount of fuel and chemicals used in their production. Native forbs are used for native prairie seedings such as CRP, wildlife acreages, roadsides, and landscaping. My project will look at producing native forb seed in an economical and sustainable manner.

**Project Description**

Our farm is located in the west central part of Minnesota near the small farming community of Hancock. The landscape is diverse, ranging from rolling hills to flat valleys. Historically, the land was covered by tallgrass prairie. The region is on the border of the lake country. Lakes, rivers, and wetlands speckle the countryside. The soil types vary from heavy clays to light sandy soils. Irrigation is prevalent on the lighter soils in the region. The main farm products of the region are corn, soybeans, swine, and beef cattle.

I farm in partnership with my brother Randy, and his family. We raise the traditional crops of corn, soybeans, and alfalfa. Approximately half of our cropland is irrigated. In addition, we maintain a beef cow/calf herd, which is grazed on cool season grass pastures from May to October, and on corn stalks as late as the winter allows. As much as possible, the beef cattle are wintered in pastures and on crop residues. Supplement and hay are fed in different areas in an attempt to spread

the manure and nutrients across the field.

The cattle are placed in a dry lot in extreme weather and just prior to calving. All of the land is rented with the majority of it rented from our father who is a retired farmer. Both my brother and I have jobs off the farm and do farm work in the evenings and on weekends. We are very fortunate to have two outstanding part-time employees who are able and willing to work in the evenings and on weekends as well. Randy's wife, Lynn, maintains our financial records and his kids love to help out with the daily chores.

Most farmers have come to realize that margins are small on traditional crops and livestock. However, it is very difficult to break out of the pattern. The uncertainty of trying new ideas and the expense of new machinery makes it nearly impossible. Nonetheless, I am always looking for crops that could fit our farm and allow us to become more diversified. Part of my off farm job gives me the opportunity to work with native prairies. It has made me more aware of the importance of maintaining our existing prairies and increasing them if possible. I found one of the roadblocks to seeding more land into native prairie is the cost of the seed. Native grass seed prices have become more stable, however native forb seed prices are extremely high. Producing native forb seed could potentially allow family farms to diversify into a new crop, provide a stable market for native forb seed, and allow for more native prairie to be seeded. Other attributes are that the native plants grow best on marginal soils and once established, can be harvested for up to 20 years, limiting the amount of fuel and chemicals used in their production.

Certified purple prairie clover and narrow leaf coneflower seeds were ordered from the USDA Plant Materials Center in Bismarck, ND. In the spring of 2001, a demonstration site was selected and the ground was tilled with a disk finisher. The two acre



demonstration site was then packed twice with a roller packer. A no-till grass drill was used to solid seed the purple prairie clover at 6 lb/A. Herbicide use was kept at a minimum as weeds were controlled by tillage and mechanically mowing the site. The seeding method for the narrow leaf coneflower has been a problem that I am still working to overcome. The recommended seeding amount is 2 lb/A in 60" plus row widths. This type of delivery is best accomplished with specialized seeding equipment similar to research plot equipment and I have been working to modify a conventional planter to accommodate the recommendations. The seed is very expensive and extreme care is being taken to ensure that favorable seeding conditions exist.

## Results

The project is being evaluated on two levels. First, I am evaluating the agronomics of producing native forb seed. In addition, the economics of producing native forb seed are being evaluated. The fall stand of purple prairie clover was rated using a 1-10 scale with 10 being the most desirable. A "10" rating would indicate a 100% stand establishment and a "1" would indicate a 10% or less stand establishment. I took 12 ratings over the demonstration plot and then averaged the ratings. The overall rating for the stand, in 2001, was a "5" which decreased over the winter to a "3." Weeds became more of a problem in the 2002 growing season. The plot was mowed in early June of 2002 and then sprayed with 8 oz/A of Plateau herbicide in July, 2002. The fall 2002 rating was also a "3." A stand rating of "3" translates to 30% of the plants seeded have survived.

Certified native forb seed supply was limited and I was unable to purchase additional seed of purple prairie clover and narrow leaf coneflower in 2002. All inputs are being monitored in order to give an accurate financial assessment. No seed was harvestable in 2001 or 2002. Generally, seed harvest can be done the third year after establishment. Input costs were \$831.00/A in 2001 and \$113.58/A in 2002. The inputs in 2001 were seed, tractor rent, labor, (including time spent hand weeding, mowing, seeding, and field tillage). The 2002 inputs were Plateau herbicide, herbicide application, tractor rent, and labor including mowing and hand weeding.

## Management Tips

1. Concentrate on making a good seedbed before seeding. Pack the soil so that it will only leave a .5 to 1" impression when stepping on the soil.
2. Pay particular attention to weeds. Spraying the site first with Roundup would be helpful.
3. If hand and mechanical weeding are insufficient, Plateau herbicide works well to control weeds. The recommended rate from the herbicide company for purple prairie clover is 8 oz/A either pre- or post-emergence. The rate recommendations and effectiveness will vary depending on the type of native forb or grass.
4. Seed is expensive so it is important to calibrate the drill to ensure proper seeding rates and seed depth.
5. Start by seeding a small area and then check the actual seeding rate and seed depth.

## Cooperators

*Dwight Tober, USDA, NRCS, Plant Materials Center, Bismarck, ND*

*Allen Holleman, Marketing Representative, Agassiz Seed Company, Hawley, MN*

*Margaret Kuchenreuther, University of MN, Morris, MN*

*Darrel Haugen, USFWS, Morris, MN*

*Av Singh, University of MN, West Central Research and Outreach Center, Morris, MN*

## Project Location

Drive 4.5 miles east of Hancock, MN on Stevens Cty. Hwy. 8. This will change to Pope Cty. 1. The certified native forb seed production site is on the north side of the hwy.

## Other Resources

Bismarck Plant Materials Center and Ducks Unlimited. 1995. Rebuilding your land with native grasses. USDA-NRCS Bismarck Plant Materials Center and Ducks Unlimited. Canada. 12pp. (Publication #2007)

Dodds, D., J. Carter, D. Meyer, and R. Haas. 1987. Grass seed production in North Dakota. NDSU Cooperative Extension Service, R-917, Feb. 1987. 30pp. (Publication #1805)

Haas, R. and L.K. Holzworth, et al. 1997. Native grass seed production manual. Cooperative Publication of USDA-NRCS Plant Materials Program. Ducks Unlimited Canada, Manitoba Forage Seed Association, and University of Manitoba. 155pp. (Publication #292)

Knudson, M.J. 1998. Plant Guide: *Helianthus pauciflorus* (stiff sunflower). USDA-NRCS Bismarck Plant Materials Center. Bismarck, ND. 1p. (Publication #1353)

Knudson, M.J. 1998. Planting Guide: *Helianthus pauciflorus* (stiff sunflower). USDA-NRCS Bismarck Plant Materials Center. Bismarck, ND. 1p. (Publication #173)

Packard, S., C. Mutel, et al. 1997. The Tallgrass Restoration Handbook for Prairies, Savannas, and Woodlands. Papers presented at the Society for Ecological Restoration's Second Annual Conference in Chicago, IL 1990. Island Press. Washington DC.

United States Department of Agriculture – Natural Resources Conservation Service - The Plant Materials Program. Web site: <http://plant-materials.nrcs.usda.gov/>

**Principal Investigators**

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Wabasha County

**Project Duration**

2000 to 2002

**ESAP Contact**

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**Keywords**

compost tea,  
flowers, foliar  
diseases, grapes,  
organic production,  
vegetables

# Evaluating the Benefits of Compost Teas to the Small Market Grower

**Project Summary**

Four growers who raise a variety of vegetables, small fruits, and flowers cooperated on this study of compost tea. All of us experienced disease in our production areas and wished to decrease disease impacts in a cost effective, least toxic manner. We hoped that compost tea would be an effective way to deal with disease problems and also boost yields.

We made and applied compost tea as a foliar spray and soil drench to grapes, ornamental flowers, and vegetables. Microbial analyses of soils, compost, and compost tea were used to determine the needs of our sites as well as how effectively we were making compost and tea. The extent of disease between treated and untreated plots was evaluated. Differences in harvest weights in grapes were also compared to evaluate the impact of compost tea on production.

**Project Description**

This project is a collaboration among four small market growers to study compost tea. Our farms are nestled among the bluffs, prairies, and forests of SE Minnesota. Two of us are certified organic, operate community shared agriculture farms, and sell to restaurants. Three sell vegetables, fruits, and flowers at farmers' markets. One sells grapes to a winery and home winemakers. Two also raise livestock and field crops. Three of us have areas of heavy clay soils. All have had difficulty with fungal and bacterial diseases on some crops and wish to prevent or treat these diseases in a sustainable way.

During the first two years of the project, we experimented with brewing compost tea and adding amendments to increase its potency. We learned about the microbial community in our soils, compost, and teas. We have learned the importance of making or buying temperature controlled, aerobic compost in order to supply a rich variety of microorganisms to make tea. See *Greenbook 2001* and *2002* for details of our previous results.

The goals of the project were to determine whether compost tea was a useful tool in suppressing disease and increasing yields in a variety of crops. The questions that we have tried to answer are: 1) how good is the compost tea that we brewed; and 2) did the tea have an impact on the crops we grew?

To evaluate the compost and compost tea, we sent samples to a laboratory that specializes in microbial analyses, Soil Foodweb Inc. We evaluated soil, compost, and tea for total and active bacterial biomass, total and active



*Pat and Peggy analyze grape quality with a refractometer.*

fungal biomass, ratios of fungi to bacteria, protozoa counts, and total nematode counts. There was also an evaluation of whether any of the nematodes were root feeders.

To test the impact of the compost tea on crops we tried to determine whether crops that were sprayed or had their soil drenched with tea, had less observable disease. In the case of grapes, yield differences were also evaluated. We feel that compost and compost tea could be extremely important in moving agriculture toward less toxic and less costly means for dealing with disease. In addition more composting could help turn waste such as manures and biosolids into useful products.

## Results

The 2002 highlights were: 1) higher grape yields were found in those rows where compost tea had been applied; 2) compost tea used on starts in the greenhouse reduced damping off considerably; and, 3) fungal attributes were generally low for soil and tea samples as had been seen in previous years.

*Microbial and soil chemistry analysis.* Soil samples from the vineyard were sent to Soil Foodweb Inc. in 2002 for microbial analyses. Five vineyard treatments included: 1) an untreated control; 2) synthetic fertilizer; 3) synthetic fertilizer plus synthetic sprays (conventional); 4) tea; and, 5) conventional plus tea. Total fungal biomass and the ratio of fungal to bacterial biomass were increased in the soil samples treated with synthetic fertilizer plus synthetic spray. Beneficial protozoa including flagellates and amoebae were increased for the groups treated with tea. Ciliated protozoa were high in all five groups, indicating anaerobic soil conditions consistent with our heavy, waterlogged spring soils. Total nematodes were increased in the conventional treatment. However, even the highest nematode value was well below the normal range of 20-40/g, which suggests the teas, and perhaps the composts, were deficient in nematodes.

*Forest floor inoculants.* The lack of fungal biomass in the previous year's compost tea samples suggested that fungal inoculants were needed. Two forest duff samples were evaluated to determine the value of adding these to compost as inoculants for fungi and other microbial attributes. The result suggested that the forest duff chosen did not provide great benefit as inoculants.

*Vegetable garden soils.* Microbial analysis of soils from two of Sandy's garden beds showed that a high level of microbial variability can be found within a single garden area. One bed had high protozoa indicating excellent nutrient cycling. This same bed had good active fungal biomass compared to a nearby bed. These differences were

due to the long-term cropping history and not the treatments applied in this study. The recommendations for improving these two beds were different because of the different microbial communities present. Such variability makes it difficult to know how to proceed in treating the soil unless extensive and expensive microbial analyses are done.

*Compost tea microbial analysis.* One sample of compost tea that was used on grapes and ornamental flowers was analyzed for microbes. Both bacterial activity and total biomass were good to excellent, but no fungi were apparently present. Ciliated protozoa were adequate. Other protozoa and nematodes were deficient. Overall, the compost tea was rich in bacteria but deficient in nearly all other analyzed microbes. These findings agree with previous years analyses.

This problem can be attributed to one of three things: 1) the compost is deficient of fungi; 2) the sock used to hold the compost does not allow fungi to move into the liquid; and/or, 3) the brewer does not adequately extract the fungi. To evaluate the last two possibilities, the design of the sock has been changed and different brands of brewers are being tried. The technology in the compost tea business is constantly changing. When we started the grant there were only two commercial brewers available. There are now at least eight.

*Compost tea recipes.* The following sample recipe was used on grapes and flowers. Place 12 gallons of rainwater in a muck bucket. Put one pint cow manure compost in the sock designed to hold and filter the compost plus 2 oz black strap molasses, 1 oz azomite, 2 oz Algamin, 1 oz Omega 1-5-5, 1 oz Humax, 1 oz MicroHume, and a handful of comfrey leaves. Brew tea with a commercial brewer for 24 to 48 hr or until the smell of molasses is nearly gone and the tea is frothing. Recipes for other batches of compost tea for grapes and flowers were similar, depending on whether the goal was for a tea dominated by fungi or bacteria.

The following recipe was used on greenhouse plants and other vegetables. Place compost (from pig and chicken manure, straw, wood chips, and alfalfa) and forest soil in a muck bucket sock. Add molasses, fish emulsion, kelp, nettles, and a handful of German chamomile. Brew tea until the desired frothiness appears (24 to 48 hr).

*Tea effectiveness on grapes.* The Frontenac grape vines displayed an early June outbreak of anthracnose. No other serious diseases were detected. The severity of the outbreak was evaluated on June 12. The standard treatment of synthetic fertilizers and foliar sprays reduced the anthracnose, with the treated vines showing less than one-third the symptoms of untreated vines. Compost tea reduced the incidence of anthracnose but not sufficiently to control the disease.

Due to the severe anthracnose infection, the study protocol was broken on June 13 to allow all treatment groups to be treated with standard sprays. Applications of compost tea were continued in the designated tea rows.

The 4-year-old Frontenac vines produced their first crop in September 2002. The differences among treatments were striking:

- untreated vines produced only 4 lb/vine;
- the group treated with synthetic fertilizer produced 6.5 lb/vine;
- the compost tea treated grapes produced 8.3 lb/vine;
- the vines treated conventionally produced 12.3 lb/vine; and,
- the conventional plus tea vines produced 13.8 lb/vine.

The additional 1.5 lb/vine obtained by adding tea to the standard sprays would translate to approximately one-half ton additional fruit per acre.

Compost tea alone did not appear to effectively reduce severity of anthracnose infection in Frontenac grapes. However, it was gratifying to see that tea alone produced more grapes than no treatment or only fertilizer, and that conventional production plus tea produced more than conventional. These differences can be meaningful financially, and may indicate greater vine health and fruit quality in future years if the use of tea continues.

*Tea effectiveness on zinnias.* Zinnias were planted in early July and treated on three separate occasions with compost tea. Untreated beds were sprayed with water. As in previous years, leaf spots developed in mid-August. Plants were analyzed for disease severity on August 30 and September 6. There was no significant difference in disease pressure as a result of the application of the tea. Last year the use of tea reduced disease, suggesting that this year's compost tea preparation was not as effective.

*Tea effectiveness on sunflowers.* Sunflowers were planted in early July and treated with compost tea on three separate occasions. Leaf spots similar to those on the zinnias, as had been observed in years past, developed on the sunflowers. Disease pressure was evaluated on September 20. There was no significant difference between treated and untreated plots. Overall, the amount of disease was low, making the impact of the tea hard to discern.

### ***Brewing compost tea with a bioblender.***

*Tea effectiveness on greenhouse flats of herbs and cucumbers.* Herbs and cucumbers were planted in the Whitewater Gardens greenhouse in an organic soil mix consisting of peat, vermicompost, perlite and trace minerals. Compost tea was used on selected starts. The tea was added to water that was used to bottom water flats of the starts. The control groups were given water but not tea. Tea was added to every other watering so that the treated plants were not overfed. Visual comparisons were made on cucumber plants and on oregano, thyme, and marjoram to determine the amount of damping off.

The control flats of herbs where only water was added lost approximately 25% of the plants to damping off. Herb flats that were treated with tea lost only 5% of the plants. Untreated cucumbers had an approximate loss of 50% due to damping off. Flats treated with tea fared considerably better with about a 10% loss.

*Tea effectiveness on heirloom greenhouse tomatoes.* Select heirloom tomato varieties were planted in an unheated hoop structure. Varieties included Thessoloniki, Dr. Wyches Yellow, Bulls Heart, German, Amish Paste, Rose de Berne, and Cherokee Purple. At planting, soil was amended with a dusting of calcium carbonate and each plant was watered with a mixture of water and compost tea. The tea was made from the same mix used for tea on greenhouse flats, but nettles and chamomile were not added to this brew. The plants were staked, tied, and pruned as they grew, and watered with the same tea recipe one more time about a month after planting.



Although fruits were not weighed or tested for brix, plants were observed for signs of any kind of blight. Tomato plants treated with compost tea and control plants were both free of blight during the season. Inadequate ventilation in the greenhouse caused some heat stress on both tomato plants and fruit. All plants continued to bear fruit until they finally were allowed to freeze in October.

*Tea effectiveness on sugar snap peas.* Three 100' rows of sugar snap peas were planted 4' apart and divided into 25' sections. Alternate sections were treated with a foliar spray of compost tea brewed from the same recipe used for the greenhouse tomatoes. The soil was also treated when plants were about 4 to 6" tall. The soil had been tested earlier in the year by Soil Foodweb, Inc. and was determined to need more beneficial fungi to insure the health of the legumes. All plants remained healthy and produced heavily on both treated and untreated sections.

### Management Tips

1. Start brewing tea in a small bucket with an aquarium aerator and play with recipes on one crop to limit the number of variables you are dealing with.
2. If you can't make quality compost yourself, buy or barter with a local composting expert.
3. Brew tea inside a greenhouse or garage to extend the season into early spring and late fall.
4. Think of compost tea as just one tool in an integrated pest management toolbox (crop variety selection, crop rotation, green manures, and soil health maintenance).
5. Due to concern over *E. Coli* and *Salmonella* contamination, organic certification is currently not offered for those using compost tea. This may change with more knowledge in the near future.

### Cooperators

*Sandra Gould, U of M Plant Disease Clinic, St. Paul, MN*  
*Russell Turner, Wabasha, MN*  
*Larry Shafer, Agro-K Corp., Minneapolis, MN*

### Project Location

Weaver Gardens is located on the north side of State Hwy. 74, .75 mile west of Hwy. 61. It is the last residence in Weaver going west. Contact Pat Bailey for directions to other sites.

### Other Resources

Cantisano, Amigo. 2000. Control plant diseases with compost teas. Growing for Market, Sept. 6.

Compost tea discussion group:  
<http://lists.ibiblio.org/mailman/listinfo>

Diver, Steven. 1998. Compost teas for plant disease control. Appropriate Technology Transfer for Rural Areas. Available at: 800-346-9140 or [www.attra.org](http://www.attra.org). Diver has recently published a supplement at: [www.attra.org/attra-pub/compost-tea-notes.html](http://www.attra.org/attra-pub/compost-tea-notes.html)

Ingham, Elaine, and Michael Alms. 1999. Compost tea manual. Available at: [www.soilfoodweb.com](http://www.soilfoodweb.com)

An extensive bibliography is available by contacting Pat Bailey at: 507-767-3225 or Mark Zumwinkle at: 651-282-6204.



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**Project Duration**

2001 to 2003

**ESAP Contact**

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**Keywords**

community supported agriculture, organic vegetable production, post-harvest handling, season extension

# Root Cellaring and Computer-controlled Ventilation for Efficient Storage of Organic Vegetables in a Northern Market

**Project Summary**

We have designed and installed an automated temperature control and monitoring system in our new root cellar. We are demonstrating the efficiency and cost effectiveness of using the earth's natural temperature differences to heat and cool a space for vegetable storage. The environmental benefits of this project are tremendous. Instead of buying produce trucked in from thousands of miles away and stored in warehouses heated and cooled by fossil fuels, our customers are purchasing high quality produce, grown locally, and stored using a minimum of energy.

**Project Description**

Our family owns and operates a 200 acre Community Supported Agriculture (CSA) farm. We offer 100 summer vegetable shares (available from mid-June through mid-October), 36 winter vegetable shares, pastured poultry, and eggs. The winter shares include a variety of vegetables for freezing, canning, and storage including carrots, beets, squash, and potatoes. Winter shares have worked well but participation has been limited because most customers lack adequate storage facilities in their homes.

Our marketing strategy also includes wholesaling vegetables to the Whole Foods Co-op in Duluth. We have a reputation for high quality with the Co-op clientele and have worked hard to maintain a good relationship with their produce department. The produce manager recognizes the superior quality of local produce and is eager to obtain vegetables locally over a longer portion of the year.

Our labor force in 2002 consisted of our two sons, Ben and Janaki, our friend and longtime employee, Dave Hanlon, and two short-term interns, in addition to myself. It is very rewarding to have committed, long-term workers.

In 1999, we decided the time was right to build a root cellar to extend the period of time we could provide vegetables to both the Co-op and our CSA members. In the summer of 2000, we built a 24' x 32' root cellar with an attached 24' x 20' packing shed. The root cellar has a number of unique design features. It is built into a hill so that a van, pickup truck, or small tractor can back completely into the structure. This allows for efficient loading and unloading of vegetables.

*Slatted walls on storage bins make for easy access.*





*The van being loaded with CSA shares in the packing shed.*

Fans were installed to draw in outside air and lower the root cellar temperatures in the fall. A ventilation control and monitoring system was installed. Whenever the outside temperature is lower than that of the root cellar, the fans come on and blow in cool air until the inside temperature reaches the desired level or until the outside and inside temperatures equalize.

The monitor stores temperature information for each of three rooms in the root cellar and the outside temperature every half hour. This information may then be downloaded and printed out. The monitoring system enables us to document the overall performance of the root cellar so we can pass this information on to interested parties (please visit the U of M web site at: <http://smfarm.coafes.umn.edu/fm2002-3.htm>).

## Results

In 2001, the root cellar increased our gross income by \$10,000 in CSA sales and by \$2,400 in extended season sales to the Whole Foods Co-op. We have limited the expansion of CSA winter shares until we can ensure our ability to operate the root cellar dependably. We are experiencing an ongoing increase in demand from our committed CSA customers.

In 2002, season extension increased CSA sales by \$10,500 and Co-op sales by \$3,000. We are achieving the steady growth and customer base we planned for.

The control and monitoring system was more time consuming than we had expected. Time was spent monitoring the equipment, reporting malfunctions, replacing a computer, and learning how to make graphs. We had problems with motorized dampers not closing and temperature sensors not being accurate. When these mishaps occur, the entire stored crop becomes vulnerable to potentially devastating temperature swings. The entire

system is vulnerable to electrical storms. We would have been completely baffled without the assistance of our sons, Ben and Janaki.

In 2000, the cellar walls were insulated on the outside with 2" Styrofoam to a depth of 2'. At the 2' level, the ground was insulated horizontally from the building to a distance of 4'. This allows the building to be maintained at the earth's ambient belowground temperature (approximately 45°F). The earth's thermal mass serves both to heat the structure in winter and cool it in summer.

In August, 2001 we were forced to re-insulate the outside wall and surrounding surface due to excessive settling of the previous years backfill. A gap had developed at the top of the foundation, allowing any surface water to funnel down the foundation wall. We decided to take this opportunity to extend the horizontal insulation from 4' to 8' since it would cost only \$400 more than the original design.

This improvement paid off during the summer of 2002 by keeping our root cellar between 50°F and 55°F all summer long. This compares to an average of 60°F to 65°F in the summer of 2001, even though the summer of 2002 was hotter. The newly extended insulation also contributed to the speed with which we were able to cool the root cellar in the fall.

During our first season of using the root cellar, we discovered that our original layout of the storage rooms was not practical. The squash room got too cold because it had too much outside wall surface area. To remedy the problem, we switched the squash and potato rooms. The squash room is now insulated and has a heater for those times when the passive system cannot keep up with the warmer temperature requirements of the squash. The heater is controlled by the same computer system that manages the rest of the root cellar.

In 2001, we maintained a temperature of 45°F in the squash room. We experienced unacceptable losses from spoilage at this temperature. On the advice of Cindy Tong, the post harvest handling specialist at the U of M, we raised the temperature to 50°F and installed an overhead fan to insure good air circulation.



Managing the root cellar takes more time than we expected. It is not unusual to spend three to four hours a week culling squash and tracking the condition of the vegetables. In the winter of 2001, unusually warm weather kept us hopping. At times, temperatures remained too warm to cool the root cellar, even with the cooling fans running. This caused the fall carrot crop to sprout and the carrots had to be rewashed.

The 2002 fall harvest season provided cool enough temperatures to cool the root cellar before harvest. Unfortunately, heavy late frost in the field damaged the potato crop, creating the need to hand sort blemished tubers.

At harvest, we took advantage of the newly installed large fans. We opened the root cellar door, turned on the fans, and rapidly cooled the facility down. Once this initial cooling process was done, the smaller fan that came with the temperature control system was adequate to maintain optimum winter temperatures.

The root cellar project has proven beneficial in an unforeseen way. The added space provided by the 24' x 20' packing shed promotes greater organization. The shed is attached to the root cellar and has storage space for boxes used in shipping. The shed also provides a place for cooling vegetables (we immerse them in water). Pre-picked vegetables like zucchini and cucumbers reside next door in the root cellar, just steps from the delivery boxes. The addition of tables to the packing shed has made handling of delivery boxes much easier. During construction of the root cellar, it appeared to be quite a bit larger than it needed to be. However, now that it is in use, we are finding that it is just big enough. It takes a lot of room to pack 100 boxes of produce.

The addition of the root cellar has evened out summer and fall workloads. There is a cool space for the pre-picked vegetables in the summer and fall harvest begins earlier. We are no longer dependent on guessing when early freeze-up, snow, or other bad weather may occur.

Cindy Tong is conducting a quality control experiment in the root cellar. She is monitoring the change in eating quality of the vegetables over time. Measurements include weight loss and sugar content throughout the storage period. She will also compare the performance of our root cellar to laboratory controlled storage.

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## Management Tips

1. Expect to spend several hours each week managing the stored vegetables.
2. Take time to design work space flow to optimize the use of both the root cellar and the storage shed.
3. Place the cold-loving vegetables against the walls with the most exposure to the outside.
4. Get to know the long-term storage needs of each crop in detail. A difference of 5°F one way or the other can mean success or failure.

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## Cooperators

*Troy Salzer, Carlton County Extension, Carlton, MN*  
*Mike LeBeau, Conservation Technologies, Duluth, MN*  
*Michael Karsch, Whole Foods Co-op, Duluth, MN*  
*Cindy Tong, Department of Horticulture, University of Minnesota, St. Paul, MN*

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## Project Location

From Duluth, take I-35 to the Carlton/Scanlon exit. Turn left on State Hwy. 45 and go to the stop sign in Carlton. Go straight on Cty. Rd. 1 through Wrenshall. After the intersection with Cty. Rd. 4, we are the 7<sup>th</sup> mailbox on the left. From the south, take I-35 to the Wrenshall/Mahtowa exit. Turn right on Cty. Rd. 4. Go 15 miles and turn right on Cty. Rd. 1.

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## Other Resources

Contact Cindy Tong for detailed results of the vegetable quality experiment. 434 Alderman Hall, 1970 Folwell Ave., St. Paul, MN 55108, 612-624-3419.  
 Email: c-tong@tc.umn.edu

Web site with information on construction expenses, a schematic of root cellar insulation, and quality of winter stored vegetables:  
<http://smfarm.coafes.umn.edu/FM2002-3.htm>

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**Project Duration**

2002 to 2004

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**Keywords**

calcium sprays,  
compost teas, corn  
gluten, organic  
strawberries

# Organic Strawberry Production in Minnesota

**Project Summary**

This past year, we started a farm called 'Wilson's Organic Strawberries', which will be the only certified organic strawberry farm in Minnesota. We are using standard production practices for Minnesota berry growers, including a matted row on a four year rotation, except that we are using no synthetic pesticides or fertilizers.

**Project Description**

By starting a certified organic strawberry farm, we want to show other growers that you can grow healthy, quality produce without synthetic chemicals. We will be starting a family soon, and we want to raise our children in a pesticide free environment. We are trying to determine which methods of weed, insect, and disease control work best and show that an organic strawberry farm can be as economical as a conventional farm.

Organic strawberry producers face a number of challenges (Table 1). As a result, many Minnesota strawberry growers want to be organic, but are afraid to make the plunge into full organic certification. We are developing strategies to overcome these challenges and become certified by a national organic certification organization.

Our site is well suited for organic strawberry production. The area had been planted in corn for many years and had few perennial weeds. We have a silt loam soil that holds water and nutrients quite well. Our farm is on a hilltop that does not have standing water after rains, has minimal frost problems, and strawberry plants will dry quickly after summer rains.

We started preparing the site for organic production a year before we planted. We kept the site fallow for the summer of 2001 to kill perennial weeds and reduce the number of weed seeds. During the winter of 2001-2002, we put five tons of composted cattle manure per acre on the site to increase nitrogen, phosphorus, and potassium while creating a healthy environment for beneficial soil bacteria and fungi. Shortly before planting, we noticed a small patch of quackgrass sprouting. We removed all the quackgrass and quackgrass roots that we could find by hand.

We planted two acres of strawberries on May 3, 2002 at the typical spacing of 20" x 48". We planted the varieties Annapolis, Jewel, Cavendish, and Honeoye. We had hoped to plant Glooscap, which is the most common strawberry variety in northern Minnesota, but there were no plants available. In June, we installed a drip irrigation system.

*Brian cultivating strawberry plants for weed control and lining up runners.*



**Table 1: Proposed Solutions for Overcoming Problems Associated with Organic Strawberry Production**

Problem	Obstacle for Organic Producers	Proposed Solutions in our Farm
Weeds	Few approved herbicides	Corn gluten, plant in clean field
Tarnished plant bug	Few approved insecticides	Monitoring, varieties, organic sprays
Gray mold	No fungicides available	Calcium sprays, compost tea
Leaf & root disease	Can destroy crop	Raise healthy plants on good site
Nitrogen	N levels fall 2 <sup>nd</sup> & 3 <sup>rd</sup> years	Corn gluten, monitoring leaves

The biggest challenge, during the first year of strawberry production, was keeping weeds from taking over the fields. We kept weeds out of the aisles with a field cultivator, and weeded in the row with hoes and by hand pulling. The field cultivator also aligned runners in the row.

In late June and early July, we finished pulling the first flush of weeds. As soon as we finished weeding a row, we applied corn gluten meal on that row in order to keep new weeds from sprouting. The corn gluten also provides nitrogen to the plants during the time of year when the plants are growing most rapidly. We applied the corn gluten at a rate of 400 lb/A banded over the strawberry row. To apply the corn gluten meal, we used a garden tractor with a Gandy applicator attached to the back and drove directly over the rows.

One challenge in raising certified organic strawberries is finding straw that is both free of pesticides and free of weed seeds. We decided that the best place to find organic straw was our farm. We harvested our oat straw in mid-July and applied the straw in mid-November.

## Results

The strawberry plants were healthy and vigorous with no leaf or root diseases. Jewel was the most vigorous variety, followed by Annapolis. Annapolis sent out a lot of runners, but the daughter plants were smaller than the Jewel. By the middle of August, plants of all varieties had so many runners and daughter plants that the rows were a solid mass of leaves. Leaf analyses showed no nutrient deficiencies in the plants.

In August, we compared the number of new weed seedlings in the main part of the field that received corn gluten with a 15' x 15' test plot that received no corn gluten meal. The rows with corn gluten averaged 3.5 weed seedlings/ft<sup>2</sup> compared to 9.4 weed seedlings/ft<sup>2</sup> in rows that did not receive corn gluten.

We spent 350 hours hand weeding during June and July. We feel we would have spent less time hand weeding if we had applied the corn gluten earlier in the spring. We plan on applying corn gluten right after planting next year.

We started the organic certification process with Farm Verified Organic out of Medina, ND. We will be certified by picking time next spring.

After the first year, our field is quite healthy and we expect few weed problems in 2003 because the plant rows are so thick. We are optimistic that our yield in 2003 will be quite high.

## Management Tips

1. Start preparing the soil a year before you expect to plant. By keeping the soil fallow the summer before planting, we eliminated most perennial weeds.
2. Be prepared to do a lot of weeding the first year.
3. Apply corn gluten shortly after planting. Don't apply corn gluten if a lot of rain is forecast because it could wash away.
4. Cultivate often to keep runners lined up and keep the aisles weed free.

## Cooperators

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

## Project Location

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

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)

Specialty Crops Management Course, Northland Community and Technical College, Thief River Falls, MN, 218-846-0741.

Web site: [www.northland.cc.mn.us/FBM/Toolshed.htm](http://www.northland.cc.mn.us/FBM/Toolshed.htm)

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**Project Duration**

2000 to 2002

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**Keywords**

alternative crop,  
grape varieties,  
grow tubes, trellis

# Viability of Wine Quality Grapes as an Alternative Crop for the Family Farm

**Project Summary**

Our family farm encompasses about 500 acres that have been farmed by our family for the better part of 100 years. This same family farm, at one time, had livestock on it as well. Currently, only the outbuildings remain. The entire acreage, while having some rolling terrain, is basically flat. The labor that is needed for the current farming operation is supplied by one of my sons and me.

The bottom line is that the return we were seeing with beans and corn was extremely poor. Anything that we could do to keep the family farm unit intact, utilize the same land but in a different way, and stay on the farm was something that we were interested in. We put in a test plot of 256 grapevines planted in the spring of 2000 to evaluate the feasibility of growing grapes as a crop. Of the 256 vines that were planted, the table grape and four wine quality grapes had selling prices on the open market of \$.25/lb and \$.50/lb, respectively. At projected yields of at least one to two tons per acre, the potential income from this crop exceeds that of corn and beans.

Looking long term, diversifying into grapes allows us to expand the family farm into a

market that is not depressed like beans and corn. The grape crop allows us to more fully control the market that we participate in instead of selling traditional grain (beans and corn) in an extremely volatile and price depressed market. The viability of a profitable crop to fit in on the family farm, whether it is grapes or something else, ultimately helps the family farm to stay intact. We plan to open a winery in May 2003.

**Project Description**

In May 2000, 256 nursery stock vines of five different winter hardy grape varieties were planted on approximately two-thirds of an acre. Bluebell, a popular table and juice grape is winter hardy to -35°F. Foch, a red wine quality grape, is winter hardy to -20°F. Frontenac, a red wine quality grape, is winter hardy to -35°F and two white wine varieties, St. Pepin and La Crosse, are less winter hardy at -10°F to -15°F and may need some winter protection.

Prior to planting, 4" x 8' posts were placed 24' apart to form 15 rows. These posts were pushed 2' into the ground with a payloader, leaving 6' exposed. We installed two trellises of 12.5 gauge high tensile wire at the 36" height and to the top of the posts at the 6'

*Don, left,  
discussing grapes  
in vineyard.*



height. The wires were attached to 36" earth anchors at the end of each row. On top of the posts and under the trellis wire we added a 4" x 4" piece of steel-belted rubber conveyor belt to prevent the wire from splitting the post when tightened by the weight of the grapes.

After digging a hole that was 8 to 10" deep and approximately 12" in diameter, the nursery stock was placed in it with the root system fanned out. After covering the root system up, the plant was watered and then a grow tube was placed over it. The grow tubes were tied to the lower trellis line with twine. Twine was then tied from the lower trellis line to the upper trellis line to allow the vine to follow this line up as it grows. As the vines continued their upward push, the vines were "wrapped" either around the twine or the trellis line to help direct their growth upward on the trellis.

Between the time that the vines were planted and they went dormant in early October, the vineyard was tilled approximately four times. A disk was used between the rows and a hand hoe was used between vines. At the end of August, all of the grow tubes were taken off of the vines to allow for proper hardening of the canes for the winter. The last activity prior to winter was to make sure that all of the double trunks were tied together and that all of the vines were tied to the trellis system to help them better survive winter. We did not do any winter protection to the vines.

## Results

### 2000

The amount of time that has been spent the first year in managing the grapes, in many ways, wasn't anymore time than what was spent in the management of traditional crop production. Admittedly, grapes require labor input at different times during the year than what traditional crops do. However, in the final tally, the total hours, in my opinion, aren't any more or less.

Comparatively speaking, the amount of pesticide that was introduced to the vineyard was less than what was applied to a similar size plot of traditional crops. Other than 1.5 oz of Sevin, no other chemical was applied. We did not apply fertilizer because the soil tests were high in nitrogen.

Plant growth and overall health was in one word – GREAT! – throughout the year. We had a total of 2,845 growing degree days in 2000 with enough moisture. Many of the vines grew with such vigor that substantial double trunks formed. The nursery stock that was planted in the spring was approximately 1/8" in diameter and 6" long. When the vines went dormant in early October, some of the trunks measured nearly 1" in diameter and had grown 6' up to the

top of the trellis and, in some cases, 4' horizontally in both directions.

We think the soil was compacted around some of the vines which somewhat stunted their growth. While pushing in the trellis posts with a payloader, the posts were pushed in *across* the rows instead of straddling the row and completing one row before moving on to the next. Ultimately, the vines grew, although at a slower rate than those vines that were not planted in compacted soil. In the future, we will straddle the row we are planting.

We did not water the vines in 2000 even though we experienced a drier than normal year. Through interaction with our collaborators, monitoring precipitation amounts and visually inspecting the vines, we did not feel that watering was necessary. This did not seem to adversely affect the growth of the vines.

In our test site, the grow tubes are 30" high while the bottom trellis line was set at 36" off of the ground. We attached the grow tubes to the trellis line with twine and semi-submerged the bottom of the grow tube in the soil. Two days into planting, we experienced sustained 25 mph winds for the better part of a day. Since there were three grow tubes in between posts, all three of the grow tubes had dislodged from the soil and had slid down the trellis line to the post. Having the trellis line equal to the height of the grow tube and having the grow tube attached with duct tape probably would have prevented this from happening. Because of this situation, we also learned to more thoroughly bury the bottom of the grow tube in the soil when placing it over the nursery stock.

### 2001

The first task this year was to determine the winter-kill damage in the grapes. The winter-kill in the 2000 planting amounted to only 18 vines out of the 256 planted. A breakdown by variety shows that the Foch lost 14, Bluebell lost two, Frontenac and La Crosse each lost one, and St. Pepin lost none. Based on the information received on each variety prior to planting, the higher number of winter-kills in the Foch variety was not a surprise. However, the fact that we did not suffer significant losses in either the La Crosse or St. Pepin suggests that these white wine varieties may do well in our location. We did not do any winter protection to the vines.

The first two full years of this project give us confidence that southwestern Minnesota is naturally a good place to grow winter-hardy wine grapes. Interesting enough, because of the snow levels associated with the winter of 2000-2001, our test plot saw a major amount of drifting through the site. This was due in part to a building sitting relatively close to the site as well as the natural snow

fences that the trellis makes. It is our belief that this snow cover helped to over-winter our vines and gave us a better survival rate than what normally could have been expected given the temperatures that were recorded.

In 2001, we expanded by adding another acre of 550 Frontenac seedlings, the best performing variety based on our 2000 planting. The intent all along with this project has been to determine the viability of grapes for this specific area of the state and then to exploit the varieties that do well by raising a crop that either can be sold to a winery or used internally for wine production.

We made a change in planting techniques in the 2001 vineyard. We lowered the trellis height by 1' (top wire at 5') to accommodate easier pruning and harvesting of the vines and grapes. We also incorporated the use of stakes to anchor the grow tubes down around the vine. We also put stakes on the second year vines. With the high winds that were experienced in southwestern Minnesota earlier this spring, these stakes helped keep the grow tubes in place.

The only chemical that was applied in 2001 was 1.5 oz of lime sulphur at the beginning of the year to help with disease control. We liked how fast the grapes grew the first year and we decided to keep the soil black between the rows and between the plants. We used old tillage equipment such as a disk and a drag to control the weeds. We then let the weeds grow in August and kept them mowed. We think this will be an effective way to start a cover crop between the rows. We did not use any fertilizer because our soil is high in nitrogen. From a cumulative heat degrees viewpoint, the site saw virtually the same number of growing degree days in 2001 as it did in 2000 (2,882 vs. 2,845 growing degree days respectively).

## 2002

The fall of 2002 was the first meaningful harvest that we had from the grapevines that were planted in the spring of 2000. Our survivability rate was 98% and was very acceptable over the last three growing seasons. While the total test plot spans approximately two-thirds of an acre, we harvested 337 lb of table grapes and nearly three quarters of a ton of wine quality grapes amongst four varieties. While the individual yields varied somewhat, on the high end, Frontenac would have pushed between 4 to 5 tons/A had we had an acre of it planted.

Information from future harvests will allow us to more completely evaluate this harvest as it relates to others; however, we are very encouraged by the prospects! The greatest impact resulting from the test plot was the decision to move forward with a winery that we plan to open in May 2003.

The weather was a non-issue in 2002 as we did not have any severe weather. The heat degree days were down over the previous two years while the precipitation was up an inch over 2001 and four inches over 2000.

With this project, farming activity has increased somewhat due to the “newness” of the crop that we are raising. We definitely have more people stopping and inquiring as to what it is that we are growing.

## Management Tips

1. Nurseries that carry grape varieties are a great source of information.
2. Make sure that the soil is not compacted prior to planting the nursery stock. Straddle the row with the tractor when installing trellis posts.
3. Install the bottom trellis line at the same height as the top of the grow tube. This allows the grow tube to be fastened to the trellis and gives it added support.
4. Bury the bottom of the grow tube in the soil when placing it over the nursery stock.
5. Grow tubes are not a necessity, however, the use of them greatly increases the time it takes for them to produce grapes.
6. Install the anchors after the wooden posts are in place so they line up with the rows.
7. Set up your markets for your harvest well in advance of harvesting your first grapes.
8. Installation of trellis posts in the fall of the prior year will aid in spring planting.
9. Leave the soil black between the rows after planting until August of the second year. Then start mowing the weeds and this will turn into a cover crop.
10. Develop a relationship with your nursery stock supplier. If you are propagating yourself, join an association that will allow you to have contact with other growers for information exchange.
11. This is not a crop that can be managed from the cab of a tractor!

## Cooperators

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*Chad Reding, son, Morgan, MN*

*Charlie and Michelle Quast, son-in-law and daughter,  
Redwood Falls, MN*

*Wayne Hansen, Redwood County Extension Educator,  
Redwood Falls, MN*

*John and Barb Marshall, Great River Vineyards, Lake  
City, MN*

*Beth Anderson, Redwood Falls Chamber of Commerce,  
Redwood Falls, MN*

*Anthony Aellen, Linganore Winecellars, Mt. Airy, MD*

*Robin Partch, Northern Vineyards, Inc., Stillwater, MN*

*Gary and Kari Morgan, Windwater Vineyard and Nursery,  
Lonsdale, MN*

## Project Location

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Take Hwy. 68 west from Morgan for 4.8 miles. Farm is on the north side of the hwy.

## Other Resources

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Historical Data Retrieval and Climate Summaries.

Climate information specific to any location in Minnesota to help with planning a vineyard. Available at: [www.climate.umn.edu/doc/historical.htm](http://www.climate.umn.edu/doc/historical.htm)

Minnesota Grape Growers Association, John Marshall, Secretary. 35680 Hwy. 61 Blvd., Lake City, MN 55041.

Email: [grapes@rconnect.com](mailto:grapes@rconnect.com)

Available at: [www.mngrapes.com](http://www.mngrapes.com)

This is a membership organization and publishes the quarterly newsletter Notes from the North with information about grape production.

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. Also available at:

[www.leopold.iastate.edu/pubinfo/papersspeeches/grapes2000.html](http://www.leopold.iastate.edu/pubinfo/papersspeeches/grapes2000.html)

*Bluebell grape cluster*





**Principal Investigators**

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**Project Duration**

2002

**ESAP Contact**

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**Keywords**

compost, corn  
gluten, new  
immigrant  
farmers, organic  
mulch, plastic  
mulch

# Research and Demonstration Garden for New Immigrant Farmers

at the University of Minnesota Outreach, Research and Education  
Park (UMore Park)

**Project Summary**

This project was initiated to demonstrate organic vegetable production techniques to new immigrant farmers. These farmers often have a pessimistic view of organic vegetable production. A survey of the growers indicated that knowledge and skills are the limiting factors to improve their small-scale vegetable operations.

We decided to use compost and mulch in tomatoes as examples of organic production options in vegetables. Compost was applied for soil improvement and mulch for weed control. Compost applied at 20 tons/A significantly increased tomato fruit yield. Several organic mulch treatments provided weed control similar to black plastic mulch.

The audiences for this project have limited resources, speak little English, and lack modern farming skills. Through this project, we feel we were able to demonstrate and disseminate organic vegetable production techniques to these important local growers.

**Project Description**

In the Twin Cities metropolitan area, there are significant numbers of immigrant farmers who grow a variety of vegetable crops. They sell their produce at Minneapolis and St. Paul farmers' markets and at other ethnic markets. The University of Minnesota-Farm Incubator Program is a "new farmer" training center at the University of Minnesota Outreach, Research and Education Park (UMore Park) in Rosemount. We provide a "hands-on" and classroom-based educational program to new immigrant farmers.

During the 2002 growing season, 19 trainees farmed 54 acres of vegetable crops. These and other immigrant market gardeners in the Twin Cities metropolitan area are used to conventional methods of vegetable production. They lack exposure to sustainable and organic production systems.

Most of the immigrant farmers came from low input farming systems. In Minnesota, they embrace the use of pesticides and other synthetic chemicals to enhance productivity. They are pessimistic and resist organic production methods. It is important to

*Nigatu, Extension  
Educator discussing  
the University  
of Minnesota  
Extension Service  
New Immigrant  
Farm, marketing  
fresh produce and  
land based issue on  
the urban fringe.*



**Table 1. Effect of Different Compost Rates on Fruit Number and Yield of Two Tomato Varieties (Jet Star and First Lady)**

Compost Rate (tons/A)	Yield per Plant			
	Jet Star		First Lady	
	Number of Fruit	Wt (lb)	Number of Fruit	Wt (lb)
None (control)	22	13	34	11
5	29	18	45	21
10	37	25	47	23
15	56	32	50	26
20	51	24	63	32

demonstrate to this group of growers that sustainable and organic vegetable production techniques can be used to grow wholesome, fresh produce that can potentially generate higher profits than conventional systems.

Our first demonstration showed the value of compost in tomato production. The use of compost is a primary technique in organic gardening. Compost builds healthy soil that provides needed nutrients for plant growth. Compost improves soil structure, supports living organisms, improves soil water retention, buffers soil chemical imbalances, maintains a steady supply of plant nutrients, controls certain soil pests, and recycles organic wastes (Stephens and Kostewicz, 2002).

Our second demonstration tested several organic mulches for their ability to suppress weeds. The immigrant farmers we work with do not use herbicides for controlling weeds. Instead, they use family labor for hand weeding and hoeing. This is costly, time-consuming, and growers still lose significant yields because of weed competition.

In addition to inhibiting weed growth, organic mulches increase soil organic matter, nutrients, and soil moisture retention. They reduce soil compaction, fertilizer leaching, pest incidence, and soil erosion. They also enhance the presence of predatory beetles and spiders. Mulches containing weed or grass seeds, rhizomes and other propagules should be avoided to prevent the introduction of further weed problems.

We applied the following mulches on tomatoes:

- wheat straw;
- alfalfa hay;
- partially decomposed fall leaves;
- wood chips;
- shredded bark;
- black plastic;
- corn gluten; and,
- a control (no mulch).

Plots received 3" thick organic mulch and corn gluten was applied at 17 lb/A. The compost trial plots received 0, 5, 10, 15 and 20 tons/A of compost. The nutrient content of the compost was 1.4% nitrogen, 0.45% phosphorus as  $P_2O_5$ , and 0.93% potassium as  $K_2O$  with a pH of 7.6. The demonstration soil at UMore Park is a Waukegan silt loam with a 1% slope, a pH of 6.2, and 3.4% organic matter. The previous crops in 2000 and 2001 were soybean and field corn. Prior to planting the tomatoes, the field was disk plowed and subsequently harrowed. Plots were single rows, 4' wide by 30' long. The distance between plants was 3'. The mulch demonstration plots were fertilized with 90 lb of N,  $P_2O_5$ , and  $K_2O$  per acre.

Two tomato varieties, Jet Star and First Lady, were used for the compost study while Celebrity was used for the mulch demonstration. Plants were hand transplanted on May 28 for the compost trial and on June 2 for the mulch trial.



***Demonstration garden field day at UMore Park.***

**Table 2. Effect of Different Mulches and Corn Gluten on Fruit Number and Fruit Weight of Celebrity Tomatoes**

Mulch Treatment	Fruit per Plant	Single Fruit Wt (lb)
Control (none)	24	0.35
Alfalfa Hay	39	0.42
Shredded Bark	31	0.45
Wood Chips	37	0.41
Wheat Straw	35	0.45
Leaf Clippings	29	0.42
Black Plastic	35	0.36
Corn Gluten	37	0.35

## Results

**Compost.** The compost applications produced significantly greater fruit numbers and higher marketable yields than the unfertilized control (Table 1). The two intermediate compost rates of 5 and 10 tons/A were not significantly different in fruit number per plant. These results suggest that the tomatoes were responsive to the high doses of compost. Total tomato yield in the two highest rates of compost (15 and 20 tons/A) treatments were more than double the yield of the control (no compost) plants in both Jet Star and First Lady varieties.

**Mulch.** The effect of different mulches and corn gluten on tomato fruit number and fruit weight is presented in Table 2. The mulched treatments produced significantly higher numbers of tomato fruits per plant than the control. In particular, alfalfa hay, wood chips, and corn gluten were the treatments that gave the highest number of fruits per plant. These results showed that a reduced input production system based on natural mulches such as wood chips, shredded bark, fall leaves and leaf compost, and clean hay or straw are useful in organic vegetable production.

The main purpose of this project was to challenge these new immigrant farmers to think outside the box. Through field days and classroom presentations, the growers are now well informed about sustainable vegetable production using compost and mulch. The challenge now for these farmers is to address the lack of parcels of land available to them to convert to organic production. New immigrant farmers rent land on a yearly basis and they cannot develop a long-term plan on the property they rent. The good news is that some landowners are willing to lease their properties on a long-term basis to farmers interested in growing organic produce. Our office has received calls from such property owners and we are working to connect growers with property owners.

## Management Tips

1. Avoid mulches that are a source of weed seeds.
2. Issues of land tenure are a greater hurdle than organic production techniques.

## Cooperators

*Bob Olson, Regional Extension Educator, Metro District, Washington Cty, MN*  
*Cindy Tong, University of Minnesota, St. Paul, MN*  
*Saeed Fahia, Confederation of Somali Communities in Minnesota, Minneapolis, MN*

## Project Location

From Hwy. 55, go west on Cty. 46 for 3.5 miles to the UMore Park office.

## Other Resources

Maynard, D., and G. Hochumuth. 1997. Knott's Handbook for Vegetable Growers, 4<sup>th</sup> Edition. New York: John Wiley & Sons, Inc.

Shock, C., C. Stanger, and H. Futter. 1988. Observation of the effect of straw on sugar beet stress and productivity. Web site: [www.cropinfo.net](http://www.cropinfo.net)

Stephens, J., and S. Kostewicz. 2002. Producing garden vegetables with organic soil amendments. Web site: [edis.ifas.ufl.edu](http://edis.ifas.ufl.edu)

**Principal Investigator**

Nathan Converse  
12113 – 61<sup>st</sup> Ave.  
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**Project Duration**

2001 to 2003

**ESAP Contact**

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**Keywords**

eastern  
gamagrass,  
perennial forage,  
winterhardiness

# Development of Eastern Gamagrass Production

**Project Summary**

I hope to determine if eastern gamagrass (*Tripsacum dactyloides*) is suitable as perennial forage in central Minnesota. Eastern gamagrass (EGG) is a native perennial warm season bunchgrass that grows in large clumps from 1 to 3' in diameter. It is related to one of the ancestors of corn and is highly palatable to livestock. Because of overgrazing, it no longer inhabits the extensive acres it did before white settlement.

The current livestock stocking level in central Minnesota is very low, requiring three to five acres per cow/calf pair. We are located on the drumlins and consequently most of our pastures are noted for the amount of rocks. Over time, the productive plant species have gradually disappeared leaving mostly plant species that are unproductive even with applied fertilizer, soil amendments, or rotational grazing. The main reason I decided to do this project was to reduce my production costs by making more efficient use of the land through increased forage production.

I believe EGG could have significant value as a perennial forage, wildlife habitat, soil stabilizer, and windbreak. Eastern gamagrass will grow up to 9' tall and has the potential to root through even compacted soils to over 9' deep. It spreads by short rhizomes and seeds that are produced from July to September.

EGG grown in other states has been found to be suited for rotational grazing, haying, and as silage. It has been shown to have high production during the summer slump that is experienced by cool season grasses, with an annual production of over 5 tons/A. Tests in other states have shown that it can produce an average daily gain of 2.3 lb/day for pregnant dairy heifers. I think all of these attributes would benefit livestock and hay producers in Minnesota.

**Project Description**

I am testing the viability of three varieties of EGG to see if they are suitable forage options for central Minnesota. The varieties are PETE, #9051771, and Nemahaw. PETE & #9051771 were acquired from USDA-NRCS Plant Materials Center in New York. Nemahaw was purchased from The Gamagrass Seed Company in Nebraska. PETE & #9051771 were planted in 2001, and Nemahaw was planted in 2002. They were planted in a one-acre plot and results of emergence, stand counts, winterhardiness, and forage quality and quantity will be reported for three years.

*Nathan checking his stand of eastern gamagrass this spring.*



## Results

### 2001

In early June 2001, the plot was sprayed with Roundup to kill the existing grass. I planted the EGG plots on June 28 with a rented 10' no-till drill from the Wadena Soil and Water Conservation District. I used a no-till drill instead of a corn planter because it provided closer row spacing and might provide better weed control through faster canopy cover. EGG seeds are similar in size to soybeans and could be planted with a corn planter.

In order to have enough seed to fill up to the agitators and feed properly, I had to mix the EGG seed with soybeans. The drill was then calibrated to plant 15 lb/A of EGG at 1.5" deep. I planted east to west making one trip down and one trip back side by side with each variety planted alternately in small plots. I did not fertilize the plots because I thought this would encourage the weeds to grow.

We did not receive any rain in the first three weeks after planting and I did not see any emergence of EGG or soybeans. On July 18 we received 1.6" of rain and eight days later I noticed the first EGG plants, but it was a very spotty stand. The soybeans grew unexpectedly well and soon covered up the plot.

I chose not to spray to kill the soybeans for a couple of reasons. Paul Salon from the USDA-NRCS Plant Materials Center recommended not to spray the EGG because it is very susceptible to injury from herbicides, especially post-emergence herbicides. The second reason for not spraying was that the soybeans were the lesser of two evils. Wherever the soybeans were not growing, crabgrass came up in huge bunches.

By the time I completed my stand counts in the fall, most of the EGG plants ranged from 4 to 7" in height. Due to the poor emergence I decided that a full count would be more representative and I counted all the EGG plants in each plot. There was a wide range in plant numbers from a low of one plant to a high of 124 plants. At this time I cannot say if one variety is better than the other.

I think the test plots were planted far too late. If the seed had been in the ground earlier, the plants could have taken advantage of the earlier rains. At this point I am happy to at least have some plants established so I can look at the winterhardiness of EGG in central Minnesota.

### 2002

After performing stand counts last year, I realized that we needed to plant another plot this year. In order to assure a decent plot, I decided to till strips with a roto-tiller to turn over the existing sod and then plant with a hand corn planter. I roto-tilled during the first week of June and planted 10 lb of pure live seed per acre using an old hand operated corn planter from June 11 to 13. I also planted a third variety (Nemahaw) that was germtec II treated. The rows were 30" apart and the seeds were spaced at 1' intervals.

By July 1, we had fair emergence with plants about 1" tall. We had a decent amount of rain and the plot did fairly well. By fall, we had good stand counts with 5 to 13 plants counted in random 10' strips, but the plants still only ranged from 4 to 5" tall.

In the original plot planted in 2001, 50% of the plants survived through the second year. There were also a few plants that were not present last fall, but came up in the spring. Neither PETE nor #9051771 seemed to out-perform the other. The most significant difference appeared to be in the rows closest to the shelter of the fencerow on the south side of the plot. This area tended to have more snow cover and more protection during the winter. There were individual plants in this area that grew 4 to 5' tall. The rows farther out from the first couple of rows did not have the added benefit of protection and survival rates declined.

As things stand now, it is still too early to determine if EGG is a viable option for Minnesota.

## Management Tips

1. Tillage is a better option than no-till for planting preparation because tillage minimizes early weed population.
2. Do not use herbicides to control weeds in eastern gamagrass plantings.
3. Plant eastern gamagrass in early spring to take advantage of spring rains.

## Cooperators

*Lynda J. Converse, Sustainable Farming Association of Central Minnesota, Browerville, MN*  
*Kirby Hettver, Livestock Specialist, Stephens County Extension, Morris, MN*  
*Paul R. Peterson, Forage Agronomist, University of*

*Minnesota, St. Paul, MN*

*Ivan Reinke, Wadena County Soil and Water Conservation  
District, Wadena, MN*

*Paul Salon, USDA-NRCS Plant Materials Center, New  
York, NY*

## **Project Location**

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From Motley go 2 miles east on State Hwy. 210 to Cass Cty. 102 (61<sup>st</sup> Ave. SW). Go north on Cty. 102 for 2 miles. The pasture is on the east side of the road.

## **Other Resources**

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Peterson, et al. Eastern Gamagrass Provides Summer Forage. September 1999. Crop and Soil Environmental News. Report of research on eastern gamagrass in Virginia conducted by Virginia Tech and the Virginia Extension Service. Available at: [www.ext.vt.edu/news/periodicals/cses/1999-09/1999-09-01.html](http://www.ext.vt.edu/news/periodicals/cses/1999-09/1999-09-01.html)

Web site: [www.grassfarmer.com](http://www.grassfarmer.com)

A comprehensive information web site on grass-based farming systems from American Farmland Trust.



**Principal Investigators**

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**Project Duration**

2001 to 2003

**ESAP Contact**

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**Keywords**

bedded manure,  
manure  
management,  
nutrient  
management,  
starter fertilizer,  
swine manure,  
water quality

# Using Liquid Hog Manure as Starter Fertilizer and Maximizing Nutrients from Heavily Bedded Swine Manure

**Project Summary**

The Dakota County Soil and Water Conservation District (SWCD), working with farmer cooperator, Duane Beissel, demonstrated that desired yield goals can be met with proper application and crediting of nutrients from hog manure. The demonstration concentrated on crediting manure nitrogen, especially heavily bedded swine manure, and on the use of collected feedlot runoff as starter fertilizer.

**Project Description**

The Dakota County SWCD is increasingly concerned that a majority of livestock producers are not properly crediting the manure they use either by not having manure samples analyzed, underestimating application rates, or both. The result is that manure and/or commercial fertilizer is often over-applied, creating the potential for ground- and surface-water pollution. It is also an economic loss to the farmer when commercial fertilizer is applied to land that has already received adequate nutrients from manure to achieve the desired crop yield.

In response to this concern, the Dakota County SWCD developed a comprehensive nutrient management program to assist farmers in the implementation of water quality best management practices in Dakota

County. The components of the program are technical assistance to develop manure management plans, cost-share assistance for manure nutrient analyses, and low interest loans for equipment for livestock producers throughout Dakota County. The focus is on the basics of proper sampling, testing, calibrating, and record keeping.

Demonstrations of the benefits of improving manure nutrient crediting on a working farm were seen as an effective way of encouraging adoption of these management practices on neighboring farms. There was also some curiosity about whether the University of Minnesota nutrient requirement recommendations for corn corresponded to the unique soils of Dakota County. Local farmers want to save money and apply only the amount of fertilizer that they need, but they want to be assured that the University's recommendations wouldn't underestimate the nutrient needs of their soil.

Duane Beissel was interested in participating in the demonstration project. Duane and his family farm 335 acres of corn, soybeans,

*Don Beissel, Brad, Duane, and Mark Flom (right to left) at harvest time.*





**Table 1. 2001 Corn Yields in Response to Different Commercial Fertilizer and Manure Treatments**

Fertilizer Treatment	Rate (Gal/A)	N-P-K <sup>1</sup>	Yield (Bu/A)
Control	-	-	147.0
Commercial No. 1	5	9-18-9	141.7
Commercial No. 2	1	3-18-18	137.2
Commercial No. 2	2	3-18-18	136.8
Commercial No. 2	5	3-18-18	139.7
Commercial No. 2 w/Trace Elements	5	3-18-18	139.7
Manure	31	.18-.006-.18	141.6
Manure	50	.18-.006-.18	138.6
Manure w/Commercial No. 2	19 & 0.4	.18-.006-.18/3-18-18	141.6
Commercial No. 3 w/Fish Extract	2.5	unknown	132.0

<sup>1</sup>Nitrogen – P<sub>2</sub>O<sub>5</sub> – K<sub>2</sub>O

small grains, and vegetables in the Vermillion Township of Dakota County. They also operate a 2,400 head feeder-to-finish swine operation. A large portion of the corn crop is fed to the hogs. The Beissels live in an area that is rapidly urbanizing and also intensively row cropped. The soils in the area are very light and have high groundwater pollution sensitivity to the Prairie du Chein aquifer, as identified by the Dakota County Geologic Atlas. The majority of the land in the township is sandy, gently rolling hills requiring center-pivot irrigation.

The Beissels had also constructed a manure pit that collects and stores manure and run-off from their livestock facilities. This run-off product could have a significant yield advantage if collected, stored, and applied as a starter fertilizer at planting. This resource could prove to be valuable in the reduction of costly inputs for area farmers.

In this area of light soils, excess nutrients can move rapidly through the soils and negatively impact the ground water resources. Through these demonstration plots on the Beissel farm, the SWCD promoted practices that maximize resources generated on the farms combined with sound research that proves that excess nutrients are an economic waste and an environmental hazard. By increasing the number of farmers with manure nutrient management plans, the SWCD can have a tremendous positive impact on water quality in Dakota County. In addition to these economic and water quality benefits, Duane believes that urban/rural relations can be improved if the public sees that farmers are raising their products in an environmentally conscious manner.

Using heavily bedded hog manure means that a significant amount of the nutrients will be tied up in the organic matter of the manure and typically aren't available the first year. Only after a period of biological breakdown do the nutrients become available, which makes proper calculation of the second and third year credits critical. This two year project allowed demonstration of second year manure nitrogen crediting. The planned third year was eliminated due to the Beissels' decision to sell their stock and not raise hogs in 2003.

## Results

In 2001, 11 adjoining corn plots were established on a nearly level, irrigated field. Seven plots were treated with three different types of commonly used, commercial fertilizer, applied at different rates. Unique components such as trace elements and fish extracts were added to the commercial fertilizers to test their effectiveness. Three plots were treated with varying rates of liquid hog manure, injected with fertilizer openers during planting. One plot was used as a control, with no fertilizer applied.

In 2002, 12 corn plots were established in a similar manner and on the same plot area as in 2001 to show the effect of second year manure nitrogen credits on corn yield. Three control plots used no fertilizer or manure, and nine plots used varying combinations of liquid manure and commercial fertilizers.

In both years, manure application rates were determined using University of Minnesota recommendations based

on soil test results, manure nutrient analysis, and yield goals. All of the plots used identical types of cultivation, herbicide, fall tillage, irrigation rates, planting style, and combining. A weigh wagon from the seed company was used to monitor yields.

Table 1 reports the 2001 corn yield results from the various fertilizer treatments. The control plot yielded over 6 bu/A more than any other plot. Several theories were proposed to try to explain this result, but no one is certain why the control plot produced markedly higher yields. The number of equipment passes over the control plot was the same as over other plots so compaction should have been equal throughout the plots. Moisture percentages for the corn from all of the plots were generally equivalent. The soil pH of the field was tested at 5.3. While this is not exceptionally low, one explanation for why the control plot yielded the highest is that the pH was too low for the soil to effectively break down the nutrients from the manure and commercial fertilizer. The Beissels decided to apply and incorporate pel-lime uniformly over the plots to raise the pH.

Another surprising result from the 2001 test plots was that commercial fertilizer No. 3 with fish extract performed so poorly. It was the most expensive fertilizer used by far, but produced significantly lower yields.

2002 test plot results also provided surprising numbers. The control plots again produced high yields. Fertilizer treatments produced a wide range of yields, from 166.5 bu/A to 151.6 bu/A, an almost 15 bu/A difference. No one fertilizer separated itself as markedly better than any other. Varying application rates and higher amounts of N, P, or K had basically no effect on corn yield.

Similar to the 2001 results, expensive commercial fertilizers that offer trace elements and advertise the use of fish extract did not prove to be worth the additional costs.

There are a number of explanations for why varying rates of fertilizer application had basically no effect on yield, and why the control plots with no fertilizer application continued to yield as high as the other test plots both years of the demonstration. One explanation offered in 2001, as noted above, was that the pH was too low for the soil to effectively break down the nutrients from the manure and commercial fertilizer. The pH of the soil tested at 5.3 and 5.8 in 2001 and 2002, respectively. While 5.8 is not unusually low, it could be part of the explanation. Duane used a new disk-ripper this season, so some deeper soils could have been pulled to the surface and effected yields, but that would not explain the test plot results in 2001.

Another explanation could be the location of the test plots. The field behind the Beissels' farmstead was chosen for

**Table 2. 2002 Corn Yields in Response to Different Commercial Fertilizer and Manure Treatments**

Fertilizer Treatment	Rate (Gal/A)	N-P-K <sup>1</sup>	Yield (Bu/A)
Control	-	-	160.7 <sup>2</sup>
Commercial No. 1	2.0	9-18-9	166.1
Commercial No. 1 w/1 gal Fish Extract and Trace Elements	9.0	9-18-9	166.1
Commercial No. 1 w/1 gal Fish Extract and 3 gal 12-0-26	2.0	9-18-9	162.2
Commercial No. 1 w/1 gal Calcium Additive	2.0	9-18-9	162.2
Commercial No. 2	4.5	3-18-18	162.9
Commercial No. 3	20.0	7-21-7	162.6
Commercial No. 3 w/1 gal 12-0-26	5.0	7-21-7	157.1
Liquid Manure	30.0	7-3-12	162.2
Liquid Manure w/2.25 gal Fish Extract	20.0	7-3-12	151.6

<sup>1</sup>Nitrogen – P<sub>2</sub>O<sub>5</sub> – K<sub>2</sub>O

<sup>2</sup>Number represents the average of corn yields from three plots.

the test site because of its level topography, relative soils, and convenient location to the farm. Because this location is convenient to the farm, the Beissels have scraped and spread manure on it for over 20 years. Although the solid manure from the feedlot was usually spread thin, and recent soil test results indicated a need for nutrients, the N, P, and K within the soil may have built up over time. The soil tests taken may not have effectively measured the amount of nutrients available throughout the entire soil horizon utilized by the corn. In the future, the Beissels would use a different location for the test plots. They would choose a site that had no history of manure application.

One conclusion that can be drawn from the study is that, if adequate nutrients to reach realistic yield goals are already available in your soil, adding additional fertilizer can be an environmental and economic mistake. Using liquid hog manure at recommended rates as a starter-fertilizer instead of over applying commercial starter fertilizer, can provide a producer with an economic and environmental win-win situation.

Overall, Duane Beissel was an ideal cooperator for this type of project. While Duane understands that starter fertilizer can be an important 'insurance policy' to protect against cool, wet springs, he now realizes that liquid hog manure offers a low-cost and effective alternative to costly commercial starter fertilizers. He understands that properly applying manure does not have to come at the expense of the environment. The results of this demonstration plus his own informal test plots have convinced him that manure has an overwhelming amount of nutrient and economic value.

## Management Tips

1. There are significant economic and environmental benefits to knowing and using the nutrient value of the manure produced on your farm. Test your manure. Test your soils. Keep accurate records.
2. Calibrate your spreader for actual manure delivery rate.
3. Contact local professional staff at the NRCS or SWCD office, or a private consultant, to help build a nutrient management plan.
4. Consider establishing test plots of your own to see how nutrient management planning could be beneficial on your farm. Choose your test site carefully to avoid areas of past manure applications.

## Cooperators

*Don Beissel, Farmer, Hastings, MN*

*Mark Flom, Legends Seed, Kenyon, MN*

## Project Location

From Hastings or from the south, take Cty. Rd. 47 south to 205<sup>th</sup> St. Go east on 205<sup>th</sup> St. for 1 mile. Or, from the north, take Hwy. 52 south to Cty. Rd. 66. Go east 4.5 miles to Cty. Rd. 47 then south 2 miles to 205<sup>th</sup> St. Go 1 mile east on 205<sup>th</sup> St. The farm is located on the north side of the road.

## Other Resources

Lewandowski, A. 2000. Manure management. Soil management series No. BU-07401-GO. University of Minnesota Extension Service, St. Paul, MN 55108, 612-625-8173 or 800-876-8636. Available at: [www.extension.umn.edu/distribution/cropsystems/DC7401.html](http://www.extension.umn.edu/distribution/cropsystems/DC7401.html)

Schmitt, M., and G. Rehm. 1998. Fertilizing cropland with swine manure. No. FO-05879-GO. University of Minnesota Extension Service, St. Paul, MN 55108, 612-625-8173 or 800-876-8636. Available at: [www.extension.umn.edu/distribution/cropsystems/DC7401.html](http://www.extension.umn.edu/distribution/cropsystems/DC7401.html)

University of Minnesota Extension Service and USDA Natural Resources Conservation Service. 2001. Nutrient management planner for Minnesota. Software program that calculates manure application rates from the farmers field and manure data. Contact Kevin Blanchet, UM-Extension, 651-480-7739, for more information.

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**Project Duration**

2002 to 2004

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**Keywords**

alfalfa, annual  
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x sudangrass,  
soybean, yield

# Yield and Feeding Value of Annual Crops Planted for Emergency Forage

**Project Summary**

Forages are the basis of ruminant diets, and ruminant livestock producers need a constant supply of forages for their animals. Weather can make the production of adequate, quality forage a challenge. We set out to investigate a number of farmer questions, such as: What can I do when forage crops cannot be planted on time due to weather challenges? I need a constant supply of forage; are there alternative crops I can plant? What crop will give me reasonable forage yield and quality when planted in June or July? To answer these and other related questions, this demonstration study included a series of alternative forage crop options. Team members included agronomists and animal scientists who can help evaluate agronomic and nutritional information about these crops. In addition, Pelican Rapids dairy producer David Sjostrom provided the on-farm site for this project and assisted with the project design, implementation, and dissemination of results, adding a practical perspective to the team.

**Project Description**

Perennial forage crops are the foundation of sustainable ruminant livestock operations in Minnesota. Because of the harshness of Minnesota's climate, perennial forage crops, particularly alfalfa, occasionally winterkill and leave producers faced with an immediate lack of high quality forage. In other years, excess spring moisture prohibits growers from planting perennial forages during

the window of time critical for establishment success. In situations like these, producers who are faced with a forage supply shortage generally need to plant an annual forage crop to fill the gap.

Due to heavy spring rains in parts of Minnesota, the 2001 growing season provided a prime example of planting delays farmers can experience. Many producers were seeking information on what to plant for emergency forage in June and even July. While some information exists on yield and feeding value of various annual crop alternatives, there is no comprehensive comparative information, particularly at the late planting dates. Proper selection and management of the emergency forage can be a key to the farm's short- and long-term profitability and sustainability.

We seeded this demonstration experiment at two locations in Minnesota: one on a dairy farm in Pelican Rapids, Otter Tail County, and the other at the University of Minnesota's UMore Park in Rosemount, Dakota County. The Otter Tail County farm location was used to represent northern Minnesota, and the Dakota County research station to represent southern Minnesota. Treatments included forage species (alfalfa and 16 annual crops having forage potential) and planting date.



*This forage entry  
is taller than  
Doug Holen.*

**Table 1. Monthly precipitation (inches), average temperatures (°F), and departures (Dep.) from long-term averages during the 2002 growing season.**

Month	Rosemount, MN				Fergus Falls (Pelican Rapids), MN			
	Temperature		Precipitation		Temperature		Precipitation	
	Avg.	Dep.	Total	Dep.	Avg.	Dep.	Total	Dep.
May	52.90	-4.60	2.32	-1.68	50.80	-6.00	2.54	-0.12
June	69.60	2.60	10.29	5.69	70.00	4.60	2.40	-1.35
July	74.90	3.90	3.34	-1.34	74.10	4.10	9.77	6.43
Aug.	68.50	-0.10	8.23	3.60	68.60	0.30	4.59	1.45
Sept.	63.60	3.70	5.92	2.40	63.00	5.10	1.23	-0.96
Avg./Total	65.90	1.10	30.10	8.67	65.30	1.60	20.53	5.45

**Table 2. Influence of planting date on total season dry matter (DM) yields of emergency forages at Pelican Rapids (Otter Tail County), MN in 2002. Yields representing multiple harvests are followed by the number of harvests.**

Entry	Planting Date		
	Early	Mid	Late
	May 21	June 17	July 3
	----- Ton DM/A -----		
Corn (81 day RM)	6.6	6.0	4.4
Corn (95 day RM)	6.6	6.0	4.3
Corn (103 day RM)	6.2	6.3	4.1
BMR Sorghum	16.7	6.9	5.1
Sudangrass	7.8 (3)	4.3 (3)	4.2
Sorghum x Sudan	6.5 (3)	3.7 (3)	4.9
Japanese Millet	0.9 (2)	0.5	2.7
Hybrid Pearl Millet	6.5 (3)	4.4 (3)	5.4
Barley	1.4	1.2	0.8
Barley/Pea	1.8	1.2	0.9
Oat/Pea	1.6	1.6	1.3
Soybean (0.8 RM)	3.0	2.4	1.8
Soybean (2.0 RM)	5.8	3.6	1.8
Siberian Foxtail Millet	1.4	2.0	1.5
Golden German Millet	2.3	3.7	2.2
Alfalfa	0.9 (2)	1.1 (2)	0.4
Chickling Vetch	0.5	1.1 (2)	1.0 (2)
<b>Mean</b>	<b>4.4</b>	<b>3.3</b>	<b>2.9</b>
<b>LSD (0.05)</b>	<b>1.5</b>		

Replicated plots were seeded at both locations. The early, mid, and late seeding dates at Rosemount were May 15, June 10, and June 28, respectively. Corresponding planting dates at Pelican Rapids were May 21, June 17, and July 3. Corn and brown midrib (BMR) forage sorghum plots were seeded 1 to 1.5" deep in four 30" rows with a single row planter at Pelican Rapids and with a 4-row corn planter at Rosemount. All other entries were seeded in ten 6" rows to a .25 to 1" depth depending on seed size. Plots containing legumes were inoculated with the proper *Rhizobium* species. Fertility was not limiting at either location. Dairy manure was incorporated prior to planting at Pelican Rapids. Soil test P and K levels were very high at both sites. All warm-season grasses (corn, BMR sorghum, sudan, and millets) received 75 lb N/A within ten days after planting. Grass entries with multiple harvests received an additional 50 lb N/A after each cutting (except the final cutting). Thus, grass entries with three harvests received 175 lb N/A during the season.

All corn and forage sorghum plots were harvested by cutting the center two rows of each four-row plot to a 6" stubble. The remaining entries were harvested with a flail harvester at Rosemount, and with a sickle harvester at Pelican Rapids. Stubble height for sudangrass, sorghum x sudan, pearl millet, and Japanese millet was left at 6" to encourage regrowth, with the last harvest at 3". All other entries were cut to a 3" stubble. In general,

harvest timing was scheduled to optimize yield and quality. The exception was the final harvest of multi-cut warm-season grasses, which were allowed to mature until temperatures were too cool for continued growth in September. Thus, midseason harvests of these entries were at vegetative stages, but their final harvest was often at a reproductive (heading) stage. Based on previous research on regrowth potential after harvesting, sudangrass, sorghum x sudan, hybrid pearl millet, and Japanese millet were scheduled for multiple harvests; and the foxtail millets were scheduled for just one harvest at boot stage.

Yield data were collected at each harvest. Feed value will be determined on samples of harvested material by drying and grinding the material and analyzing for several parameters in the University of Minnesota Forage Quality Laboratory. Feeding value (forage quality) parameters will include crude protein, neutral detergent fiber (NDF), NDF-bound crude protein, ether extract, ash, and NDF

digestibility. For some of the forage species, starch content will also be measured. The MILK2000 spreadsheet will be used to estimate potential milk production per ton and per acre, and to estimate the energy content of each forage. An economic evaluation of the forage options for use by dairy and beef farms based on yield, production cost, and feeding value parameters will be performed.

Table 1 summarizes precipitation and temperatures at the research sites. After a cool, dry May at both locations, the remaining growing season (June-Sept.) was very warm and wet with temperatures averaging 3°F above long-term averages. Rainfall was 8" above long-term averages at Rosemount and 10" above near Pelican Rapids during just July and August.

## Results

Total season yield results are reported in Tables 2 and 3.

Forage quality data were not yet available at the time this article was prepared. We caution that these are only one-year yield results and another year of data is needed in order to make more reliable conclusions.

**Table 3. Influence of planting date on total season dry matter (DM) yields of emergency forages at Rosemount (Dakota County), MN in 2002. Yields representing multiple harvests are followed by the number of harvests.**

	Planting Date		
	Early	Mid	Late
Entry	May 15	June 10	June 28
	----- Ton DM/A -----		
Corn (81 day RM)	6.8	6.8	6.2
Corn (95 day RM)	6.9	7.7	6.9
Corn (103 day RM)	9.3	9.0	6.6
BMR Sorghum	7.7	6.6	6.4
Sudangrass	8.3 (3)	7.6 (3)	5.9 (2)
Sorghum x Sudan	7.6 (3)	8.2 (3)	6.4 (2)
Japanese Millet	4.7 (3)	3.6 (3)	4.9 (2)
Hybrid Pearl Millet	7.4 (3)	6.6 (3)	5.9 (2)
Barley	2.0	1.2	1.5
Barley/Pea	2.2	2.1	0.5
Oat/Pea	2.4	2.3	1.2
Soybean (0.8 RM)	2.0	2.5	--
Soybean (2.0 RM)	2.8	--	--
Siberian Foxtail Millet	2.0	2.9	2.2
Golden German Millet	3.2	3.7	4.0
Alfalfa	1.6 (2)	1.7 (2)	1.2
Chickling Vetch	0.1	0.5	--
<b>Mean</b>	<b>4.5</b>	<b>4.3</b>	<b>3.5</b>
<b>LSD (0.05)</b>	<b>0.8</b>		

Yields of warm-season species were unusually high at both locations, probably due to the combined effects of above average temperature and rainfall. Entries did not always produce less at later planting dates. For example, at Rosemount, yields of the 81 and 95 RM corn entries planted June 28 did not differ from yields for earlier planting dates. However, the longer-season 103 RM corn and BMR sorghum did produce greater yields when planted earlier. In contrast, at Pelican Rapids, late (July 3) planting resulted in reduced yields of all four of these entries. Nevertheless, within a location, these entries produced similar yields when planted late.

Total season yields of multi-cut warm-season grasses were competitive with corn and BMR sorghum at all planting dates. The exception was the June 17 seeding at Pelican Rapids, and Japanese millet at all planting dates and both locations. Japanese millet may produce higher yields under a one-cut system. The one-cut foxtail millets (Siberian and Golden German) produced less forage than the other warm-season forages, but they produced this yield in significantly fewer days. They tended to perform best at the middle seeding date

in mid-June. The 3.7 ton/A produced by Golden German foxtail millet planted in mid-June was achieved within about 60 days. In addition, the foxtail millets established well at all planting dates and locations.

Barley and small grain/pea mixtures produced considerably less forage than the warm-season grasses, and had difficulty with weed competition at later planting dates. Soybeans struggled with deer damage and weed competition at Rosemount, but performed surprisingly well at Pelican Rapids, where deer damage was lower and weed control more effective. The later-maturing soybean produced more forage than the earlier maturing soybean only for the early (mid-May) planting date. At Pelican Rapids, the 5.8 tons/A of forage produced by the later maturing soybean planted in mid-May was greater than total season yields of most established alfalfa stands, and based on previous work with soybean, forage quality may be similar. Thus, full-season soybean may have potential as an alfalfa forage replacement in emergency situations. Alfalfa generally produced considerably less forage than all warm-season species at all planting dates, reinforcing the potential value of the warm-season forage species in emergency situations. Stands of chickling vetch were generally poor, which may reflect inappropriate seeding depth. Plants that did establish appear to compensate for the thin stands, but regrowth after harvest was typically limited.



***Paul Peterson and  
Vince Crary measure  
forage yield.***

## Management Tip

With only one year of data collection, yields presented in Tables 1 and 2 are preliminary. The 2002 growing season was ideal for maximum production of warm-season annual species, thus performance of these entries in 2002 is probably not representative of production potential during more “normal” growing seasons. With two years of data we will be able to make stronger recommendations.

## Cooperators

*Paul Peterson, Dept. of Agronomy and Plant Genetics,  
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*Douglas Holen, Jr., University of Minnesota Extension  
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*Vince Crary, University of Minnesota Extension Educator,  
New York Mills, MN*

*Craig C. Sheaffer, Department of Agronomy and Plant  
Genetics, University of Minnesota, St. Paul, MN*

## Project Location

Otter Tail County site: Approximately 2.5 miles south of Pelican Rapids on the west side of Hwy. 59 at David Sjostrom farm.

Dakota County site: At University of Minnesota UMore Park in Rosemount. From the intersection of Hwy. 42 and Akron Ave., go south .5 mile.

## Other Resources

Dan Undersander, Forage Agronomist Extension Specialist, Department of Agronomy, University of Wisconsin, 1575 Linden Drive, Madison, WI 53717, 608-263-5070, [djunders@facstaff.wisc.edu](mailto:djunders@facstaff.wisc.edu)

University of Wisconsin Forage Web site. Available at: [www.uwex.edu/ces/crops/uwforage](http://www.uwex.edu/ces/crops/uwforage)



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**Project Duration**

2001 to 2003

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**Keywords**

ag drainage,  
rock inlets, tile  
drainage

# Replacing Open Tile Intakes with Rock Inlets in Faribault County

**Project Summary**

The Faribault County Soil and Water Conservation Districts worked with several landowners who were interested in improving water quality by replacing open tile intakes with rock tile inlets. Rock intakes reduce sediment, nutrients, and pesticides entering tile drainage systems. The landowners/operators were also interested in the inlets because they would eliminate a standpipe that they currently farm around.

**Project Description**

The Faribault County Soil and Water Conservation District (SWCD) worked with several farmers who are interested in replacing open tile intakes with rock inlets. We felt that this change would improve the quality of surface water. Research has indicated that approximately 50% of the sediment that is delivered through standard surface intakes is conveyed through the rock inlets. Other advantages include improved sub-surface drainage and farmers being able to farm directly over the inlet area without having to go around any obstacles.

Protecting and improving surface water quality and reducing sedimentation were identified in many of the goals and objectives in the Faribault County Comprehensive Water Plan. Replacing the existing open tile intakes with

rock inlets will reduce the amount of sediment, nutrients, and pesticides entering drain tile systems which outlet into drainage ditches, rivers, and lakes. The goal of completing 20 of these projects will be a start in the right direction to improving the quality of the surface water in Faribault County and downstream areas.

**Results**

Twenty existing open tile intakes have been replaced with rock inlets. The inlets were installed on five different farms by five different contractors. The process for installing the inlets starts with excavating the area around the existing open intake so that it can be removed. A trench 2 to 3' wide by 12 to 15' long by 3 to 4' deep is excavated perpendicular to the tile line. A 12 to 15' section of 5" muck pipe with 5/8" holes and a "Big-O" sock is connected to the tile line. Finally, the excavated area is filled with about four cubic yards of 1/4 to 7/8" pea rock.

The actual installation costs were in line with the estimate we made in 2001 (Table 1). When replacing open tile intakes with rock inlets, the cost of installing the new technology is important to farmers. A comparison of the costs of installing different types of surface inlets gathered from other studies is shown in

*Rock inlet installed  
in 2001 in  
Blue Earth County.*



Table 1. Check with local contractors and the SWCD for local prices.

The rock inlets have been popular with the landowners because they seem to be constantly draining sub-surface water and provide equal, if not better, drainage compared to open tile intakes. Thus, the area around the rock inlet is able to take on more water during a rain event. The landowners are also happy that they do not have to farm around any standpipes. Many neighboring landowners have seen the inlets being installed and have expressed interest in replacing their open tile intakes. We currently have a long list of people waiting for cost share to install the inlets.

### Management Tips

1. Make sure the rock that is used is washed rock and that it does not have any fines in it. The fines will reduce the effectiveness of the inlet over a period of time.
2. For areas with larger watersheds, it may be beneficial to install two or three inlets to provide adequate drainage and reduce crop loss.
3. Conservation/reduced tillage practices should be implemented on the watershed area. This should extend the life expectancy of the inlets by keeping the soil particles on the upland area.

### Cooperators

*Paul Carr, University of Minnesota Extension Educator, Blue Earth, MN*  
*Tom and Nathan Legred, Farmers, Briceyn, MN*  
*John Wettlaufer, Farmer, Easton, MN*  
*Gary Engelby, Farmer, Winnebago, MN*  
*Doug Bruckhoff, Farmer, Wells, MN*  
*Everett Wessels, Farmer, Blue Earth, MN*

### Project Location

Contact Shane Johnson for directions to demonstration sites.

### Other Resources

Gieseke, Tim. 2002. A comparison of sediment and phosphorus losses from rock inlets and open inlets in the Lower Minnesota River Basin. Carver SWCD, 219 E. Frontage Rd., Waconia, MN 55387, 952-442-5101. Also see the article on Tim Gieseke's project in this Greenbook.

Morreim Drainage, Inc. 71610 – 263<sup>rd</sup> St., Albert Lea, MN 56007, 507-826-3449.

University of Minnesota, Department of Biosystems and Agricultural Engineering. 2002. The Drainage Outlet. Available at: <http://d-outlet.coafes.umn.edu/>  
 Web site provides access to online drainage resources, current drainage research, planning and design information, and meeting and events.

Wanous, Mike. 2002. Rock inlet study. Carver SWCD, 219 E. Frontage Rd., Waconia, MN 55387, 952-442-5101. Available at: [www.co.carver.mn.us/SWCD/rock.htm](http://www.co.carver.mn.us/SWCD/rock.htm)

**Table 1. Surface Inlets: A Comparison\***

	<b>Rock Inlet (15' length)</b>	<b>French Drain</b>	<b>Standpipe (3 pc set – 5")</b>	<b>Basket (5")</b>
<b>Materials</b>	\$ 94.00	\$174.00	\$27.00	\$20.00
<b>Backhoe</b>	\$ 37.50	\$ 75.00	\$37.50	\$37.50
<b>Labor</b>	\$ 17.50	\$ 35.00	\$17.50	\$17.50
<b>Total</b>	\$149.00	\$285.00	\$82.00	\$75.00
<b>Conditions that could cause plug-up</b>	Small ponding area and large field around the inlet; poor erosion control on uplands contributing to inlet; improper rock size.	Small ponding area and large field around the inlet; poor erosion control on uplands contributing to inlet; improper rock size.	Stalks and sediment under extreme runoff events or flooding conditions; damaged by equipment.	Stalks and sediment under extreme runoff events or flooding conditions; damaged by equipment.

\*Costs are 2001 estimates.

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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 are installing contour curbs and rock tile inlets to improve runoff collection, infiltration, and water quality. The stored water will be used to provide for wildlife, groundwater recharge, and potentially for irrigation of grapes and hardwoods.

**Project Description**

The existing farm operation consists of 210 acres. I currently row crop 45 acres. A 25-acre field and a 19-acre field are rotated with corn and soybeans. A neighboring hog operation provides nutrients through manure, fall injected into the soybean field for the following corn crop. A

*Installing contour curbs on the Gieseke farm.*

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 are fivefold:

1. to demonstrate a rock inlet waterway weir system;
2. to demonstrate a contour curb system;
3. to promote 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.

The rock inlet waterway weir system was installed to demonstrate its effectiveness in controlling erosion in smaller watershed drainage ways. Ideally, grassed waterways provide a protected conduit for excess runoff from fields, but due to the use of indiscriminate 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 perpendicular to the waterway at about 200' intervals. Installation consisted of digging a trench 2.5' wide across the 20' 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 are being planted. The curb system in the vineyard will be installed in the spring of 2003. 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 are constructed with a 0.5% gradient toward a collection pond to route any runoff.

Fifty black walnut seedlings were planted this fall. A 9" auger was used to drill 30" deep holes to plant the seedlings. About 75 more black walnut seedlings and grape seedlings will be planted in the spring of 2003 and weed suppressing blankets, tree tube protectors, and a gravity-fed drip irrigation system will be installed to demonstrate the cost-effectiveness of reducing labor inputs in the establishment of each.

At planting, each hole is inoculated with commercially available mycorrhizal fungi and a small amount of compost. Every tenth plant receives no inoculant and will act as a control.

## Results

In October 2002 we installed the collection pond, the rock inlet waterway weir system, and a section of the contour curb. Starting in the spring of 2003, we will collect runoff samples as well as the volume of water used for irrigation. As of the fall of 2002, no significant precipitation events occurred after construction was completed.

Starting in 2003, monitoring of the runoff collection and storage system will include:

- 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.

## Management Tips

1. When constructing a rock tile inlet, use the excavated material as a berm downstream to collect runoff.
2. Excessive buildup of crop residue from severe storms may affect the performance of the rock tile inlet.
3. Minimum tillage reduces the amount of soil brought into the rock inlet.
4. After several growing seasons, it may be advantageous to pull a chisel plow through the rock to loosen up any tire compaction.
5. Soil that is mixed into the rock inlet does not significantly migrate below the tillage line.
6. Eventually, the top one foot of rock may have to be removed and replaced with clean rock.

## Cooperators

*Vern and Myrt Gieseke, New Ulm, MN*

*Ken Schneider, North Central Region SARE, Lincoln, NE*

## 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

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

Minnesota Grape Growers Association, John Marshall, secretary. 35680 Hwy. 61 Blvd., Lake City, MN 55041. Email: [grapes@rconnect.com](mailto:grapes@rconnect.com)

This is a membership organization and publishes the quarterly newsletter "Notes from the North" with information about grape production.

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**Project Duration**

2001 to 2003

**ESAP Contact**

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**Keywords**

dairy, manure  
management,  
nitrogen,  
phosphorus,  
water quality

# Dairy Manure Application Methods and Nutrient Loss from Alfalfa

**Project Summary**

Dairy farmers in Central Minnesota face nitrogen management challenges. Based on nitrogen budget studies, many dairy farms have a nitrogen surplus due to inputs from alfalfa and manure. The common crop sequence is 3 to 4 years of alfalfa followed by 2 to 3 years of corn. There may or may not be soybeans grown before going back to alfalfa. There is appreciable nitrogen available from the alfalfa for first and second year corn. This poses a challenge to apply manure in the rotation where a maximum amount of nitrogen is recovered by the corn. Ideally, manure would be applied between first and second year corn. In a less than ideal world, it is often applied on established alfalfa due to storage, weather, and other constraints. Often farmers see a response by the alfalfa to nutrients in the manure other than nitrogen.

Alfalfa does require large amounts of nitrogen and will use manure nitrogen. This is a disposal strategy since, in the absence of applied nitrogen, alfalfa will fix its own from the soil atmosphere. Thus, manure application to alfalfa poses a very low risk of nitrogen leaching. The environmental risk associated with manure application to established alfalfa is the potential for runoff losses of organic matter in the manure and various forms of phosphorus. For some soils, this risk may be high because of the inability to incorporate manure applied to established alfalfa.

An alternative is to apply liquid manure with a tillage tool similar to a soil aerator used on golf

courses. This study investigates the use of an AerWay mounted on the liquid manure applicator. The AerWay is a rolling tined implement, consisting of a horizontally mounted rotating gang of 9 to 12" teeth that produce holes in the soil.

If the tillage is able to provide surface storage and some incorporation of liquid manure, it may reduce the environmental risks posed by a surface application. However, even small amounts of tillage can affect alfalfa yield. According to anecdotal evidence by custom manure applicators and farmers, salt damage to the alfalfa stand does not appear to be a problem with low application rates made shortly after cutting alfalfa. The objective of this study was to evaluate both the water quality and alfalfa yield effects of liquid dairy manure application to existing alfalfa with and without tillage.

**Project Description**

This research was conducted at two locations, the Joe Christen farm and the Brad Fehr farm. The Joe Christen farm is located near Albany, MN. The crop rotation consists of corn-corn-soybeans-corn followed by alfalfa with a small grain cover crop. Alfalfa remains in production for three to four years. Manure from the dairy operation is stored in an earthen pond and is usually applied in the

*Manure application with the Aer Way.*





**Table 1. The Effect of Tillage and Liquid Manure Applied to Alfalfa on Chemical Parameters in Surface Runoff Water at the Fehr Site (Late July, 2001)**

Parameter	Tillage			Manure		
	Control	AerWay	P>F	Control	Dairy	P>F
	(lb/A)			(lb/A)		
Bioavailable P	0.25	0.21	N.S.	0.15	0.31	**
Dissolved P	0.19	0.15	N.S.	0.11	0.23	**
Particulate P	0.29	0.36	N.S.	0.25	0.40	*
Total P	0.48	0.51	N.S.	0.35	0.63	**
Ammonium	0.95	0.95	N.S.	0.18	1.72	**
Nitrate	0.27	0.28	N.S.	0.13	0.42	**
Total Solids	296	313	N.S.	297	313	N.S.
BOD	4.6	4.3	N.S.	1.7	7.2	**

N.S. = not significant, \* = significant with  $P < 0.10$ , \*\* = highly significant with  $P < 0.05$

fall or spring prior to corn. Manure is custom applied by a licensed commercial animal waste technician. A drag hose system is used to deliver liquid dairy manure at 8,000 gal/A. The soil is sandy loam formed in glacial outwash parent material. The average slope at this site is 4%. Experimental treatments were established after first alfalfa cutting in early June, 2001.

The Fehr farm is located near Morris, MN. The crop rotation consists of corn-corn followed by three to four years of alfalfa. The site was in the third year of alfalfa. The soil is a silt loam formed in glacial till parent material. The average slope at this site is 2%. Experimental treatments were established and runoff measured after the second alfalfa cutting in late July, 2001.

At each site, the following treatments were applied:

- broadcast manure followed by AerWay tillage;
- broadcast manure with no tillage;
- AerWay tillage with no manure application; and,
- control (no manure and no tillage).

Treatments were replicated three times on 40 x 60' plots at both sites. Initial soil samples, alfalfa stand counts, and yield samples were taken in each plot on May 27, 2001. The first crop of alfalfa was harvested prior to manure application on June 1, 2001. Second crop alfalfa yield samples and stand counts were taken in 2001 at the Christen farm and in 2002 at the Fehr farm (one year after the manure application).

The impact of tillage on runoff was measured using a Purdue-type rainfall simulator beginning immediately after manure application in 2001. Each rain event consisted of a 2"/hr storm applied for one hour. Runoff samples were

collected to measure biochemical oxygen demand (BOD), soluble phosphorus, particulate phosphorus, bioavailable phosphorus, total phosphorus, nitrate, ammonium, and total solids (sediment) concentrations.

## Results

*Runoff and Water Quality.* The volume of runoff generated from the simulated rainfall was not affected by tillage or manure application at either research site. Runoff averaged 0.15" at the Christen farm and 1.4" at the Fehr farm. Runoff at the Christen farm was low because of the high permeability of this soil, whereas the soil at the Fehr site was much less permeable. Other studies have shown a higher runoff volume following liquid manure application because the applied liquid elevated initial soil moisture when compared to the same soil without applied manure. For the Fehr study, soil moisture prior to simulating rain was 22% and 19% for manure and control treatments, respectively. This difference did not result in a difference in runoff volume. Tillage did not affect soil moisture. In general, the tillage was not effective in reducing runoff volume for either soil type.

The AerWay tillage tool has adjustable tillage intensity. More aggressive tillage is achieved by increasing the angle of the gang relative to the travel direction. In this study, the convention of setting the tool for the minimum tillage intensity for established alfalfa was followed. Future research may investigate the effect of increasing tillage intensity on runoff volume and alfalfa yields.

Runoff water quality is reported here only for the Fehr site (Table 1). At the Christen site, the source water used for rainfall simulation was contaminated, preventing meaningful analysis of the runoff water quality. However, because of the low runoff volumes, it can be concluded that

loss of nutrients in surface runoff was minimal relative to the losses reported for the Fehr site. Assessment of the environmental risk of manure application to existing alfalfa should consider soil permeability, since this factor had a much larger effect on runoff than either manure application or tillage.

At the Fehr site, tillage had no significant effect on any of the water quality parameters evaluated, while manure application affected loss of many water pollutants. Total solids losses were low and were similar for all treatments. Losses of phosphorus in bioavailable, soluble, and particulate forms were generally low, but were approximately two times greater when manure was applied than for control plots. Nitrogen losses were also greater when manure was applied than for the control plots. Most notable were the higher losses of ammonium-nitrogen. Elevated BOD in runoff water with applied manure was also observed. The degradation of runoff water quality after manure application on existing alfalfa highlights the potential environmental risks associated with this practice. The use of the AerWay tillage device set at the lowest tillage intensity was not an effective tool for reducing this risk.

In this research project, the manure applicator was configured so that the AerWay tillage tool followed behind the actual manure application. The researchers observed that very little liquid manure entered into the holes created by the tillage tines. This is due to a small ridge that is formed around the rim of the hole, created by a lifting action as the tines are rotated out of the soil. Reconfiguring the applicator so that the manure application follows the tillage may allow for greater infiltration of liquid manure into the holes and may give different results than those observed here. For example, the tillage tool made 72,600 holes per acre. The holes were 7.5" long by 1" wide by 4.5" deep. Each hole held a volume of 0.036 gallons of liquid. The total capacity of the holes was 2,600 gal/A, or roughly one-third of the total volume of manure applied per acre in this study.

*Alfalfa Yield.* At the Christen site, the effects of the treatments on alfalfa yields were assessed for the second cutting in 2001. Neither tillage nor manure application had a significant effect on alfalfa yield which averaged 2.2 tons/A. No differences were found in either the density of alfalfa crowns or the number of stems per crown.

At the Fehr site, the first yield comparison was made for the second alfalfa cutting in 2002. For this cutting, there was a significant yield reduction associated with tillage. Yields averaged 1.9 tons/A for the control treatment and 1.5 tons/A when tillage was performed. As observed at

the Christen site, manure had no significant effect on yield. Some farmers have concern that manure applications to established alfalfa will result in yield losses from salt burn. No yield loss was observed in this study. In some locations, alfalfa may have a positive yield response to manure application as a result of the addition of phosphorus or potassium. No yield improvement was associated with manure in either site, most likely because both soils tested in the high category for both nutrients.

#### *Summary:*

- Given the configuration of the Aerway tillage manure applicator used in this study, tillage did not reduce runoff losses following manure application.
- Surface applied liquid dairy manure increased runoff losses of soluble phosphorus, particulate phosphorus, total phosphorus, biochemical oxygen demand, ammonium, and nitrate.
- Yields were not reduced by manure application, but they were reduced by tillage at one of the two locations.
- Future research should evaluate the effects of more aggressive tillage and a possible reconfiguration of the tillage/manure applicator on both water quality and alfalfa yields.

This study reinforces the importance of following MN Feedlot Rule 7020 manure application setbacks from protected waters.

### **Management Tips**

1. Apply manure to alfalfa fields that have been established for at least two years.
2. To avoid injuring or killing a stand of alfalfa, use conservative dairy manure application rates ranging from 3,000 up to 5,000 gal/A. Avoid applying over 120 lb/A manure nitrogen. Apply liquid manure after harvesting alfalfa but before the field begins to regrow (to minimize crop injury).
3. Consider hiring an experienced custom manure application service.
4. Test manure for nutrient content and calibrate manure application equipment.
5. Locate protected waters and wetlands on your cropland so 'Special Protection Areas' can be identified. 'Special Protection Area' means land within 300' of protected waters and wetlands.



## Cooperators

*Joe and John Christen, Dairy Farmers, Albany, MN*

*Brad Fehr, Dairy Farmer, Morris, MN*

*Matt Solemsaas, West Central Research and Outreach Center, Morris, MN*

*Roger Boecker, R-Way Pumping, New Munich, MN*

*John Moncrief, Department of Soil, Water and Climate, University of Minnesota, St Paul, MN*

## Project Location

Contact Dennis Fuchs for directions to demonstration sites.

## Other Resources

For additional information on identifying ‘Special Protection Areas’ on your cropland and applying manure near protected waters, contact your county SWCD/NRCS office, county feedlot officer, or the MPCA. Ask for the publication, “Applying Manure in Sensitive Areas”.

For more details on the 7020 Rule:  
[www.pca.state.mn.us/hot/feedlots.html](http://www.pca.state.mn.us/hot/feedlots.html)

Lewandowski, A. 2000. Manure management. Soil management series No. BU-07401-GO. University of Minnesota Extension Service, St. Paul, MN 55108, 612-625-8173 or 800-876-8636. Available at:  
[www.extension.umn.edu/distribution/cropsystems/DC7401.html](http://www.extension.umn.edu/distribution/cropsystems/DC7401.html)

MPCA web site: [www.pca.state.mn.us/publications/feedlots-manureapplication.pdf](http://www.pca.state.mn.us/publications/feedlots-manureapplication.pdf)

Schmitt, M. 1998. Fertilizing cropland with dairy manure. No. FO-05880-GO. Available at:  
[www.extension.umn.edu/distribution/cropsystems/DC5880.html](http://www.extension.umn.edu/distribution/cropsystems/DC5880.html)

University of Minnesota Extension Service and USDA Natural Resources Conservation Service. 2001. Nutrient management planner for Minnesota. Software program that calculates manure application rates from the farmers field and manure data. Contact Kevin Blanchet, UM-Extension, 651-480-7739, for more information.



*Collecting runoff from  
rain simulation plot.*

**Principal Investigator**

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**Project Duration**

2000 to 2004

**ESAP Contact**

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**Keywords**

canning crops,  
cover crops, soil  
conservation,  
vegetable  
production

# Soil Conservation of Canning Crop Fields

**Project Summary**

We are expanding our cover cropping practices at R., C., and A. Hart Farms to protect and build our soil resource. Our goal for this project is to show the feasibility of using barley and oat cover crops in vegetable crop fields, specifically in sweet corn and peas. We want to show how cover crops can reduce soil erosion and promote land stewardship. We are investigating the effect of these cover crops on the yields of the following year's row crops.

There were over 35,000 acres of peas and sweet corn planted in southeastern Minnesota in 2002. Most of these acres are normally left open to wind and water erosion for seven to ten months out of the year. For example, an early pea crop may be planted in mid-April and harvested in mid-June. This field is then left untouched and exposed to wind and water erosion for ten months until it is planted to row crops the following April. By including a cover crop after pea harvest, we can protect the soil, build organic matter, and encourage earthworm activity, providing a loose soil condition for the next year's crop. A good soil condition allows us to use no-till in the following crops of field corn and soybeans.

**Project Description**

R., C., and A. Hart Farms is a family farm partnership in southeastern Minnesota. We raise corn, soybeans, sweet corn, peas, lima beans, and hay. We are interested in developing practices in canning crop fields that promote land stewardship by reducing erosion while maintaining productivity. Over the past three years, we have successfully established oats and barley throughout the summer with minimal soil moisture to work with. We have demonstrated cover crop establishment techniques that minimize cost and use resources available to the average farmer. We want to share these findings with neighbors who raise canning crops.

The project was initiated in 2000 by planting test strips of oat and barley cover crops after both sweet corn and peas. We know that the cost of establishment of the cover crops is a major impediment to adoption of this practice so we tried to establish these plots at a low cost. The treatments were chosen to highlight several establishment options available to area farmers. The tillage and seeding equipment is commonly used in farm operations other than for cover crop establishment. We are comparing the quality of the stand and the cost of establishment. Ten 30' wide cover crop establishment test strips were set up including:

*Test strip on left is protected by oat cover crop. Test strip on right is conventional production. (December)*



- two checks with no tillage or planting;
- one conventional check, disked and left unplanted (typical post-harvest management for canning crops; and,
- seven combinations of tillage, seeding, and cover crop options (see Tables 1 and 2).

The same cover crop test strip design was repeated at two new sites in 2001 and 2002, and is being tested for residue and field corn yield, in the same way as at the first site.

We are evaluating the test strips by comparing the residue or ground cover available to reduce wind and water erosion. The greater the ground cover, the better the soil erosion protection. Ground cover is also a direct measure of the success of cover crop establishment and growth. In the spring of 2001 and 2002, we planted the cover cropped fields to field corn using a no-till planter. In the fall, we did field corn yield comparisons on the ten strips.

## Results

In each of the last three growing seasons, all but one of the cover crop strips developed significant stands in the fall. With the exception of the fall chisel plow treatment, ground cover increased from August to October to sufficiently protect our soil (see Table 1 and Table 2). Ground cover in most cover crop strips ranged from 85 to 95% in October but ranged from only 15 to 39% without cover crops and from 25 to 30% in the chisel plow treatment. It is likely that the chisel plow removed soil moisture needed for cover crop germination. The ground cover benefit from the cover crops carried over through the following spring. The only visually noticeable soil erosion occurred in the pea plots without cover crops.

The cover crops following sweet corn performed similar to those following peas. However, the following years field corn yields were uniformly lower.

The cost of establishment of the cover crops in 2001 and 2002 are presented in Table 3. Costs ranged from \$10.75/A (for seeding oats with a regular grain drill using no tillage) to \$24.75/A (for seeding oats with a no-till grain drill using a DMI deep ripper or chisel plow). Our cost per bushel for barley seed rose dramatically from \$1.25 in 2000 to \$6.50 in 2001 and 2002 making oat establishment more than competitive with barley. We have found that it pays to take the time to shop for both price and a weed free seed source.

Since most of the establishment options performed quite well, we feel it makes sense to encourage the use of the lower cost methods. For example, seeding oats with a regular grain drill or barley with an air flow fertilizer spreader provided adequate ground cover at the lowest cost.

Compaction is a common problem when raising canning crops. In two of the test strips we are comparing fall chisel plowing to the use of a DMI deep ripper just prior to planting the cover crop as ways to alleviate compaction. The midsummer deep tillage produced a good cover crop and avoided exposing soil in the fall. When the cover crop experiment was repeated in new ground in 2001 and 2002, we found similar results.

We planted field corn this spring on the 2000 and 2001 cover crop test plots. Corn grain yields in 2002 were not affected by the previous cover crop (see Table 1 and Table 2). We were surprised that there was no yield benefit to the DMI deep tillage. This is further encouragement to stay with the lowest cost cover crop establishment methods. In the near-term, farmers should expect cover crops to improve soil conservation, build organic matter, and encourage earthworm activity with no yield reduction.

We believe this cover cropping system will help our farm to be profitable into the future. We are able to reduce machinery costs by no-till planting field corn into cover cropped fields the following spring. Soil structure, organic matter cycling, and soil moisture retention improve markedly immediately after cover cropping, making residue management easier.

We have successfully combined the use of canning crops and cover crops to establish conservation structures. The canning crops were planted early on fields that were to receive a terrace or a waterway after canning crop harvest. We had ample time to complete the conservation project and establish a cover crop before fall freeze-up.

In addition to this demonstration, we planted 23 fields in two counties totaling 1,300 acres this year to cover crops after harvesting peas or sweet corn. Oats and barley were used until September 1 when a switch was made to winter rye. The winter rye makes a good stand in late fall. It will not winterkill and provides a good living cover the following spring. We believe these 1,300 acres of cover crops planted across a diversity of farm landscapes show that this system can be adapted to any farm.

**Table 1. Ground Cover and 2002 Field Corn Yield after Peas with Oat and Barley Cover Crops**

Tillage/Seeding Equipment	Cover Crop	Cover (%) on Three Dates			Field Corn Yield (bu/A)
		8-29-01	10-28-01	4-28-02	
none/none	none	30	24	20	167
disk/none	none	18	15	10	168
none/regular grain drill	oats	30	90	75	165
disk/regular grain drill	oats	23	95	77	161
none/no-till grain drill	oats	30	95	78	166
fall chisel/no-till grain drill	oats	30	25	19	154
DMI/no-till grain drill	oats	31	95	76	163
disk/air flow fertilizer spreader	barley	22	90	82	160
none/air flow fertilizer spreader	barley	30	85	67	158

**Table 2. Ground Cover and 2002 Field Corn Yield after Sweet Corn with Oat and Barley Cover Crops**

Tillage/Seeding Equipment	Cover Crop	Cover (%) on Three Dates			Field Corn Yield (bu/A)
		8-29-01	10-28-01	4-28-02	
none/none	none	46	39	30	157
disk/none	none	28	23	18	154
none/regular grain drill	oats	55	93	88	146
disk/regular grain drill	oats	40	93	90	146
none/no-till grain drill	oats	52	95	88	152
fall chisel/no-till grain drill	oats	51	30	20	150
DMI/no-till grain drill	oats	52	95	85	156
disk/air flow fertilizer spreader	barley	38	90	80	153
none/air flow fertilizer spreader	barley	50	85	76	157

**Table 3. Cost of Establishment of Cover Crops in 2001 and 2002 Using Several Tillage and Seeding Equipment Combinations (Dollars/A at Custom Hire Rates)**

Tillage	Cost (\$)	Seeding Equipment	Cost (\$)	Cover Crop <sup>1</sup>	Cost (\$)	Total
none	0.00	none	0.00	none	0.00	0.00
disk	10.00	none	0.00	none	0.00	10.00
none	0.00	regular grain drill	8.00	oats	2.75	10.75
disk	10.00	regular grain drill	8.00	oats	2.75	20.75
none	0.00	no-till grain drill	12.00	oats	2.75	14.75
fall chisel	10.00	no-till grain drill	12.00	oats	2.75	24.75
DMI	10.00	no-till grain drill	12.00	oats	2.75	24.75
disk	10.00	air flow fertilizer spreader	5.00	barley	6.50	21.50
none	0.00	air flow fertilizer spreader	5.00	barley	6.50	11.50

<sup>1</sup>Oats and barley seeded at 1 bu/A

## Management Tips

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1. Plant the cover crop as early as possible after harvest, even if the soil is dry. It takes very little moisture to get good germination.
2. Don't be afraid to shop around for a good price on cover crop seed but buy seed that is weed free.
3. Cover crop seed can be spread during a fertilizer application or sown with a drill.
4. Switch from oats and barley to rye after September 1. Rye is much more cold hardy and will produce significant biomass early the following spring.

## Cooperator

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*Dave L. Copeland, NRCS District Conservationist,  
Olmstead County, MN*

## Project Location

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From Rochester, go north on US Hwy. 63 for 5 miles to Olmsted Cty. Rd. 21. Turn right (east). Travel 2 miles on Cty. Rd. 21 to Cty. Rd. 11. Turn left (north) on Cty. 11 and go 1.5 miles. The demonstration plot is on the right side of the road.

## Other Resources

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University of California-Davis. Cover crops. Database available at: [www.sarep.ucdavis.edu/ccrop](http://www.sarep.ucdavis.edu/ccrop)



*Andy describes cover crop  
establishment techniques.*

**Principal Investigator**

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**Project Duration**

2001 to 2003

**ESAP Contact**

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**Keywords**

artificial drying  
of corn, Bt  
corn, corn, corn  
varieties, field  
drying, Roundup  
Ready® corn

# In-field Winter Drying and Storage of Corn: An Economic Analysis of Costs and Returns

**Project Summary**

I designed a project to determine if leaving corn to dry in the field is more economical than artificially drying the corn. In-field drying of corn is economical at a certain percentage of moisture coupled with the cost of the drying fuel. I want to determine that point. The purpose of this project is to gather information to help farmers make rational decisions on when corn should be field dried. I also want to gather data on the amount of field loss that can be expected. This project fits into the long-term plans for my farm because reducing costs and improving the environment are beneficial. The use of a nonrenewal resource (LP gas) would be eliminated. In addition, the natural barrier provided by standing corn would reduce the amount of drifting snow and provide improved habitat for wildlife.

**Project Description**

Red Rock Stock Farm consists of approximately 1,500 tillable acres in western Douglas County. The crops consist of 800 acres of corn and soybeans, and 100 acres of alfalfa. A small amount of wheat is also grown as a cover crop for alfalfa establishment. The remaining 600 acres are rented to neighbors. One hundred twenty beef cows are kept with the calves that are fed to maturity on the farm. The moderately hilly land is heavy clay soil. I am the

main source of labor. My wife and daughter also help out. A foreign trainee is also usually present during the growing season. Labor is a limiting factor.

Energy is a major input cost for crop production. One of the major uses of energy is drying the corn crop. Corn drying would seem to be an area where energy costs could be reduced easily. My experience in 31 years of farming has indicated that sometimes corn is better left in the field until spring rather than harvested in the fall at a high moisture content. The low return on corn and the relatively high cost of LP gas for drying could make in-field drying of corn economically feasible.

The cost of corn drying is a major problem. The savings to Minnesota farmers could be huge should the in-field drying of corn be determined to be economical. Using the year 2000 statistical figures for Minnesota, there were 6,600,000 acres harvested at 145 bu/A. If \$.10/bu in drying costs could be saved, the potential savings to Minnesota farmers could be over \$95 million. A realistic goal would be a 10% reduction in drying costs which would still reduce the costs of a nonrenewable resource by \$9.5 million.



*Jensen corn being  
harvested.*

I want information on the amount of field loss that could be expected should corn be field dried over the winter. Since the amount of loss would change with the severity of the winter, a three year comparison was developed. Likewise, the amount of loss will differ with the variety of corn planted. This information will help farmers make an intelligent decision on which varieties of corn to field dry based on the amount of expected field loss, especially in years when weather conditions, such as an early frost, could result in high moisture corn and large drying bills.

In 2001, I chose to plant varieties of conventional corn and their Bt (corn borer resistant) or Roundup Ready® (RR) counterparts. The purpose of planting different varieties was to determine if there was a significant difference in the amount of field loss between hybrids, especially Bt and Roundup Ready® hybrids. The expectation was that the Bt corn would have better standability and less field loss. Roundup Ready® corn was included because it has been observed that the corn has very tough stalks and also good standability. Some varieties with longer maturity than would normally be planted for this area were also included. I would like to see if a higher yielding corn that is wetter at harvest will be more profitable if field dried than normal maturing corn. The varieties planted and harvested included: NK 4242, NK 4242 Bt, NK 3030 and NK 3030 Bt, and DeKalb 440 and its Bt and Roundup Ready® variety, DeKalb 440 Bt RR.

The corn was planted somewhat later than normal on May 10, 2001. Thirty two, 30" rows of each variety were planted with 16 rows harvested on October 29 and 16 rows remaining for spring harvest. Each plot was 3.7 acres. The planting population was 32,600 plants/A. The fertilizer and chemical applications were the same as for the rest of the corn planted on the farm.

In 2002, eight varieties of corn (NK 4242 Bt, NK 4242, NK 3030, NK 3030 Bt, DeKalb 4628, DeKalb 4222 Bt RR, NK 32L9 RR, and NK 43C4 RR) were planted on May 15 with the fall portion harvested on November 8. The spring portion will be combined in April, 2003.

## Project Results

Growing conditions were wet during the first part of 2001 and then turned dry in July and August. Later rains helped and the crop yielded surprisingly well. After the corn was harvested, the yields were verified by weigh wagon from "Garb's Sales" of Kensington. The corn was sold at harvest for \$1.66/bu with a \$.05 loan deficiency payment. The standard elevator deductions for moisture shrinkage and drying expenses were used. The results are presented in Tables 1, 2, and 3. The results for 2001/2002 were evaluated

by comparing the net value/A of the fall harvested corn with the net value/A of the spring harvested corn.

It should be noted that for both fall and spring harvest, the corn was considered hauled directly to the local elevator and sold immediately. The spring harvest was valued at the same price per bushel as the fall harvest, even though spring prices are usually higher than fall. Higher spring prices offset costs of storage as well as normal market movements. Should I have chosen to store the fall harvest and sell it at spring prices, I would have had to account also for the costs of storage and handling.

The 2001/2002 winter was almost snow free until the middle of March. Then a severe snow storm dumped a considerable amount of snow into the standing corn, in some cases burying the ears. This snow resulted in what I would consider a normal amount of stalk breakage. Approximately 10% of the stalks were broken or leaning to some degree. Some corn was lost because of the breakage. Corn loss to wildlife was not significant, which was surprising given the size of the deer herd in the area. Tables 1 and 2 provide a comparison of typically measured characteristics for the fall vs. spring harvested corn from 2001/2002. Average fall yield per acre exceeded average spring yield per acre by 16.67 bushels.

Harvesting the corn in the spring was quite easy because the corn was dry enough to bin. The corn head had to be run closer to the ground to salvage as much of the corn as possible. For 2001/2002, the average fall net return exceeded average spring net return per acre by \$25.03 (Table 3). Therefore, for the 2001/2002 season, it was not economical to harvest corn in the spring. This was due to the fact that the 2001 corn crop was unusually dry resulting in less savings.

I do not believe that leaving corn with 17-18% moisture content in the field to dry is economical. This would mean that the field loss would have to be less than 2.5-3%. If the corn was harvested at 20-25%, in-field drying is probably economical.

The project has already reduced input costs by reducing the amount of dryer gas that has to be purchased. In addition, my labor input costs have been reduced because of the lower number of times the corn will have to be handled. The negative side is that corn would be harvested in the spring when farmers would prefer to be spending their time planting that season's crop.

The 2002 corn was planted on the same plot at the usual rate of 32,600 plants/A. I felt that the field would be most



**Table 1. Yield and Moisture Content Results for Harvested Corn 2001/2002**

	Variety	No. of Days to Mature	Yield (bu/A) Fall 2001	Yield (bu/A) Spring 2002	Moisture (%) Fall 2001	Moisture (%) Spring 2002
<b>Plot 1</b>	NK 4242 Bt	101	153.4	126.7	19.5	13.3
<b>Plot 2</b>	NK 4242	101	143.5	144.3	18.5	13.0
<b>Plot 3</b>	NK 3030	93	157.8	143.2	17.3	13.0
<b>Plot 4</b>	NK 3030 Bt	93	165.8	145.3	18.9	13.0
<b>Plot 5</b>	DeKalb 440	94	164.6	157.5	18.9	13.1
<b>Plot 6</b>	DeKalb 440 Bt RR	94	182.1	150.1	17.1	12.8
<b>Average</b>			161.2	144.53	18.4	13.0

**Table 2. Test Weight and Value Results for Harvested Corn 2001/2002**

	Variety	Test Wt (lb) Fall 2001	Test Wt (lb) Spring 2002	Gross Value (\$)/A After Drying Costs Fall 2001	Gross Value (\$)/A After Opportunity Cost* Spring 2002
<b>Plot 1</b>	NK 4242 Bt	57.0	57	219.58	206.09
<b>Plot 2</b>	NK 4242	56.0	59	211.78	236.99
<b>Plot 3</b>	NK 3030	56.0	59	241.43	234.48
<b>Plot 4</b>	NK 3030 Bt	56.5	59	241.72	237.73
<b>Plot 5</b>	DeKalb 440	56.5	57	247.66	258.79
<b>Plot 6</b>	DeKalb 440 Bt RR	56.5	57	280.25	244.70

\*Interest opportunity costs were calculated based on fall gross income (after drying), using an 8% rate for 6 months.

**Table 3. Net Return Over All Listed Costs of Producing Corn Crop 2001/2002**

	Variety	Fall 2001 Net Return (\$)/A	Spring 2002 Net Return (\$)/A
<b>Plot 1</b>	NK 4242 Bt	25.01	(13.15)
<b>Plot 2</b>	NK 4242	16.18	21.21
<b>Plot 3</b>	NK 3030	31.98	6.56
<b>Plot 4</b>	NK 3030 Bt	32.44	3.06
<b>Plot 5</b>	DeKalb 440	26.08	19.85
<b>Plot 6</b>	DeKalb 440 Bt RR	69.18	13.14
<b>Average</b>		33.48	8.45

convenient for a field day. This was a mistake. The corn on corn rotation resulted in a yield from the test plot that was significantly lower than my other fields. The volunteer corn caused a considerable yield loss even though the field was cultivated. Corn fields harvested in the spring should be planted to other crops. Results for the 2002 fall and 2003 spring harvest will be presented in *Greenbook 2004*.

### Management Tips

1. Do not plant corn after spring harvested corn. The volunteer corn will cause a yield reduction, even if it is cultivated.
2. Harvest at least 24 rows around the outside of the field to stop the snow and lower the crop loss.
3. Monitor the deer pressure. If deer are a problem, chase them away or consider installing an electric fence.

## Cooperators

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*Bret Oelke, University of Minnesota Extension Service,  
Elbow Lake, MN*

*Edgar Persons, Retired University of Minnesota  
Professor, Kensington, MN*

*David Peper, Crop Consultant, Alexandria, MN*

## Project Location

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From Alexandria, go west on MN Hwy. 27 approximately 15 miles to Douglas Cty. Rd. 1. Turn right on Douglas Cty. Rd. 1 and travel about 3.5 miles. Red Rock Stock Farm is located on the right side of the road across from Urness Township Town Hall. The Jensen name is on the mailbox.

## Other Resources

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Nichols, T.E., Jr., 1985. Economics of on-farm corn drying, NCH-21. Purdue University - Cooperative Extension Service, IN.

Web site: [www.agcom.purdue.edu/AgCom/Pubs/NCH/NCH-21.html](http://www.agcom.purdue.edu/AgCom/Pubs/NCH/NCH-21.html)

**Principal Investigator**

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**Project Duration**

2002 to 2004

**ESAP Contact**

Meg Moynihan  
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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 project made lemonade out of lemons after heavy rains flooded out the experiment and generated a healthy crop of Canada thistle. Instead of evaluating chickling vetch, the project team turned their attention to evaluating thistle control with organic-permitted sprays including acetic acid.

**Project Description**

Dan Juneau has farmed near Red Lake Falls since 1972. He grows barley, wheat and soybeans on 950 acres. He transitioned his own land to organic production during the past five years and is transitioning rental land to organic, hoping to buy it in the future. Dan undertook this project to help other farmers learn about ways to fix nitrogen. 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.”

*Integrated Pest Management researcher Bobby Holder sprays Dan's plots on July 3.*

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 Dan will collect or observe include biomass, crop residue, root nodules (which indicate activity of nitrogen-fixing bacteria), and observations about wind and rain erosion.

Dan used a 15 acre test plot for the study. He solid seeded separate subplots with chickling vetch, alfalfa, hairy vetch, soybean, and wheat using a John Deere 9000 drill. Dan planned to use a spring tooth harrow to thin weed stands.

**Results**

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 they could use this opportunity to test vinegar (acetic acid) for thistle control. The year before, a number of growers in the Moorehead area tested vinegar with mixed results. In addition, a month earlier, the USDA Agricultural Research Service reported 100% Canada thistle control with a 5% vinegar solution, findings that were fresh in the collaborators' minds. "It's rare to find a nice, square thistle patch," said Hans Kandel. "This was a great opportunity for us to test an alternative to plowing."

Dan and his collaborators decided to try a number of natural sprays that would not jeopardize his organic status. They chose to use a soybean/thistle patch, because soybeans are tough plants and their high value makes them a more expensive crop for an organic farmer to lose. 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. Treatment details are shown in Table 1. 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.

Plots were sprayed on July 3 at about 1:00 p.m. when conditions were warm and humid. Application rate was a light mist at about 10 gal/A. For the most part, thistle plants were in the pre-bloom stage. Plots were scored for damage on July 4 (Table 1). "We would never recommend to spray that late – a farmer should do it early," commented Hans Kandel. "But if it had worked, we would have had a new rescue treatment," he added.

*Damage to thistle and soybean plants was apparent on July 4. Most of the thistle plants recovered, however.*

According to Dan, results from all treatments were fairly consistent and disappointing. Although some thistle plant damage was observed in the vinegar treatments, especially at the 20% concentration, no treatment was enough to set the plants back, even with surfactants. There was no significant difference between plot scores for 5% vinegar, 5% vinegar + Tomahawk™, Alldown™ or hydrogen peroxide. All treatments had little to no observable effect on the thistles, soybean plants, or grassy weeds. Later in July, Dan observed that the plants treated with a weaker acetic acid solution bloomed like normal, while those treated with a stronger solution headed out later.

Dan and the collaborators speculate 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.

During the course of this experiment, the collaborators observed rust on the thistle leaves that appeared to stunt and weaken the thistle plants. When Kandel asked other colleagues, they reported having noticed it too. Red Lake Falls does not have facilities necessary to culture this disease, but rust may have some potential as a biological control for Canada thistle.

Dan says he is still interested in exploring alternative strategies to controlling Canada thistle and is interested in work being done by weed scientist Don Wyse and others at the University of Minnesota. Next year, Dan plans to go back to his original experiment of evaluating chickling vetch for potential as a green manure crop in Northwest Minnesota.



**Table 1. Treatments\*\* and damage scores\***

Treatment	Plot score***	% Thistle damage	% Soybean damage	% Grass damage
20% vinegar	6.3a	21.8a	27.5a	14.5a
15% vinegar	4.3b	14.3b	20.0b	10.8ab
10% vinegar + .25% Invader™	4.3b	14.8b	13.5c	8.5bc
10% vinegar + .25% Tomahawk™	2.8c	11.3bc	13.8c	7.5bc
10% vinegar	2.8c	9.3c	12.3d	5.8cd
5% vinegar + .25% Invader™	2.0cd	7.3c	5.8d	2.8de
AllDown™	1.3de	1.5d	5.3d	2.3de
5% vinegar	0.8ef	3.0d	3.3de	2.0de
5% vinegar + .25% Tomahawk™	0.5ef	2.5d	3.8de	1.3e
Hydrogen peroxide	0f	0d	0.3e	0e

\*Treatments within a column that are followed by the same letter are not statistically different at  $P=0.05$ .

\*\*Tomahawk™ and Invader™ are surfactants. AllDown™ is a non-selective herbicide approved for use in organics.

\*\*\*0 = no effect; 9 = all plants show burn.

## Management Tips

1. If a project doesn't turn out like you hoped it would, see if the problem generated another interesting question you can investigate.
2. Spray Canada thistle early for best opportunity of control.
3. Weed control keys lie in the time of day, the strength of the solution, and the amount you apply.

## Cooperators

Glen Borgerding, Consultant, Albany, MN  
 Bobby Holder, University of Minnesota, Crookston, MN  
 Carlyle Holen, University of Minnesota, Crookston, MN  
 Hans Kandel, Extension Educator, Red Lake Falls, MN  
 David and Ida Kruze, Farmers, Flasher, ND  
 Blaine Schmaltz, Farmer, Rugby, ND

## Project Location

From Red Lake Falls, go west on State Hwy. 92 approximately 3 miles. Go east on State Hwy. 92 for 6 miles, then turn south on Cty. 12 for 1 mile. At Cty. 17 (gravel road) go east 1.5 miles. Plots are on the south side of the road across from 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)

Dela Cruz, Rita T. 2002. Vinegar: the effective weedkiller. In Bureau of Agricultural Research Today, 4:2. United States Department of Agriculture, Washington, DC. Available at:  
[www.bar.gov.ph/bar\\_today/biotechnology1.shtml](http://www.bar.gov.ph/bar_today/biotechnology1.shtml)

**Principal Investigators**

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**Project Duration**

2001 to 2003

**ESAP Contact**

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**Keywords**

forages, grazing,  
potassium fertilizer

# Potassium Rate Trial on an Established Grass/Legume Pasture: Determining Economic Rates for Grazing/Haying Systems

**Project Summary**

We have a 236 acre farm with 197 tillable acres. Our Spring Valley farm is on gently rolling, silt-loam soils, with Spring Valley Creek flowing through the northern half of the farm. Crops consist of several different combinations of grasses and legumes for the purposes of haying and grazing. We have a 51 cow purebred Angus beef herd and we custom graze 50 to 90 dairy heifers. Any surplus forage is made into hay.

The goal of this demonstration/research project is to help farmers that rotationally graze livestock to gain a better understanding of the effects of potassium fertilization on forage production in pastures. We are testing whether a seven year old grass/legume pasture will respond positively to potassium fertilizer. In recent years, on-farm research in southeast Minnesota has shown profitable yield increases with application of nominal rates of potash fertilizer on corn fields that have relatively low potassium soil test levels of 80 ppm or less. We want to see if our grass/legume pastures with potassium levels of 60 ppm will also respond to potassium applications.

**Project Description**

We want to study the effect of potassium fertilizer on the longevity of a four year old grass/legume stand. The size of the demonstration is about one acre in one of our grazing paddocks. We are using four

treatments with four replications randomly applied on 10 x 150' strip plots. The treatments of potash for 2001 were 0, 50, 100, and 150 lb/A and in 2002 the treatments of potash were 0, 75, 150, and 225 lb/A. We decided to increase the amounts of potash to see if we could get more of a response than with the 2001 rates.

In order to eliminate confounding soil fertility factors, additional fertilizer was applied according to soil test results. In the spring of 2001, a mixture of 40 lb  $P_2O_5$ /A and 2 lb boron/A was broadcast on the entire plot area in the spring. In 2002, 50 lb  $P_2O_5$ /A was applied in the spring.

Forage samples will be taken at least three times a year to evaluate forage yield and quality. We also use visual observations to determine if there are any changes in the percentage of grasses and legumes in the stand.

Each time the paddock is ready for grazing, the trial strips will be windrowed. Grazing periods will be determined by forage growth stage in order to obtain high forage quality and to enhance regrowth. Harvest weights from each strip will be determined

*Dan and Cara speaking  
at field day.*





by weighing three randomly selected 6' portions of the windrow. A sub-sample will be analyzed for percent moisture in addition to a routine feed analysis. The remaining windrows will be baled and removed from the plot area after each harvest.

## Results

### 2001

The results for 2001 were greatly affected by the weather. Due to a dry and poor forage growing season in 2001, yield results were not sufficient for analysis. We received very little rain from June to August and had poor growth on the forages. Consequently, we took only two forage cuttings instead of the planned three or four. From these samples and our visual observations, we did not see significant differences between the treatments in yield, forage quality, or legume to grass ratio.

### 2002

2002 was a good growing season in contrast to the very dry year of 2001. Although forage yield results were not significantly different within sample harvest dates, the total yields for the season trended higher with increasing potash fertilizer rates (Table 1). Potassium soil test results taken from each plot in the spring and fall of each growing season have shown a significant increase from the spring of 2001 to fall of 2002. This may explain the overall increase in forage yield.

**Table 1. 2002 Forage Dry Matter Harvested at the Miller Farm**

Treatment (lb K <sub>2</sub> O/A)	— Harvest Date —			Total
	5/31	7/12	9/10	
----- lb dry matter/A*-----				
0	2,617.9	1,582.8	597.9	4,798
75	2,552.1	2,006.2	773.9	5,332
150	3,110.3	1,650.3	792.0	5,553
225	2,928.4	1,711.7	773.9	5,414
*average of four replications				

Another objective of the study was to determine the relative amount of legume in the harvest sample and to test for feed quality. Table 2 shows the results of relative feed value for each harvest date and the percent legume in the sample. Again, the relative feed value and percent legume results were not significantly different for the harvest dates. The July 12 harvest date was an exception where increasing potash rates showed a significant increase in percent legume.

**Table 2. 2002 Relative Feed Value and Percent Legume at the Miller Farm**

Treatment (lb K <sub>2</sub> O/A)	Harvest Date			Harvest Date		
	5/31	7/12	9/10	5/31	7/12	9/10
---Relative Feed Value*--			----Percent Legume*----			
0	125.6	110.4	115.3	17.0	10.6	15.5
75	122.1	111.0	119.1	17.1	13.4	22.8
150	125.4	110.0	115.3	16.9	14.0	14.9
225	128.2	111.3	115.0	19.7	18.0	16.8
*average of four replications						

It is hoped that 2003 will provide consistent results similar to 2002 for better determination of the use of potash in pastures.

## Cooperators

*Alfredo Dicostanzo, Beef Specialist, University of Minnesota, St. Paul, MN*

*James Fisk, Beef Farmer/Custom Hay Harvester, Roberts, WI*

*Hugh Kramer, Livestock Fence Expert, Zumbro Falls, MN*

*Howard Moechnig, NRCS USDA Grazing Lands Specialist, Rochester, MN*

*Paul Peterson, Forage Specialist, University of Minnesota, St. Paul, MN*

*Jerry Tesmer, Fillmore County Extension, Preston, MN*

*Tim Wagar, Crops and Soils Area Extension Educator, Rochester, MN*

## Project Location

Go east from Spring Valley on State Hwy. 16 for 1.5 miles. Turn left onto the first gravel road just past the white Amoco fuel storage tanks and go north for 1.5 miles. Farm is on the west side of the road.

## Other Resources

Albert Lea Seed House. 1414 W. Main, PO Box 127, Albert Lea, MN 56007, 800-352-5247.

Web site: [www.alseed.com](http://www.alseed.com)

Bartlett, Ben. 1999. Watering systems for grazing livestock. Michigan State University, PO Box 168, Chatham, MI 49816, 906-439-5880.

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



Graze, PO Box 48, Belleville, WI 53508, 608-455-3311, [graze@mhtc.net](mailto:graze@mhtc.net)

Newspaper devoted to grazing. Published ten times per year.

Graze-L email discussion group ([graze-l@cygnus.taranaki.ac.nz](mailto:graze-l@cygnus.taranaki.ac.nz)). There is also an archive of past discussions at the web site: <http://grazel.taranaki.ac.nz>

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

University of Wisconsin Extension Service. Identifying pasture grasses. Publication No. A3637. University of Wisconsin Extension Publications, 630 Mifflin Street, Room 170, Madison, WI 53703, 608-262-3346. A spiral bound 4 x 8" color pocketbook with information on seed, seedling and mature stages of all the major cool season pasture grasses, tailored to the north central region.

University of Wisconsin Extension Service. 1997. Pastures for profit: A guide to rotational grazing. WI No. A3529 or MN No. AG-FO-6145. University of Wisconsin Extension Service, Madison, WI, 608-262-3346 or University of Minnesota Extension Distribution Center, 612-625-8173 or 800-876-8636.



*Field day participants.*

**Principal Investigator**

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**Project Duration**

2002 to 2003

**ESAP Contact**

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**Keywords**

certified organic  
farms, compost,  
dairy manure,  
turkey manure

# Northwest Minnesota Compost Demonstration

**Project Summary**

We want to show that using compost in an agricultural application, especially on an organic farm, is an important alternative to selling the compost for non-farm uses. There are environmental benefits as well because many of our soils have shallow water tables. We want to know what the fertilizer analysis looks like and develop a consistent product so that we can determine if the compost can be economically and efficiently applied to make a farm operation more viable. In our project, we applied Class I compost on plots at two farms. Class I compost is made from dairy and turkey manure using an in-vessel method.

**Project Description**

Plots were established on two organically certified farms. Both farms are located in the Red River Valley on flat topography. Compost was made using an in-vessel system. In-vessel compost is preferable because the compost produced is more uniform and consistent than windrow produced compost. Manure was converted to compost in 14 days and applied to the plots.

Our original purpose was to add value to manure by making compost and selling it off the farm. The reason for having the experimental plots was to show there is value in applying compost to agricultural cropland. We

eventually hope to show some of the additional value of compost besides the economic value of nitrogen (N), phosphorus (P), and potassium (K). The compost was tested for N, P, and K and many of the more common micronutrients. A test for heavy metals was also completed to show that, over a long period of time, there is no adverse effect of compost. A soil test of the plots was completed to establish fertility levels prior to compost application. Compost was applied at three different rates, 5 tons/A, 8 tons/A, 12 tons/A, and a check, to help establish the optimum application rate.

Soybeans were planted on plots at the Albert and Maxine Penas farm in Badger, MN. Dry edible beans were planted on plots at the Michael and Marypat Klawitter farm in Euclid, MN. A combine, with a yield monitor from the canola growers, was used to determine yields.

**Results**

Results for 2002 were somewhat disappointing. The Penas farm (Tables 1 and 3) is located in Roseau County and was seriously affected by the mid-June flooding that occurred in Northwest Minnesota and Roseau County. The soybeans were replanted after some crop damage from drowning occurred. The intent was to keep the plots organic. However, with the flooding problems,

*An in-vessel composter.*



**Table 1. Penas Farm Results for Soybeans**

Variable	Compost Rate (Tons/A)				LSD (.05)
	Check - No Compost	5	8	12	
Yield (bu/A)	48.08	43.95	46.70	46.60	NS
Protein (%)	36.43	36.68	36.90	37.25	NS
Oil (%)	18.00	17.85	17.88	17.73	NS

**Table 2. Klawitter Farm Results for Dry Edible Beans**

Variable	Compost Rate (Tons/A)				LSD (.05)
	Check - No Compost	5	8	12	
Yield (bu/A)	23.65	25.75	25.23	25.80	NS
Protein (%)	37.00	37.70	37.18	37.60	NS
Oil (%)	16.68	17.13	17.03	16.75	NS
Population (# bean plants/A)	193,116	184,404	197,427	190,212	NS
Weeds/sq ft:					
Green foxtail	4.17	3.27	3.10	4.43	NS
Barnyard grass	1.40	3.20	3.13	1.63	NS
Smart weed	0.33	0.63	0.40	0.23	NS
Ragweed	0.07	0.17	0.23	0.03	0.18
Mustard	0.03	0.17	0.10	0.07	NS
Pigweed	0.03	0.03	0.00	0.03	NS
Knotweed	0.00	0.00	0.07	0.10	NS
Canada thistle	0.00	0.00	0.03	0.03	NS

**Table 3. Soil Test Analyses**

Location	Texture Estimate	Organic Matter (%)	pH	N (lb/A)	P (Olsen) (ppm)
Klawitter Farm	medium	5.6	7.6	46	9
Penas Farm	medium	3.4	7.8	64	11

there were weed problems, especially rough pigweed. The renter did not want to risk losing the crop and, as a result, applied a herbicide thus removing the organic certification for the farm and plots.

Organic matter on the Penas plot was very high because the field had been in Conservation Reserve Program for ten years prior to this. Because of this, we did not see a significant difference in yields between the different application rates of compost.

The plots on the Klawitter farm were planted in late May and were doing very well (Tables 2 and 3). However, a midsummer hail storm seriously affected the crop. It is estimated that the yield was reduced by approximately 10 bu/A. Fertility levels were excellent prior to plot establishment and there was no significant difference in the final yield among the three application rates. Weed populations were also measured on the Klawitter farm.

There are environmental benefits of using compost as a soil amendment. This is especially important for nitrogen and phosphorus and the effect they have on water quality. Compost is environmentally friendly and helps hold nutrients in the soil making them available to the plant. Compost also improves soil quality by increasing soil organic matter levels. Compost has the potential to improve crop resistance to diseases, insects, and other pests without the addition of chemicals.

A benefit of using compost from animal operations is to demonstrate how these operations can be compatible with the environment. Composting adds value to manure and produces a material that is easier to handle. A separate project showed how compost can be made with an in-vessel system. The compost produced in-vessel is a high quality product. The compost used on the plots in this project was produced from this in-vessel system.

Some organic farmers have indicated that they would be ready customers for a producer that could provide a consistent compost product of good quality. This could benefit all of agriculture. A large animal operation could add value to their manure and do it in an environmentally friendly manner. If an organic farmer could purchase a reliable, dependable, and consistent compost product, they could reduce some of their labor requirements and increase efficiency in other parts of their organic farm operation.

## Management Tip

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Compost applied consistently over many years has the potential to improve soil quality for an organic farm operation.

## Cooperators

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*Curt Nygaard, University of Minnesota Extension Service,  
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*Howard Person, University of Minnesota Extension  
Service, Thief River Falls, MN*

*George Rehm, Soils Specialist, University of Minnesota  
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*Albert and Maxine Penas, Badger, MN*

*Michael and Marypat Klawitter, Euclid MN*

*Jerome Burkel, Greenbush, MN*

## Project Location

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Contact John Schmidt for directions to the farms.

## Other Resources

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Diver, Steve. 1998. Farm-Scale Composting Resource List. Appropriate Technology Transfer of Rural Areas (ATTRA), PO Box 3657, Fayetteville, AR 72702. 800-346-9140.

Web site: <http://attra.ncat.org/attra-pub/farmcompost.html>

Northeast Regional Agricultural Engineering Service. 1992. On-Farm Composting Handbook, NREAS-54.

Web site: [www.nraes.org/publications/nraes54.html](http://www.nraes.org/publications/nraes54.html)

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### Farmer Cooperators

Anthony Farm,  
Conventional  
Operation  
Brekken Farm,  
Organic Operation  
Langlois Farm,  
Organic Operation  
Runck Farm,  
Conventional  
Operation  
Thomas Farm,  
Organic Operation

### Project Duration

2002 to 2005

### ESAP Contact

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### Keywords

cover crops, green  
manure, 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. There is inefficient use of rainfall, solar radiation, and nutrient cycling. The result is nutrient loss through leaching (especially nitrogen), and wind and water erosion of our soils. This project evaluates the use of a fall-planted rye cover crop prior to soybeans in various cropping systems at five on-farm locations across the state. At the five locations, rye was planted in the fall of 2002 into corn or small grain residue. After early spring regrowth, the rye will be killed in the spring of 2003 and soybean will be planted into the rye residue. Rye growth and development, soybean growth and yield, and weed pressure will be monitored. We anticipate repeating the studies at all five locations, with modifications based on what we have learned, with rye plantings in the fall of 2003 and 2004.

## Project Description

Studies are being conducted on each of five farms where rye was planted in the fall of 2002. The studies at the Anthony and Runck farms are similar in that they involve evaluating the rye variety Homil21 at two seeding rates using herbicides to control the rye growth. The studies

at the other three farms all involve organic production techniques, and each evaluates two of the following three rye varieties: Rymin; Homil21; or Prima.

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

The trial design is:

- no rye;
- rye seeded at 1.25 bu/A; and,
- rye seeded at 2.5 bu/A.

There are three replicates of these three treatments. The approximate plot size is 44 x 1,100'. The rye variety is Homil21.

Rye was broadcast seeded with a 40' fertilizer spreader into sweet corn residue that had been worked with a JD512 disk ripper. The sweet corn residue was worked because of unevenness in the field due to sweet corn harvest truck traffic in the field at harvest. The rye was broadcast seeded on September 17, 2002, after the residue had been worked.

Because the rye seed was broadcast and not incorporated, it was slow to germinate and emerge. By September 27, the rye had not germinated, but by October 3 it was up with a height of about 2". The rye plant stand appeared uneven, in part because the seed was broadcast. The best stand was in the

*Lee Thomas inspects an emerging stand of rye on September 11, 2002.*



wheel tracks where the soil was slightly compacted. The rye plant stands in early November were approximately 22 and 43 plants/ft<sup>2</sup> for the 1.25 and 2.5 bu/A seeding rates, respectively.

Soybeans will be planted in 22" rows on this field. The field may be too uneven to no-till the soybeans into the rye residue – a practice that would be preferred. Also, there is some concern for soybean yield loss in no-till situations with the relatively wide-row soybeans compared with drilled soybeans. The rye will be killed with a herbicide.

***Brekken farm: organic operation in Polk County in northwest Minnesota.***

The trial design is:

- Homil21 rye at 2.1 bu/A; and,
- Prima rye at 2.1 bu/A.

There are four replicates of the two rye varieties. The plot size is approximately 140 x 2,640'. Soybeans will be seeded perpendicular to the rye rows at two different seeding rates.

The rye was broadcast seeded on October 5, 2002 with a 70' floater into spring wheat residue that had been worked with a DMI Eclo-tiger deep tiller, and cultivated. Rye seed was incorporated with a harrow after planting. Seeding occurred later than desired, but wet weather delayed a more timely planting. Because of the relatively late planting, the rye was barely out of the ground by the time of freeze-up.

The rye will be 'killed' by mowing after it has headed (most likely after soybean emergence).

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

The trial design is:

- Homil21 rye at 2.1 bu/A;
- Prima rye at 2.1 bu/A;
- Homil21 rye at 3 bu/A; and,
- Prima rye at 3 bu/A.

There are two or three replicates of the two seeding rates and two rye varieties. The plot size is approximately 40 x 1,000'.

The rye was seeded with a 40' AirSeeder into barley residue that had been worked with a chisel. The AirSeeder is on 7" row widths with 9" shovels, which results in a relatively wide band of seeded rye. The rye was seeded on October 6, 2002. This was later than desired, but wet weather delayed a more timely planting of the rye. Because of the relatively late planting of the rye, it was barely out of the ground by the time of freeze-up and snow cover.

Soybeans will be planted in 22" rows with a 24 row planter that is 44' wide, hopefully around the first week in June. Again, there is some concern over the potential for soybean yield loss in no-till situations with the relatively wide row spacing. Soybeans will be planted perpendicular to the direction of planting of the rye. It is envisioned that some of the rye will be 'killed' by mowing after it has headed (most likely after soybean emergence), whereas some of the rye will be disked under prior to planting the soybeans.

***Runck farm: conventional operation in Redwood County in southwest Minnesota.***

The trial design is:

- no rye;
- rye seeded at 1.25 bu/A; and,
- rye seeded at 2.5 bu/A.

There are three replicates of these seeding rates. The plot size is approximately 60 x 1,000'. The rye variety is Homil21.

The rye was drilled directly into corn residue that had been chopped after corn harvest. The rye was seeded on November 2, 2002, with a 15' JD750 no-till drill on 7.5" row widths. This rye seeding date is very late, in part because the cool fall temperatures delayed corn dry-down and harvest.

Because of the cool temperature after planting, the rye was very slow to germinate and emerge. By mid-December much of the rye had not germinated, and it was not possible to see the rye rows. Much of the seed had yet to imbibe water. Given all the corn residue, the seed-to-soil contact was very uneven. This contributed to the uneven rye germination. What seed had germinated by mid-December was less than 1" tall.

Soybeans will be planted with a 15' JD750 no-till drill on 7.5" row widths. The rye will be killed with a herbicide, most likely after soybean emergence, perhaps on two separate dates to test the influence of herbicide application date on soybean yield.

***Thomas farm: organic operation in Clay County in west central Minnesota.***

The trial design is:

- Homil21 rye at 1.4 bu/A;
- Homil21 rye at 2.2 bu/A;
- Rymin rye at 1.4 bu/A; and,
- Rymin rye at 2.2 bu/A.

There are four replicates of these four treatments. The plot size is approximately 40 x 1,000' with Rymin and 20' x 1,000' with Homil21.

The rye was drilled in 6" rows with a JD9356 drill comprised of 3 x 10' units. Two of the units were filled with Rymin and the other unit was filled with Homil21. Seeding rates were changed manually halfway across the field on each pass. The rye was seeded into wheat stubble that was chiseled, field cultivated, then worked with a seed bedder basket (to break up clods). The rye was seeded on September 10, 2002 into dry soil. Germination and emergence of the rye was good. A good rain fell shortly after planting which brought up the rye seedlings uniformly.

Soybeans will be planted with a JD no-till drill with 7.5" rows at 220,000 seeds/A. The rye will be 'killed' by mowing after it has headed (most likely after soybean emergence).

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## Results

These studies, which evaluate rye as a fall-planted cover crop prior to subsequent soybean production, compare rye varieties and seeding rates as well as method of killing the rye and timing of killing the rye, were initiated in the fall of 2002. Results will be forthcoming in next year's Greenbook. Stay tuned, and watch for field day announcements.

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## Management Tips

1. Having access to the proper equipment to drill the soybeans into the rye residue, to shred or mow the rye, and (if organic) to separate rye from soybean seed is critical for success.
2. For optimum weed control, do not incorporate the rye residue. Instead, plant no-till directly into the rye or rye residue.
3. Time of soybean planting may be slightly delayed. This and management of the rye residue (either chemically or mechanically) will be dependent on climatic conditions.
4. 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.
5. There will be re-growth after the rye has been shredded or mowed, but there is less re-growth the later the rye is mowed in the spring (for example, after heading).

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## Project Locations

Contact Paul Porter for directions to cooperators farms.

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## Other Resources

General information on rye is available on the web at:  
[www.sarep.ucdavis.edu/cgi-bin/CCro.exe/show\\_crop\\_12](http://www.sarep.ucdavis.edu/cgi-bin/CCro.exe/show_crop_12)  
[www.hort.purdue.edu/newcrop/afcm/rye.html](http://www.hort.purdue.edu/newcrop/afcm/rye.html)  
[www.mgo.umn.edu/crops/rye.htm](http://www.mgo.umn.edu/crops/rye.htm)  
While this information is quite good about rye in general, it is weak on the use of rye as a cover crop.



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**Project Duration**

2000 to 2002

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**Keywords**

cover crops, inter-seeding, nitrogen management, rye, soil erosion, soybean cyst nematode

# Aerial Seeding Winter Rye into No-till Corn and Soybeans

**Project Summary**

Over the years, Minnesota farmers have tended to specialize in either row crops or livestock. Farmers in row crops no longer have available a diversity of natural/organic tools such as hay, small grain, or manure to provide fertility and break disease cycles. For many farmers, this amounts to an intense and tight rotation between corn and soybeans. As a result, we have an increased incidence of crop diseases and pests such as soybean cyst nematode (SCN), soil erosion, and natural fertility problems. Many farmers have expressed the need for a third crop in their rotation. My goal is to test the feasibility and benefits of interplanting a third crop of winter rye (non-harvestable) into the two year corn-soybean rotation to alleviate these problems.

**Project Description**

I farm 1,080 acres in a corn-soybean rotation. The corn is strip-tilled and the beans are no-tilled. I have been in no-till since 1992. Our soil textures vary extensively, ranging from light, rolling sandy (droughty) soil to flat, wet ground high in organic matter.

Faribault County was the first county in Minnesota to detect SCN (in 1978). Since then, some local farmers have been forced to quit growing soybeans altogether as the yield losses to SCN became insurmountable. These farmers were forced into continuous corn which has its own set of insect, disease, and yield problems.

*Ray surveys excellent spring regrowth of rye cover crop in corn stubble.*

I have witnessed firsthand the benefits of longer rotations on my farm. During the years of farm acreage set-aside programs, I consistently experienced a 5 to 8 bushel soybean yield increase when soybeans followed set-aside small grain versus a corn crop. This also led to the soybeans looking much healthier all year long. It has been suggested by many leading researchers that the best potential for controlling SCN may lie in the alteration of soil biology. Some researchers feel that there may be a benefit from the decaying residue of small grain. After seeing all the problems associated with shorter crop rotations and all the benefits of longer, more varied rotations, I decided to try winter rye inter-seeded in late summer into standing corn and soybeans.

By inter-seeding rye into corn and beans, I hope to achieve these objectives:

- determine the feasibility of establishing a stand of rye in corn or soybeans in early September using an airplane;
- improve crop yields;
- reduce SCN pressure;
- reduce incidence of diseases;
- reduce erosion;
- increase soil biomass; and,
- check compatibility/antagonism of rye with the planted crop.



In the first week of September from 1999 through 2001, winter rye was aerial seeded at a rate of 90 lb/A into corn and soybean fields. There is a strong possibility that corn yields may be reduced when immediately following rye due to allelopathy or water or nutrient use. Consequently, the acreage of rye planted into soybeans was kept to a minimum. Rye aerial seeding was accomplished using a turbine Air Tractor with a 50' spread. Each rye plot was approximately ten acres in size and was located in the middle of the field, providing a no-rye comparison on either side of the rye strip. In late April of the following spring, the rye was burned down with Roundup and planted the following week to corn after beans, or beans after corn.

The test strips were monitored for cash crop yield, rye population and biomass production, changes in SCN egg counts, and available nutrients in the soil. Soil erosion was monitored by observing the formation of rills.

## Results

*Rye Cover Crop Establishment Using an Airplane.* Stand establishment was a resounding success for all three fall inter-seedings. This held true across a dry fall in 1999, a wet fall in 2000, and a normal fall in 2001. In the fall of 1999, the cover crop germinated in four days and was 4" tall one week after planting.

The following spring season in 2000 started with very dry conditions. I was worried that the rye could be using the

remaining limited moisture reserves needed for cash crop production. In hindsight, it may have been beneficial to burn down the rye a week earlier. The rye was 10" tall at spraying on April 24. On April 29, 2000, the rye in the test strips was sampled. The rye plant population averaged 50 plants/ft<sup>2</sup>. The rye biomass production was 2,400 lb/A after soybeans and 1,500 lb/A after corn. I had similar results with the rye planted in the fall of 2000 and 2001 with good plant populations and biomass production. In 2002, hairy vetch was mixed with the rye seed in an attempt to capture extra symbiotically fixed nitrogen. The vetch seed was expensive and did not germinate well so this practice will be eliminated in future cover crop plantings.

Due to the dense stands of rye achieved each year, I believe the seeding rate could be reduced significantly. Next year I plan to cut the seeding rate in half.

*Cash Crop Yields.* The soybean yield response to the rye was not consistent across the three test years. Overall, rye has not delivered the 5 to 8 bu/A increase in soybean yields that I've observed when soybeans were planted after small grains. Yield variability depended on the extent of exposure to saturated soil from heavy spring rains. The soybean crop responded positively where soils were hilly, sandy, and drought prone. At these sites, the rye prevented erosion and allowed rainfall to recharge subsoil moisture. Soybean yields were higher in the rye strip than in the control.

**Table 1. Cost for Seeding 30 Acres of Rye by Airplane**

	Price/A (\$)	Rate	Total (\$)
<b>Airplane</b>	8.33	\$250 minimum	250.00
<b>Rye</b>	9.82	90 lb/A	294.00
<b>Total</b>	18.15		544.00

**Table 2. 2002 Corn and Soybean Yields as Affected by Rye Cover Crop**

Field	Soil and Landscape Position	Cash Crop	Cover	Yield (bu/A)
Field # 1	clay loam, flooded in spring	soybeans	rye	44.9
			no rye	41.3
Field # 2	sandy loam, knoll	soybeans	rye	54.4
			no rye	47.3
Field # 3	clay loam, low, poorly drained	soybeans	rye	47.1
			no rye	51.3
Field # 4	sandy loam, knoll	corn	rye	175.0
			no rye	174.5

Soybean fields low on the landscape, high in organic matter, and poorly drained, were flooded by the same heavy rains. The rye increased the flood damage by retaining water and then later delaying the recovery of the soybeans.

This trend was emerging in the 2000 and 2001 cash grain yields so in 2002 I began targeting droughty, hilly soils as good rye sites. This is paying off in increased soybean yield. The soils that are responding most positively to the rye cover are the same soils that are most prone to erosion so it makes sense both ways.

The field planted to corn after rye in 2000 was clearly set back by the rye. The corn recovered in midseason but the early season stunting was expressed in lower yields at harvest. I suspected that the corn suppression was due to allelopathy or reduced access to nitrogen so I applied a low level, late sidedress of 20 lb/A nitrogen. This apparently has removed the nutrient competition caused by the presence of the rye. There was effectively no difference in corn yield due to the rye in 2002.

A portion of the corn field had attained a particularly vigorous rye stand. Corn growth there was stunted, again pointing out the need to control the rye before excessive growth occurs.

**SCN Population.** The effect of the rye cover crop on SCN populations was variable. Rye treated fields had lower SCN populations than the control in 2000 and 2002 but the opposite was true in 2001. When all four fields are analyzed for the long-term change in SCN pressure, it appears that the rye has helped achieve a reduction. From April 2000 to November 2002, the rye treated fields have shown a 25% reduction in SCN egg counts. Fields without rye have gone up by 7%. This reduction is confounded by the use in 2002 of SCN resistant soybeans. The combination of the resistant soybeans and rotating to corn reduced SCN egg counts.

**Disease and Weed Pressure.** I have observed much less brown stem rot and white mold in soybeans planted into the rye cover crop. Visual observation revealed that the rye cover helped control foxtail, lambsquarters, and pigweed but had no effect on wooly cupgrass.

**Erosion Control.** When corn or soybeans are no-till planted into a stand of rye, wind and water erosion are almost eliminated. Projects like this one show that most soil erosion is preventable. We have the tools to get the job done. Now, we must show that we have the will.

Rain water infiltration into the soil is being helped by increased worm activity. The night crawler population is increasing dramatically in the rye when coupled with my

no-till and strip-till system. There were about two worm middens per square foot indicating a tremendous amount of residue processed and soil aerated by worm activity.

**Soil Biomass.** Rye makes an unbelievably dense root mass. I firmly believe the strong stands of rye achieved over the last three years have benefited the soil by increasing organic matter and water holding capacity.

**Compatibility with the Cash Crop.** I have learned that this does not have to be a problem if the timing of burndown and the fertilizer program are handled correctly. Rye burndown should occur when the rye is 6" tall. A 20 lb/A nitrogen sidedress eliminates early season competition for this nutrient.

**Conclusions.** It appears that getting a rye crop established into standing corn or beans is very feasible. The rye cover crop dramatically reduces soil erosion, increasing the soil and water protection already provided by my no-till and strip-till system.

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## Management Tips

1. Rye burndown in spring should be timed to optimize resources for both the cover crop and the cash crop. The cover crop should not be allowed to grow taller than 6".
2. Target the rye for use on hilly, sandy positions on the landscape.
3. Rye established in corn provides an opportunity to graze both crops in late fall. This does not significantly affect the spring regrowth of the rye.

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## Cooperator

*Paul Porter, Department of Agronomy and Plant Genetics,  
U of M, St. Paul, MN*

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## Project Location

From I-90, take exit 128 (Cty. Rd. 17) north 4.5 miles. Go east 1 mile on 160<sup>th</sup> St., then north .5 mile on 480<sup>th</sup> Ave. The farm is in the grove on the east side of the road.

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## Other Resources

Shirley, C., G. Bowman, and C. Cramer. 2001. Managing cover crops profitably. 2nd Edition. USDA-Sustainable Agriculture Research and Education Program. Order from Sustainable Agriculture Publication, Hills Building Rm. 210, University of Vermont, Burlington, VT 05405-0082, 802-656-0484. Available at: [www.sare.org/handbook/mccp2/index.htm](http://www.sare.org/handbook/mccp2/index.htm)

University of California-Davis. Cover crops. Database available at: [www.sarep.ucdavis.edu/ccrop](http://www.sarep.ucdavis.edu/ccrop)

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**Project Duration**

2001 to 2003

**ESAP Contact**

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**Keywords**

pasture renovation,  
water quality

# Mechanical Tillage to Promote Aeration, Improve Water Infiltration, and Rejuvenate Pasture and Hay Land

**Project Summary**

Traditionally, established forage stands have been considered off limits to renovation by tillage. Although a farmer may have a need to aerate the soil or increase permeability to water, there has not been an effective way to accomplish a deep soil renovation without causing damage to the forage crop.

Robert Schelhaas and four other farmers are investigating the use of a Hay King pasture renovator in an attempt to improve the soil condition on permanent pasture, rotational pasture, and hay land. The forage renovating implement is designed to accomplish aggressive sub-soil tillage with a minimum of surface disturbance. They want to determine both positive and negative effects of this type of tillage.

**Project Description**

I have a stock cow herd and finish out my calves on a drug-free program. I have extensive permanent pasture on my hilly ground. Land suited to row crops is rotated between corn, barley, and an alfalfa/grass hay crop.

Several years ago, I began looking for a piece of equipment to aerate my soil. I wanted something to reduce compaction and let more water into the ground on my pasture and hay land. Most of

the equipment I looked at was too large and expensive to fit into my operation. Two years ago, I found an affordable tool that could work my uneven ground. The Hay King pasture renovator has been tested on Bermuda grass in southern states and has been shown to improve forage production. I felt the next step was to test the renovator at several sites in a northern climate.

This project involves five cooperating farms, each actively engaged in either beef or dairy production. Collectively, we have established ten sites, each approximately eight acres, to compare renovated and unrenovated forage ground. Each site contains test strips using the Hay King pasture renovator and adjacent unrenovated control strips. At several sites, a new renovated strip is being added each year so that by the end of the project, there will be one, two, and three year old renovated sites.

The implement used in this demonstration is ten feet wide. The Hay King pasture renovator penetrates to an average tillage depth of 5 to 7". Tillage is accomplished

*Side view of the Hay King pasture renovator.*





*Hilly pasture ripped on the contour using the Hay King.*

with eight individual shovels spaced 15" apart (the shovel spacing is flexible) and staggered from front to back. They are designed to impart a significant lifting and shattering action on the soil above the base of the shovel. The forward shank moves the soil laterally in one direction while the back shank moves the soil back in the opposite direction. The width of each shank is one-half inch where it enters the ground (compared to an average width of two inches for a typical chisel plow). The narrower shank width makes it easier to accomplish significant subsoil aeration but with the sod returning almost to its initial pre-tilled position.

A coulter is placed directly in front of each shank to provide the initial cut in the sod. A shear pin at each shank protects against damage from large rocks. The recommended speed of operation is four miles per hour. Tillage is done on the contour to minimize erosion and facilitate water capture.

The effects of pasture and hay ground tillage are being measured by comparing renovated and unrenovated ground in the following ways:

- forage productivity;
- the rate of water infiltration into the soil profile and runoff using simulated rainfall;
- the level of compaction of the soil;
- changes in species composition of the forage stand (stand counts of desirable and undesirable plant species); and,
- an economic comparison at the end of the project.

For the sake of economic comparison, I am documenting direct and indirect costs including equipment and labor. These will be weighed against changes in pasture carrying capacity and hay crop yields.

At the James Sovell farm, rain simulations are being used to test the effectiveness of both the Hay King and the Rolling Dutchman pasture renovator. The Rolling Dutchman is designed to rip 2" wide and 2" deep furrows in the sod every 40". This is done on the contour to capture and infiltrate water. The renovation significantly increases the surface roughness of the field. Please refer to *Greenbook 2001* for a detailed description of the Jim Sovell project.

## Results

*Ease of Use of the Hay King Pasture Renovator.* Because of a wet spring, I was unable to renovate any pasture early in the 2001 growing season. In late August, I was able to renovate several test strips on each of the cooperating farms, including strips in alfalfa hay ground, permanent pasture, and rotational pasture.

In the first year of the project, there were varied reactions as to the ease of use of the Hay King. The Schelhaas farm contains few rocks and renovation proceeded smoothly. However, at the Sovell farm, the combination of extensive rocks and low soil moisture led to the breaking of an unacceptable number of shear pins.

In 2002, we renovated at a higher soil moisture level and were much more satisfied with the ease of operation. There was a narrow window for renovation under optimal conditions in late April. Then conditions became too dry until heavy rains returned in mid-August when we received 6.7" of rain for the month.

The deep tillage leaves pasture ground acceptably level but hay ground may be rougher than desired for later hay cutting. I found that, with a minimum of effort, renovated hay ground can be easily leveled with a drag.

At the 15" shank spacing and 6" tillage depth, we found the Hay King left behind approximately equal zones of deep tillage and undisturbed soil. It remains to be seen whether this pattern delivers the desired improvement in water infiltration and forage productivity.

*Pasture Productivity.* In early June of 2002, forage samples were taken of the first alfalfa cutting. The unrenovated hay ground yielded 6,050 lb/A (fresh weight). The renovated hay ground yielded 7,260 lb/A, a 20% increase.

After the heavy August rains, the strips renovated in late April in permanent pasture could easily be seen from a great distance across our river valley. They were obviously greener than the adjacent unrenovated pasture. I do not know whether this was due to improved nutrient cycling, water infiltration, or both. When observed close-



up, the grass in the renovated strips was deeper green, indicating improved nitrogen cycling. The effect was most pronounced in the grass directly over the path of the shanks.

Another unforeseen renovation benefit showed up in 2002. An extensive stand of native black medic germinated after renovation. The appearance of this legume was obviously due to the tillage. Just as with the improved forage condition, the medic appeared directly over the path of the shanks. In fact, this was the only place where the medic could be found in the immediate area.

**Water Infiltration and Runoff.** Two renovated pasture sites were tested for water infiltration and runoff in 2002 using simulated rainfall. The first site was located on permanent pasture at the Schelhaas farm. The rain simulations were performed on August 14. The Hay King pasture renovator was compared to unrenovated control strips. There were no differences in infiltration and runoff due to the renovation done in April.

The second rain simulation site was located on heavily grazed pasture at the Sovell farm. Test strips were renovated in the first week of October using both the Hay King and the Rolling Dutchman pasture renovator. These were compared to an unrenovated control.

Both renovation techniques dramatically reduced runoff compared to the control (see Figure 1). Extensive animal impact immediately prior to the rain simulations had created surface soil compaction, making the site particularly vulnerable to runoff. Only 15 minutes into the rain event, the unrenovated pasture was losing 90% of the

water being applied. At the same point in time, the plots renovated with the Hay King and Rolling Dutchman were losing 45 and 20%, respectively.

Early results from this project suggest that the Hay King will provide an immediate benefit to overgrazed pasture. Pastures with moderate grazing pressure may respond positively as well. However, more experimentation is needed to determine the optimum timing of renovation with the seasons, soil moisture availability, and an adequate rest period before the next grazing cycle.

## Management Tips

1. Stony ground should be worked before the soil becomes too dry. Adequate soil moisture helps to minimize the resistance imparted by rocks, thus saving on the labor and cost associated with replacement of shear pins.
2. Renovated hay ground can easily be leveled using a drag.
3. Renovated alfalfa should be allowed to recover significantly before exposing it to animal impact. Cows will forage on the exposed alfalfa crowns.

## Cooperators

*Richard Vander Ziel, Dairy Farmer, Chandler, MN*  
*Steve Gleis, Dairy Farmer, Lake Wilson, MN*  
*James Sovell, Cow/calf Operator, Ivanhoe, MN*  
*Dennis Schentzel, Cow/calf Operator, Canby, MN*  
*Mark Zumwinkle, MN Dept. of Agriculture, St. Paul, MN*

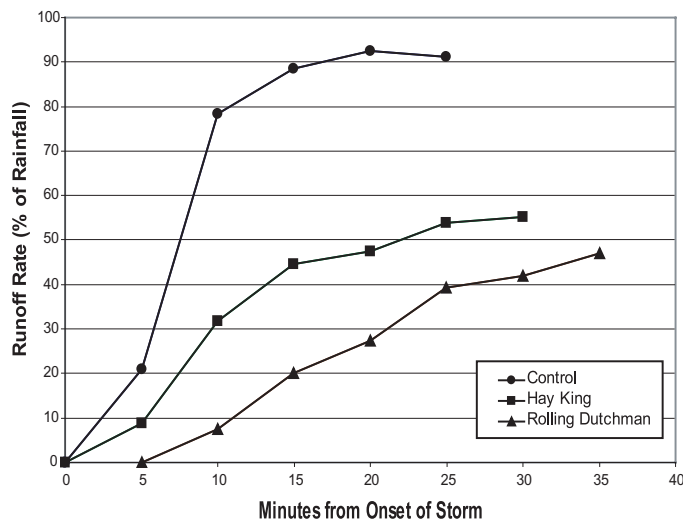
## Project Location

From Pipestone, go 10 miles east on Hwy. 30. Turn south on Cty. Rd. 18 and go 6.5 miles south. The farm is on the east side of the road.

## Other Resources

The reader is referred to the Jim Sovell article in *Greenbook 2001*. Jim's work shares similar goals with this project. The farmers in both projects are testing the Rolling Dutchman pasture renovator and the Hay King pasture renovator.

**Figure 1. Effect of Pasture Renovation on Runoff from Simulated 3.7"/hr Storm. Barnes Loam, 6% Slope, 10-22-02**



### Principal Investigator

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### Project Duration

2001 to 2003

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### Keywords

cover crops,  
organic farming,  
organic Vinton  
81 soybeans,  
rye seed, tillage,  
woolly cupgrass

# Woolly Cupgrass Research

## Project Summary

I am an organic farmer. I care for and manage our family's century old farm. My continuing goal is to maintain good soil health, manage weeds, and harvest a better yielding organic crop. Weed management, controlling erosion, cover crops, and green manure are all important to a balanced farming method. My objectives in this project are to look at the use of rye as a cover crop in soybeans and the management of woolly cupgrass without chemicals in the production of a rye seed crop.

## Project Description

My farm is 58 tillable acres, all under the organic certification standards with 18.5 acres in transition. I use a rotation of small grains, legumes, and soybeans. I also have 11 acres in the Conservation Reserve Program. The soil is black with clay hills. My field preparation equipment includes a Howard Rotovator, a field cultivator, and a long tooth harrow. There isn't any livestock. My wife, our two sons, and I are the labor force.

In 1996, woolly cupgrass began showing up in some of my fields. I felt I needed to do something other than cultivating. I had read about the use of rye as a cover and weed control crop. I decided to try this method. I also began reading about a tillage tool called a rotovator. The rotovator leaves crop residue on the surface of the field. This was what I needed in order for the rye to do its job as a weed control crop so I purchased a Howard Rotovator and used it for field preparation. I was able to incorporate the rye residue into the

top three inches of soil. By just working the topsoil, I can leave weed seed undisturbed at lower levels. Organic matter is available for quick breakdown and the nutrients can be used by the newly planted crops. Field work was reduced considerably with just one pass of a field cultivator and one pass with the rotovator. With the combination of rye as a cover crop and the use of the rotovator, I have spent less time on field preparation work, have cleaner fields, and have reduced cultivating time. With rye as a cover crop, I also have less hillside erosion and something green is always growing.

My project has two parts. I wanted to see how a cover crop of rye would help to alleviate weed problems in my organic Vinton 81 soybean field, particularly woolly cupgrass. I also wanted to look at how rye could control weeds in a rye seed production field.

### Part I. Winter Rye as a Cover Crop in an Organic Soybean Field

In Fall 2001, the organic beans were harvested and rye seed at 5 plants/ft<sup>2</sup> from combining was allowed to grow and overwinter on 14.4 acres of land. I let the rye grow in the spring until a few weeks before planting the organic Vinton 81 soybeans. My intention was to incorporate the rye in three different ways: I would plow 1/3 of the field at 6" deep; I would disk another 1/3 at 4.5"; and finally, I would rotovate 1/3 of the field at 3" deep so that I

*Leo incorporating rye  
into soybean planting.*





could observe how these different treatments affect the growth of woolly cupgrass in the beans. In late May, when the rye was about 14" high, I chopped it down. By doing this, it did not head out and lose its ability to help control weeds. On May 20, I field cultivated the rye at 5" deep. I did my final rotovating on May 25, and planted soybeans at 2.25 bu/A. The soil temperature was 43°F. After rotovating, a heavy, large root system left the field with more lumps than I would have liked. The timing of rotovating and field cultivating may need to be closer in order for the soil lumps to be softer.

On June 1, I dragged the beans in both directions. The beans had not emerged yet, and some roots were still present. On June 10, the beans were 1.5" tall. I dragged the field twice with the bean rows at 1.5-2 miles/hr. It was the first time I tried this. The woolly cupgrass was now showing signs of growth. It rained for three days. On June 22, using a front and rear mounted cultivator, I made one pass and then turned around and went the opposite direction. On July 6, a second cultivation occurred. Woolly cupgrass was 12" tall which was equal in height to the beans. On July 15, I cultivated one more time.

On October 11, I began the bean harvest. Moderate to heavy woolly cupgrass was present only in the rows. The weed population was 4 plants/ft<sup>2</sup>. This plant had already released its seed onto the ground in September. The dried plant was still a challenge for the combine due to damp ground conditions in the field. On October 18, I chisel plowed at 6.5" deep.

## Part II. Rye Seed Field and Weed Control

In fall 2001, I seeded rye. This stand was 3" tall before a snowfall. This field had beans in 2001 with 31 bu/A, and was clean. Seeding was done with a spreader at 4 bu/A. I then rotovated it in at 2".

On May 4, 2002, I planted a test strip of spring wheat. The seeding rate was 2.5 bu/A, placed with a grain drill and a cultipacker. Next to the wheat area, I left a bare strip. This area was monitored over the summer to see what woolly cupgrass would do without any competition. On the other side of the bare strip was a rye plot.

On May 28, we received 3.5" of rain with heavy hail. At this time, the rye was in the bootstage and sustained severe damage. On June 11, I rotovated the rye down. I waited seven days and rotovated again. On June 18, I planted buckwheat at 1.25 bu/A in place of the rye. Fifty-five days after planting, I noticed a strong surge of woolly cupgrass emerging between the buckwheat rows. By swathing time, it was as high as the buckwheat and very dense. Even so, this grass did not mature and drop its seed. The seed remained on the stem. Some seed was saved and checked for germination. Only about 5% of the seed tested matured enough to grow again. From planting to swathing was 71 days.

The buckwheat population was 5 plants/ft<sup>2</sup>. The plants seemed very healthy. This planting rate, was suggested to me by other growers. The woolly cupgrass population filled in any area not covered by buckwheat, averaging 3 plants/ft<sup>2</sup> with tillers averaging 6/plant. Woolly cupgrass could germinate as deep as 6", perhaps because rotovating at 3.5" provided enough oxygen, water, and sunlight to this disturbed soil to bring on another wave of cupgrass.

The harvest of the buckwheat was a challenge, even though we did not receive any rain while the crop was on the ground. Combining was slow. The yield averaged 21 bu/A. Test weight and other information is not yet available. On September 12, after harvest, I rotovated this field once. On October 18, I seeded rye and hairy vetch. The seeding rate was 1 bu rye:20 lb hairy vetch. This mix of seeds will provide a cover crop, a green manure, and a nitrogen builder, for the 2003 bean crop.

**Table 1. Comparison of Planting Strategies in Soybeans**

Action	Plant Health	Weed Control*	Soybean Yield	Overall Yield Bu/A
Plowed (6") then rotovated	Normal size	Increase in woolly cupgrass, 5.5 - 6 plants/ft <sup>2</sup>	19-24 pods/plants	23
Disked (4.5") then rotovated	Smaller than normal	Slightly better control than normal, 3 plants/ft <sup>2</sup>	15-18 pods/plants	18.5
Rotovated (3") only	Taller than normal	Slightly better control than normal, 3 plants/ft <sup>2</sup>	18-24 pods/plants	23

\* Normal is 4 plants/ft<sup>2</sup>

## Project Results

### Part I. Winter Rye as a Cover Crop in an Organic Soybean Field

Results of the rye cover crop in the Vinton 81 soybeans was not as I had hoped (Table 1). Early signs led me to believe I would see heavy weed pressure. Twelve days after planting, woolly cupgrass was already showing its head. Harrowing helped some, but it was difficult to get out of the rows. Areas varied with the amount of woolly cupgrass present. There was also an increase in the common ragweed population. This weed, where present, prevented the growth of woolly cupgrass.

In 2002, I used my own organic seed which I saved from the previous year. I did not do a germination test before planting but I counted plant population at the time of emergence. I had 10-12 plants/ft row which was the planter setting. After my final cultivation, plant count was averaging 9 plants/ft. Overall, for 2002 harvest, the Vinton 81 soybeans averaged 25 bu/A whereas in 2001 it averaged 30 bu/A.

### Part II. Rye Seed Field and Weed Control

My test plot for spring planting was designed to evaluate spring planting versus fall planting of rye. This was done to see if either was better at controlling woolly cupgrass.

On May 4, spring wheat test plot was planted on the edge of the rye field. On May 28, we received a hail storm. Most of the spring wheat sustained a considerable amount of damage. This eliminated any further observations. The bare plot also received hail. It ended up with a heavy mix of woolly cupgrass and foxtail. Both of these grasses remained short, went to seed, and dried down in the fall. Plant count was 3 plants/ft<sup>2</sup> of woolly cupgrass, and 5 plants/ft<sup>2</sup> of foxtail.

The field of winter rye, which was also hailed out, was planted in buckwheat. This late planting, had me believing it would stay clean. But as mentioned earlier, it had a huge flush of woolly cupgrass just before swathing. It appears that this grass will emerge three times a growing season no matter what the circumstances are. This buckwheat field has been prepared for soybeans, with a fall seeding of rye and hairy vetch. It is my hope that these combined crops will give some relief to the constant pressure of woolly cupgrass.

## Management Tips

1. Rotovating twice after planting the rye provides the best protection against woolly cupgrass.
2. Allow time for the rye trash to break down before planting the spring crop.

## Cooperators

*Elizabeth Dyck, formerly University of Minnesota, Lamberton, MN*

*Tim Arlt, Steele County Extension Office, Owatonna, MN*

*Beth Schultz, Organic Foods-Cash Wise Groceries*

*Dee Meiners, Minnesota Bio. Ag. Inc. Owatonna, MN*

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

*Jeanne, William, and Charles Seykora, Owatonna, MN*

## Project Location

Go south on I-35 past Owatonna. Take the exit for Hwy. 14 and go east for 2 miles. Turn left off of Hwy. 14 onto Cty. Rd. 45 going south for 10 miles to 98<sup>th</sup> St. SE. Turn east onto 98<sup>th</sup> and go 2 miles then turn south onto 24<sup>th</sup> Ave. and go 1 mile to the Seykora farm.

## Other Resources

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.

Sustainable Ag. Network. 1998. Managing cover crops profitably, Second Edition. National Ag. Library. Web site: [www.sare.org/htdocs/pubs/resources/index.html#Profitably](http://www.sare.org/htdocs/pubs/resources/index.html#Profitably)

Sustainable Ag. Network. 1997. Steel in the field: A farmers guide to weed management tools. National Ag. Library.

Web site: [www.sare.org/htdocs/htdocs/pubs/resources/index.html#Profitably](http://www.sare.org/htdocs/htdocs/pubs/resources/index.html#Profitably)

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**Farmer Cooperators**

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**Project Duration**

2002 to 2003

**ESAP Contact**

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**Keywords**

big bluestem,  
biofuel, forage,  
grazing, Illinois  
bundleflower,  
indiangrass,  
little bluestem,  
native perennials,  
switchgrass, warm  
season grasses

# Native Perennial Grass - Illinois Bundleflower Mixtures for Forage and Biofuel

**Project Summary**

A team project involving producers in diverse areas of Minnesota, nonprofit organizations, and the University of Minnesota was initiated to determine the forage and biomass productivity and forage quality of native warm season grass-Illinois bundleflower mixtures and nitrogen fertilized warm season grasses. Warm season perennial grasses (e.g. switchgrass, big bluestem, indiangrass, and little bluestem) and the legume, Illinois bundleflower, were once components of southern Minnesota prairie landscapes and provided many ecosystem functions.

**Project Description**

Native prairies provided several ecosystem services such as water and soil filtration, carbon sequestration, wildlife habitat, and herbage and grain for wildlife nutrition. Native species have the potential to be re-introduced to increase diversity in present and future agricultural systems. In contrast to cool season grasses and legumes, warm season species begin growth in June with maximum production in July and August. Ultimately, increased use of warm season grasses and legumes has potential to improve environmental quality and profitability on farms.

Forage of warm season species has potential to be harvested and sold as a biofuel for electrical generation. For example, switchgrass is recommended by the Department of Energy (DOE) as a biofuel for electrical generation. Although switchgrass is noted for its tolerance of harsh environmental conditions and infertile soils, there is a lack of information on switchgrass production practices for Minnesota and especially its productivity in association with Illinois bundleflower as a natural source of nitrogen instead of using synthetic fertilizer.

The perennial legume project at the University of Minnesota has developed unique populations of Illinois bundleflower, an upright perennial prairie legume. Illinois bundleflower has potential to fix large quantities of atmospheric nitrogen for transfer to perennial grasses when grown together. When grown alone, it has produced high yields of leafy forage. However, the forage productivity and quality of mixtures of Illinois bundleflower with warm season grasses needs to be determined in diverse regions of Minnesota.

The project was initiated to evaluate native grasses and legumes in diverse environments and in diverse farming operations. Three

*Richard Handeen  
in his field  
seeding Illinois  
bundleflower.*



farms are currently in this project: a cash grain farm in Scott County operated by Jesse Theis, a beef farm in Chippewa County operated by Don Struxness, and a beef-grain farm in Chippewa County operated by Richard Handeen. Additional sites will be established in southeastern Minnesota in 2003.

## Project Results

In spring 2002, we seeded replicated large plots of Illinois bundleflower-warm season grass mixtures at the Struxness and Theis farms (Tables 1 and 2). At the Struxness farm, we used a Truax drill on a previously tilled seedbed. At the Theis farm, we used a Brillion seeder. Illinois bundleflower seed was treated with appropriate *Rhizobium* to insure nodulation and nitrogen fixation.

Following seeding at both locations, we experienced unusually heavy rainfall that reduced emergence of the warm season grasses and Illinois bundleflower but also stimulated significant emergence of annual grass weeds and broadleaf weeds. Additional rainfall stimulated multiple weed flushes in June and July. Consequently, we observed significant competition by annual weeds with the seeded native species.

To reduce weed competition at the Struxness location, we mowed several times during the seeding year when the weeds formed a canopy over the Illinois bundleflower. Herbicide use at the Struxness farm was not possible because of the use of an organic production system. At the Theis farm, we compared mowing with application of the herbicide, Plateau. At both locations, we observed that because of the rainfall pattern in 2002 and the prevalence of high populations of lambsquarters, mowing for weed control suppressed weeds but did not kill them. Mowing also removed foliage from Illinois bundleflower seedlings and may have injured them. While the herbicide treatment suppressed weeds, it did not kill lambsquarters. Therefore, during the growing season, we observed competition from both older weeds that had emerged in the spring and newly germinated seedlings for both mowing and herbicide treatments.

In early December 2002, we conducted a dormant no-till seeding at the Handeen Farm in Chippewa County using a Truax drill. The seedbed was a fall harvested soybean field. We felt that this no-till approach that did not disturb the soil would reduce weed populations germinating in the spring of 2003 and allow better growth of the warm season grasses and the Illinois bundleflower. Treatments were similar to those used on the Struxness farm.

**Table 1. Warm season grasses and Illinois bundleflower mixtures - Theis farm, Shakopee, MN**

Seed Mixture	Species	Rate (lb/A)*
1	big bluestem	9
	indiangrass	7
2	big bluestem	5
	indiangrass	3
3	Illinois bundleflower	17
	big bluestem	9
	indiangrass	7
4	Illinois bundleflower	8
	big bluestem	5
	indiangrass	3
5	Illinois bundleflower	17
6	Illinois bundleflower	17
	switchgrass	1
7	Illinois bundleflower	17
	big bluestem	9
8	Illinois bundleflower	17
	indiangrass	7
9	switchgrass	3

\*lb/A= pounds per acre of pure live seed

**Table 2. Warm season grasses and Illinois bundleflower mixtures seeded - Don Struxness farm, Milan, MN**

Seed Mixture	Species	Rate (lb/A)*
1	big bluestem	10
	Illinois bundleflower	14
	indiangrass	8
	little bluestem	3
	switchgrass	1
2	big bluestem	10
	indiangrass	8
	little bluestem	3
3	big bluestem	6
	Illinois bundleflower	14
	indiangrass	5
	little bluestem	3
	switchgrass	1
4	big bluestem	6
	indiangrass	5
	little bluestem	3

\*lb/A= pounds per acre of pure live seed

Because of the presence of many weeds in the plant canopy and the suppression of the growth of seeded species, we were unable to conduct planned sampling for forage yield and quality on either the mowed or herbicide treated plots. We estimated that weeds constituted over 95% of the plant biomass throughout the growing season. In addition, determination of grass and Illinois bundleflower populations was impossible for mowed treatments at both locations. For the herbicide treatment at the Theis location, we determined that Illinois bundleflower populations averaged 3 plants/ft<sup>2</sup> for the grass mixture treatments.

In early spring of 2003, we will do a controlled burn of the weed crop residue at both the Theis and Stuxness locations. In 2003, we expect to collect yield and quality samples from two to three harvests at each location established in 2002. We also plan to conduct additional seedings at the Southwest Research Outreach and Education Center at Lamberton and at on-farm sites in Southeast Minnesota.

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### Management Tips

1. To reduce potential competition with undesirable weeds, seed warm season grasses and Illinois bundleflower in fields where weeds have been controlled in the previous year or where the field has been fallowed. Perennial broadleaf weeds like Canada thistle must be controlled prior to Illinois bundleflower seeding.
2. Do not have high expectations that spring seeded warm season grasses and Illinois bundleflower will provide significant yield during the seeding year.
3. Mowing is not an effective strategy for control of weeds competing with native legumes and grasses in the seeding year.

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### Cooperators

*Audrey Arner, Land Stewardship Project, Montevideo, MN*  
*Nancy Ehlke, University of Minnesota, St. Paul, MN*  
*Paul Peterson, University of Minnesota, St. Paul, MN*  
*Karen Stettler, Land Stewardship Project, Lewiston, MN*

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### Project Locations

Contact Craig Sheaffer for directions to farms.

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### Other Resources

Minnesota Department of Agriculture. Greenbook 1998. Establishing and maintaining warm season grasses, pp. 26-29. St. Paul, MN.

Indigenous Native Legumes Web site. Department of Agronomy and Plant Genetics.  
<http://agronomy.coafes.umn.edu/index.asp>, then type "Indigenous Native Legumes" in Search Box.

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**Project Duration**

2001 to 2003

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**Keywords**

livestock, manure  
management,  
nutrient  
management,  
spreader  
calibration

# Manure Spreader Calibration Demonstration and Nutrient Management Planning

**Project Summary**

One of the natural resource concerns in Wabasha County is the potential for ground and surface water pollution from livestock operations. Farm manure spreader calibration demonstrations and nutrient management planning with livestock farmers in the county would reduce run-off of nutrients into surface water with the added benefits to the producer of minimizing the purchase of commercial fertilizer, and improving profits.

**Project Description**

One of the natural resource concerns in Wabasha County is the potential for ground and surface water pollution from livestock operations. The geology and geography of Southeast Minnesota lead to greater environmental quality risks associated with nutrient runoff and leaching. Manure disposal is sometimes done near farmsteads – many of which were established in valleys near water sources. Excess manure application affects all waterways and watersheds downstream and, in a karst area such as Southeast Minnesota, can negatively impact drinking water.

An important step in nutrient management is manure spreader calibration. Inaccurate manure application estimates can lead to over-application and wasted nutrients which could lead to non-point water pollution. This project was driven by the need to progressively work toward water quality goals set by the Minnesota Pollution Control Agency. Landowners say they are worried about economic and compliance issues. County-wide, producers have an interest in becoming more efficient with available resources. This project also aligns with the long-term resource management and water plan goals in the county. Quantified reduction of nutrient loading and economic impact are imperative to State compliance concerns.

Under-crediting of the nutrient value of the spread manure can result in unnecessary commercial fertilizer purchases and added expense. Even though all livestock producers in the county have some portion of their manure applied using a broadcast spreader, many have not calibrated their manure spreaders because of a lack of equipment, time, knowledge, economics, and/or logistics. Calibration demonstrations show producers first hand the actual application rates they have been spreading, and calibrated equipment promotes confidence in crediting the nutrient value of manure. Their bottom line can be helped through reducing purchase of fertilizer.

To address water quality concerns, 30 livestock producers agreed to work with county extension, the Wabasha Soil and Water Conservation District (SWCD), and USDA Natural Resources Conservation Service (NRCS) staff to improve manure spreader calibration skills and learn more about nutrient management planning. Livestock producers were also introduced to incentive programs such as the county's nutrient management program and the NRCS Environmental Quality Incentive Program (EQIP), which both require spreader calibration and a nutrient management plan in order to receive payments. In addition, state feedlot rules have been discussed.

**Results**

The initial step taken by county SWCD and extension staff was assessing current nutrient management methods used by the farmer cooperators. Farmers were surveyed to determine their prior knowledge of nutrient management plan components such as nutrient analysis of manure, manure spreader rates, crop nutrient needs, crop yields and crop rotations. They were also asked about their knowledge of the cost-share programs available to them for nutrient management. Once the surveys were completed, county staff and a private crop consultant worked one-

to-one with the farmer cooperators to calibrate spreaders using portable load cells and to estimate application rates by measuring spread patterns in the field. Proper manure sampling techniques were also discussed and samples were taken for analysis if requested. Farmers began developing nutrient management plans that balance livestock numbers (volume of manure), crop acres (nutrient needs and yield goals), and temporary or permanent cover available for spreading manure year round.

Two on-farm demonstrations of spreader calibration and estimation of application rates provided opportunities for farmers in the county to learn more about maximizing use of manure, manure and legume crediting, the economics of using manure-supplied fertility, environmental factors affecting manure application, government cost-share and incentive programs, and the state feedlot rules. Attendees were provided with an example of nutrient management planning and costs using local conditions, crop yield goals, and soils (Table 1).

In 2002, low milk prices discouraged producers from taking on additional soil testing costs. After a calibration consultation with SWCD staff, however, many of these producers realized the economic benefit of properly crediting legumes and each load of manure, and they tended to pursue soil sampling. After working through calibration and nutrient management planning with six farmers in 2002 (2,284 acres), one project collaborator calculated that resulting phosphate ( $P_2O_5$ ) fertilizer reduction could have been as much as 19,530 lb.

By the end of the project, more than 20 producers had participated in the project, resulting in nutrient management plans on almost 3,070 acres. Wabasha Soil Conservation District has plans to work with 13 more landowners during 2003. Fifteen of the 20 participants have chosen to take nutrient management to the next level by developing nutrient management plans based on NRCS standards on 3,400 acres.

About six of the initial calibration participants (accounting for approximately 100 acres) decided it would be beneficial to set aside some of their acreage. By keeping it out of row crop production in order to spread manure throughout the growing season, they reasoned, they would save fuel, time, and stacking loss. They will follow these so-called “sacrificial acres” with corn to utilize fertility and organic matter build-up.

The initial survey and the educational activities project will be followed by a survey of the farmer cooperators to assess changes to their nutrient management practices and any contact initiated with NRCS or SWCD officials about cost share programs. The manure application practices and volume applied before the project will be compared to the practices and volume after calibration and nutrient management planning assistance. The reduction in fertilizer purchases and the resulting savings can then be calculated.

As we conclude this two-year project, we recognize a need for more conservation technical staff to demonstrate more

**Table 1. Effects of Crediting Dairy Manure and Alfalfa Fertility on Fertilizer Costs**

Scenario	Crop Fertility Needs (lb/A) and Cost/A of Fertilizer with No Manure or Legume Credit	Manure/Alfalfa Nutrients Available (lb/A)	Commercial Fertilizer (lb/A) and Cost (\$) if Credit Manure/Legume	Savings if Credit Manure and Legume (\$/A)*
Corn after corn – manure incorporated within 12 hr of application	120-40-60** \$39.40	66-56-81	54-0-0 \$9.72	\$29.68
Corn after corn – manure incorporated more than 4 days after application	120-40-60 \$39.40	24-56-81	96-0-0 \$17.28	\$22.12
Corn after alfalfa – manure incorporated more than 4 days after application	120-40-60 \$39.40	124-56-81	0-0-0 \$0.00	\$39.40

\*Savings were calculated by subtracting the cost of fertilizer purchased to balance nutrients supplied by manure/legume from the cost of fertilizer when no manure/legume credits are taken. For example, for the first scenario, \$39.40 - \$9.72 = \$29.68.

\*\*Nitrogen –  $P_2O_5$  –  $K_2O$ .



calibrations on more farms. We have also learned that producers and input suppliers are becoming more familiar with calibration and credit concepts, and many will use the information when the conservation office provides loaded spreader weights. To follow up on the work to date, we would like to learn more about participants' record keeping methods and interactions with fertilizer suppliers, along with cost and yield information. Nutrient management is becoming a cost of doing business, and all livestock producers would benefit from awareness of actual nutrient availability.

## Management Tips

1. Properly calibrating your manure spreader and estimating application rates prevents non-point water pollution and saves money by preventing both over- and under-application of manure.
2. Careful recordkeeping is important to accurately credit manure and legume nutrients that can reduce commercial fertilizer purchase costs.
3. Read, and attend workshops and demonstrations. If possible, get set up with a nutrient management software program and make adjustments to your practices. Maps and quads are available at your conservation office to help you do your planning.

## Cooperators

*Monte Bany, Oak Center, MN*  
*Paul Brietzke, Consultant, Fountain City, WI*  
*Dennis Busch, University of Minnesota Extension, Water Resources Center, Waseca, MN*  
*Steve Drazkowski, University of Minnesota Extension Educator, Wabasha, MN*  
*Mark Kulig, NRCS, Wabasha, MN*  
*Paul Moechnig, Farmer, Lake City, MN*

## Project Location

Contact Jim Straskowski for directions to demonstration sites.

## Other Resources

University of Minnesota Extension Service Publications, St. Paul, MN 55108, 612-625-8173 or 800-876-8636.

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**Project Duration**

2000 to 2002

**ESAP Contact**

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**Keywords**

aerator, pasture  
renovation

# Pasture Aeration and its Effects on Productivity Using a Variety of Inputs

**Project Summary**

This is a collaborative project of producers, local, state, and federal agencies, extension educators, and grazing organizations in a six county area in northeast and east central Minnesota to provide educational programs in pasture management. This group focused on using a pasture aerator to increase pasture productivity without destroying existing pasture. The aerator was used to: 1) improve pasture production; 2) control weeds and brush; 3) increase beneficial legume species; 4) do a better job of seeding and fertilizing pastures; and, 5) provide better wildlife habitat. Increased pasture productivity will result in increased farm profitability and improved animal health with better pasture management.

This project involved four beef cattle producers who utilize pasture as the staple for summer feeding of their livestock. The demonstration project locations covered a wide variety of soil types and production systems.

These producers became interested in pasture aeration because of the importance of pasture productivity to their livestock operations. All of them have seen the benefit of rotational grazing, and, therefore, were interested in

evaluating the use of aeration as a technique to improve production, quality, recovery, and species makeup.

**Project Description**

This project evaluated the use of an aerator as a low cost way of renovating pastures without having to take them out of production. This machine reduces the cost of operating equipment, and decreases the risk of erosion. Many producers might not be able to renovate by traditional means because they cannot afford to take pasture out of production during renovation.

The aerator has a rotating gang of 9 to 12" teeth that make holes in the soil. This small amount of tillage does not affect the forage stand. The aerator can also be used on both sod and tilled fields for incorporation of manure. This application method decreases the evaporative losses and allows better absorption of the nutrients into the soil, especially on hillsides. The cost of renting and using the aerator is between \$10 and \$15/A.

In 2000, ten different treatments were established in plots in the pastures on the four participating farms. The treatments were repeated on each farm for three years. The

*Troy, Carlton  
County Extension  
Educator shows  
aerator at a field  
day.*



treatments were designed to show the effects of the aerator on the pastures. The treatments were:

- control: existing pasture with no aeration, seeding, or fertilization;
- aeration with no other treatment;
- aeration with manure application;
- aeration with lime and fertilizer;
- aeration with over-seeding of red clover;
- aeration with red clover seed, lime, and fertilizer;
- no aeration with manure application;
- no aeration with lime and fertilizer;
- no aeration with over-seeding of red clover; and
- no aeration with red clover seed, lime, and fertilizer.

The sizes of the plots were 20 x 60' for each of the treatments. The average application rate for soil amendments for the treatments were:

- lime at 2 tons/A;
- red clover at 8 lb/A;
- potash at 166 lb/A;
- nitrogen at 50 lb/A; and
- manure at 20 tons/A.

Amendments were determined for each site according to soil test recommendations analyzed at the University of Minnesota.

Just prior to grazing, forage samples from a 4 ft<sup>2</sup> area in each plot were collected and analyzed for yield, forage quality, forage species, and stand density. Comparisons of the treatments were conducted over three years to observe the trends in the conditions of the pasture.

## Results

### 2000

The project went as planned in 2000 with the treatments applied late in the spring at all four locations. We were able to get all of the lime, fertilizer, seed, and equipment to properly apply the treatments. We were also fortunate that we had access to rock or counter weights to allow the aerator to properly penetrate into the soils. The existing pastures were quite compacted and dry so the aerator tended to not penetrate into the soil as it would in normal conditions. Ideally, the aerator would penetrate 8".

After the first season, the pastures had a dramatic response to fertilization with manure and commercial fertilizer. This was determined by both visual appraisal and dry matter samples.

### 2001

In 2001, the treatments were repeated on three of the farms, but later than normal because of the cool, wet spring. The area had one less grazing rotation because of the late spring and slow start.

The data collected thus far have not clearly demonstrated the value of aeration of pastures on production. It does however, show that, with the use of aeration and lime, soil pH improved in heavy clay soils. It was common to see an increase in pH of .1 to .4 with the highest of .9. Many of the heavy soil sites had pH levels of 5.7. We did not find this same response in sandy soils.

We did see a dramatic increase in forage yield in the plots that were fertilized, whether they were aerated or not. In some plots there was a five-fold increase in the weight of the samples over the control plots.

In addition to the scientific data, we also did visual appraisals to evaluate aeration and its impact on manure use. We found that the forage growth in the aerated plots looked more even over the entire plot, had a deeper green color, and had longer timothy heads (3" vs. 2") than in the non-aerated plots.

In the commercial fertilizer plot there was not a clear difference in the reaction to the aeration. The plots looked the same both with and without the aeration. We did see a slight increase in the amount of red clover present in the aerated and seeded (red clover seeded at 8 lb/A) plot compared to the non-aerated and seeded plot.

### 2002

The weather in all areas had a major impact on how things grew in 2002. Our spring in NE MN was very cold and dry. In addition, the Erickson's pasture was flooded continuously after the end of June. Therefore, we had only one opportunity to collect data and it was impacted by the poor spring growth.

We did not see the same dramatic increases in productivity with the applications of manure and fertilizers. I think it was weather related and also impacted by having the opportunity to collect data only once during the season. At the Ron Alm site, there was an increase of 1.06 tons dry matter/A with the manure application and only .37 tons increase with no manure application. Other sites did not see such dramatic increases from the applications.

We also observed that inter-seeding red clover increased the relative feed value, crude protein, and percent legume in the forage. However, the seeding of red clover did not seem to increase the forage yield over the control plots. We did not

see much difference in the amount of red clover in the plots where seeds were applied with and without the aeration. The reason this might not have worked quite as well as hoped is we planted the red clover too late. We planted in late June rather than early spring.

This project demonstrated that aeration can be very useful if you intend to renovate your pasture with manure and/or lime. Aeration seems to help with distributing and incorporating the materials into the soil profile. This could be due to incorporation of the materials into the soil, allowing for the material to be bound to the soil quicker and potentially have less loss of nutrients.

In addition, some of the producers also tried the aerator for other uses. They are using it to do some clearing normally done with a caterpillar, trying it for tillage instead of a disk, and spreading manure packs from feeding areas to get the forages growing sooner in spring. All of these uses will lend themselves to further demonstrations to producers during future field days.

### Management Tips

1. It takes time for the benefits of aeration to show up in the pastures.
2. Pastures respond quickly to applications of fertilizers and manure.
3. It may be necessary to add weights to the aerator so it can penetrate 8" into hard sod pastures.
4. Set the aerator to aggressively stir the soil to provide better soil to seed contact when inter-seeding red clover in the pastures.

### Cooperators

*Ron Alm, Farmer, Brook Park, MN*  
*Richard Erickson, Farmer, Isle, MN*  
*Willis Finifrock, Farmer, Barnum, MN*  
*Calvin Harth, Farmer, Cloverdale, MN*  
*Bob Korth, Natural Resources Conservation Service, Hinckley, MN*  
*Denny Tressel, Natural Resources Conservation Service, Duluth, MN*  
*Tri County Cattlemen's Association, Pine City, MN*  
*Snake River Cattlemen's Association, Milaca, MN*  
*East Central Forage and Grasslands Council, Hinckley, MN*  
*Northeast Forage and Grasslands Council, Virginia, MN*  
*Hank Ratinz, AerWay Company, Orono, MN*  
*Lori Schott, University of Minnesota Extension Service, Milaca, MN*  
*Paul Mahoney, University of Minnesota Extension Service, Hinckley, MN*

### Project Location

Contact Troy Salzer for directions to the farms involved in this project.

### Other Resources

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

Guide for Rural Living. 2000. University of Minnesota Extension Service Carlton County, 218-384-3511 or 800-862-3769 ext. 223.

Missouri Forage Management Guide. 1998. Natural Resource Conservation Service. 573-876-0901.

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

University of Minnesota Extension Service. 2000. Minnesota Soil Management Series. No. PC-7398. Distribution Center, 405 Coffey Hall, 1420 Eckles Ave., St. Paul, MN 55108, 612-625-8173 or 800-876-8636.

University of Wisconsin Extension Service. 1997. Pastures for profit: A guide to rotational grazing. No. A3529. University of Wisconsin Extension Service, Madison, WI, 608-262-3346.

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**Project Duration**

2002 to 2003

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**Keywords**

conventional  
building,  
finishing hogs,  
hoop building,  
Pig Win software

# Comparing Performance of Hoop Buildings to an Older Conventional Building for Finishing Hogs

**Project Summary**

We have a 170 sow farrow to finish hog operation that uses rented finishing and nursery buildings. Most of these buildings were built or remodeled in the 1970's. The operation is very time consuming because of all the time spent on the road, usually 2 to 3 hours/day. I wanted to move the finishing pigs home to save time.

I became interested in hoop barns as a way to build low cost finishing. I felt I could not afford new confinement buildings. As I started to research options, I began to wonder if hoop barns might be a more enjoyable way to raise pigs, both for the pigs and for myself. Also, the money now spent on lease payments could be used to pay off the hoops.

The purpose of this project is two-fold. First, I want to compare the hoop barns to older confinement buildings. Most comparisons have compared hoop barns to new facilities. New facilities are something many of us do not have. Secondly, I want to help smaller operators keep better records. Often, smaller operators do not have the time or the staff to devote to record keeping. I plan to use a computer software program called Pig Win to get a better handle on my record keeping. The Pig Win program utilizes a palm pilot for data entry.

*Dismantling hoop structure prior to moving it to the Connolly farm.*

**Project Description and Results**

In the summer of 2002 we purchased two used 30 x 72' hoops from a farmer who was retiring. Because of the wet weather, we experienced many delays putting up our first building. With the help of my neighbors, the first hoop was put to use on August 19. The second building is partially up and will hopefully be completed by the end of the year.

It is too early for me to give out any data as we have not closed out a group of hogs yet. I weighed 5 to 10 average pigs out of my nursery on entry into the hoop barn. I am recording all feed and death losses, and making observations with the palm pilot. I will analyze this data and make comparisons between the hoop and a confinement system for feed conversion, death loss, growth rates, and, hopefully, cost per pound of gain.

We had some mycoplasma-pneumonia disease problems in all of our facilities this fall. It seems that the disease problem is less in the hoop barn than in the confinement building. I am sure that our first group closeouts will not look very good.



I can make a few early observations about the two systems. The pigs in the hoops have had a much lower death loss. It looks like they will have a better growth rate, even with our disease problems and the lower protein levels we fed due to the low hog prices. We have had no tail biting problems in the hoop like we had in our confinement building. At this early point, I find myself preferring to work in the hoop barns over the confinement buildings. I think I have to see what it will be like this winter.

One thing I noticed is that in the confinement system, you have to manage differently than in the hoop system. In confinement, you must try to create a good environment with fans and supplemental heat. It is also important to have a handy way to sort pigs in either system.

I knew that for hoop barns to work you need access to lots of bedding. It is often hard to get custom balers to come in the fall, so I felt it was important for us to own our own baler. We bought an older New Holland round baler and made about 150 corn stalk bales off our farm. It proved to be important this year to have our own equipment because there were only a few days to bale due to a very wet October.

I think that converting more of my operation to solid manure will have a positive effect on the environment both for water quality and odor reduction. I also like the fact that the system uses minimal electricity and no supplemental heat.

At this point I am very happy with the palm pilot for data entry of my records. I just write the information in the palm pilot every day and it takes a few minutes to download it to the computer.

I think next year we will start to get some good data and be able to draw some conclusions. And, hopefully, we will have better hog prices.

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## Management Tips

1. Record keeping is very important no matter what size operation.
2. The use of a palm pilot is an easy way to keep records.
3. It is important to use lots of bedding in hoop barns and other deep-litter facilities.

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## Cooperators

*Will Marsh, FarmWise Systems, Little Canada, MN*

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

*Beth Nelson, MN Institute for Sustainable Agriculture, University of Minnesota, St. Paul, MN*

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## Project Location

From Le Center, go north on Le Sueur Cty. 11. Turn left at first stop sign, go .25 mile and turn right (stay on Cty. 11). Farm is approximately 2 miles on the right. House number is 33221.

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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 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.



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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 intend to test 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 are in the first year of establishment. So far, we have marked the stands, taken initial forage samples, and begun tree removal. We will follow the progress of the stands for the next several years.

**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 cow/calf farm in Cass County, a demonstration/research project is being established to see the impact of crop tree management of grazed woodlots on both forage yields and timber growth. Initial forage samples were taken this past summer. During the next two years, forage sampling will be 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.

*Mike marking  
woodland grazing plots.*

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. 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).

This year is the first year of the project. We want to compare forage yields and quality in woodlots managed under a crop tree system and woodlots that are unmanaged. We marked six plots: three for a crop tree thinning and three as controls. We took three forage plot samples from each plot in midsummer. This winter and spring we thinned, fenced, and planted the three forage plots.





## Results

So far, we have taken initial forage samples as the plots are still being established. The yield of the standing crop of forage cut to one inch 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 grasses.

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 such as 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.

## 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. 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.

## 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*

## Project Location

Plots are located off of State Route 64 north of Motley. For more information as to specific locations, call Mike Demchik at: 218-894-5167.

## Other Resources

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

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

*Woodland grazing.*



**Principal Investigator**

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**Project Duration**

2002 to 2004

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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 verses slatted finishing barns in northern climates. This project will split groups of 400 finisher pigs into two groups, 150 going into hoops and 250 into slatted finishing barns. Each group was weighed going into the finishing units. Feed consumption and days on feed are being tracked. After slaughter, feed conversion, rate of gain, and carcass data of the two groups will be compared. By comparing the dollars received in each system with the dollars spent to build each building, we can compute profit of each building as to return 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 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 of the reduced cost to build hoop barns but we need to see if the savings transfer this far north.

*Kent working in his office.*

**Results**

We have had only one turn of the finishers at this point. It is too early to make any definitive conclusions about the two systems because we are still learning how to manage hogs in a hoop barn as well as getting the hoop as equipped as we want. The close-outs from this first comparison of finishers did show that the pigs in the slatted barn out-performed the pigs in the hoop barn. Some of the close-out data is shown in Table 1.

**Table 1. Comparison of Close-outs with First Group of Finishing Hogs in a Hoop Barn to a Slatted Barn**

	Hoop Barn	Slatted Barn
Avg. Daily Gain	1.50 lb	1.65 lb
Lb Feed/Lb Gain	2.90 lb	2.53 lb
Feed Costs/Head	\$29.46	\$27.88
Profit/Head	\$13.66	\$26.99
% Death Loss	3.4%	2.05%
Avg. Carcass Wt	192 lb	196 lb
Avg. Backfat	0.97	1.01

Cannibalism flared up in the hoop barn on the first group we finished and accounted for three of the five deaths in that building. This was completely unexpected because they





*Hoop barn used for comparison.*

have access to bedding and we kept lower pig numbers per square foot. We checked rations and stocking numbers per square foot to see if they caused the problem. This may be part of the reason why the hoops did poorer than the slatted barn.

We tried to limit as many variables as possible from the study. However, we had a three-year contract for a single source of early wean pigs prior to entering this study. The person on the other side of the contract decided to break the contract, so the first group will be a different source than later groups but with the same genetics. After the problem with our source, eight neighbors formed a Limited Liability Partnership (LLP) 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.

The software we developed to help us figure the financials needs to have some refinements. After the first group we decided the program should do more calculations. We are adding 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. One additional 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. One issue that needs to be considered when considering hoop barns is that they cannot be insured for wind damage. Slatted buildings are insurable for both wind and fire.
3. There is a greater risk of suffocation losses in slatted barns than in hoop barns. It is costly to insure against suffocation losses.

## 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.



*Slatted barn used for comparison.*

**Principal Investigator**

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**Project Duration**

2001 and 2002

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**Keywords**

alfalfa pastures,  
dairy heifers,  
grazing  
economics,  
implants, intensive  
rotational grazing,  
stocker steers

# Enhancement of On-farm Alfalfa Grazing for Beef and Dairy Heifer Production

**Project Summary**

Many farmers want to graze more legumes because they provide high nutrient forages and fix nitrogen which adds nutrients to the grasses in the pastures. This project is a joint project between West Central Research and Outreach Center (WCROC) researchers and two farmers to evaluate two intensive rotational grazing systems on alfalfa pastures in central Minnesota. One system is with dairy heifers and the other with stocker steers.

**Project Description**

This project compares the performance and economics of two different cattle operations. One project is on the Roger Imdieke farm near Elrosa in Stearns County. Roger is a professional dairy heifer grower. The farm has heavy soil and is located near wetlands and a lake. Roger is comparing the dairy heifers in an alfalfa grazing system to a traditional feedlot and cropping system. He wants to learn if soils that produce large yields of corn and soybeans can be profitably converted to heifer grazing.

The second project is on the Don and Bev Struxness farm near Milan in Stevens County. The Struxness' investigated alfalfa grazing systems for beef stocker cattle and determined cattle performance from these systems in 2001. They have a preference for producing beef primarily from forage as that meets their goals of safeguarding the land and producing a healthy high-quality

meat product at a profit. Their question was whether or not they would benefit from utilizing a moderate potency growth promoting implant with grazing stocker steers and/or provide an average of 5 lb of cracked corn per day as a supplement to help meet a growth goal of 2.5 lb/head/day. Growth across the grazing season was evaluated.

**Results****Roger Imdieke**

This project is a replicated study that began in 2000 and was repeated in 2001 and 2002. Dairy heifers were grown in a feedlot and fed a total mixed ration (TMR) or were grazed on an alfalfa pasture. The growth of the heifers and the economics of the systems were compared. All of the feed, labor, and other inputs were recorded so that accurate and statistically valid comparisons could be made between the systems.

Twenty-eight acres of established alfalfa pasture was used to graze growing dairy heifers. The trial was for 145 days in 2000, 127 days in 2001, and 147 days in 2002. There were 2 treatments in the trial, feedlot and pasture.

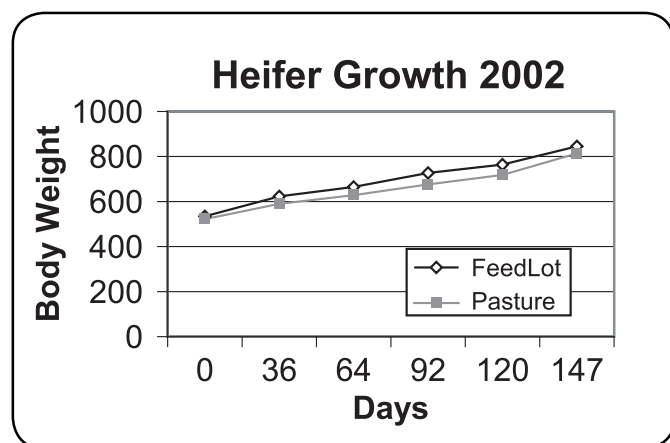
**Roger Imdieke**  
*preparing to move  
heifers and water tank.*





Over three years, 200 heifers gained an average of 2.00 lb/day on pasture and 202 heifers gained an average of 2.04 lb/day in the feedlot. Graphical results for growth of the heifers during the summer of 2002 are shown in Chart 1. Project results clearly show that short yearling heifers raised on pasture or feedlot may achieve equivalent growth in the five months immediately before they are ready to breed at approximately 800 lb of body weight.

**Chart 1. Heifer Growth in 2002 on the Roger Imdieke Farm**



In the three years, the daily gains were consistent at 2 lb/head/day in the feedlot as well as on pasture. However, there are important differences in costs. The average total cost/head/day in the pasture averaged \$0.94 vs. \$1.30 in the feedlot system. The main difference is in feed cost, \$0.28/day in pasture compared to \$0.77/day in the feedlot. There was almost no difference in the labor requirement, only about 10 min/day for either system. Costs/lb of gain was \$0.65 in the feedlot and \$0.47 in the pasture. The body conditions were the same for both groups of heifers.

Costs/head/day for each year is presented in Table 1. The pasture system was more cost effective than the feedlot system. The biggest difference between the systems is in feed costs and machinery costs.

Another measure of system productivity for growing livestock in an intensive pasture system is lb of gain/A. This measure is a function of the number of animals per acre or stocking rate, and the rate of gain of the individual animals. It is a measure that is of interest to both heifer grazing operations and beef stocker operations, where animal performance is measured by weight gain. Gain/A was 739 lb/A, 521 lb/A, and 734 lb/A in 2000, 2001, and 2002 respectively. It is interesting to note the lowest gain/A occurred in 2001, which was the year that had the lower stocking rate. High gains/head at low stocking rates may lead to low gains/A and vice versa.

Per acre returns for intensive rotationally grazed pasture raised dairy heifers must be comparable to other cropping enterprises. If intensive pasture systems are to be adopted in the Upper Midwest, more acres of improved pasture may be needed. This could result in converting highly productive row cropland into pasture. Net returns/A were calculated for the pasture system for 2000, 2001, and 2002. The heifers were valued at \$0.67/lb of gain. Return/A for grazing was \$123.25 in 2000, \$26.31 in 2001, and \$215.46 in 2002. This compared to the net return/A in 2000 for corn in West Central Minnesota of -\$18.20/A and -\$56.05 in 2001. Net return for soybeans in West Central Minnesota in 2000 was \$35.23 and \$16.17 in 2001. Comparisons are highly sensitive to yields and prices.

These results helped answer Roger's question of, "Can I afford to graze animals on land where I could grow corn or soybeans?" There were positive returns in each of the three years of the trial. The lowest returns were seen in

**Table 1. Costs/Head/Day for Dairy Heifers on the Imdieke Farm**

	2000		2001		2002		Avg. Over 3 Years	
	Feedlot (\$)	Pasture (\$)	Feedlot (\$)	Pasture (\$)	Feedlot (\$)	Pasture (\$)	Feedlot (\$)	Pasture (\$)
Feed	0.73*	0.28	0.74*	0.34	0.85	0.20	0.77	0.27
Bagging				0.01				0.01
Labor	0.17	0.10	0.16	0.15	0.20	0.07	0.18	0.11
Machinery	0.16	0.06	0.17	0.07	0.18	0.07	0.17	0.07
Facilities	0.05		0.07		0.05		0.06	
Bedding	0.07		0.12		0.11		0.07	
Fencing		0.08		0.15		0.10		0.11
Pasture Charge		0.23		0.32		0.22		0.26
Seed				0.06		0.02		0.04
Fertilizer				0.05		0.03		0.04
Health Costs	0.03	0.04	0.03	0.03		0.02	0.03	0.03
Death Loss		0.15						0.15
TOTAL COST	1.21	0.94	1.29	1.18	1.39	0.71	1.30	0.94

\* Cost/head/day

2001. This again is related to the lower stocking rate and shorter grazing season. When compared to row crop returns, intensively grazed heifer system surpassed returns for corn and soybeans in each of the three years. Roger thinks that grazing better or at least equals the net income of corn and soybeans on the same land, especially with more grazing experience and improved forage management.

### **Don and Bev Struxness**

Eighty beef steers averaging 700 lb were delivered to the Struxness farm on May 15, 2001. All steers were fed hay for the first ten days of the trial while they were exposed to pastures to allow the cattle to adapt to the alfalfa and minimize the risk of bloat. The cattle were rotationally grazed on high quality alfalfa pasture starting in mid-June and continued through mid-September for 84 days. The steers were supplemented with monensin to help them with feed efficiency and with a granular poloxalene beginning seven days prior to grazing to help prevent bloat.

The steers were separated into 4 treatments:

1. Implant: graze alfalfa with moderate potency implant;
2. Supplement and implant: graze alfalfa, moderate potency implant, and cracked corn supplement;

3. Supplement: graze alfalfa and cracked corn supplement; and
4. Control: graze alfalfa.

The cracked corn supplement was based on the energy requirements of a 2.5 lb/head/day rate of gain and was increased throughout the season as the cattle grew. The two supplement groups received 3.3 lb/head of cracked corn in period 1, 4.4 lb/head/day in period 2, 5.5 lb/head/day in period 3, and 6.6 lb/head/day in period 4.

Pasture alone provided 2.03 lb of gain/head/day (Table 2). Steers fed cracked corn with or without an implant met the 2.5 lb/head/day goal for growth over the 84 days of grazing. The implant without a supplement of grain improved the rate of gain by about .25 lb/head/day over the pasture alone group.

A comparison of the costs of each of the treatments is shown in Table 3. Care must be taken when interpreting the costs. The difference between the Supplement, and Supplement & Implant groups is due primarily to the death loss in the Supplement group. Had death loss been similar between these two groups, costs would not have differed.

**Table 2. Average Daily Gain (ADG) and Gain/A for Beef Steers Over 84 Days While Grazing on the Struxness Farm in 2001**

	Avg. Initial Wt (lb)	Avg. Final Wt (lb)	ADG (lb/head/day)	Gains/A (lb)
Implant	774.7	1,036.2	2.25	427.9
Supplement & Implant	743.4	1,035.8	2.52	505.0
Supplement	742.9	1,042.1	2.58	489.6
Control	787.1	1,022.7	2.03	342.7

**Table 3: Summary of Total Costs for Each Treatment Group on the Struxness Farm in 2001**

	Implant	Supplement & Implant	Supplement	Control
Corn		\$416.00	\$416.00	
Ralgro Magnum (Implant)	\$18.50	\$18.50		
Poloxalene	\$400.00	\$400.00	\$400.00	\$400.00
Rumensin/Mineral Pellets	\$186.25	\$186.25	\$186.25	\$186.25
Pasture Charge	\$935.00	\$935.00	\$935.00	\$935.00
Fencing Charge	\$308.00	\$308.00	\$308.00	\$308.00
Death Loss	\$633.08		\$624.75	\$1,266.86
<b>Total Cost</b>	<b>\$2,480.83</b>	<b>\$2,263.75</b>	<b>\$2,870.00</b>	<b>\$3,096.11</b>
<b>Cost/Head/Day</b>	<b>\$1.19</b>	<b>\$1.03</b>	<b>\$1.33</b>	<b>\$1.67</b>
<b>Cost/Lb Gain</b>	<b>\$0.53</b>	<b>\$0.41</b>	<b>\$0.52</b>	<b>\$0.82</b>

The high cost of the Control group was also the result of the death loss. Death loss affects the costs in two ways. First, the total cost is higher because of the death loss. Secondly, because there are fewer head, the per head pasture and fencing costs are higher. It isn't possible to determine if the differences in death loss were random or caused by the treatments in a demonstration of this size. Thirdly, the Control group had the lowest ADG. Combining lower ADG and lower number of animals grazing, the gain per acre is lower than the other groups. Or to put it another way, the combination of ADG and stocking rate impacts the per unit cost of the system.

## Management Tips

1. Consider grazing cattle to reduce feed costs. Feed costs are 50% less when feeding cattle on pasture vs. feeding cattle in feedlots.
2. Grazing can equal or beat the net income of the same land planted to corn or soybeans.
3. When grazing alfalfa, it is important to monitor closely for bloat. Provide bloat guard to minimize risk.
4. Improving your grazing skill will help maintain forage production and improve profit per acre.

## Cooperators

*Don and Beverly Struxness, Farmers, Milan, MN*  
*Greg Cuomo, Station Head, WCROC, Morris, MN*  
*Av Singh, Forage Agronomist, WCROC, Morris, MN*  
*Margot Rudstrom, Ag Economist, WCROC, Morris, MN*  
*Mike Reese, Project Coordinator, WCROC, Morris, MN*  
*Roger Imdieke, Farmer, Elrosa, MN*

## Project Location

Contact Dennis Johnson for directions to the farms involved in this project.

*Don Struxness reeling out polytwine to divide paddock.*

## Other Resources

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

Graze, PO Box 48, Belleville, WI 53508, 608-455-3311, [graze@mhtc.net](mailto:graze@mhtc.net)  
 Newspaper devoted grazing. Published ten times per year.

Graze-L email discussion group ([graze-l@cygnus.taranaki.ac.nz](mailto:graze-l@cygnus.taranaki.ac.nz)). There is also an archive of past discussions at the web site: <http://grazel.taranaki.ac.nz>

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

Undersander, D., B. Albert, D. Cosgrove, D. Johnson, and P. Peterson. 2002. Pastures for profit: A guide to rotational grazing. WI No. A3529. University of Wisconsin Extension Service, Madison, WI, 608-262-3346.





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**Project Duration**

2002 to 2004

**ESAP Contact**

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**Keywords**

fall grazing,  
livestock  
wintering, manure  
management,  
stockpiling

# Low Cost Fall Grazing and Wintering Systems for Cattle

**Project Summary**

This project includes three farmers who are using an innovative and low-input livestock system for fall grazing and winter feeding. The system has two components. The main focus is the development of a winter feeding system that uses round bales strategically placed during good autumn or winter weather. This becomes the “rotational winter feeding area.” When possible, the site is selected to provide both winter protection for the animals and proper placement of manure nutrients and organic matter where they are most needed for soil improvement.

Secondly, we are grazing our third crop hay rather than cutting and storing it. This enables us to stockpile other permanent paddocks for fall and early winter grazing. Our goal is to promote a livestock management system that is economically viable, environmentally friendly, with low labor input, and high energy efficiency. We wish to show farmers and other professionals a livestock wintering system that works for everyone and leads to a better quality of life.

**Project Description**

**Farm Descriptions.** Dennis Rabe operates a diversified farm consisting of 320 acres of forages and row crops, a 75-cow beef cow-calf operation, and a 600 hog farrow-to-finish operation. Dennis also direct markets meat. Art Thicke operates a 477 acre grass-based

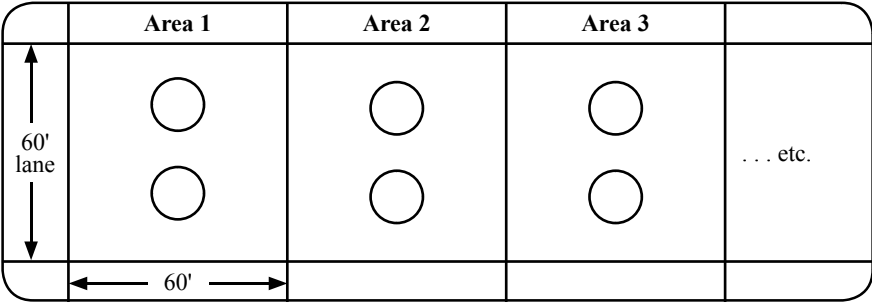
dairy farm with 90 milk cows. Art raises no row crops. He purchases his grain and winters his dry cows and replacements using the same low-input system. Of the 477 acres, 135 are tillable. Ralph Lentz operates a 160 acre grass-based 40 cow beef cow-calf operation. One hundred ten acres are in grass or forage. All three farmers are rotational graziers using a low-input management system.

**Rotational Winter Feeding Area.** A description of Ralph Lentz’ winter feeding area is presented here as an example. Each farmer is exploring variations on this theme. In late fall, Ralph places round bales in ‘lanes’ (see Figure 1, *on page 118*). A 4’ tall perimeter electric fence is placed to surround all of the bales in the 60’ wide winter feeding lane. We use 16 gage wire and 3/8” round steel posts sharpened to a point. These posts can be moved in winter with a vise grip. A 60’ temporary fence is placed between the first and second feeding area. Starting with “area 1,” the herd is allowed access to two bales at a time using round bale feeders. As the animals are allowed into succeeding round bales, they continue to have access to the previously used portion of the lane. High fiber hay that is left behind becomes a convenient bedding site for the animals.

*Art, Ralph, and Dennis discuss wintering techniques at a field day.*



**Figure 1. Round Bale Placement in a Typical Winter Feeding Area at the Ralph Lentz Farm**



*Even distribution of manure after wintering in lanes on Ralph's farm.*

We want to show that this is a low-cost, energy saving, labor saving way to farm. We are documenting the performance of this system in the following ways:

1. We are keeping track of the length of time the animals spend in the winter feeding area. From this we are able to estimate the labor and machinery savings due to reduced manure handling compared to a confinement system.
2. We are documenting the time spent in daily management of cattle and in hauling and placing round bales.
3. Animal health is being observed. Veterinary costs are being recorded.

### Results

We are observing far better animal health, lower vet costs, lower machine costs, and increased labor efficiency. The long-term benefits of this system are apparent to us more and more as we observe what is happening to the land and to the livestock. We see increased soil fertility and better soil tilth. We find the greatest benefit of this system is that it enables us to get away from the confinement of livestock. Pollution problems from accumulation of manure and urine are greatly reduced.

Art Thicke Farm. Three groups of cows were wintered in an outside feeding area, including 55 dry cows and bred heifers, 30 heifer calves, and 56 milking dairy cows as weather permitted. The wintering system provided the following savings in manure handling over 4.5 months:

Group 1	55 tons per month
Group 2	15 tons per month
Group 3	56 tons per month
Total	126 tons per month or 567 tons per wintering season

In other words, this system has saved the time, fuel, and equipment use that would have been required to haul 567 tons of manure. The bales were placed in November with a labor investment of 20 hours. This does not include the

milking dairy herd. They are wintered away from the barnyard only in good weather.

Art used six round bale feeders for each group. His feeding time for each group is as follows:

Group 1	20 to 30 minutes every 6 to 7 days
Group 2	15 to 30 minutes every two weeks
Group 3	20 minutes every third day

He reports animal health to be excellent and had no vet bill for these groups in the winter.

Dennis Rabe Farm. Dennis wintered two groups of cattle for five months using the new system. The estimated manure output for this time period was:

Group 1	60 tons manure per month
Group 2	20 tons manure per month
Total	80 tons manure per month or 400 tons per five month wintering season

Dennis moved all of his bales in November. He found that round bale set-up time depends largely on hauling distance. The set-up time for one person and one 65 horsepower tractor was:

Group 1	4.5 hours (150 bales)
Group 2	1.5 hours (20 bales)

Feeding times for Dennis' two groups of cattle were:

Group 1	1.0 hour every two days (move three round bale feeders)
Group 2	0.5 hour every three days (move one round bale feeder) plus 0.3 hour per day (feeds some corn silage)

Animal health is excellent. Dennis incurred no veterinary costs in 2002.

Ralph Lentz Farm. Ralph winters two groups over a period of six months. The first group consists of 40 cows and one bull. The second group is 37 calves. The estimated manure output for this time period was:

Group 1	48.0 tons manure per month
Group 2	17.5 tons manure per month
Total	65.5 tons manure per month or 393 tons per six month wintering season

At Ralph's farm, bales are not placed in quantity until January during good weather. The time required for bale placement varies depending upon hauling distance. The chore time for moving bales and placing feeders for both groups of cattle is, at most, two hours per day. This includes checking animal health and fences.

General Observations. Unseasonably wet weather can result in problems with mud and over-disturbance of the feeding area. We find that longer rest the following spring and summer is necessary to compensate for extreme disturbance.

Pure stands of alfalfa do not work well in our system for the following reasons:

- round bale thatching ability – a bale that is half grass shows far less loss over time;
- leaf loss – alfalfa takes far longer to dry when harvesting;
- cows do not like the coarse stems; and,
- a mix of grasses and legumes recover far better from cattle impact than alfalfa.

We find that wintering on cornstalks and/or bean residue does not work as well as on hay fields or grass paddocks. The lack of sod combines with hoof action to create more mud and compaction problems.

Wintering sites have been targeted to optimize the placement of manure. For example, on the Lentz farm, last winter's site was intentionally located on a clay knoll. The combination of hay, manure, and animal impact create extensive pockets for water storage during spring snow melt. Ralph has found that the wintering system seeds the land. He has seen a good increase in red clover and orchardgrass after wintering on these sites.

Overall, animal disease problems are far less. Daily chores are much easier. None of the three of us involved in this project would go back to a conventional confinement system.

## Management Tips

1. This system of wintering is adaptable to any size dairy or beef operation. Severe land disturbance problems can occur when the group size gets to be 60 to 100 cows. However, at this point you can simply divide the cattle into smaller groups.

2. Cold weather doesn't seem to be a problem. However, wind and storm protection must be available.

3. Cows can utilize extremely poor quality hay. If there is waste, the cows will use it for bedding. The adage "pollution is a resource out of place," can be applied here. The organic matter is then returned to the land where it is needed to rebuild the soil. This is extremely important to long-term sustainability.

4. The less livestock are confined, the better. Our system benefits the land, the livestock and the farmer.

## Cooperators

*Steve Draskowski, Extension Educator, Wabasha, MN*  
*Mark Kulig, Natural Resources Conservation Service, Wabasha, MN*

*Larry Gates, Minnesota Department of Natural Resources, Rochester, MN*

*Rodger Meyer, Minnesota Pollution Control Agency, Wabasha, MN*

*Howard Moechnig, Natural Resources Conservation Service, Cannon Falls, MN*

*Chuck Schwartau, Extension Educator, Red Wing, MN*  
*DeEtta Bilek, Sustainable Farming Association of Minnesota, Aldrich, MN*

## Project Location

Lentz Farm: When entering Lake City from the north on Hwy. 61, turn right on Goodhue Cty. 5 and go 2 miles west. Turn left on 340th Street. The farm is .25 miles on the left. Contact Ralph for directions to other cooperators farms.

## Other Resources

Graze-L email discussion group at:

[graze-l@cygnus.taranaki.ac.nz](mailto:graze-l@cygnus.taranaki.ac.nz)

There is also an archive of past discussions at the web site:

<http://grazel.taranaki.ac.nz>

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

Graze. PO Box 48, Beltsville, WI 53508, 608-455-3311, [graze@mhtc.net](mailto:graze@mhtc.net)

Newspaper devoted to grazing. Published ten times per year.

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**Project Duration**

2001 to 2003

**ESAP Contact**

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**Keywords**

animal health,  
management  
intensive grazing,  
medicinal herbs,  
rotational grazing

# Potential of Medicinal Plants for Rotational Grazing

**Project Summary**

An assortment of medicinal plants was introduced into rotationally grazed pastures on three livestock farms to study their effects on herd health. The farmer cooperators developed methods for managing the medicinal plants and made observations on livestock health, livestock preference, and medicinal plant grazing tolerance.

**Project Description**

Dairy farmers have constant concerns about breeding efficiency, somatic cell counts, and other animal health problems. Both farmers with organic herds (organic certification restricts the use of antibiotics and other medications) and farmers trying to improve animal health without antibiotics or hormones are particularly interested in preventative strategies and herbal or holistic remedies. There has been some work done on the herd health benefits of grazing hedge rows and the medicinal properties of plants. Certain plants have been shown to be natural spring or stomach tonics (peppermint) or to aid with calving, pre-breeding, worming (wormswood), or infections.

The possibility that cows could graze on medicinal plants in the pastures and self-medicate as needed is very appealing to the three farmers involved in this project: Dave Minar has a 280 acre grass farm with 135 milking cows in New Prague; Dan French has a 250 acre grass farm with 130 milking cows near Mantorville; and, Doug Gunnink farms 100 acres and grazes replacement heifers and a beef herd near Gaylord. All three farms are intensively rotationally grazed. Paddocks have a high percentage of highly digestible grasses and legumes but lack the variety of herbs and forbs that have potential medicinal qualities. Besides the potential herd health benefits, all three farmers are interested in the added ecological benefits of increasing diversity along field edges – habitat for birds and predatory insects, for example.

Initially, ten species of medicinal plants were planted under the lane wire on the three farms (Table 1). Plants that had poor regrowth after grazing or that were not grazed the first year of the project, were replaced with new plant species in the second year of the project. The cattle could eat the plants each time they passed in the lane but the plants were protected when the pastures were clipped. From the placement of the plants, cattle had access to the plants for several days at a time adding up to about half of the summer. The farmers observed which plants the cattle ate and whether certain groups of cattle were eating particular plants. For example, if cows that typically had trouble calving were eating rosemary, and calving was easier, then rosemary had a potential benefit to that group of cows. The effect of grazing on the plants was also observed. Planting location could be modified for plants that were unable to handle much grazing pressure.

**Results**

Table 1 lists the plants used in both years of this project as well as the two years' observations on cow grazing behavior and on plant response to grazing. From two years of observations, there are a number of plants that cannot tolerate grazing but were readily eaten by the cows. These plants need to be planted in areas that are grazed less frequently, possibly only by cows that have problems, or planted in freshening pastures. Echinacea, because of its apparent intolerance to grazing, may need to be used in special calving or "sick" paddocks where grazing would be infrequent. Willow should probably be planted in paddock corners or outside the fence in remote areas to limit grazing and to avoid damage to fences as the trees grow taller.

**Table 1. Medicinal Plants, Planting Information, Animal Preference and Grazing Tolerance**

<b>Plant Common Name and Health Effects</b>	<b>Planted as</b>	<b>Animal Grazing Behavior</b>	<b>Grazing Tolerance</b>	<b>Winter Survival</b>
<b>Basil</b> Antibacterial and possibly wormer activity	Transplant	Moderate		Died
<b>Catnip</b>	Transplant	Did not eat		
<b>Chicory</b> Very high in minerals such as calcium and sodium; high in copper	Seeded with pasture mix - .5 to 1 lb/A	Ate completely early in the season if medium to low plant density; consumed lightly in the fall	Very good tolerance if grazed on slow rotation; needs rest period	Good
<b>Comfrey</b> Rich in B12, used for hemorrhaging and ulcers, good for bones and ligaments	Tubers	Consumed very well	Good regrowth	Survived
<b>Echinacea</b> Immune system stimulant	2-4" transplants; no-till seeded into pastures	Grazed heavily on some farms, lightly on others	Died due to heavy grazing	
<b>Nettle</b> Used for poor appetite and lung disorders	4" transplants	Grazed very little		
<b>Peppermint</b> Good for colic, gas, and indigestion	5" transplants	New growth consumed lightly, grazed moderately second year	Good regrowth, spread a little	Died on one farm, survived on others
<b>St. John's Wort</b> An astringent; known for soothing qualities	4" transplants	Grazed heavily at two farms, grazed little at third	Moderate growth	
<b>Thyme</b> Aromatic, used for digestive problems like colic	4" transplants	Slight grazing by calves		
<b>Willow</b> Used for fevers and intestinal inflammation	18" cuttings first rooted in water	Ate all of the leaves	May not survive	Died on two farms
<b>Yarrow</b> Aromatic and bitter; used for pneumonia and dysentery	Transplant	Eaten completely at one farm, untouched at others	Grew slowly	

Based on the grazing preference information from the first year, fennel, wormwood, applemint, and burdock were discontinued, fennel and applemint because they were not eaten, and wormwood and burdock because of potential weed problems. Yarrow, catnip, St. John's wort, thyme, nettle, and basil were added to the 2002 plantings. Observations continued for all plants remaining in the pasture. In addition to preference and tolerance for grazing, winter survival was noted.

Chicory and Echinacea were readily eaten by the cows and have the potential to be planted by seed when planting new pasture, though the Echinacea did not compete well with existing plants when no-till seeded into pastures. Chicory was heavily grazed, had good regrowth and winter survival. Comfrey also appears to have potential: it was grazed moderately to heavily and tolerated grazing. There were no trends observed on which cows ate different plants or any noticeable effects on animal health.

## Management Tips

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1. Let the cows nibble on herbs or forbs with medicinal value. Animals instinctively seek out specific plants.
2. Grazed cows are generally in a healthy equilibrium over the long run. Fresh grass and exercise helps keep the animals vigorous and healthy.

## Cooperators

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*Dan French, Farmer, Mantorville, MN*

*Doug Gunnink, Farmer and Consultant, Gaylord, MN*

*Will Winter, Veterinarian, Minneapolis, MN*

*Jerry Brunetti, Agri Dynamics, Easton, PA*

## Project Location

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Contact Dave Minar for directions to project locations.

## Other Resources

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Brunetti, Jerry. 1999. Health from the hedgerow. Acres USA. PO Box 91299, Austin, TX 78709, 800-355-5313.

Web site: [www.acresusa.com](http://www.acresusa.com)

Audiotape of a presentation at the 1999 Acres USA Conference.

Cornell University. Department of Animal Science.

2001. Medicinal plants for livestock. Available at:

[www.ansci.cornell.edu/plants/medicinal/](http://www.ansci.cornell.edu/plants/medicinal/)

This site also includes detailed descriptions of many medicinal plants.

Graziers Supply. 25303 – 461<sup>st</sup> Ave., Gaylord, MN 55334, 507-237-5162. Web site: [www.grassfedisbest.com](http://www.grassfedisbest.com)

Offers consulting services, seed and other products for graziers.

Karreman, H.J. 2002. Natural treatments for dairy cows.

Available on the Complementary, Alternative, and Holistic Veterinary Medicine (AltVetMed)

Web site: <http://altvetmed.com/dairy.html>

The website includes other related articles.



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**Project Duration**

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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 and Description**

We currently farm over 700 acres with Trent's parents. The majority of the acres are in a corn and soybean rotation with some alfalfa acreage and occasionally oats for feed and bedding. We raise butcher chickens, cattle, and purebred Berkshire hogs. We made the switch from Landrace/Yorkshire sows to purebred Berkshire gilts in May 2000 so that we could market in the Berkshire Gold Program. We currently have a 40 sow herd.

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 into a deep bedded system. Also, our whole family has allergies and we wanted to get away from the dust collection that was associated with our old nursery building and move to a more natural ventilation building.

In this project we will study how nursery age pigs gain and interact in a deep bedded 24 x 48' hoop barn. We plan to use 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 will be monitored.

The move to hoop buildings also helps us to be a more environmental 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. This hoop barn fits into our farm's future because it can be used for farrowing, as a nursery, grower, or a

finisher building. The building can also be used for other types of livestock, machinery, or hay storage.

**Results**

The first group of 84 nursery hogs was put in the hoop barn on May 11, 2002. Before moving the 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. The first group stayed in the barn for 41 days and all 84 hogs were taken out on June 23. A total of three round 1,000 lb bales and five small square bales were used for bedding during this period.

We had one runt in the first group. It weighed just 10 lb when he went into the nursery and was 40 lb when moved out 41 days later - a gain of .73 lb/day. The largest hog was 50 lb when moved in and 115 lb when moved out for 1.58 lb/day gain. We fed a total of 12,636 lb (150 lb/head) of feed during this period.

The hottest outside temperature during this period was 85°. The hottest inside temperature was 90°. We spent 22 hours on labor for daily chores over the 41 days and 1.25 hours to clean with the skid loader, tractor, and spreader after the group was removed.

*Trent outside the nursery hoop barn.*



The second group of nursery hogs was put in the nursery beginning on July 16 and taken out October 19, for a total of 96 days. We did a little experiment with this group by not bringing in all the hogs at one time to see how they behaved with split mingling. We put 32 hogs in on July 16, 18 pigs on July 17, and the last 47 on July 20. We were very pleased as they did not fight or single out any pig to pick on and all 97 hogs were moved out. The natural environment of foraging, digging, and burrowing seems to keep them quite active and content.

This group gained better than the first group. The smallest pig went in at 23 lb and left the nursery at 118 lb, gaining .99 lb/day. The largest pig was 51 lb when put in and 218 lb when leaving, gaining 1.74 lb/day. We fed a total of 34,386 lb of feed, or 354 lb/head. A total of 7 round bales and 30 small square bales were used for this group. We had 51 hours of labor with this batch and 3.5 hours of cleaning with machinery.

The second group had both summer and fall weather conditions. During the hotter months, the temperatures inside the hoop were 5° warmer than the outside temperatures. Whereas, when the outside temperatures became cooler, the inside temperatures averaged 11° warmer than the outside temperatures. The manure pack temperatures usually ranged 40 to 60° warmer than the barn temperature.

We are quite pleased with the hoop barn as a nursery. We have not yet had a single death among either of the two groups that used the barn. The one-pen system is a nice change. We noticed that the pigs get used to the one-pen system while in the nursery, and when they are moved to the finisher hoop barn, they adapt very easily because it is the same setup only on a larger scale. It is nice to not have a separate pen for the runt pigs. Even though the runts do not catch up to the larger pigs, they seem to be much more active and healthy than what we used to see in our old confinement barn.

The only thing we would change about this nursery barn is the vent doors. We made hinged green treated plywood doors with latches along both sides. We thought these vent doors would provide more air circulation on hot days because the building is situated between other buildings with a lot of protection from trees. However, with the manure pack and nosey pigs these vent doors were not a very good idea. We like the bi-fold doors that we have on our nursery hoop barn.

We have not yet tried the hoop barn as a nursery for pigs in the winter. Next year's report will have results of moving small pigs into the hoop barn from a heated farrowing facility.

## Management Tips

1. Bed the floor of the barn immediately after cleaning to maintain ground heat.
2. Use plenty of bedding so the pigs can burrow without digging in the ground.
3. Do not use corn stalk bales for bedding in a nursery hoop in the winter. Corn stalks do not provide enough heat.
4. Bi-fold doors are a good investment. You can drop the doors from the top down to provide fresh air while keeping a direct draft off the pigs.

## Cooperators

*Wayne Martin, University of Minnesota Alternative Swine Program, St. Paul, 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.



*Berkshire pigs in the hoop nursery.*

### Principal Investigator

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### Project Duration

2000 to 2002

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### Keywords

beef cow/calf,  
CRP land, gopher  
control, grass-  
based, pasture  
renovation,  
rotational grazing,  
sheep

# Programmatic Approach to Pasture Renovation for Cell Grazing

## Project Summary

Land that has been in the Conservation Reserve Program (CRP) was brought into production using cell grazing with a beef cow/calf herd and stockers. The majority of the pastures were kept in the grazing cycle while renovations occur. Many of the renovations dealt with heavy weed infestations and gophers.

## Project Description

The Rafter P Ranch is a forage-based beef and sheep operation in West Central Minnesota. The ranch consists of 480 acres of hay and grazing land set in the rolling hills along the Chippewa River. At the beginning of 2002, we were stocked with 60 stock cows and 250 ewes. During the year we liquidated our beef enterprise and expanded to 600 ewes. All of the mature stock is rotationally grazed from mid-April to late fall or early winter. The pastures are a combination of tillable and native vegetation lands.

Much of the land that is being grazed was former crop ground that was seeded to alfalfa and orchardgrass in 1997. When we seeded the ranch, we realized that we would have to renovate it someday to maintain high quality pastures. In 1999, we rented 160 acres of former CRP ground that was mostly old brome grass. This ground needed renovation to increase its carrying capacity. It provided us with the impetus to do the additional renovation on the homeplace. Gopher mounds, thistles, and rocks

were particular problems we needed to deal with in the former CRP areas.

This was the final year of a three year pasture renovation project. In 2000, we devoted 35 acres to this project using a combination of minimum and no-till methods. During this process one of our goals was to do the renovation with minimal effect on grazing days. We were interested in increasing the productivity of the pastures through legume introduction and species diversification. At the start of the project, our pastures were primarily brome grass with an insignificant amount of alfalfa.

## Results

We chose to begin renovation on two sites in 2000. We used five acres at each site. The first parcel was on the homeplace, the upper half of a nine acre field with steep slopes and a heavy thistle infestation. The second was a 28.6 acre former CRP field that has sloping land and a gopher problem. Over time, the gophers in the CRP field were not as much of a problem as the thistles on the home field. The gophers were probably the cheapest tillage we have. The grass was always the tallest around and on the top of the mounds. The thistles were so thick in the home field planned for renovation that the cattle would not graze the area, leaving a high percentage of the forage untouched. At

*Dan (far right)  
explains his pasture  
renovation plan.*



both sites, we used a field cultivator with 7" sweeps. This worked to knock down the gopher mounds and scratch a shallow seedbed but multiple passes were necessary.

The seeding consisted of 50 lb each of orchardgrass, annual ryegrass, perennial ryegrass, alfalfa and red clover seed mixed with fertilizer and spread over the ten acres. Seed was spread by the co-op in early April followed by a light dragging. In late summer, we made the decision to spray part of the new planting with an herbicide to control the thistle, sacrificing the legume plants to save the grass. We planned to reintroduce alfalfa and clover in 2001 where herbicide was applied in 2000 to control thistles.

The results of the 2000 renovation were good, with very good stands of mixed forages where only brome grass was before and the pastures carried livestock all summer long due to the alfalfa that was seeded into them. From our experience with the 2000 renovation, we are very pleased with the ability of renovated pastures to keep on producing even during the establishment year. The home parcel was grazed three times in 2000. About 100 animal units grazed this site on May 29, 2000 for two days, only 50 days after it was seeded. The second parcel was clipped to a height of 6" early in June. About 100 animal units grazed this site for two days on June 29, 2000. The two renovated pastures carried about 800 animal unit days or a total of 26 AUM (animal unit months) or 2.6 AUM/A for the year even though they had been worked to the point of bare ground in early April. This compares to 3.27 to 3.82 AUM/A in 1999.

The 2001 renovation was planned for spring but was delayed by major flooding. We decided to postpone the seeding until fall, trying a dormant seeding just before freeze-up. We grazed the two parcels, totaling 26 acres, very close then used a heavy box scraper to pull the tops off of the gopher mounds. The scraper also picked up any rocks that were laying on the surface and allowed us to get them into a pile. We pulled the scraper with the blade just one-half inch or so above the ground to disturb as little soil as possible and yet do a good job of leveling. In mid-November, a Haybuster no-till drill was rented from the NRCS office and used to seed 15 lb/A of a commercial seed blend of 40% alfalfa, 20% orchardgrass, 20% tall fescue, 10% timothy, 7% tetraploid perennial ryegrass, and 3% ladino clover. We switched to the box scraper and no-till drill after experiencing some poor stands last year that we attributed to poor seed to soil contact when using the field cultivator and air seeder last year.

In 2001, the year after renovation, pastures continued to improve. They recovered from grazing better. They also had weaning weights which increased by 10 lb while carrying five more cow/calf pairs, 75 more ewes and they still had hay to cut. In August, 2001 the new seeding was green and the old brome pasture adjacent to it was brown and drying up.

Renovation expenses for these two sites in 2000 and 2001 are shown in Table 1.

**Table 1. Renovation Expenses per Acre, 2000 and 2001**

2000 Input	Expenses/A 2000	2001 Input	Expenses/A 2001
Fertilizer (21N, 100P, 20K)	\$ 24.31	Fertilizer applied to 2000 seeding (40N, 0P, 0K)	\$16.56
Seed: 5 lb/A – Mixture of: Penlate orchardgrass Linn perennial ryegrass TetraMax perennial ryegrass Hurricane annual ryegrass Columbia 2000 alfalfa Marathon red clover	\$ 41.60	BLM3 Croplan Mix	\$34.41
Chemical: 2 pt/A Curtail	\$ 9.23		
Spray chemical	\$ 4.40		
Field cultivation: 4 passes @\$6.00/A/pass	\$ 24.00		
Apply fertilizer and plant seed	\$ 4.50	Apply fertilizer and plant seed (drill rental/tractor use)	\$12.54





*Pasture before (left) and after (right) grazing.*

In November 2001, the final renovation sites were leveled using a box scraper and seeded with a minimum till drill. This seed was dormant until spring. Due to the unusually cool and dry spring, we feel our stands were reduced and the existing brome was a strong competitor. It was very difficult to see any of the seedlings in the spring. In August, 2002 it began to rain and by the end of August you could begin to see the effects of the seeding. Based on the stand that was visible at the end of August, we are anticipating a better mix in the pastures in 2003. We were able to hold our grazing days nearly stable throughout the three year project on even the most severe of the tillage treatments.

When comparing reseeding treatments we are happiest with the field where the most severe tillage took place. The stand is much more uniform and thicker in this area and production in the year of renovation was the greatest. We found if we truly wanted to affect the final mix in the pasture we needed to deal with the existing vegetation severely to reduce competition in the seeding year. The spring seeding resulted in no loss of production in the overall unit because by the time the older pastures had been grazed the new seeding was ready to be clipped or grazed itself. The fall dormant seeding however needed a bit more management as there were plants of varying stages of development and it was difficult to determine when to graze the paddock.

We expected the fall dormant seeding to be more successful than it was. We believe the success of this method is very dependant on the weather and that controlling the plant to plant competition is a key element of success. With high seed costs, the risk of stand failure may not be worth the cost.

## Management Tips

1. It is important to manage competition with weeds and other existing plants if a major species change is desired.
2. Chemical control of thistles seems to be the fastest and surest way to stop their spread and competition with desired species. Eliminating thistles increases the utilization of the pasture. However, you sacrifice a loss of legume and the cost to reestablish them.
3. Make a light application of nitrogen in mid-June after seedlings are established. This should eliminate some of the reduction in forage yields during the renovation year.
4. We much preferred the box scraper method of leveling. It did a better job, was faster and less expensive, plus the rocks disappeared as we worked. It did require that the pasture be burned or grazed very short prior to use.
5. It is not necessary to keep livestock off of the new seeding as long as good grazing practices are followed and the paddock is given plenty of rest time.

## Cooperators

*Eric Tufton, Hoffman Co-op Agronomy Center, Hoffman, MN*  
*Greg Cuomo, West Central Research and Outreach Center, Morris, MN*

## Project Location

From Hoffman, MN at Hwy. 55, go south on Grant Cty. 5 for 3.1 miles to the intersection with an unnumbered township road on the left. Turn left. The driveway (which is .5 mile long) is .75 mile on the right. Or, from Kensington, at Hwy. 55, go south on Douglas Cty. 1 to the edge of town, turn right on Township Rd. 99. Go 3.5 miles, the driveway is on the left.

## 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)

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

University of Wisconsin Extension Service. 1993. Pastures for profit: A guide to rotational grazing. WI No. A3529 or MN Publication No. AG-FO-6145. University of Wisconsin Extension Service, Madison, WI, 608-262-3346 or University of Minnesota Extension Service, St. Paul, MN, 612-625-8173 or 800-876-8636.

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### Project Duration

2001 to 2003

### ESAP Contact

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### Keywords

grazing season  
extension,  
perennial  
ryegrass, tall  
fescue, winter-  
hardy forages

# Can New Perennial Grasses Extend Minnesota's Grazing Season?

## Project Summary

Perennial ryegrass and tall fescue are important grasses globally that have not been commonly used for forage in Minnesota. Both have a reputation for inadequate winter hardiness, and tall fescue has been reported to be less palatable than other grasses. Nevertheless, both grass species have characteristics that warrant their evaluation for grazing systems in Minnesota. Since 2000, we have seeded several varieties each of perennial ryegrass, tall fescue, and festulolium (a cross between ryegrass and fescue) on three farms and three University of Minnesota research stations, and evaluated their performance compared to more commonly used grasses. In general, so far, perennial ryegrass has had better first year productivity and higher forage quality, but tall fescue has demonstrated better second year productivity and persistence. Tall fescue has also demonstrated strong potential as stockpiled forage for fall grazing. Some varieties of festulolium have also looked promising, but festulolium varieties vary greatly. Persistence performance of these grass species through another winter will tell us much more about their adaptation and potential use in Minnesota.

## Project Description

Well managed pasture provides high quality forage. On average, pasture is available for 120 days in northern Minnesota to 180 days in southern Minnesota.

The potential exists to extend the grazing season by at least 60-90 days if appropriate

species and management regimes could be identified to provide grazing earlier in spring and later in fall. This would be a significant cost savings to livestock producers and reduce the use of non-renewable resources.

Tall fescue and perennial ryegrass are species that have not been commonly recommended for forage use in Minnesota. Farmers are interested in using them, and new varieties are available. To evaluate the potential of new varieties for Minnesota, we seeded replicated plots with over 20 varieties on three farms and three experiment stations. All varieties are being grazed, and yield, persistence, palatability, and forage quality are being evaluated.

Three farms are taking part in this project: a dairy grazing farm in Dover (Olmsted County) operated by Chuck Henry; an Angus cow-calf grazing farm in Spring Valley (Fillmore County) operated by Dan Miller; and, a commercial cow-calf grazing farm in Leonard (Clearwater County) operated by Todd Johnson of Johnson Farms.

The three University sites are: North Central Research and Outreach Center (NCROC) at Grand Rapids, where the plots are grazed by beef cow-calf pairs; West Central Research and Outreach Center (WCROC) at Morris where plots are cut to simulate grazing; and, St. Paul Campus Farm where plots are grazed by sheep.

*Paul describing grass research results at Dan Miller's field day.*





## Results

The results included below are summaries of the research conducted. For complete data and analysis for all varieties contact Paul Peterson. The grasses planted at each site are listed in Table 1.

### 2001

In spring 2001, we seeded four to six varieties of tall fescue and four to five varieties of perennial ryegrass in replicated strips on each of the three farms. Each species was planted in replicated strips in five acre paddocks. Tall fescue varieties included Barolex (Barenbrug), Martin 2 (Cebeco International), Courtenay and Montebello (Dawson, Canada), Kokanee (Parsons, Canada), and Hykor festulolium (DLF). About one-half of each paddock was seeded with red clover.

Perennial ryegrass varieties included BG-34 and BG-23 (Barenbrug), Respect (Cebeco International), Spring Green

festulolium (Olds Seed), and the turf-type 'WH x TQ' (University of Minnesota). About one-half of each paddock was seeded with 'Alice' white clover.

The Miller Farm plots were broadcast seeded in a tilled seedbed on May 17, 2001, with an oat companion crop. The plots at the Henry Farm were drilled into a tilled seedbed on May 18, 2001; no companion crop was used. The plots at the Johnson Farm were seeded with a Brillion seeder in a tilled seedbed on June 23-24, 2001. Planting was late due to unusually wet spring soil conditions and no companion crop was used. Target seeding rates were 30 to 35 lb/A for perennial ryegrass varieties (20 to 25 lb/A at Johnson Farm), and 20 to 25 lb/A for tall fescue varieties. Where planted, red clover and white clover were seeded at 6 to 8 and 2 to 3 lb/A, respectively, and oats seeded at 2 bu/A.

The spring 2001 seeding at the Miller Farm produced one crop of oat hay in early July and one grazing in October-November after application of 30 lb N/A in early October.

**Table 1. Species and Varieties of Grasses Planted at Six Locations**

Species	Variety	Miller Farm	Henry Farm	Johnson Farm	Grand Rapids	Morris	St. Paul
<b>Perennial Ryegrass</b>	BG-34	X	X	X	X	X	X
	BG-23	X	X	X			
	WH x TQ			X	X	X	X
	Bandit					X	
	Respect	X	X	X	X	X	X
	Barfort				X	X	X
	WH Select					X	X
	P101				X	X	X
	Grand Daddy				X	X	X
<b>Festulolium</b>	Hykor	X	X	X		X	X
	Spring Green	X	X	X		X	X
	Emrys				X	X	
<b>Tall Fescue</b>	Montebello	X	X	X		X	X
	Courtenay	X	X	X		X	X
	Select				X	X	X
	Kokanee	X	X	X		X	X
	Barolex	X	X	X	X	X	X
	Martin 2	X	X	X	X	X	X
	Ky 31				X	X	X
	Jesup MaxQ				X	X	
	Jesup E-				X	X	
<b>Meadow Fescue</b>	WMF-1					X	X
<b>Orchardgrass</b>	Ambassador				X		
	Takena				X	X	
	Benchmark				X	X	X
<b>Reed Canarygrass</b>	Palaton				X	X	X
<b>Smooth Bromegrass</b>	Alpha				X	X	X

Despite seedling damage from an early season heavy rain and hail, the year was generally very dry. After removal of the oat hay crop, stands looked questionable. However, by fall, stands looked good and thus establishment was successful.

The spring 2001 seeding at the Henry Farm produced the most forage of the three on-farm sites. The ryegrass and fescue plots were utilized four times during 2001. They were lightly grazed in early July, chopped in early September, then grazed in both November and December. Plots received about 200 lb N/A during 2001 in split applications of 35, 35, 65, and 65 lb N/A. This site also experienced drought during 2001, but not as severe or prolonged as at the Miller Farm.

The late seeding at the Johnson Farm was followed by drought, so no forage was utilized during 2001. To reduce broadleaf weed pressure, however, the field was clipped and windrows blown back on the field with a chopper in mid-September. Despite initially slow and some sparse-looking establishment, plots appeared uniformly thick and green in October. Plots received only 45 lb N/A during 2001 in one application incorporated prior to seeding.

Replicated small plot trials of 18 varieties were seeded at the NCROC at Grand Rapids and the WCROC at Morris in August 2000. Due to generally poor winter survival over the 2000-2001 winter at Morris, those plots were terminated and new plots with the same and some additional varieties (25 total) were seeded in August 2001. The reseeding included three Canadian fescues that should have better winterhardiness than the fescues used in the original seeding attempt. In October 2001, the reseeded plots had good stands. Similar entries were seeded at St. Paul in August 2001.

The August 2000 seeding at Grand Rapids generally had good winter survival, so those plots were rotationally grazed by beef cow-calf pairs four times during 2001. The first three grazing periods were initiated on May 31, July 5, and August 1. Eight replications of all varieties were seeded so that the fourth and final grazing period could occur at different times on four of the eight replications. The “early” final grazing period began on September 17. The “late” final grazing period, designed to represent grazing of stockpiled forage, began on October 31. Plots received a total of 150 lb N/A during 2001 in split applications of 50, 50, 30, and 20 lb N/A.

Early indications suggest marginal winter hardiness of perennial ryegrass and tall fescue in western Minnesota. However, the preliminary observations of superior winterhardiness of varieties of perennial ryegrasses developed at the University of Minnesota and the testing

of tall fescue varieties developed in Canada may yield varieties of these species that can persist in western Minnesota.

Based on just one winter, survival of these species was considerably better at Grand Rapids probably due to more consistent snow cover in that region of the state. Performance of several of the species and varieties at Grand Rapids and on the cooperating farms are encouraging. However, it is too early to draw any definitive conclusions from this project since winter survival is one of the key issues that will determine the potential of these species.

## 2002

Stand and vigor of plots after one winter on the Miller farm were observed on April 26, 2002. All entries survived well, averaging about 75% stand. Tall fescue generally had better vigor than perennial ryegrass. Spring Green festulolium had greater vigor than perennial ryegrass, and Hykor festulolium had greater vigor than tall fescue. Kokanee tall fescue had the least spring vigor.

The Miller plots received 120 lb N/A in 2002 split in two applications. The five ryegrass acres produced six 1,300 lb bales in three cuttings, for a total of 3.9 tons/A. The tall fescue plots produced seven 1,300 lb bales, or 4.5 tons/A. In addition, in early December, 54 Angus cows averaging 1,250 lb grazed the entire ten acres for four days. Cattle readily grazed both tall fescue and perennial ryegrass, but showed a slight preference for ryegrass. Tall fescue varieties produced more stockpiled forage. The fescues also seemed to be more drought and heat tolerant than the ryegrasses.

The plots on the Henry farm also produced four crops, but were cut twice and grazed twice. All entries survived the first winter well, with the exception of Respect perennial ryegrass which had spotty winterkill in areas that had been manured and thus some rejected forage late season in 2001. Tall fescue plots produced more forage, particularly where mixed with red clover. Spring Green festulolium performed better than the perennial ryegrasses. Similar results were observed on the Johnson farm, except three crops were produced; two hay cuts and then stockpiled forage grazed in the fall. Based on bale counts, tall fescue plots produced about twice as much forage as perennial ryegrass plots in 2002, one year after seeding.

At Grand Rapids, fall stockpiling in 2001 generally resulted in thinner perennial ryegrass and orchardgrass stands in spring 2002 compared to rotational grazing management in fall 2001 (Table 2). In contrast, tall fescue, smooth brome grass, and reed canarygrass stands appeared to be largely unaffected by grazing management the previous fall. Tall fescue persisted well after two winters, but

perennial ryegrass was severely injured after two winters. Of the ryegrasses, the winter hardy turf-types P101 and WHxTQ had the best survival. Of the fescues, Select and Ky 31 had the greatest stands in May 2002. Orchardgrass varieties did not differ in stand persistence. There was evidence that perennial ryegrass plots recovered to some degree during 2002.

Differences in forage quality among entries within species were relatively small at Grand Rapids during 2001. Both perennial ryegrass and tall fescue tended to produce lower fiber (ADF and NDF) concentrations than orchardgrass, suggesting higher forage quality. Also, perennial ryegrass tended to have about two percentage units higher NDF digestibility over the season than tall fescue or orchardgrass (56.8 vs. 54.6% NDF), suggesting more digestible fiber and thus higher forage quality. Forage quality data from 2002 are not yet available.

Total fiber content (NDF) was about nine percentage units higher (59.1% vs. 50.5%), and NDF digestibility about nine units lower (53.2% vs. 61.9%) in summer compared to spring, suggesting considerably higher forage quality

of tall fescue and perennial ryegrass in spring compared to summer. In spring, NDF digestibility of perennial ryegrasses was particularly high, averaging about six percentage units higher than for other grasses in the trial. In contrast, in summer, ryegrass tended to have the lowest NDF digestibility.

At St. Paul, spring 2002 stands of all entries were about 90% or greater survival rate with the exception of Ky 31 and Kokanee tall fescue, and Palaton reed canarygrass. Fall grazing management did not influence total season yields at St. Paul, perhaps because the rotationally grazed treatment produced two fall grazing periods that totaled the same forage produced in one grazing of stockpiled forage in the other treatment. BG-34 and Respect were consistently among the highest yielding (avg. 3.8 ton DM/A) perennial ryegrasses at St. Paul regardless of fall grazing management. The festulolium entries were the highest yielding grasses in the trial, averaging 4.4 tons DM/A. Tall fescue, meadow fescue, and Hykor festulolium produced about double the stockpiled forage of perennial ryegrass. In contrast, at the June 12 harvest, perennial ryegrass (P101) and Spring Green festulolium produced about twice as much forage as tall

**Table 2. Stands of perennial cool-season grasses seeded at Grand Rapids, MN, in August 2000, and rotationally grazed by cow-calf pairs in 2001; and percent change in stands from Sept. 2000 to May 2002 as influenced by fall grazing management in 2001**

Species	Variety	Sept. 2000	May 2001	May 2002			
				Fall Rotational <sup>a</sup>		Fall Stockpiled <sup>a</sup>	
				% Stand	Change <sup>b</sup>	% Stand	Change <sup>b</sup>
Perennial Ryegrass	P101	98	73	<b>48<sup>c</sup></b>	-48	<b>18</b>	-82
	WHxTQ	98	87	<b>40</b>	-59	<b>22</b>	-77
	BG-34	100	91	21	-78	5	-95
	Grand Daddy	98	89	11	-87	2	-95
	Barfort	97	89	9	-87	1	-97
	Respect	99	90	6	-91	2	-98
Festulolium	Emrys	99	45	0	-99	0	-100
Tall Fescue	Select	94	75	<b>79</b>	-16	<b>81</b>	-12
	Ky 31	93	71	<b>75</b>	-15	<b>76</b>	-19
	Martin 2	95	66	<b>77</b>	-18	61	-34
	Jesup MaxQ	92	60	<b>68</b>	-26	64	-27
	Barolex	93	56	64	-29	59	-33
	Jesup E-	47	19	29	-10	30	-25
Orchardgrass	Benchmark	89	86	82	-1	62	-33
	Takena	90	91	77	-11	66	-26
	Ambassador	92	84	82	-10	55	-37
Smooth Bromegrass	Alpha	94	84	71	-23	84	-11
Reed Canarygrass	Palaton	58	53	15	-31	33	-37
Mean		90	72	48	-40	41	-51

<sup>a</sup>Fall grazing management treatment: rotational grazing vs. August stockpiling for fall grazing

<sup>b</sup>Change in percent stand from Sept. 2000 to May 2002

<sup>c</sup>Entries with values in **bold** were statistically among the highest within a species and column.

fescue at St. Paul. Of the tall fescues, Select and Barolex produced the most forage on June 12, which was similar to Hykor festulolium.

At Morris, ryegrass and Spring Green festulolium were less productive relative to tall fescue than at St. Paul. However, as at St. Paul, tall fescue and Hykor festulolium produced about twice as much stockpiled forage as perennial ryegrass and Spring Green festulolium. The three festulolium demonstrated highly variable performance. Emrys performed poorly due to inadequate winter survival. Spring Green was intermediate in performance due to some winter injury. Hykor was the top performing festulolium. Jesup MaxQ established, whereas Jesup E- did not; however, Jesup MaxQ did not persist as well as other tall fescue entries and was thus not one of the higher yielding tall fescue entries at Morris in 2002. The two Canadian tall fescue varieties Montebello and Courtenay together with Select tall fescue were consistently the most productive tall fescue entries at Morris; Hykor festulolium performed similarly to these entries. The perennial ryegrass entries did not vary greatly in 2002 yield performance at Morris, with the exception of Grand Daddy which had low yield due to poor winter survival.

After two years of research a few generalities are emerging. Perennial ryegrass had better first year productivity and higher forage quality, but tall fescue has demonstrated better second year productivity and persistence. Tall fescue has also demonstrated strong potential as stockpiled forage for fall grazing. Some varieties of festulolium have also looked promising, but festulolium varieties vary greatly.

## Management Tips

1. Do not plant large acreages to monoculture perennial ryegrass; it may not persist beyond two winters. Plant it either in mixtures or on small acreages.
2. Tall fescue varieties are showing good persistence and stockpiling ability. However, seeding year productivity following spring seeding is limited. Stockpile established stands by taking a hay cutting or removing livestock around August 1 and fertilize with 50-60 lb N/A for fall grazing.
3. Festuloliums include varieties with diverse performance. Spring Green festulolium performance is similar to perennial ryegrasses, whereas Hykor festulolium performs more like tall fescue. Emrys festulolium has not persisted well in any of our trials.

## Cooperators

*Greg Cuomo, Station Head and Agronomist, WCROC, Morris, MN*

*Nancy Ehlke, Agronomist, University of Minnesota, St. Paul, MN*

*Chuck Henry, Farmer, Dover, MN*

*Todd Johnson, Farmer, Leonard, MN*

*Russ Mathison, Research Agronomist, NCROC, Grand Rapids, MN*

*Dan Miller, Farmer, Spring Valley, MN*

*Terrance Nennich, Regional Extension Educator, Bagley, MN*

*Craig Sheaffer, Agronomist, University of Minnesota, St. Paul, MN*

*Av Singh, Agronomist, WCROC, Morris, MN*

## Project Location

Contact Paul Peterson for directions to the farms involved in this project.

## Other Resources

Jim Gerrish, 21451 Ivy Drive, Brookfield, MO, 64268, JRGerrish@hotmail.com

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

Dan Undersander, Forage Agronomist, Department of Agronomy, University of Wisconsin, 1575 Linden Drive, Madison, WI 53717, 608-263-5070, email: djunders@facstaff.wisc.edu



***Chuck Henry, dairy grazer, measuring yields in perennial ryegrass and tall fescue demonstration, using a rising plate meter.***

**Principal Investigators**

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**Project Duration**

2001 to 2003

**ESAP Contact**

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**Keywords**

alternative swine  
system, antibiotic-  
free hogs,  
co-mingling,  
marketing, pen  
farrowing, winter  
farrowing

# High Value Pork Production for Niman Ranch Using a Modified Swedish System

**Project Summary**

We farm 350 acres where we grow corn, oats, hay, and pasture. We try to feed all of our crops to our livestock. We have an 80 cow beef herd and finish out the calves. We also have a 50 sow farrow-to-finish hog operation. A small flock of sheep, chickens, and rabbits complete our farm. My wife, Diane, and our children, Hannah (17) and Ethan (12), all help on the farm.

Since 1998 we have been selling our pigs to Niman Ranch, a pork marketing company based in Iowa. In return for a premium and a solid floor price, we raise pigs with bedding and without antibiotics. It has been a very good market for us. Part of their humane protocol requires no use of crates for farrowing. When our old barn that was used for farrowing burned in April 2000, we decided to use a hog house built on our farm in 1989 for winter farrowing rather than build a new building.

We will monitor the effectiveness of winter farrowing in this hog house. This building had been a nursery-to-grower combination building; hence, we dubbed it a “starter” hog house. We will modify this building to meet the farrowing requirements of Niman Ranch. Also, Niman Ranch needs more hogs of market size in the summer months and we want to have hogs available for that market.

*Pigs in co-mingling area.*

**Project Description**

During the summer of 2001 we remodeled our 30 x 48' starter hog house to make it ready for winter farrowing. The remodeling included installing an insulated ceiling with chimney ventilation. The chimneys are 2 x 2' with a sliding plywood baffle. This replaced an insulated roof with an open ridge. Waterers and feed troughs were modified to accommodate 10 lb piglets to 500 lb sows. The feed trough was 10" deep with a 3.5" lip with 15" wide openings with solid dividers. It also has a homemade plywood feeder that runs on the outside wall the length of the building. Small pigs could climb into the trough with their front legs but would not get trapped with the solid dividers. The waterers were trough style also, with lower heights for the small piglets.

The building has a 7' x 4" gutter that I clean with a tractor loader. The building was divided into four pens, each with a 12 x 12' bedded area next to the gutter.

We built gates from home-sawed oak boards that allowed us to make three farrowing pens in each 12 x 12' section, giving us a total of 12 farrowing pens in the building. The pens were



constructed as trapezoids, allowing the sows more room to turn around and making an obvious choice for the creep area. The pens were made to be disassembled. A 2 x 2.5' piece of plywood was used as a door that is dropped in to keep the sow in or out of her farrowing pen.

The building was rewired and a 110,000 BTU LB White heater was installed. Originally, we were not going to use any supplemental heat, but we decided to include the LB White along with heat lamps in a creep area. As one of our advisors said, "After all, this is a Minnesota winter you are trying to farrow in."

## Results

We had 47 sows farrow in the building from late November through February of 2002. On November 29, 2001, our first pigs were farrowed in our remodeled "starter house." This was the beginning of a group of 11 sows. These sows and their piglets were co-mingled at three weeks of age in a group nursing situation in another building. We weaned an average of 10.6 pigs per litter.

In the middle of January we farrowed a group of 18 in our 12 pens. The extra six litters were moved to various sites on the farm at 2 to 3 days old. These sites included places that had not been satisfactory during the previous winter. But they worked very well if the pigs were a couple of days old. We even put a hut on dirt in the back of our cattle shed. That litter had no death loss! At three weeks of age, the litters were all co-mingled in another building. This group had an average weaning of 9.9 pigs per litter.

Finally, another group of 18 sows farrowed in the latter half of February with the extra six litters moved out at 2 to 3 days old. The 12 litters in the starter hog house remained and at three weeks the farrowing pens were removed for each set of three litters to co-mingle.

Our weaning numbers compare very well with the Adult Farm Management Records from 56 farms of similar size from across the state of Minnesota. We had a weaning average 10.5 pigs per litter whereas, the Adult Farm Management participants have an average of 8.7 (Table 1). We also compared the death loss from birth to co-mingling because, on typical hog farms, the weaning age is similar to our co-mingling age of three weeks. Our system had a much lower death loss percentage than the Adult Farm Management group. The numbers are a little hard to compare because of many variables including parity number. Our sows were all second litter. Obviously, the Adult Farm Management Records include many gilts.

In general, we had a very successful winter farrowing. Co-mingling occurred on average at three weeks of age

**Table 1. 2001-2002 Winter Farrowing Comparisons with Adult Farm Management Records**

Farrowing Month	Number of Litters	Death Loss from Birth to Co-mingling	Litter Size Weaned
December	11	6.1%	10.6
January	18	5.1%	9.9
February	18	4.8%	11.0
Adult Farm Management Records	433	14.0%	8.7

with weaning at an average of nine weeks of age. The late weaning has really helped with raising the pigs without antibiotics. We lost one pig per night due to crushing for the first three nights after the December pigs were co-mingled. We started leaving the lights on and the losses stopped. We left the lights on for January and February's co-mingling and had no crushing losses.

Our biggest problem was after co-mingling the January sows and litters for group nursing. It was 18 large litters. Even though it was a mild winter, we had too many pigs that couldn't make it in the group nursing setting. We euthanized several runts. It may have been too many litters in one group.

Of course, the winter of 2001-2002 was one of the mildest on record. We only used 75 gal of LP for the entire winter in our three farrowings.

In 2002, we concentrated on remodeling our two hog houses that serve as "pre-wean to finish." We move the sows and their litters into them when the piglets are approximately four weeks old. The pigs stay in the same building until they are sold as market hogs. In one building we installed an insulated ceiling with chimney ventilation much like our "starter" hog house remodel. In the other building, we completely replaced the entire deteriorating west wall with an insulated wall with drop down insulated doors. Both remodeling efforts were to "tighten up" the buildings to make them warmer for the group nursing situations in the winter. With tighter buildings we wanted to compare the benefits of supplemental heat in a creep area in group nursing situations. We also compared sizes of group nursing situations.

We had another very successful winter farrowing in 2002-2003. Co-mingling occurred on average at four weeks of age with weaning at an average of nine weeks of age. Although our numbers were not as impressive as last winter's numbers, we were still above industry averages



**Table 2. 2002-2003 Winter Farrowing Comparisons with Adult Farm Management Records**

	Number of Litters	Number Born Alive (Avg.)	Number at Co-mingling (Total)	Death Loss from Birth to Co-mingling	Number at Weaning per Litter	Death Loss % from Co-mingling to Weaning
December Farrowing	10	11.3	108	4.4%	10.0	7.4
January Farrowing	15	10.3	136	12.2%	8.8	2.9
February Farrowing	11	10.5	100	13.0%	8.9	2.0
Adult Farm Management Records		10.1		14.0%	8.7	

(Table 2). We were able to lower our death loss during group nursing. In the December 2002 farrowing we used group nursing groups of five sows and litters with no heated creep areas. We housed all 15 sows in one group in the January group with a heated creep area.

Based on our death loss percentages, the heated creep areas appear to be more important than group nursing size. The February group had no heated creep areas, but this is really a group nursing in early spring instead of a winter situation. The pigs that we lost in the group nursing situations were primarily pigs that didn't compete well and fell further behind. We did have a higher death loss this year prior to co-mingling. There were many reasons for this including very weak pigs born, castration losses of herniated pigs, and crushing losses.

Next year I plan on trying to wean the runts and non-competitive pigs early and isolate them and to give more TLC before they regress too much.

### Management Tips

1. For farrowing or group nursing situations in the winter, make sure your building is well insulated and tight, and provide supplemental heat.
2. Use heated creeps in both farrowing and group nursing situations.
3. Keep the lights on when you co-mingle the sows and pigs. This will help prevent the crushing of little pigs.
4. Smaller groups are not as important as adequate space and heated creep areas.
5. Co-mingling of sows and pigs works well at three weeks of age.
6. Do not over-crowd the sows and pigs when co-mingling. Not enough space may cause too many pigs to not make it in a group nursing setting.
7. Group nursing works well for late weaning situations. It saves tremendous labor.

8. When considering remodeling or building a new structure, put together an advisory team of engineers, people with experience in alternative housing systems, university swine researchers, and farmers using alternative systems. They will provide very good information and help you see the numerous issues you need to deal with.

### Cooperators

Dwight Ault, Farmer, Austin, MN  
 Glen Bernard, Farmer, Rushford, MN  
 Dick Carroll, Farmer, Austin, MN  
 Joe Hahn, Architect, Harmony, MN  
 Diane Halvorson, Animal Welfare Institute, Northfield, MN  
 Marlene Halvorson, Resource on Swedish Systems, Northfield, MN  
 Lori Janzen, Niman Ranch, Thornton, IA  
 Larry Jacobson, Engineer, University of MN, St. Paul, MN  
 Arvid Jovaag, Farmer, Austin, MN  
 Wayne Martin, University of Minnesota, St. Paul, MN  
 Dave Munkel, Construction Manager, Lime Springs, IA  
 Paul Willis, Niman Ranch, Thornton, IA

### Project Location

From Spring Valley go south 5 miles on US Hwy. 63. Turn right on Cty. Rd. 14 and go 11 miles and turn left (south) on township road. Farm is .25 mile on the right.

### Other Resources

Alternative Swine Production Systems Program,  
 University of Minnesota, 385 Animal Science Building,  
 1988 Fitch Ave., St. Paul, MN 55108, 877-258-4647,  
 marito067@umn.edu

Niman Ranch Pork Company of Iowa, 2228 Eagle Ave.,  
 Thornton, IA 50479, 515-998-2683, [www.nimanranch.com](http://www.nimanranch.com)

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.

**Principal Investigator**

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**Project Duration**

2000 to 2003

**ESAP Contact**

Meg Moynihan  
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**Keywords**

dairy, forage,  
grazing maize,  
input costs,  
organic, sorghum-  
sudangrass, winter  
feeding

# High Quality – Low Input Forages for Winter Feeding Lactating Dairy Cows

**Project Summary**

Dairyman and crop farmer Mark Simon undertook this project to evaluate brown midrib sorghum-sudangrass and grazing maize as alternatives to winter grain feeding for his dairy operation. Mark was interested in looking at labor, costs, and feed values compared to his current system. Over the past two years, he tried conventional field preparation and no-till seeding. Late, wet springs and dry summers the first two years affected the project, and a wet spring and summer in the final year prevented him from making the kind of progress he had hoped. Despite these difficulties, Mark believes that with more modifications in experiment location and field preparation, these crops can fit into his farming operation.

**Project Description and Results**

I have a forage-based organic dairy farm on about 160 acres near New Prague in Rice County. The dairy has been certified organic for three years, and cropland has been certified for six. Roughly 33 acres of my land is peat ground, 11 acres is woodland, 16 acres is pasture. The remaining 90 are rolling hayfields. I raise my own forages. I own about 95 head of milk cows and young stock (currently milking 30 head). Breeds are Holstein, Holstein x Shorthorn, Holstein x Dutch Belt, Shorthorn, Shorthorn x Dutch Belt, Shorthorn x Jersey, and Dutch Belt x Jersey. My herd is well-adapted to grazing and forage consumption. Lactating cows get 2 lb of grain/day and average 35 to 40 lb of milk/day. My wife, Mary, and my father help me on the farm, along with various hired teenagers who help with haying. Several custom machine operators handle baling.

I started this project because I was looking for a high-energy winter feed for my lactating dairy cattle. My grazing group discussed both grazing maize and sorghum-sudangrass, which are reported to have high feed values as summer replacement feed. I thought I'd like to try these as stored winter feed.

One of our big obstacles in dairy farming is the cost of inputs. I feel that by lowering my inputs I can free up more money to pay down debt and eventually have more free time with my family and to do more direct marketing. I hoped that the project findings would help small operators like me find alternative means of producing a high energy feed without using a lot of costly inputs.

For this demonstration project, I wanted to experiment with several different forages, types of tillage, planting, and harvesting. I also wanted to try double cropping to get more forage per acre. My idea was to plant brown midrib sorghum-sudangrass, grazing maize, and annual ryegrass to harvest and store for winter feeding.

Sorghum-sudangrass is a hybrid cross between forage sorghum and sudangrass. It is a warm season annual grass, 5 to 12' tall, with an aggressive root system. Reported benefits include smothering weeds, suppressing some types of nematodes, and improving tilth of compacted soils. It is widely adapted and, once established, can tolerate very dry conditions. On a fertile soil with ample moisture, multiple cuttings can yield up to 9 tons of dry matter per acre. When mowed, tops grow back green and vegetative until frost. Tillers can produce as many as six stalks per plant. *Hoard's Dairyman* has reported crude protein in silage between 5.8 and 15.2%, depending on plant height at cutting. According to Penn State University, there is risk of prussic acid poisoning, so producers should harvest after the plants are at least 30" tall, delay feeding after frost, and/or ensile for at least four weeks before feeding.

'Grazing maize' is also a warm season grass. It is the same species as regular field corn (*Zea mays* L.). 'Grazing maize' was selected for forage characteristics like leafiness, digestible nutrient content, and protein content, which can range from 11 to 16% in the vegetative plant parts (Mundy,

1995). Some farmers and extension educators in New Zealand, Australia, the Midwestern U.S., and Canada have reported acceptable gain in beef cattle and milk production in dairy cows on grazing maize, and have remarked that the crop compliments other forages, adding flexibility to their systems. In addition, while requiring some investment for fencing and watering, grazing can save producers money in areas like combining, transportation, drying, storing, feeding and manure management (Gompert, n.d.).

My tillage treatments included direct seeding into a prepared seedbed with a planter, and no-till drilling into residue. Ideally, I would plant in May and chop the forage when it was 4 or 5' tall. Any taller and it would be hard to cut with a haybine. I also figured that once it was wrapped in bales it would be easier to feed at this length. In addition, I wanted to try blowing crops into my silo in layers so I could monitor production and herd health on each type of feed. I also planned to test forage quality using the resources of my local Dairy Herd Improvement Association (DHIA).

Weather has impacted the project since it started. We had a wet spring and early summer in 2000. Soil at the experiment location is a clayey, 'gumbo' type soil, and, although the land is tilled, it remained too wet to work until early August, when my father and I plowed, disked, and dragged 13 acres. I seeded 'Baldridge' grazing maize and brown midrib sorgum-sudangrass with a drill. Soybean/milo mix seed was not available. After planting, it barely rained until November and nothing came up in my experimental plots. I planned to order seed and plant earlier in 2001.

Spring 2001 was moist, too. The ground was too wet to work until after the weeds grew too tall to till under. I cut the field for hay, then planted the brown midrib sorghum-sudangrass and 'Baldridge' grazing maize using a rented no-till planter. Because of my uncertainty about the experiment after last year, I chose not to invest in forage soybean/milo seed mixture. Drought again this year produced nothing except foxtail and some other weeds. The seed I planted didn't germinate or germinated and then did not get enough moisture to continue growing.

While I did not get a crop off to test for feed value in 2001, I did evaluate some of the harvest practices. I found that at \$25/ton, wet-baling and wet-wrapping bales is very expensive compared to filling my own silo. Filling my 238 ton silo with wet-wrapped bales would cost almost \$6,000. Filling it myself would cost \$1,000 to \$1,500.

In May 2002, I plowed a peat field on lower ground than the fields I used in previous years, since dry conditions during the first two summers of the project negatively

affected my experiment. After an early, wet spring, several family members had health problems, which prevented us from getting the seeding done. Neighbors were busy seeding their own crops. Needless to say, the weeds soon took over and, since the field had only been plowed, it was too rough to cut. Then we had over 16" of rain between June and September, which prevented us from establishing the experiment.

Conventional seedbed preparation by plowing and disking didn't work, and I was not impressed with no-till performance. I thought minimum tillage would be a better option, but we ran into trouble not being able to cut this year, as I described earlier. It seems that weather has been a factor in the project from the beginning. Even though the experiment hasn't worked out the way I had hoped, I still think there is much left to be learned with this project and I am optimistic that my idea will turn out in a positive way.

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## Management Tips

1. Persistence is important when trying something new. Sometimes a project may still have merit, even though it doesn't work right away.
2. Grazing groups and veteran farmers can be great sources of information and ideas.
3. Farmers should work with tillage and harvesting systems that they are familiar with, even though experimenting is good.
4. Farmers should be aware that there are a number of alternative forages and harvesting practices available for them to try.

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## Cooperators

*Brad Carlson, Rice County Extension Educator,  
Faribault, MN*  
*Doug Gunnink, Consultant, Gaylord, MN*  
*Caroline van Schaik, Land Stewardship Project, White  
Bear Lake, MN*

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## Project Location

From the Twin Cities go south on 35W to Hwy. 19. Exit west, continue through Lonsdale to Veseli. Turn west, going through Veseli to 45<sup>th</sup> St. W. Farm is third place on the south side. It has a long driveway and white buildings with green roofs.

## Other Resources

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Gompert, Terry. n.d. Grazing corn, turnips and small grains. University of Nebraska Cooperative Extension, PO Box 45, Center, NE 68724, 402-288-4224.

*Graze* (Formerly *Pasture Talk*) PO Box 48, Belleville, WI 53508, 608-455-3311. Available at: [graze@mhtc.net](mailto:graze@mhtc.net)  
Devoted to grazing, published ten times each year.

Mundy, Victoria. 1995. It's not just for combining anymore. Experiences with a new summer annual: grazing maize. Nebraska Sustainable Agriculture Society Newsletter, PO Box 736, Hartington, NE 68739, 402-254-2289.

Mundy, V., B.E. Anderson, T.L. Gompert, T.L. Mader, and C.A. Shapiro. 1997. *Zea mays* grazing in cattle production systems. Pp. 29-3, 29-4. In Proc. XVIII Int. Grassl. Congr. Winnipeg, Manitoba and Saskatoon, Saskatchewan, Canada.

Penn State University. Penn State Extension Circular 396 – harvesting and utilizing silage. Department of Dairy and Animal Science. 324 William L. Henning Building  
University Park, PA 16802-3504, 814-865-1362.  
Available at: [www.das.psu.edu](http://www.das.psu.edu)

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

Underwood, John F., and R.W. Van Keuren. n.d. Emergency and supplemental crops for forage, AGF-019-90. The Ohio State University Extension. Columbus, OH.  
Available at: <http://ohioline.osu.edu/agf-fact/0019.html>

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**Project Duration**

2000 to 2003

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**Keywords**

Berkshire hogs,  
crates, farrow to  
finish, hogs, nest  
boxes, pens

# Farrowing Crates vs. Pens vs. Nest Boxes

**Project Summary**

This project used an on-farm study to compare sow behavior and weaning success rates when farrowing was done in crates, pens, and nest boxes. The Stassens recorded information on pigs born alive, number crushed, and number weaned from sows in eight conventional crates, eight nest boxes, and eight pens. Starting with gilts, three to four farrowing cycles were observed by the end of the project.

**Project Description**

Steve Stassen and his family raise purebred Berkshire hogs for alternative markets and for direct marketing top end gilts to other growers for breeding stock. They raise corn and beans in rotation on 18 acres and have 35 acres of pasture. Their operation has evolved from crossbred Berkshires to a purebred herd and Steve has found a niche, and potential for increased profits, in marketing purebreds and naturally raised hogs. Steve is a qualified producer for Niman Ranch which provides a premium price for hogs sold to east and west coast markets.

All of the Stassens are involved with the farm. Steve and his wife, Jane, have four children: Amber (18), Kimberly (15), Stephanie (13), and Matthew (11). The kids raise Jersey steers for direct marketing and sheep for 4-H projects. Steve also works at Glacial Plains Cooperative in Kerkhoven. He has raised hogs on his farm for more than ten years and grew up helping his father raise hogs. Steve is president of the county Pork Producers Board and serves on the boards of the American Berkshire Association and University of Minnesota's Swine Task Force.

*The Stassen kids are now experts at handling pigs in the straw-based system.*

The Stassen farm is set up for environmentally-friendly hog production that emphasizes animal health and well-being. Their original setup included a farrowing house with eight crates. Steve wanted to add capacity with the flexibility to raise hogs for the alternative markets. He also feels that it is more economical to build nest boxes and pens rather than purchase crates and adapt a building to a conventional system.

Steve splits his 40 sow Berkshire herd into two groups with each group farrowing twice per year. He wants to make the operation efficient enough so everyone in his family can be involved.

**Results****2000 Results**

In the initial year of this project, the Stassens moved a used building to the farm for nest-box farrowing and built a hoop barn for farrowing pens and for use as a wean-to-finish facility. They compared the pens and nest boxes with conventional crate farrowing which continued in an existing barn.



During this first year, the Stassens reached some preliminary conclusions about each system.

#### *Crates:*

While crates required daily manure scraping, the danger of sows crushing little pigs (especially from birth to four days) was lowest (Table 1). Sows were least protective of their offspring in crates; it was easier for Steve and the Stassen children to handle the little pigs for notching, vaccinations, and other processing.

#### *Nest boxes:*

These stayed cleaner longer than crates, because sows tended to manure in one spot. Steve's sows were good nesters and the restricted space seemed to prevent crushing. Sows seemed to have a better appetite in boxes than in crates, maybe because they were more active. Steve observed that all sows in a group should farrow within seven to ten days so pigs stay with their mothers and sows don't steal from other litters.

#### *Pens:*

Like boxes, the pens stayed cleaner longer than crates because of sow manuring habits. Pens had the greatest danger of sows crushing little pigs when rolling over during farrowing. Steve thought guard rails might help this situation. It was relatively easy for Steve and the children to move through pens and do chores, but it was more difficult to separate little pigs from their mothers for processing in pens than in crates. As with boxes, appetites were better than for crated animals. Steve found that all sows in a group should be introduced to the pen system at the same time because adding one later created problems in the group.

The first year of their project, the Stassens learned to manage for "boss" sows in the more natural setting by making more room between pens. Boss sows want to be closer to feed and water, so extra room has to be made to accommodate timid sows and make sure they get enough to eat and drink. For more details about farrowing setup and first year results, see *Greenbook 2001* available at: [www.mda.state.mn.us](http://www.mda.state.mn.us) or by calling the Minnesota Department of Agriculture.

### **2001 Results**

In 2001, the Stassens built off what they learned during the initial year of the project. To make the best use of available space, they switched farrowing pens from the hoop barn to the building they had moved onto the farm the previous year, and moved nest boxes from the used building to the hoop barn.

Another change the Stassens made in 2001 was position of the nest boxes. Steve and his family found that nest boxes worked best when the sow had access to both ends. Before, they had the boxes up against a wall. The sows didn't like to back out of boxes and sometimes stood on the sides, damaging the boxes. When the sows could climb into the boxes from either end, they seemed more comfortable and less stressed.

After observing "boss" sow behavior in 2000, Steve allowed plenty of room between the boxes in the hoop house, because when boxes were too close, the boss sows chased the gilts or young sows away.

The Stassens found advantages and drawbacks to the nest box system. One benefit was crush protection during farrowing that was better than pens and similar to crates (Table 1). In this more natural setting, sows could come and go as they wanted. Exercise seemed to boost their appetite and made for bigger pigs at weaning. Steve and his family also observed that the sows weaned out of the boxes and those weaned out of the pens came into heat better than the sows from crates.

Limiting factors to the nest box system were space and flexibility. Steve says you need plenty of room in the front and back for easy access, and room between the boxes prevents the sows from fighting. He also found that using the boxes in the hoop barn limited farrowing to a certain time of year. The boxes worked best when the temperature was 55 to 60°F or higher – from mid-April to the end of September. "If it gets any colder, the pigs scour and pile under the sow and more crushing results," Steve said.

Steve also made improvements to the pen system. One of his ideas at the end of 2000 was to add rails and bumper guards to the pens to encourage sows to settle down more quickly, like they did in the nest boxes. He added them this year and said they seemed to help.

After observing "boss" sow behavior in 2000 and the way the boss sows kept the more timid sows from food and water, Steve separated the sows in the pens with gates so that each sow had a pen for farrowing and a separate place for feed and water. With these changes, Steve and his family felt the pens worked fairly well.

Steve suspects his family's situation may be different from that of other producers because of the type of pigs they have chosen to raise for specialty markets. With the added value of their specialty market, Steve says they need to save as many pigs as they can. He says that the purebred pigs can be weaker and more susceptible at birth than crossbred animals with hybrid vigor.



## 2002 Results

The Stassens started this project in order to compare the performance of crates, pens, and nest boxes. By 2002, they had enough information to make some decisions for their operation (Table 1). At one point, Steve thought he might not continue to use the pens along with the farrowing crates, but changed his mind after he observed how well the sows and gilts adjusted and adapted to the system with bedding. He added bumpers to the pens to cut down on the risk of crushing. He also adjusted the breeding schedule so as not to farrow between mid-June and mid-August, because of the heat. The Stassens decided to keep using the crates and the pens, but to stop using the nest boxes, mostly because the boxes require so much more space.

Steve and his family noticed that the sows weaned from pens and nest boxes came into heat better than the sows weaned from the crates. They also observed that sows who have farrowed twice or more in the pens adapt very well and seem to be the best mothers. Even the biggest sows did well in the pen system. The Stassens learned that if they process the little pigs at less than four days of age, the sows don't get as excited and ear notching can occur right in the pen.

Steve said he and his kids have really enjoyed working with this project because the pigs react well to the systems they are using, and are easy to work with. All by themselves, the kids have weaned sows, gotten the crates or pens and boxes cleaned, then put sows in the cleaned systems. It seems the sows are easier to handle when using bedding and pens during gestation, lactation, nursery, and finishing.

Reflecting on what he and his family have learned during the three years of this project, Steve says that other farmers could experiment with remodeling older buildings to accommodate these farrowing systems. He recommends that additional research be done about how cross bred sows would do in these systems compared to the purebreds he uses. Since the sows are adjusting to being on bedding during gestation and farrowing, Steve says he plans to

continue using crates and pens. The nest boxes are nice, but can only be used seasonally, since they take a lot of space and require an insulated building in harsh weather.

Would he recommend this system to others? Steve said he would recommend the pen system to farmers who have a specialty market and raise a moderate number of pigs. "If someone had 100 sows, it would be a lot of work to do all by yourself," Steve said. "But the straw system is nice to work with because of the way the sows like straw and it has less odor and dust than conventional systems."

Steve says he has discussed his methods with a few neighbors who are considering conversion to a straw system. "I feel more people would be interested in his system, but we need two things," said Pete. "First, we need consumer demand for pork raised this way. The other thing we need are better prices for pigs raised in this system. You cannot raise any hog in any system for under \$30."

## Management Tips

1. Avoid farrowing in the extreme heat of summer (mid-June to mid-August) because sows get too hot and lazy, and the risk of crushing little pigs increases.
2. Make sure temperature in the farrowing area is above 55°F. Otherwise, pigs are more likely to pile under the sow and be crushed.
3. When using pens, separate the farrowing area from feed and water. This method limits the power of "boss" sows.
4. If you process little pigs at less than four days of age, sows don't get excited and processing can occur right in the pens.
5. Compared to sows that farrow in crates, sows that farrow at least once in the pen system seem to come into heat better and to be better mothers.

**Table 1. Comparison of Farrowing Methods 2000 to 2002**

Farrowing Method	Avg. No. Born			Avg. No. Alive			Avg. No. Weaned		
	2000	2001	2002	2000	2001	2002	2000	2001	2002
Crate	8.77	8.85	10.45	8.14	8.30	9.06	7.14	6.90	7.60
Pen	8.40	8.65	9.44	8.00	8.10	8.36	6.40	6.35	7.26
Nest box	8.00	8.40	9.45	8.00	8.00	8.66	7.00	6.60	7.36

## Cooperators

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*Wayne Martin, Alternative Swine Production Systems*

*Program, St. Paul, MN*

*Jim Van Der Pol, Farmer, Kerhoven, MN*

## Project Location

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One mile south of Kerkhoven on Swift Cty. 35. Go straight ahead on gravel road 1 mile south. The Stassen farm is on the east side of the road.

## Other Resources

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

Dwight Ault, Farmer, Austin, MN, 507-437-3085. Dwight has used a Swedish deep straw farrowing system since 1996.

Nolan Jungclaus, Farmer, Lake Lillian, MN, 320-664-4843. Nolan has used a Swedish deep straw farrowing system since 1995.

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.

### Principal Investigator

Ralph Stelling  
Ral-Den Dairy  
RR 1, Box 19  
Millville, MN  
55957  
507-798-2410  
Wabasha County

### Project Duration

2000 to 2003

### ESAP Contact

Meg Moynihan  
651-297-8916

### Keywords

dairy, forage  
production,  
rotational  
grazing,  
sorghum-  
sudangrass

# Forage Production to Maintain One Mature Animal Per Acre for 12 Months

## Project Summary

This project involved improving forage produced from paddocks in order to feed an animal year round. By grazing dairy cows and producing quality feed at optimum times, Ralph Stelling hopes to produce enough pasture and hay to maintain 185 mature cows and heifers for 12 months, reducing the amount of winter feed purchased for his dairy cows and eliminating grain supplements.

## Project Description

Ralph and Phyllis Stelling, son Dennis, and daughter-in-law Ronda operate Ral-Den Dairy, a 180-cow operation on 248 acres. About 185 tillable acres are in pasture, and the rest of the Stellings' land is lightly wooded. All 240 acres are grazed. The Stellings currently milk 115 cows twice daily, use rotational grazing, and emphasize direct marketing. Most of the cows are Jersey, Jersey x Holstein, or Normande x Holstein. They also have a few others breeds.

The Stellings use a management intensive grazing (MIG) system. They currently have about 20 pastures fenced with high tensile fence subdivided with polywire into smaller paddocks as needed. Heifers and dry cows graze the lower quality paddocks, while milk cows rotate through paddocks that contain higher quality forages. Cows are offered grain after each milking; Ralph estimates they consume 10 to 11 lb of grain/animal/day. By improving the paddocks

and the quality of stored feed, Ralph believes he can eliminate purchased grain from the farm budget while maintaining the quality of the animals and milk products.

Ralph has been farming since 1969 and converted to grazing almost ten years ago. Annual profit has increased by about \$500/cow since the conversion, which took two years to complete. While not a seasonal dairy, the Stellings calve in spring and fall, milking minimally in the winter. Production is above average for late lactation cows. Ralph has belonged to a grazing group for eight years and has held many field days at Ral-Den. The Stellings also belong to PastureLand, a group of farmers involved in direct marketing dairy products including butter and cheese.

The goal of the Stellings' project was to produce enough forage on 185 acres to feed 185 mature cows year round. Ralph and Dennis want to make their farm sustainable and eliminate purchased feed. They also want to increase profit and have more family time. During the three years of his demonstration grant, Ralph planned to reseed two-thirds of the farm to grass and legumes that are palatable, highly digestible, and nutritious. Excess pasture would be harvested and stored for winter feeding. Harvesting would be timed to produce the highest quality feed.

*Ralph shows field day visitors what his pastures are producing.*



In 2000, the Stellings planted about 40 acres of ryegrass and Alice grazing white clover for pasture and silage. They rotated dry cows through paddocks and harvested paddocks that were not being grazed to make silage for winter feeding. Harvested forage was tested for protein content, relative feed value (RFV), and calcium content.

Around Memorial Day in 2001, Ralph plowed up about 14 acres of orchardgrass and seeded brown midrib sorghum-sudangrass to begin the process of converting to a new pasture mix. “While the cows like orchardgrass in spring and fall,” he said, “it has a tendency to head out during the heat of summer and the cows don’t like it much then.” Ralph planted sorghum-sudangrass as a quick way to break up the orchardgrass pasture without using chemicals. He said he anticipated a dry season and chose sorghum-sudangrass partly because it is a warm season grass that withstands drought better than many other forages.

Ralph took two cuttings of sorghum-sudangrass: one in late July or early August when the grass was 12 to 13’ tall (cut to a height of 6”), and one after Labor Day. To harvest such tall grass, he used a lacerator and cut slowly. Despite the height at first cutting, the sorghum-sudangrass stems were soft, juicy, and palatable, not woody. The sorghum-sudangrass was piled in a stack, covered with plastic, and fed to the cows throughout the winter.

Ralph followed the sorghum-sudangrass with a mixture of perennial ryegrass and Alice grazing white clover, which he seeded in mid-September. He said this new pasture “looked good” in spring 2002. He seeded another 14-acre pasture with a mixture of ‘Hakari’ mountain brome and clover, and still another five to six-acre pasture with perennial ryegrass and clover.

In addition to sorghum-sudangrass, Ralph tried several other management tools in 2001. He introduced winter rye as an annual forage, seeding in fall to provide early season grazing for the cows in spring 2002. He also tried out pasture irrigation in 2001, watering some of his “better” paddocks.

In 2002, the Stellings grazed the forage mixtures he seeded in fall 2001, used some existing pastures more intensively, and continued to irrigate when needed, although 2002 was a wet year and less irrigation was required. They also fertilized paddocks with composted manure right after grazing.

## Results

Tests from the 2000 silage showed 18% protein, 95 RFV, and average calcium levels. Ralph was pleased with

the results considering that the harvest was completed somewhat late and soon after a rain.

During the winter of 2000, the Stellings were able to reduce their purchased feed by about one-third compared to prior years. One field was harvested twice during the summer rotation. At the end of the grant’s first year, Ralph believed that he and Dennis could have maintained 100 head on 185 acres in a sustainable manner, which is approaching their goal of one animal unit/A.

In 2001, Ralph and Dennis did not conduct any forage quality testing. Ralph estimated that the sorghum-sudangrass yielded 5 to 6 tons/A, and that the feed quality was good to excellent. He observed lots of weeds in the first cut, particularly buttonweed (*Abutilon theophrasti* Medic., also known as “velvetleaf”), which reduced quality. By the second cutting, however, weeds were practically eliminated.

Ralph was particularly pleased with the winter rye he seeded in Fall 2001. The rye was the first thing cows grazed the following spring and when they started grazing, he saw a big jump in milk production. The cows ate the winter rye eagerly – some even passed up the grain offered after milking, preferring to head back to the pasture for more rye. Ralph was also happy with the irrigation he did, estimating that irrigation provided at least one extra grazing when he applied water on an as needed basis.

In 2001, the Stellings had 150 head of mature cattle on the farm and only purchased half the feed they normally buy, putting them closer to their goal of buying no off-farm feed for their cows. Their gross margin in 2001 was \$464/A.

In 2002, the Stellings’ gross margin was \$503/A. At the beginning of the project, the operation supported 0.5 cow/A on pasture and by 2002, had progressed to 0.75 cow/A as a result of planting new grasses, rotating some existing pastures more intensively, fertilizing paddocks with composted manure right after grazing, and using irrigation when needed. The year was a wet one, and Ralph said he irrigated less frequently than in 2001. Forage was again tested for protein and relative feed value. Quality was a little lower this year, which Ralph attributed to untimely rains. Despite the wet season, he observed that there was very little water runoff during heavy rains due to the soil cover that the pasture provided. Several stock ponds even lost water depth because they received less runoff.

Ralph said it is taking longer to get grasses established than he thought it would, so several more years will be required to get to the goal of meeting all the forage needs of 185 head from the farm’s 185 acres in MIG pasture. Nevertheless,

**Table 1. Stelling Gross Margin Analysis 2002**

Number of acres in MIG pasture	185*
Number of paddocks	20
Type of livestock	dairy
Total number of animals	180
Animal units [(total no. of animals x avg. wt)/1000]	219
Number of animal units/A	1.23
Date animals began grazing	4/17/02
Date animals stopped grazing	11/03/02
Total number of days on pasture	190
Estimated labor/day (hours)	2
Tons of hay baled from pastures	406
<b>Productivity of Pasture</b>	
Milk (cwt/cow) produced on IRG pasturing system	11,000
<b>Gross Profit from Pasturing Acres</b>	
Milk sales	\$128,000
Cull cows sold	\$8,400
Calves sold	\$6,400
<b>Total Gross Revenue (all receipts)</b>	<b>\$142,800</b>
<b>Gross Revenue per Grazing Acre</b>	<b>\$793</b>
<b>Variable (Out-of-Pocket) Expenses</b>	
<b>Purchased Feed Costs</b>	
Grain	\$22,500
Concentrates	\$4,000
Minerals/salts	\$2,500
Forage	\$9,500
<b>Total Purchased Feed Costs</b>	<b>\$38,500</b>
<b>Livestock, Pasture and Operating Expenses:</b>	
Milk hauling	\$1,440
Bedding	\$1,500
Veterinarian/medicine costs	\$2,100
Breeding costs	\$4,150
<b>Total Livestock Costs</b>	<b>\$9,190</b>
<b>Pasture Expenses</b>	
Seed costs	\$660
<b>Total Pasture Expenses</b>	<b>\$660</b>
<b>Operating Expenses for Pasture</b>	
Electricity	\$2,800
Supplies	\$800
Fuel costs	\$500
Repair costs (Building/equipment maintenance)	\$1,120
<b>Total Operating Expenses for Pasture</b>	<b>\$5,220</b>
<b>Total Variable Costs</b>	<b>\$53,570</b>
<b>Variable Cost per Grazing Acre</b>	<b>\$290</b>
<b>Gross Margin per Grazing Acre</b>	<b>\$503</b>

\*185 acres are managed intensively. An additional 55 lightly wooded acres are also grazed.

Ralph said his goal of feeding all their dairy cows with farm-grown forages is still in sight. He said he has enough confidence in this system that he would recommend it to other farmers and, although none of his neighbors have adopted the system, their attitude has changed during the three years Ralph has been doing this project and they seem less skeptical. He also recommended that further grass and legume research for pasture systems be done to help make this kind of system more adoptable by other Minnesota farmers.

### Management Tips

1. Continue to plant improved grass varieties.
2. Be aggressive and graze paddocks when ready.
3. Use irrigation when needed in order to maximize yield of quality forage and extend the grazing season.

### Cooperators

*Doug Gunnink, Consultant, Gaylord, MN*

### Project Location

From Zumbro Falls, go east on Hwy. 60 approximately 5 miles to Cty. Rd. 2. Turn right on Cty. Rd. 2. Go 1.5 miles to first gravel road on left, Cty. Rd. 69. Go 2 miles to "T," turn left, go .5 mile, turn left, Stelling farm is first place on left.

### Other Resources

Barenbrug USA. PO Box 239, 33477 Highway 99E, Tangent, OR 97389, 800-547-4101, [www.barusa.com](http://www.barusa.com)  
Seed research company and distributor.

University of Minnesota, West Central Research and Outreach Center, 46352 State Hwy. 329, Morris, MN 56267, 320-589-1711.

Available at: <http://wcroc.coafes.umn.edu>  
Grazing system research and outreach.

# Completed Grant Projects...

Year Completed	Title of Project	Grantee
<b>Livestock Grants</b>		
<b>2001</b>	Grazing Beef Cattle as a Sustainable Agriculture Product in Riparian Areas . . . . .	Frank & Cathy Schiefelbein
	Improvement of Pastures for Horses Through Management Practices . . . . .	Wright County Extension
	Increasing Quality and Quantity of Pasture Forage with Management Intensive Grazing as an Alternative to the Grazing of Wooded Land . . . . .	Michael Harmon
	Supplement Feeding Dairy Cattle on Pasture with Automated Concentrate Feeder . . . . .	Northwest MN Grazing Group
	Viability of Strip Grazing Corn Inter-seeded with a Grass/Legume Mixture. . . . .	Stephen & Patricia Dingels
	First and Second year Grazers in a Year Round Pasture Setting Served by a Frost Free Water System . . . . .	Don & Dan Struxness
	Reviving and Enhancing Soils for Maximizing Performance of Pastures and Livestock. . . . .	Doug Rathke & Connie Karstens
<b>2000</b>	Whole System Management vs. Enterprise Management. . . . .	Dennis Rabe
	Working Prairie – Roots of the Past Sustaining the Future . . . . .	John & Leila Arndt
	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
<b>1999</b>	Low Cost Sow Gestation in Hoop Structure . . . . .	Steve Stassen
	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 Assn. 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
<b>1998</b>	The Values Added Graziers: Building Relationships, Community and Soil. . . . .	Values Added Graziers
	Buffalo: Animal From the Past, Key to the Future . . . . .	Richard & Carolyn Brobjorg
<b>1997</b>	Grass Based Farming in an Intensive Row Crop Community. . . . .	Douglas Fuller



Year Completed	Title of Project	Grantee
	Marketing Development - Small Farm Strategies Project . . . . .	Sustainable Farming Assn. of NE MN
	Pastured Poultry Production and Riparian Area Management . . . . .	Todd Lein
1996	Butcher Hogs on Pasture . . . . .	Michael & Linda Noble
	Developing Pastures Using Various Low-input Practices . . . . .	Ralph Lentz
	Establishing Trees in Paddocks . . . . .	Dave & Diane Serfling
	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
1995	Dairy Waste Management Through Intensive Cell Grazing of Dairy Cattle . . . . .	Scott Gaudette
	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
1994	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
1993	Economics of Rotational Grazing vs. Row Crops . . . . .	Harold Tilstra
	Winter Grazing Study . . . . .	Janet McNally & Brooke Rodgers
1992	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
1991	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

Year Completed	Title of Project	Grantee
<b>Cropping Systems Grants</b>		
<b>2001</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>2000</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
<b>1999</b>	Techniques for More Efficient Utilization of a Vetch Cover	
	Crop for Corn Production . . . . .	Carmen Fernholz
	Forage Mixture Performance . . . . .	Itasca County SWCD
	Growing Corn with Companion Crop Legumes for	
	High Protein Silage. . . . .	Stanley Smith
	Inter-seeding Hairy Vetch in Sunflower and Corn . . . . .	Red Lake County Extension
<b>1998</b>	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
	CRP in a Crop Rotation Program . . . . .	Jaime DeRosier
<b>1997</b>	Evaluating Kura Clover for Long-term Persistence . . . . .	Bob & Patty Durovec
	Timing Cultivation to Reduce Herbicide Use in Ridge-till Soybeans. . . . .	Ed Huseby
	Sustainable Agriculture in Schools. . . . .	Toivola-Meadowlands School
<b>1995</b>	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
<b>1994</b>	Weed Control and Fertility Benefits of Several Mulches and Winter Rye Cover Crop . . . . .	Gary & Maureen Vosejpka
	Energy Conserving Strip Cropping Systems . . . . .	Gyles Randall
	Integration of Nutrient Management Strategies with	
	Conservation Tillage Systems for Protection of Highly Eroded Land and Lakes in West Otter Tail County . . . . .	Harold Stanislawski
<b>1993</b>	Reducing Soil Insecticide Use on Corn Through Integrated	
	Pest Management . . . . .	Ken Ostlie

Year Completed	Title of Project	Grantee
1993	Annual Medics: Cover Crops for Nitrogen Sources. . . . .	Craig C. Sheaffer
	Biological Weed Control in Field Windbreaks . . . . .	Tim Finseth
	Fine-tuning Low-input Weed Control. . . . .	David Baird
	Flame Weeding of Corn to Reduce Herbicide Reliance . . . . .	Mille Lacs County Extension
1992	Chemical Free Double-cropping . . . . .	Jeff Mueller
	Demonstration of Land Stewardship Techniques in the Red River Valley . . . . .	Donald H. Ogaard
	Early Tall Oat and Soybean Double Crop . . . . .	Charles D. Weber
	Nitrogen Utilization from Legume Residue in Western MN. . . . .	Arvid Johnson
1991	Alternative Methods of Weed Control in Corn . . . . .	Sr. Esther Nickel
	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
1990	Hairy Vetch and Winter Rye as Cover Crops . . . . .	Mark Ackland

## Manure & Nutrient Management

2001	Agricultural Use of Rock Fines as a Sustainable Soil Amendment. . . . .	Carl Rosen
	Turkey Litter: More is Not Always Better . . . . .	Meierhofer Farms
	Land Application of Mortality Compost to Improve Soil and Water Quality . . . .	Neil C. Hansen
2000	Applying Manure to Corn at Agronomic Rates. . . . .	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
1998	The Winona Farm Compost Strategies . . . . .	Richard J. Gallien
1997	An Evaluation of Variable Rate Fertility Use on Ridged Corn and Soybeans . . . . .	Howard Kittleson
	Farming Practices for Improving Soil Quality . . . . .	Sustainable Farming Assn. of SC MN
1996	Converting from a Corn-Soybean to a Corn-Soybean-Oat-Alfalfa Rotation . . . . .	Eugene Bakko
	Manure Application on Ridge-till: Fall vs. Spring . . . . .	Dwight Ault
1995	Building Soil Humus Without Animal Manures . . . . .	Gerry Wass
	Controlled Microbial Composting to Improve Soil Fertility . . . . .	Howard & Mable Brelje

Year Completed	Title of Project	Grantee
1994	Manure Management/Utilization Demonstration. . . . .	Timothy Arlt
	Taconite as a Soil Amendment . . . . .	Donald E. Anderson
1992	Cooperative Manure Composting Demonstration and Experiment . . . . .	Rich Vander Ziel
	Economically and Environmentally Sound Management of Livestock Waste . . . . .	Fred G. Bergsrud
	NITRO Alfalfa, Hog Manure, and Urea as Nitrogen Sources in a Small Grain, Corn, Soybean Crop Rotation . . . . .	Carmen M. Fernholz
1991	Soil Building and Maintenance . . . . .	Larry H. Olson
1990	Strip-cropping Legumes with Specialty Crops for Low-cost Mulching and Reduced Fertilizer/Herbicide Inputs . . . . .	Mark Zumwinkle

## Alternative Markets & Specialty Crops

2001	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
2000	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
1999	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

Year Completed	Title of Project	Grantee
1998	Cultural and Management Techniques for Buckwheat Production and Marketing . . . . .	Tom Bilek
	Development of Mating Disruption and Mass Trapping Strategy for Apple Leafminer . . . . .	Bernard & Rosanne Buehler
	Jessenland Organic Fruits Project . . . . .	MN New Country School
	Pond Production of Yellow Perch . . . . .	John Reynolds
1997	Alternative Point Sources of Water . . . . .	Joseph & Mary Routh
	Comparison of Alternative and Conventional Management of Carrot Aster Leafhoppers . . . . .	MN Fruit & Vegetable Growers Assn.
	Establishing and Maintaining Warm Season Grasses (Native Grasses) . . . . .	Pope County SWCD
	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
1996	Community Shared Agriculture and Season Extension for Northern MN . . . . .	John Fisher-Merritt
	Living Mulch, Organic Mulch, Bare Ground Comparison . . . . .	Dan & Gilda Gieske
1994	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
1991	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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# **Big Woods Dairy at Nerstrand-Big Woods State Park**

The Big Woods Dairy is the only modern operating dairy farm within a state park in the nation. This unique distinction provides an opportunity to share farm life with the public during designated tour days. The everyday challenges and rewards of working a grass-based dairy operation will come to life through the eyes of Phil and Dawn Brossard, a young couple who have agreed to rent the farm and cooperate with several state agencies in a demonstration of sustainable agriculture. 2002 marks the halfway point in the ten-year relationship between Minnesota State Parks and Phil and Dawn.

The Brossards moved on the farm in January 1997 to begin the dairy operation. The Brossards and their three children, Amber, Trent, and Seth are working more than 50 head of dairy cattle using a system of rotational grazing on about 80 acres of state owned land. The Brossards also rent an additional 40 acres from a neighbor which is being incorporated into the grazing system. The demonstration project will continue through 2006 at which time the Brossards hope to have the dairy herd paid for and the assets accumulated to purchase their own dairy farm.

The Brossards' efforts, along with measurements of the environment surrounding the farm, will be recorded for several years. The Minnesota Department of Natural Resources (DNR), the Minnesota Department of Agriculture (MDA), The Nature Conservancy, and many other partners hope to gain valuable economic, social, and environmental data from this demonstration. An Advisory Committee of local, state and federal agencies, the extension service, non-profit organizations, and area residents was formed to oversee the demonstration, monitoring, and outreach activities for the project.

### **Monitoring Nutrient/Manure Management - *Tom Coffman (NRCS) and Brad Carlson (Rice County Extension)***

Phil and Dawn Brossard are working with Tom Coffman of the Natural Resources Conservation Service (NRCS) and Brad Carlson, Rice County Extension Educator, to ensure that the manure from the dairy is not polluting the environment. The farm is located near an intermittent stream and keeping excess nutrients from entering the stream is a priority.

The Brossards were the recipients of cost-share funds from the USDA's Environmental Quality Incentives Program (EQIP) to prevent pollution from leaving the building site. The funds provided earth-moving work to divert water around the feedlot to prevent movement of nutrients to the stream. Rain gutters were put on the barn to help keep clean water from washing over the lot. A hoop structure was built in 1999 that allows the dry cows and heifers to be under cover with straw as bedding. The hoop building will prevent manure runoff.

Technically, it is possible to manage all the manure on the pastures contained within the Big Woods Dairy, but restrictions placed by the county feedlot ordinance make it very difficult. Because of the presence of an intermittent stream running along the east border of the property, manure is required to be injected in order to maximize spreading acreage. However, the act of injecting manure causes major damage to the pastures by ripping up the grasses, weeds then grow in the disturbed rips, and the ruts made by the injection makes it very difficult to drive machinery across the pastures.

The application problems described above contributed to Phil's decision to work with the neighboring farmer who raises corn and soybeans. Phil provides the neighbor with manure in exchange for corn to feed the cows. There is now significantly more flexibility in the manure management plan for the farm.



### Monitoring Soil Quality - Mark Zumwinkle (MDA)

Good soil quality allows the land to be productive, soak up the rainfall, and keep nutrients in the soil so they do not escape and cause pollution problems elsewhere. This demonstration farm serves as a great place to do a long-term study looking at changes in soil quality in a grass-based system and how this system affects the natural environment.

A group of University of Minnesota and MDA soil scientists, extension educators, and farmers are looking at the benefits and/or problems that arise from land being in grass with a management intensive grazing system. The study focuses on changes in soil quality over time on 18 acres of newly seeded pastures the Brossards began renting in 2000. This land was in row crop production and now is part of the grazing system.

In the pasture system, soil samples taken in 1999 showed a higher pH, substantially lower nitrate nitrogen, and an increase in organic matter in the top 3" compared to the corn ground. Applications of commercial nitrogen fertilizers are known to lower soil pH. The pasture system eliminates the added commercial nitrogen. It makes sense that our monitoring may be picking up a real increase in pH. This would be a benefit to legumes in the pasture system. A pH of 6.3 or greater is optimal for nitrogen fixation by rhizobia.

The 50% reduction in nitrate nitrogen under the pasture system may be showing that this system is less prone to nitrogen loss downward. Also, a reduction in immediately available nitrogen further increases the likelihood of optimizing biological nitrogen fixation by the legumes. The legume will harbor more nitrogen fixing nodules at a low level of soil nitrate.

The increased organic matter at the near-surface in the pasture system is promising, so we will continue to monitor this parameter.

Long-term monitoring using a Purdue Rainfall Simulator will track changes in phosphorus movement through the soil, changes in aggregate stability of the soil, changes in soil organic matter, water infiltration rates, and how much rainwater the soil can absorb before run-off occurs as the system becomes a grass system. Results will be compared to the adjacent already established pasture.

One question simulated rainfall can help answer is how the dairy is handling intense storms in relation to the corn-beans rotation common in the area. In 2000, an across-the-fence comparison was made between the intensively grazed pasture on the dairy and the newly planted pasture on row crop ground. On May 25, 2000, two rain events (2.3"/hour) were applied to each system. Runoff from 3 x 24' plots was collected and analyzed for sediment, total phosphorus, and runoff volume (Table 1).

**Table 1. Effect of Cropping Systems on Runoff Water Quality (on May 25, 2000)**

Treatment	Cumulative Material Transported One Hour into a 2.3" Rainfall Event	
	Sediment (lb/A)	Total Phosphorus (lb/A)
Pasture	63	0.07
Corn Field	170	0.20

The results were somewhat mixed. The pasture did a good job of filtering the runoff water and reducing both sediment and phosphorus loss when compared to the row crop ground. However, the volume of runoff was high in both systems. One hour into the storm event, the grazing system had reduced sediment losses by 63% and phosphorus losses by 65% (Table 1). The pasture reduced total runoff but was losing nearly 60% of the water applied after one hour. The grass is helping to filter the water but something needs to be done to improve the rate at which water can infiltrate into the soil so that subsoil moisture can be recharged.

The Purdue Rainfall Simulator will be used again in 2003 to further monitor changes in soil quality on this grazing system.

### Monitoring Birds, Frogs, and Toads - Elaine Feikema (Area Naturalist, Nerstrand-Big Woods State Park)

Bird monitoring continued for the fifth season on the Big Woods Dairy. One new species was added, the Eastern Phoebe. Phoebes build nests under overhangs like eaves or rafters and are frequently found on farms near wooded areas. This discovery brought the five-year bird species total to 54. A total of 40 species were seen or heard during the official 2002 bird counts.

The number of amphibian species remained constant. The Brossard family keeps an eye out for new species throughout the year. Frogs and toads are identified by their calls during spring and from observations in the summer.

Why monitor? Healthy land means sustaining the ecosystem that supports the farm. Biodiversity is an important component of a sustainable, productive ecosystem base. Frogs and toads help measure water quality because of their sensitivity to changes in the water. Birds respond to both short and long term changes in the habitat. Together they provide valuable environmental indicators of biodiversity on the Big Woods Dairy Farm. Over the course of ten years we will continue to monitor the conservation measures on the grass-based dairy and the birds, frogs and toads on the farm.

**Table 2. Birds, Frogs, and Toads  
Big Woods Dairy Farm in 1998 to 2002**

<b>BIRDS</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>
Blackbird, Red-winged	X		X	X	X
Bluebird, Eastern		X	X	X	X
Bobolink	X	X	X	X	X
Cardinal, Northern				X	X
Catbird, Gray	X		X	X	X
Chickadee, Black-capped	X	X			X
Cormorant, Double-crested		X		X	X
Cowbird	X	X	X	X	X
Crow, Common	X	X	X	X	X
Dickcissel				X	X
Dove, Mourning	X	X	X	X	X
Duck, Mallard			X	X	X
Flycatcher, Least			X		
Goldfinch, American	X		X	X	X
Grackle, Common		X	X	X	X
Great Blue Heron			X	X	
Grosbeak, Rose-breasted	X		X	X	X
Hawk, Red-tailed		X			
Jay, Blue	X	X		X	X
Kestrel, American				X	
Killdeer	X	X		X	X
Kingbird, Eastern	X	X		X	X
Kingfisher, Belted		X			
Meadowlark, Eastern		X		X	
Meadowlark, Western	X	X	X	X	X
Oriole, Northern		X	X	X	X
Pheasant, Ring-necked	X	X	X	X	X
Phoebe, Eastern					X
Pigeon		X	X	X	X
Robin, American	X	X	X	X	X
Sparrow, Chipping	X	X	X		X
Sparrow, Field				X	X
Sparrow, House	X	X	X	X	X
Sparrow, Savannah	X	X	X	X	X
Sparrow, Song	X	X	X	X	X
Sparrow, Vesper		X		X	X
Starling, European	X	X	X	X	X
Swallow, Barn	X	X	X	X	X
Swallow, Tree	X	X	X	X	X
Swift, Chimney	X	X		X	X
Thrasher, Brown		X			X
Turkey, Wild		X		X	
Vireo, Warbling				X	
Vulture, Turkey		X	X		
Warbler, Tennessee				X	
Warbler, Yellow				X	
Woodpecker, Northern Flicker		X		X	X
Woodpecker, Red-bellied		X			X
Woodpecker, Red-headed	X	X	X		X
Woodpecker, Yellow-bellied Sap	X				
Wren, House	X		X	X	X
Wren, Sedge	X	X		X	
Yellowthroat, Common	X	X		X	X
<b>Total Bird Species</b>	<b>28</b>	<b>36</b>	<b>28</b>	<b>42</b>	<b>40</b>
<b>TOADS AND FROGS</b>					
Chorus Frog	X	X	X	X	X
Leopard Frog	X	X	X	X	X
American Toad	X	X	X	X	X
Tiger Salamander		X		X	X
<b>Total Toads/Frogs Species</b>	<b>3</b>	<b>4</b>	<b>3</b>	<b>4</b>	<b>4</b>

**Monitoring Economics - Chuck Schwartau (Goodhue County Extension) and Phil and Dawn Brossard (Farm Managers)**

Not only is this farm a good demonstration site for monitoring the natural environment, it also serves as a great site for demonstrating the business side of grass-based farming. Farms are economic businesses that use natural resources to generate income for the farm family as well as support for the local economy. Valuable information about the economics of grass-based farming will be collected as well as telling the realities of a young farm family as they begin their farm career in today's economy.

Gene Kuntz, Farm Business Management advisor with whom the Brossards work on their farm management program provided some comments on the 2002 financial situation for the business. It is fair to say the Brossards were subject to the same forces affecting every other dairy in Minnesota. The milk prices didn't allow for much, if any, progress in 2002, but still being in business is some success in itself. There were some shifting numbers within their financial statement, but their bottom line net worth was nearly the same as it was at the end of 2001. Being a grass-based dairy didn't insulate them from low milk prices, but it may have softened some of the impacts affecting other dairy farms.

The Brossards managed to increase production in 2002 due primarily to an excellent and abundant availability of forage production from their pastures. Optimal rain and temperatures during the growing season last year aided in this forage production.

They are managing their herd with more focus on breeding and milk quality. Changes were made to the barn by removing old mats and using sawdust bedding and this has greatly reduced mastitis issues.

The Brossards have also enrolled in the SE Minnesota Dairy Initiative and made excellent use of the resource of this group in directing them to sound management decisions.

The only disappointment was low price received for their milk. This is an industry-wide issue and will plague every dairy producer until we get management of supply and price for Midwestern dairy producers.

The percent return to assets and equity is considerably higher for the Big Woods Dairy than traditional dairies. Much of this difference is due to the fact the land base is leased rather than being purchased. The Brossards' assets are focused more on income-generating assets (cattle) and a relatively small amount in machinery. The cows are high return items. This is also reflected in the asset turnover rate

since milk income easily matches and exceeds the value of the cow and the other overhead items are kept down. This is important for beginning farmers and fits the Brossards' goal of having the cows paid for before they buy their own farm.

### **Tours and Education Opportunities**

The open house changed dramatically in 2002 by offering "Chore Time" tours. Rather than talk about paddocks, electric fences, and water tanks, we went out through the paddocks to get the cows for milking. Here we saw a demonstration of how electricity keeps a herd of cows right where you want them. Instead of just talking about the relationship between vegetative cover, soil quality, and cows, we took a closer look. We identified the many different species of plants and looked at the lifespan of a cow pie to see the dynamic role manure plays in maintaining high quality forage. Instead of mentioning that the dairy does not use chemicals, we talked about the food chain while listening for birds and looking for insects. These hands-on experiences gave visitors an opportunity to connect the various aspects of ecology with the healthy balanced environment they see at the Big Woods Dairy.

Once the cows were secured in their stalls, visitors had an opportunity to feed the calves, look at farm record keeping, see the modern dairy operation, and try milking a cow by hand. Visitors were then invited to enjoy a dairy milkshake as they waited for a shuttle back to their car.

Everyone working on the Chore Time tours enjoyed the informal hands-on approach. Judging from comments, we believe the visitors gained a deeper understanding of the benefits and complexities of rotational grazing.

A schedule of Big Woods Dairy Chore Time Tours will be available at the Nerstrand-Big Woods State Park office and through area newspapers. The farm will be used to demonstrate more sustainable forms of agriculture to students, park visitors, and others through scheduled farm tours. The farm is open for visits only during scheduled tours. For additional information about tours and education opportunities, contact Nerstrand-Big Woods State Park at: 507-344-8848.

For more information about grazing and sustainable agriculture contact Wayne Monsen, MDA's Energy and Sustainable Agriculture Program, 651-282-2261 or Wayne Edgerton, DNR Agricultural Policy Director, 651-297-8341.

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# **Diversification Spotlight: Organic Growth in Minnesota**

Organic production continues to grow in Minnesota. In 2001, according to researchers at USDA Economic Research Service (ERS), there were 421 certified organic growers in Minnesota – the fourth highest in the US behind California, Washington, and Wisconsin. Our state ranks sixth in the nation for most certified organic acreage. The number of certified organic acres in Minnesota grew by 62% between 1997 and 2001 (from 63,685 acres to 103,297 acres).

Minnesota is a top producer of a number of crops:

- #1 in organic corn
- #1 in organic soybeans
- #1 in organic rye
- #1 in total organic beans
- #2 in organic buckwheat
- #3 in organic pasture and hay

Our state is also in the top ten for many other organic agricultural products including oats, wheat, barley, milk cows, hogs and pigs, sheep and lambs, beef cows, and dry beans.

In addition to the certified operations, there are also Minnesota farms that follow organic practices but either choose not to certify, or sell less than \$5,000 in organic produce per year and are thus exempt from certification under provisions of the federal law. We also know that there are farms in transition to organic status. Information about non-certified and traditional operations in Minnesota is not readily available.

One indicator of interest, however, may be response to a new program for transitional growers. Recognizing that sound organic practices can provide resource conservation benefits, the USDA Natural Resources Conservation Service (NRCS) in Minnesota last fall made available a cost-share program for farmers who are transitioning to organic production. During the 36 months of transition required before a crop can be certified organic, producers are exposed to

risk as they learn new management and marketing skills. According to a NRCS news release, in 2002, organic transition cost share incentive payments were approved on 32,819 acres of cropland being converted to organic production, and on 2,212 acres being converted to organic livestock production. More information about this program is available from District Conservationists in Minnesota counties.

The MDA estimates there are also currently 80 to 100 companies certified to process and handle organic products. As the consumer market continues to grow, MDA receives more and more calls from companies who are considering adding organic to their processing and handling operations.

### **New Nationwide Standards**

The first United States Federal organic standards became effective October 21, 2002. They address production, processing and labeling, certification, recordkeeping, and allowed inputs. These standards were developed over more than ten years in response to the Organic Foods Production Act of 1990. Proposed rules were published for public comment twice: in 1997, USDA received 275,603 comments that shaped revisions of the rule. In 2000, nearly 41,000 individuals and organizations commented on the second proposed rule. The Final Rule was published in the Federal Register on December 21, 2000.

According to the Final Rule, products that make organic claims must be certified by a USDA-approved organization. (There is an exemption for farms that earn less than \$5,000/year in organic receipts and sell direct to consumers.) Third-party certification assures consumers that the product was grown and processed according to a set of organic standards, and assures farmers and organic companies that they are operating on an equal footing, under consistent and uniform standards. There are stiff penalties for fraud.

In general, organic crops are grown on land that is managed to reduce erosion and improve soil quality, and are fertilized with non-synthetic nutrients for three years before harvest. A few synthetic nutrients and soil additives appear on a special National List and are allowed. There are strict manure and compost guidelines. Weeds, insects, and other pests are controlled using practices like crop rotation, variety selection, biological control, mulching, and tillage. Most synthetic herbicides and pesticides are prohibited in organic production. Organic livestock must eat feed that is organically grown and handled. If they are grazing animals, the pasture must be organic. Growth hormones and antibiotics are prohibited, as is feeding urea, manure, or animal by-product.

Organic livestock must be raised in conditions that allow access to the outdoors (as appropriate to the species) and appropriate exercise. Ruminants like cows and goats must have access to pasture. Physical alterations such as 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. It is forbidden to withhold medical treatment from a sick animal in an effort to "keep it organic." In such cases, the animal loses its organic status.

In addition to production issues, the Final Rule also contains regulations concerning 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 rule. There must be no opportunity for organic products to mix (or "commingle") with similar non-organic products.

## State and Federal Activities

The Minnesota Department of Agriculture recognizes organics as a choice preferred by a growing number of farmers and consumers. They are a fast-growing sector of the food industry domestically and abroad. The United States Department of Agriculture, the Organic Trade Association, and other groups have been tracking organic sales growth rates at more than 20% per year during the last decade, and predict organic sales will continue to grow as much as 20 to 30% per year.

The Minnesota Department of Agriculture provides information and technical assistance on organic production methods, conversion to organic methods, certification, and marketing of crops and livestock. It also administers a federally-funded cost share program to reimburse certified growers and handlers for a portion of their certification expenses and works with other public, educational,

research, and non-profit groups in the state to coordinate organic activities. One project MDA is currently leading is an Organic Short Course for Ag Professionals series to train agriculture advisors like NRCS staff, extension educators, lenders, rural development authority, and weed inspectors in the basics of organics so they can improve their ability to serve the needs of organic clients.

There is a wealth of information about organics available. Your first stop should probably be the **United States Department of Agriculture National Organic Program (NOP)**, which is in charge of overseeing implementation of the national organic standards. From the National Organic Program you can get a copy of the national standards that govern organic production, processing, handling, labeling, marketing, and sales. All this and more are available at the NOP web site: [www.ams.usda.gov/nop](http://www.ams.usda.gov/nop), or by calling 202-720-3252.

The National Organic Program also maintains a list of organizations that are USDA-accredited to certify organic operations. If you are a grower 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. If you want to locate an accredited certifier that takes clients in Minnesota, contact the MDA Energy and Sustainable Agriculture Program at 651-297-8916 or at: [www.mda.state.mn.us/esap/organic](http://www.mda.state.mn.us/esap/organic)

## 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. You can call 301-504-6559 or visit their web site at: [www.nal.usda.gov/afsic](http://www.nal.usda.gov/afsic)

**Appropriate Technology Transfer for Rural Areas** - an organization that offers many resources about production, marketing, and supplier topics. Reach them at: 800-346-9140 or at: <http://attra.ncat.org>  
See especially their *Overview of Organic Crop Production*.

**Midwest Organic and Sustainable Education Services** - a non-profit organization that educates about organics and sponsors the enormous Upper Midwest Organic Farming Conference each winter. MOSES publishes the *Upper Midwest Organic Resource Directory*. Call 715-772-3153 or visit their web site at: [www.mosesorganic.org/](http://www.mosesorganic.org/)

**Minnesota Organic Farmers Information Exchange** - a network of experienced Minnesota organic farmers who are willing to talk to others who are interested in learning

to grow organically. Information about the program is available at: <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 their brief overview, *About Organic*.

#### **Other MDA Information Resources About Organic and Sustainable Agriculture**

- **Energy and Sustainable Agriculture Program Organic Web Site.** This web site offers information about organics and links to the National Organic Program, production information, certifiers, organic farming groups, and organic product buyers in the Upper Midwest.  
Available at: [www.mda.state.mn.us/esap/organic](http://www.mda.state.mn.us/esap/organic)
- **Sustainable Agriculture Resource & Information Directory.** Updated biennially, this booklet is a list of sustainable agriculture organizations and programs that offer information and assistance to people who want to grow and eat sustainably-produced products. Available at: [www.mda.state.mn.us/esap/esapdirectory.pdf](http://www.mda.state.mn.us/esap/esapdirectory.pdf) or by calling 651-296-7673.
- **Minnesota Grown Program.** This program promotes farm products produced in Minnesota, including organics. A yearly guide highlights farms and farm markets that sell direct to consumers. More information is available online at: [www.mda.state.mn.us/mngrown](http://www.mda.state.mn.us/mngrown) or you can call 800-657-3878.

For more information about organic information and services provided by MDA, or to apply for the certification cost share program, call Meg Moynihan at: 651-297-8916.



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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. It looks beyond the use of preventative regularly scheduled pesticide applications. 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.

## Vegetable and Fruit IPM

The Minnesota Vegetable IPM Newsletter is produced in cooperation with Dr. Bill Hutchison at the University of Minnesota, Entomology Department. 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 can be found at the University of Minnesota web site: [www.vegedge.umn.edu/mnvegnew/mnindex.htm](http://www.vegedge.umn.edu/mnvegnew/mnindex.htm)

The US Environmental Protection Agency (US EPA) funded the "IPM – Food Quality Protection Act - Fruit and Vegetable IPM Survey." Three individual surveys for vegetable, apple, and strawberry growers were developed and mailed in fall, 2001 to assess the impact of the loss of minor use pesticides as part of the Food Quality Protection Act. Results from the survey are available on the MDA web site along with 15 fruit and vegetable grower profiles highlighting the use of IPM or organics on Minnesota farms. Both can be found at: [www.mda.state.mn.us/ipm/ipmpubs.html](http://www.mda.state.mn.us/ipm/ipmpubs.html)

This past year the US EPA funded the production of four 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 guides will be published in spring 2003 and will be available on the MDA web site in early summer. In addition a weekly *Apple & Strawberry Report* is published with information about current pest problems. The Report 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 addition, the IPM program funded several research projects between 2000 and 2003. Figure 1 is a list of these research projects.

## Figure 1. IPM Funded Research Projects

### Selection for Pesticide Resistance in Parasitoids of Green Peach Aphid (2001 – 2003)

*Dr. David Ragsdale, University of Minnesota, Dept. of Entomology.*

They mass reared and released resistant parasitoids of green peach aphid to enhance performance of these beneficial insects in potato pest management.

### Wool Mulching Systems for Specialty Crops (2001 – 2003)

*Mr. Steven Poppe, University of Minnesota, West Central Research and Outreach Center.*

The project looked at providing a safe and reliable weed management alternative in high value specialty crops.

### New Tools for Apple Scab Decision Making (2001 – 2003)

*Dr. Emily Hoover, University of Minnesota, Dept. of Horticultural Science.*

She developed a decision-making tool for monitoring and quantifying apple scab.

### Risk-efficiency and Value of Vegetable IPM Programs (2001 – 2002)

*MN Fruit and Vegetable Association in cooperation with Dr. Bill Hutchison, University of Minnesota, Dept. of Entomology.*

They developed a new method to quantify and present the benefits and risks associated with vegetable IPM programs for researchers, practitioners and clients.

**Weed Management in Niger Production (2001 – 2002)**

*Dr. Hans Kandel, University of Minnesota, Red Lake County Extension Service.*

This project looked at weed and nutrient management in production of niger seed in NW Minnesota.

**Can Canola Control Weeds in Strawberry Fields? (2000 – 2002)**

*Dr. Emily Hoover, University of Minnesota, Dept. of Horticultural Science.*

On-farm research and demonstration in growers' fields evaluated the effectiveness of canola as a weed control strategy in strawberries on a larger scale and in several different climatic regions of Minnesota.

**Implementing Vegetable IPM: Value of On-farm Research and Demonstration (2000 – 2002)**

*Dr. Bill Hutchison, University of Minnesota, Dept. of Entomology.*

This project evaluated and demonstrated new on-farm IPM practices for cabbage, sweet corn, and cucurbit pests under both irrigated and non-irrigated production systems. It also quantified the economic impact of IPM vs. conventional pest management practices.

**Organic Blueberry Production (2000 – 2002)**

*Dr. Dave Wildung, University of Minnesota, North Central Research and Outreach Center.*

The project determined if a high value crop like blueberries could be grown organically, demonstrated the impact of organic weed control with and without wood chip mulch, and identified potential cover crops that can suppress weeds in a blueberry management program.

**Deep Zone Tillage and Crop Rotation as an Integrated Management (2000 – 2002)**

*Dr. Vince Fritz, University of Minnesota, Southern Research and Outreach Center.*

This project looked at reducing deep soil compaction and improving internal soil drainage in pea production to decrease the incidence of pea root rot.

**Apple Bagging (2000 – 2002)**

*Mr. Larry Zilliox, University of Minnesota, Douglas County Extension Service.*

This project looked at a method which would eliminate the need for homeowners to spray their apples for the control of apple maggot fly and produced the video "Maggots for Lunch....No More."

**IPM Manual: "Insect Pests of Midwest Landscapes" (2001)**

*Dr. Vera Krischik, University of Minnesota, Dept. of Entomology.*  
An integrated pest management color manual, *Insect Pests of Midwest Landscapes*, was developed.

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**School IPM and IPM for Kids**

The MDA received funding from the Minnesota Future Resources Fund as recommended by the Legislative Commission on Minnesota Resources to develop IPM fact sheets and refine our IPM training curriculum and develop a day long IPM Training Workshop for K – 12 school staff (such as school health and safety officers and building and grounds managers) responsible for pest management decisions. The workshops were carried out in 2002 and provided participants with an understanding of school IPM, with the ability to develop an IPM policy, and with the capacity to implement an IPM plan.

The IPM fact sheets for schools 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 was written using Minnesota Graduation Standards. This was a collaborative effort of MDA's Agricultural Resources Management and Development, Agronomy and Plant Protection, and Agricultural Marketing Services Divisions and was jointly funded by the US EPA and the MDA. Available at: [www.mda.state.mn.us/ipm/IPMPubs.html](http://www.mda.state.mn.us/ipm/IPMPubs.html)

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## Plant Pest Survey Program

The mission of the Plant Pest Survey (PPS) is to provide current information on the abundance and distribution of major pests in Minnesota crops. In 2002, pest surveys were conducted in the following crops: corn, soybeans, small grains, alfalfa, and sunflowers. Surveys were conducted in seven of the nine crop reporting districts including the northwest, west central, central, east central, southwest, south central, and southeast. The PPS also publishes The Minnesota Pest Report, a weekly newsletter summarizing trends in pest abundances. Fact sheets, field pest identification guides, weather information, and other links to crop and pest information can be found on the PPS page located at [www.mda.state.mn.us/pestsurvey/default.asp](http://www.mda.state.mn.us/pestsurvey/default.asp)

### Special Projects

- The PPS is currently developing an online insect database of insects collected by survey personnel during the 2001 season. Thousands of specimens have been collected and identified for the database, which will include digital images and distribution maps for all species included in the database.
- PPS also assisted the Weed Biological Control Project with developing a GPS information system for mapping weeds (invasive, exotic, and agricultural) statewide.

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## Weed IPM

A multi-agency Weed IPM Working Group was formed as a result of the 1996 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 twice yearly in the late fall and early spring. “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 University of Minnesota. If you are interested in signing up to receive the “Thicket!”, please send an email to either Jeanne or Anthony.

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Minnesota Department of Agriculture (MDA)

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[anthony.cortilet@state.mn.us](mailto:anthony.cortilet@state.mn.us)

### Weed Biological Control Program

Over the past three years, the MDA Weed Biological Control Program (WBCP) has successfully built a diverse list of cooperators who have been responsible for incorporating individual weed biological control strategies in their local communities. The involvement of all our cooperators has made the WBCP a statewide success.

This program continues to collect, archive, and publish weed data (including monitoring, release, and harvest data) from counties throughout Minnesota on its online database. This database informs cooperators and the general public on the status of weed biological control activities in their local communities. This information also allows biological control professionals nationally to gain understanding of weed activities in Minnesota. Web pages for leafy spurge, spotted knapweed, exotic thistles, and purple loosestrife can be found on the WBCP’s web page: [www.mda.state.mn.us/weedcontrol/default.htm](http://www.mda.state.mn.us/weedcontrol/default.htm)

### Special Projects

- The WBCP has been cooperating with Cornell University’s Bernd Blossey to help develop an artificial diet for *Cypholeonus achates*, the root-boring beetle.
- They developed a weed herbarium at the Biological Control Facility.
- They developed a GPS information system for mapping weeds (invasive, exotic, and agricultural) statewide, with help from the Plant Pest Survey.

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## General Biological Control Program

### Indoor Plantscape and Urban Biological Control

The Indoor Plantscape Biological Control Project (IPBCP) educates the public on the effective use of biological control products and supports efforts to adopt biological control as a method for managing plant pests in greenhouses, conservatories, atriums, and homes. Activities of the IPBCP include: demonstrating indoor plant pests, showing how to purchase and apply natural enemies, guest lectures, and publishing information about insects and ways to manage them. Information created by the IPBCP can be found on its web page at: [www.mda.state.mn.us/biocon/plantscape/default.htm](http://www.mda.state.mn.us/biocon/plantscape/default.htm)

**Special Projects**

- Published series of indoor plant pest fact sheets for thrips, mealybugs, soft scales, fungus gnats, spider mites, aphids, and whiteflies—and poster titled Understanding Biological Control.
- Developed and posted rearing procedures for three beneficial insects commonly used in greenhouses and indoor landscapes—*Cryptolaemus montrouzieri*, *Chrysoperla harrisii*, and *Hippodamia convergens*.
- Provided lab support and live specimens for three University of Minnesota Entomology Department's IPM and Biological Control Short Courses which provided employees of over 60 Minnesota greenhouse and nursery growers with practical information on how to incorporate IPM techniques into their growing programs.

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Minnesota Department of Agriculture (MDA)  
651-282-6809 and 651-284-3867  
john.luhman@state.mn.us and  
neil.cunningham@state.mn.us

**Outreach**

The Plant Pest Survey and Biological Control Outreach gave talks with displays on many aspects of entomology to schools, science centers, environmental fairs, and similar groups. School presentations are typically in classrooms to students and their teachers in grades K to 12, although most are grades 3 to 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 included 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.

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**The Biological Control Facility (BCF)**

The BCF functions as a resource for information about biological control by offering demonstrations of biological control and by participating with community groups interested in using living organisms to manage plant pests. Since 1999, 2000 people from over 120 groups including garden clubs, master gardeners, science teachers, university and K to 12 students, professional organizations, entomologists, government inspectors, and environmental educators have visited the BCF. For more information on the BCF, visit: [www.mda.state.mn.us/biocon/plantscape/biofacility.htm](http://www.mda.state.mn.us/biocon/plantscape/biofacility.htm)

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neil.cunningham@state.mn.us

**Biological Control Laboratory**

The laboratory serves a support function for all Plant Pest Survey and Biological Control programs. It contains several reach-in environmental chambers as well as three large walk-in chambers; all are utilized for insect rearing and plant growth. Major activities are centered on maintaining insect colonies for beneficial releases, research, or educational projects and insect identification and preservation. The laboratory also focuses 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 Minnesota Department of Agriculture's Insect Reference Collection which currently contains close to 20,000 pinned insect specimens and cared for by Dr. John Luhman.

**Special Projects**

- Beginning work on the development of an artificial rearing system for Spotted Knapweed biological control agents.
- Investigations into the mass rearing of the minute pirate bug and lacewing utilizing an artificial diet.
- Development and archiving of insect rearing protocols.

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## Project Coordinator

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# Minnesota Grown Opportunities: Choices, Options and Opportunities

*To flourish and prosper, Minnesota farms and farmers must come in different shapes, sizes and locations, and produce a variety of food and fiber products.*

Minnesota Grown Opportunities (MGO) offers information about a wide variety of crop, livestock, farming practice, and value-added options (including organics). The MGO program aims to help Minnesota agriculture thrive, serving agricultural producers and rural communities that want to research new agricultural opportunities. The project is jointly sponsored by the Minnesota Department of Agriculture, the University of Minnesota, and the Agricultural Utilization Research Institute (AURI), and a new partner, USDA Risk Management. The MGO program doesn't tell growers what to do – instead, it links them to the resources they need to make informed decisions about which agricultural options may be a good fit for their operations.

MGO can:

- Get you information (printed and electronic) on everything from Alfalfa to Asparagus, Angus to Alpacas, so you can make informed choices about what to raise and how to grow it;
- Link you with resources about market research, business planning, value-added processing, and co-op development;
- Make it easier to locate reliable information from government, nonprofit, and university sources;
- Put you in touch with other people who have tried or are trying the crop, livestock, or practice that interests you (even if they are in states other than Minnesota); and,
- Tell you about opportunities like the Minnesota Department of Agriculture's Sustainable Agriculture Grant and Loan Programs and Organic Certification Cost-share Program.

Located at [www.mda.state.mn.us/mgo](http://www.mda.state.mn.us/mgo), the MGO web site offers hundreds of bulletins, reports, and links to information about:

- Crops (including field, vegetable, and specialty crops)
- Livestock (from barnyard animals like chickens and cattle to exotics like bison and boar)
- Farming systems, marketing and alternative enterprises (like organics, agritourism, and direct marketing).

People who want information about topics not listed can submit questions electronically through the "Have a Question?" feature of the web site, or can call: 651-297-8916. We give priority to queries from Minnesotans.

## MGO's Menu

### Crops

Adzuki beans  
Agroforestry  
Alfalfa  
Alternative crops  
Amaranth  
Apples  
Apricots  
Aquatic plants  
Artichoke  
Asparagus  
Bamboo  
Barley  
Basil  
Bean sprouts  
Beans, dry  
Beans, snap, lima, pole  
Bedding plants  
Beet  
Belgian endive  
Blackberry  
Blueberry  
Broccoli  
Broomcorn  
Buckwheat\*  
Cabbage  
Camelina  
Canarygrass (seed)  
Canola  
Cantaloupe  
Caraway  
Carrots  
Castorbean  
Catnip  
Cauliflower  
Celery  
Chamomile  
Cherry  
Chestnut  
Chickpea  
Chicory\*  
Christmas trees  
Clover  
Comfrey  
Cool season grass  
Coriander  
Corn  
Corn, specialty  
Corn, sweet  
Cover crops  
Cowpea

Crambe  
Cranberry\*  
Cucumbers  
Currants  
Dill  
Echinacea\*  
Eggplant  
Elderberry  
Faba bean  
Fennel  
Fenugreek  
Feverfew  
Field bean  
Field pea\*  
Flax\*  
Flowers, cut & dried  
Forage, brassicas  
Forages  
Fruit  
Garlic  
Ginseng, American  
Ginseng, Asian  
Ginseng, Siberian  
Goldenseal  
Gooseberry  
Grapes  
Greenhouse, general  
Greens  
Guar  
Hairy vetch  
Hazel\*  
Herbs  
Herbs, medicinal  
Hops  
Horseradish  
Hybrid poplar\*  
Hydroponics  
Industrial hemp\*  
Jerusalem artichoke  
Jojoba  
Kenaf  
Kiwi  
Kochia  
Lavender  
Leek  
Lemon balm  
Lentil  
Lettuce  
Lingonberry  
Lupin  
Maple syrup  
Meadowfoam  
Millet, pearl

Millet, proso  
Mint\*  
Mungbean  
Mushrooms  
Mushrooms, oyster  
Mushrooms, shiitake  
Mustard  
Native wildflowers  
Niger  
Nut trees  
Oats  
Oilseed crops  
Okra  
Onions  
Oregano  
Parsley  
Peaches  
Peanut  
Pears  
Pears, Asian  
Peas  
Pecans  
Peppers, hot  
Peppers, sweet  
Pigeon pea  
Plums  
Popcorn  
Potatoes  
Potatoes, sweet  
Psyllium  
Pumpkin  
Quinoa  
Radish  
Raspberry  
Red clover  
Reed canarygrass  
Rhubarb  
Rice  
Rosemary  
Rutabaga  
Rye  
Safflower  
Sage  
Sesame  
Sorghum  
Soybeans  
Spelt  
Spinach  
Squash  
St. Johns wort  
Strawberry  
Sugarbeet  
Sunflower

Teff  
Thyme  
Tomato  
Tomato, greenhouse  
Triticale  
Turnip  
Vegetables  
Vernonia  
Walnuts  
Watermelon  
Wild rice

### Livestock

Alpaca  
Aquaculture  
Beef  
Beekeeping  
Bison  
Boar  
Chickens  
Dairy  
Deer, fallow  
Deer, red  
Deer, white-tail  
Ducks  
Earthworms  
Emu  
Gamebirds  
Geese  
Goats, angora  
Goats, cashmere  
Goats, dairy  
Goats, meat\*  
Grazing  
Guinea fowl  
Livestock, general  
Llamas  
Manure management  
Ostrich  
Partridge  
Peafowl  
Pheasant  
Poultry  
Quail  
Rabbits  
Reindeer  
Rhea  
Sheep  
Sheep, lamb  
Swine  
Turkey  
Yak

### Farming Systems, Marketing & Alternative Enterprises

Ag diversification  
Ag education  
Agri-tourism  
Agroforestry  
Alternative crops  
Beginning farming  
Community supported agriculture (CSA)  
Composting  
Cooperatives  
Essential oil production  
Farmers market  
Financing  
Grazing  
Greenhouse, general  
Hydroponics  
Integrated pest management (IPM)  
Irrigation  
Manure management  
Marketing  
Marketing, internet  
Organic farming  
Risk management  
Small-scale farming  
Starting a food business  
Sustainable agriculture  
Value-added

\* Denotes special MGO report is available.



## Project Coordinator

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# Soil Quality and Rainfall Simulation

*Recent Work in Southwest Minnesota.* In 2002, we continued our simulated rainfall work with ESAP farmer grantees, Jim Sovell and Robert Schelhaas, as they explored pasture improvement options. Please refer to the Schelhaas article in this *Greenbook* for more details on this project. We have worked with this group of farmers on the Coteau Ridge for several years and we have learned much about how water moves on their landscape.

The past two years' rain simulations have provided a breakthrough in our understanding of the potential for the loam soils on the Sovell and Schelhaas farms to better infiltrate water. These soils have the potential to either infiltrate water at a high or low rate depending on management. The same Barnes loam soil that showed high infiltration rates in 2001 under hayed grass-legume forage when a significant stubble height was maintained, showed overall low infiltration rates in 2002 under heavily grazed pasture. In fact, we were unable to get the hayed ground to produce runoff, even at a 4"/hr rainfall rate!

It is our hope that these results can be used to help the farmers explore a longer rest period between grazing cycles as a tool for improved water infiltration. We still do not know how long it would take for a heavily grazed site to respond to longer rest periods or how much it would cost in short-term lost forage productivity before the water cycle could be improved.

Water is like gold to these farmers, especially because they are located in a relatively dry region, and are extensively involved in forage-based systems that respond positively to adequate rainfall and available soil moisture. There are many pasture situations across the state that may benefit from this work. [Our work with the Sovell and Schelhaas farms is directly reflected in the thoughts expressed by Art Thicke in his essay on managed grazing in this year's *Greenbook*. Art is adamant about the need to give the pasture sufficient rest between grazing cycles.]

*Rain Simulation Plans for 2003.* The focus of this year's work will be in southeast Minnesota. We will compare runoff from improved rotational pasture, continuously grazed pasture, and row crop ground. Our goal is to document water quality improvements while simultaneously enhancing the profitability of pasture-based animal agriculture systems in southeast Minnesota. A long-term by-product will be the addition of a detailed pasture component to the state phosphorus index, delineating between phosphorus removal from overgrazed pasture compared to highly managed grazing systems. Current phosphorus databases lump all pastureland into one category.

*New Soil Quality Indicators.* Three new indicators – aggregate stability, active fraction organic matter, and a combination of stubble height and rooting depth (for forage production systems) - have been researched in an attempt to add to the rain simulation work. All three will be road tested during this coming growing season.

Aggregate stability measures the ability of soil aggregates (the soil clumps that look like grape nuts) to resist the forces of water and wind without breaking down into unstructured sand, silt, and clay particles. Stable aggregates improve water infiltration, protect organic matter from excessively rapid decomposition, and facilitate a slow and steady release of plant nutrients. A well aggregated soil is an indicator of sustainable land management.

Active fraction organic matter is the portion of soil organic matter that can be expected to be released for plant nutrition within one to three years. It may make up only a fraction of the total organic matter present in the soil, but it is largely responsible for the living nature of soil. When sustainable soil amendments such as manure, cover crops, or complex rotations are implemented, active fraction organic matter increases can be measured before there is a noticeable change in total organic matter. This makes the active fraction a good indicator of an eventual increase in total organic matter.

In perennial forage systems, maintenance of the combination of a reasonable stubble height (two to four inches) and a healthy root system ensure the long-term productive potential of a forage stand. When plant roots are allowed to penetrate deep into the soil profile, more water and nutrients are made available for plant uptake. We will initially use these soil quality indicators on a subjective level. For example, when comparing pasture productivity, we will expose a soil profile and look at rooting depth under different management scenarios.

Growers who have soil health issues that they feel could be addressed using rainfall simulation or the above mentioned indicators should contact:

Mark Zumwinkle at Energy and Sustainable Agriculture  
Program 651-282-6204  
email: [Mark.Zumwinkle@state.mn.us](mailto:Mark.Zumwinkle@state.mn.us)

Soil Quality Literature Review. “Assessing the Soil System,” authored by Anne Lewandowski and Mark Zumwinkle and edited by Alison Fish, was reissued in May of 2001. This review gives a good background of the renewed focus by soil scientists in the last decade on the need to optimize the holistic, living nature of the soil resource to benefit long-term agricultural productivity and environmental quality. For anyone interested in pursuing the endlessly complex world of soil health, this literature review will be a good reference. The primary topic areas included in the review are:

- what is soil quality,
- influential early publications,
- indicators of soil quality,
- making soil quality assessments, and
- managing for soil quality.

Although the source of most of the cited literature was the soil science community, the audience was chosen to be non-soil scientists. We hope that this document can help increase communication between soil scientists and those who make decisions on the land. Copies of “Assessing the Soil System” can be obtained for free by contacting:

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## Loan Technical Review Panel

Laura Bihl  
Farmer

John Hobert  
Farm Management  
Specialist

Tim Klassen  
Ag Lender

Mark Moulton  
Farmer

Dennis Schentzel  
Farm Management  
Specialist

Lynn Sorenson  
Farmer

John Wegmann  
Ag Lender

# Sustainable Agriculture Loan Program

## Program Purpose

The Sustainable Agriculture Loan Program was created in 1988 with a \$1 million appropriation as a revolving fund to accelerate the adoption of sustainable farming practices and technology in Minnesota. Loans up to \$25,000 per farmer or up to \$100,000 for joint projects are made at a fixed 6% 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. As loans are repaid and the funds redistributed, approximately \$250,000 is available each year for new loans.

## 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:

**a) Long Term Plans for the Farm:**

How does this investment fit the long-term plans for the farm?

**b) Effect on the Farming System:**

How will this investment lead to a more sustainable farm system?

**c) Environmental Impact:**

Is there an environmental benefit to the proposed project?

**d) Farm Income:**

What is the added return to the farming operation from the proposed project?

**e) Input Reduction:**

Does the project reduce or make more efficient use of inputs?

## Project Categories

Project Type	Number of Accounts
Energy Savings	31
Livestock Management	102
Conservation Tillage	73
Weed Management	33
Nutrient Management	45
Alternative Crops	23
<b>Total Loan Accounts</b>	<b>307</b>

## Impact of Program

Sustainable Agriculture Program loans have given Minnesota farmers added incentive to make changes toward more efficient use of inputs while enhancing profitability and protecting the environment. A total of 307 farmers have borrowed over \$3.4 million from the loan program. Farmers are successfully incorporating profitable new farming practices into their operations. This is shown by the incredible payback record on the loans by these farmers.

When farmers implement innovative changes, their neighbors have an opportunity to observe and decide whether to adapt changes to their farming systems. 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.

# 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** - Secretary, has been working the program since it began in 1988. Linda provides administrative and clerical support to the staff. Linda is responsible for and assists in a variety of sustainable agriculture projects.

**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), serves on the Alternative Swine Production Task Force, 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** - Agricultural Diversification Specialist, joined the Minnesota Department of Agriculture in 2002. She educates about and promotes crop, livestock, management and marketing options, including organics. 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					•
Whole Farm Planning			•		