

CONSERVATION INNOVATION GRANTS FINAL PROGRESS REPORT

Three Rivers Resource Conservation and Development

Productive Conservation on Working Lands

6/1/2010 to 11/31/2010

Date Submitted: 12/22/2010

Grant funds used to date: \$633,520.50

In-kind and matching documented to date: \$795,600.00

PCWL WORK SUMMARY:

During this reporting period the primary focus has been on securing future funding, finishing work on the PCWL Technical Handbook and completing outreach and project dissemination. We finished a hazelnut propagation guide which we distributed to several project cooperators. This guide will also remain available free of charge in PDF format on the PCWL website. This guide will assist hazelnut growers with propagation of their most productive bushes. This knowledge will allow them to increase yields over time without the expense and unknown genetic potential of purchased seedlings propagated from seed.

SIGNIFICANT RESULTS, ACCOMPLISHMENTS, AND LESSONS LEARNED:

GOAL I: TO FINALIZE THE PCWL MODEL, AND DEMONSTRATE SUCCESS NEEDED TO SECURE PRIVATE, STATE AND FEDERAL FUNDING FOR A LARGER SCALE STATEWIDE DEMONSTRATION PROJECT OR NATIONWIDE PROGRAM.

This objective in regards to perennial crops has largely been pre-empted by the Biomass Crop Assistance Program, and some components of the EQIP program. BCAP and EQIP offers higher establishment incentive rates and harvest subsidies than PCWL is able to offer.

Seeing the duplication of other federal programs as unnecessary and wasteful, we continue to seek funding that will expand or continue the work of PCWL by promoting practices and farming methods that allow conservation and profitable productivity to coexist. We are doing this by developing programs to promote agricultural practices and crops that help farmers achieve conservation goals while remaining profitable farm enterprises.

We continue to refer producers to federal programs such as BCAP and EQIP when appropriate as well as assisting in promotion of these and other federal conservation programs. We will also continue to develop a model for conservation programs that fits the concept of "Productive Conservation", but the crop establishment portion will likely be significantly different than the structure used for the current Productive Conservation on Working Lands program.

We have been investigating Minnesota State funding sources to support future Productive conservation projects, but unfortunately the majority of potential sources have focused on non-working lands conservation and habitat restoration. There are sources in Minnesota such as the Legislative-Citizen Commission on Minnesota Resources, and the Lessard-Sams Outdoor Heritage Council that fund conservation related work in Minnesota. Unfortunately for productive conservation, the emphasis in the request for proposals and the record of past projects funded generally focus on wildlife habitat restoration on land protected by a permanent conservation easement. There are also some projects that have been funded that focus on research investigating causes and remedies for water quality

impairments. Permanent conservation easements have been a hard sell in most row crop dominated areas of Minnesota. Most farmers shy away from placing permanent restrictions which would eliminate development potential and restrict land uses on their property.

OBJECTIVE A: THE RC&D COUNCILS IN MN WILL WORK WITH PROJECT PARTNERS TO FINALIZE PROGRAM DEVELOPMENT & PREPARE EDUCATIONAL/PROMOTIONAL/SIGN UP MATERIALS.

This was one of the first items accomplished at the early PCWL Technical Committee meetings. The PCWL Technical Committee consisted of representatives from NRCS, USDA Agriculture Research Service, RC&D coordinators, RC&D council members, non-profits and farmers.

OBJECTIVE B: THE RC&D COUNCILS IN MN WILL EDUCATE AND TRAIN PARTICIPATING SOIL & WATER CONSERVATION DISTRICTS (SWCD) AND NRCS STATE OFFICIALS ABOUT PCWL BY.

In order to fulfill this objective we attended many meetings of conservation professionals and volunteer conservation organizations. Among these was the 2007 meeting of Minnesota State Association of Soil Water Districts. This meeting was attended by over 600 conservation professionals from across the state. At this meeting we had a booth at the trade show displaying information on the PCWL program in addition to giving a presentation on the PCWL program. Our participation in this meeting lead to several leads for crop establishment projects and an interview with a local reporter. As a result of this interview we received some free advertisement in the form of an article on PCWL in the Minnesota news paper Agri News. This early publicity helped in our landowner recruitment for the crop establishment program. We were also asked to submit an article to Watonwan County SWCD news letter which is distributed in the Town and Country Shopper.

The following meetings were attended to educate participating SWCD and NRCS State Officials:

Meeting	Date	Location			
Fillmore SWCD Energy Fair	2/28/09	Fillmore County	Minnesota Association of RC&D Councils Winter Meeting	1/30/08	St. Cloud, MN
Greater Blue Earth Basin Alliance Technical Committee Meeting	6/20/07	Mankato, MN	Minnesota Association of RC&D Councils Summer Meeting	9/11/07	International Falls, MN
NRCS Leadership Team Meeting	6/17/08	Rochester, MN	Area 6 MASWCD Meeting	6/19/07	
Minnesota Association of RC&D Councils Business Meeting	8/28/08	Willmar, MN	Area 6 Employee Meeting	7/10/07	St. Peter, MN
			Pembina Trail RC&D Board Meeting	6/29/07	Red Lake Falls, MN

Coteau des Prairie RC&D Meeting	3/25/07	St. Cloud, MN	Minnesota Association of RC&D Councils Business Meeting	1/30/08	St. Cloud, MN
Coteau des Prairie RC&D Meeting	6/27/07	Slayton, MN			
North Central Association of RC&D Councils Conference	3/9/08	Rochester, MN			

OBJECTIVE C – THE RC&D COUNCILS WILL EDUCATE A MINIMUM OF 200 LANDOWNERS ABOUT PCWL PROGRAM.

Producer Meetings and Conferences Attended to Promote PCWL

Meeting	Date	Location			
Biomass for Energy: a Balancing Act	8/16/2007	Morris, MN	Biomass for Local Renewable Energy and Economic Development	3/26/2009	Ponsford, MN
Southeast Clean Energy Resource Team Hazelnut Farm/Passive Solar Greenhouse Tour	9/13/2007	Lake City, MN	Youth and Sustainability Confabulation	4/4/2009	St. Peter, MN
Dakota County Extension & Conservation Office	12/11/2007	Farmington, MN	Biomass Feedstock Tour	7/10/2009	Wadena, MN
Midwest Value Added Agriculture Conference	1/24/2008	Eau Claire, WI	A Sustainable Small Farm Experience	7/15/2009	Belle Plain, MN
Farmfest 2008	8/5/2008	Morgan, MN	Working Trees: Energy, Food and More	7/27/2009	7 mile Creek Park, Nicollet County
AgroEcology Summit Bioenergy Crops and Water Quality	8/15/2008	Windom, MN	Farmfest 2009	8/4/2009	Morgan, MN
A Whole-Systems Approach to Bioenergy	8/22/2008	Benson, MN	Perennials for Food and Fuel	8/14/2009	Benson, MN
Midwest Value Added Agriculture Conference	1/23/2009	Rochester, MN	Hazelnuts for Food and Fuel	9/26/2009	Lake City, MN
Fueling the Future: The Role and Use of Woody and Agriculture Biomass for Energy Workshop	3/19/2009	Morris, MN	Midwest Value Added Agriculture Conference	1/21/2010	Eau Claire, WI
			Midwest Organic and Sustainable Education Service Conference	2/25/2010	La Crosse WI

OBJECTIVE D – THE RC&D COUNCILS WILL SIGN UP APPROXIMATELY 25 LANDOWNERS TO GROW 1,000 ACRES OF PRODUCTIVE CONSERVATION CROPS.

During the course of the PCWL Crop establishment program we enrolled 25 landowners with 61 projects representing 975 acres. Of those 975 acres our participating producers were able to complete 837 acres before the end of this project. The high landowner match ratio on many of these establishments shows significant investment on the part of the landowners and a commitment to the success of these perennial crops.

OBJECTIVE E – LANDOWNERS WITH ASSISTANCE FROM THE RC&D COUNCILS IN MN AND PROJECT PARTNERS WILL PLANT AND MAINTAIN A MINIMUM OF 1,000 ACRES OF PCWL CROPS.

While the enrollment for the crop establishment portion of this project got off to a slow start, we were able to establish 837 acres of PCWL crops throughout the state of Minnesota. During the 3 year course of this project we saw drastic swings in the commodity grain markets. These economic conditions contributed to the slow enrollment. In northern Minnesota where land rent is significantly lower than the southern portion of the state, farmers were seeing wheat at \$6 per bushel. This combination of high grain prices and low rental rates made selling perennial conservation crops very difficult.

GOAL 2: INCREASE AND DEVELOP NEW MARKETS FOR PCWL CROPS.

OBJECTIVE F: THE RC&D COUNCILS IN MN WILL WORK WITH PROJECT PARTNERS TO IDENTIFY MARKETS FOR PCWL CROPS.

We have identified several current and potential markets for PCWL crops. However as market conditions are constantly changing, we will continue to put significant efforts towards this objective.

OBJECTIVE G: THE RC&D COUNCILS IN MN WILL EDUCATE A MINIMUM OF 12 PRIVATE BUSINESSES ABOUT THE BENEFITS OF PCWL CROPS, RENEWABLE ENERGY AND VALUE ADDED OPPORTUNITIES BY DECEMBER 2008.

This objective is complete. A partial list of businesses educated includes: Kaste Seeds, Mn. Native Landscapes, Rahr Malting, Feders Seed, Mankato Free Press, Agri News, MN. Farm Guide, Prairie Moon Nursery, McPherson Crop Management, Blue Earth Consulting, Ag Resource Strategies, Prairie Restoration Inc., Market Street Energy.

GOAL 3: RESEARCH, EDUCATION & PROMOTION OF THE ECONOMIC AND ECOLOGICALLY SUSTAINABLE PRODUCTION OF PCWL CROPS.

OBJECTIVE H: THE RC&D COUNCILS IN MN WILL WORK WITH RESEARCHERS TO COMPLETE RESEARCH ON PRODUCTIVE CONSERVATION CROPS. WE WILL EDUCATE POLICY MAKERS, GROWERS, AGENCIES, PRIVATE INDUSTRY AND OTHERS NATIONWIDE BY DECEMBER 2009.

PCWL MARKET DEVELOPMENT STUDIES:

ADDING VALUE TO THE BIOMASS COMPONENT OF THE TURF SEED INDUSTRY

This market study examined the value of marketing the biomass by-product of the turf seed industry in Northern Minnesota and developed a grower's guide which was distributed to turf seed growers in the region.

Grass seed crops have been raised in northwest Minnesota for several decades. The supply and demand curve for grass seed crops is similar to other crops (corn, wheat, soybeans). In times of short supply, the demand rises as does the price. Conversely, in times of excessive production, demand weakens, and prices fall. An additional risk associated with grass seed crops if market demand is weak, not only will crop movement come to a halt the crop cannot be sold. For example, if a grower has wheat in the bin and decides to sell, the farmer can haul to the elevator and get paid, even if the price is below the breakeven cost of production. For the grass seed crops this option doesn't exist. If market demand is weak the crop will stay in storage, as it has no place to move, and the producer cannot sell this crop until the market demand improves. This lack of a market can place tremendous cash flow demands on producers who have grass seed to sell in times of weak grass seed demand.

MARKETING MINNESOTA'S FIELDS AND FORESTS: RESEARCH ON THE POTENTIAL FOR DEVELOPING A FARM STAY DATABASE AND JOINT MARKETING PROGRAM IN MINNESOTA

Agritourism is growing in popularity throughout the United States, and this farm-stay study provided a starting point for the development of more agritourism opportunities in Minnesota. Farm-stay is an overnight, paid, guest accommodation situated on five or more acres of working lands. This report provides an initial understanding of the potential of farm-stay in Minnesota as a form of agritourism activity that might potentially boost rural economies. This study was a community-university supported initiative with major funding from the Productive Conservation on Working Lands (PCWL) program of Three Rivers Resource Conservation and Development, the University of Minnesota Extension, and the Center for Urban and Regional Affairs. Other project partners include the Center for Integrated Natural Resource Agricultural Management (CINRAM), and the Sustainable Farming Association of Central Minnesota.

DEVELOPMENT OF AN ECOLOGICAL COMMODITY PAYMENT PACKAGE [ECoPayPack]

The goal of this project was to develop an Ecological Commodity Payment Package [ECoPayPack] program for implementation by completing the following tasks:

- Complete an integrated assessment of multiple ecological commodity markets currently being used in the United States and internationally.
- Conduct a non-market valuation survey.
- Identification of ecological commodity buyers for perennial energy crops grown in Minnesota
- Develop a model ECoPayPack program for perennial biomass grown in Minnesota.

Rural Advantage was able to complete all objectives of the project and the report included in the Technical Handbook provides the results and findings from the project. This project could not have been completed without the involvement of several partners who brought expertise to the project at a variety of levels. They include farmers and landowners within the region; SWCD and NRCS staff; Dean Current- Center for Integrated Natural Resources and Agricultural Management; William Easter, William Pham – University of Minnesota; Jim Kleinschmit- Institute for Agriculture and Trade Policy; Shannon Fisher, Karnell Johnson and Susan Carlin- MN River Board; Brooke Hacker- Greater Blue Earth River Basin Alliance; Jim Klang- Keiser and Associates; Tom Green- Ag Flex; Brian Brant- American Farmland Trust; Dennis Fuchs and Carrie Raber- Stearns County SWCD; and Holly Kavorik- Sauk River Watershed District.

PCWL FIELD STUDY:

EQUIP ELIGIBLE FARMER PARTICIPATORY RESEARCH IN PROPAGATION OF HYBRID HAZELNUT FOR PRODUCTIVE CONSERVATION ON WORKING LAND

Hybrid hazelnut is a woody perennial crop with potential to enhance the

environmental sustainability of the agricultural landscape of Minnesota and at the same time provide a new economic opportunity for farmers. The biggest obstacle for growers interested in establishing commercially-viable hybrid hazelnut plantations is the lack of uniformly consistent planting stock. The hybrid hazelnut germplasm currently used is propagated from openpollinated seed, which results in plantations with too much variability to be effectively managed on a commercial scale. The only way to eliminate this variability is through vegetative propagation. Currently there are no consistently reliable methods for the vegetative propagation of hybrid hazelnut. This is a primary deterrent to the development of a viable hazelnut industry in Minnesota. In this collaborative on-farm project we will work with EQUIP eligible farmers to evaluate and develop techniques for the vegetative propagation hybrid hazelnut. Methods to be evaluated include mound layering, stem cuttings, and root cuttings. By working with growers we can expand our research capacity and make the research results directly available to farmers which will result in an immediate increase in the availability of uniform hazelnut germplasm. We have identified 83 hazelnut growers, of whom at least fifteen to twenty are interested in collaborating with us on this project. The initial objective is to develop techniques that will allow farmers to vegetative propagate their superior hybrid hazelnut germplasm for planting directly on their farms or marketing to other producers.

Summary

Developed a protocol for mound layering hybrid hazelnuts, and a how-to-bulletin to instruct growers in the method. The bulletin is available at <http://www.nuts.beestbuilt.com/>

Incremental progress was made in trials with softwood and hardwood stem cuttings. Although the use of hothouses as an alternative for rooting softwood cuttings did not lead to the break-through in rooting softwood cuttings that we had hoped for, hothouses did prove to be useful in rooting hardwood cuttings; we plan to continue research on this approach. For softwood cuttings, we also learned that collar suckers are more likely to be successful than the canopy cuttings we had been using, so future research with softwood cuttings will focus on collar suckers. Other than that, few of the variations in softwood cutting protocol that we trialed proved to be better than the protocol we had been using. The exception is that we learned that a lighter 1:8 peat:perlite rooting mix is better than the 1:4 mix we had been using.

In seedling trials it was learned that, as expected, seedlings grown in larger pots are more vigorous and thus more likely to survive than seedlings grown in small pots. Large pots are better even if many seedlings are grown together in open containers which requires root disturbance for transplanting.

This study found that hazelnut seedlings may be established in ground with minimal pre-plant soil preparation, as long as good weed control is provided. Woodchips and weed fabric are effective forms of weed control, as long as good quality weed fabric is used. However, the woven nylon

fabric available from DeWitt should be used only in situations where irrigation is possible, because it interferes with the infiltration of rainwater.

Four germplasm performance trials were established (St. Paul Experiment Station, Lambertson, Norm Erickson farm, and Larry Fickbaum farm), with a total of 606 clonal hazelnuts representing 56 different elite accessions.

An additional 202 clones were established from 15 different accessions, in stock plant beds, for use in future propagation trials, and for the production of additional layers that we will need for future agronomic trials.

Seedling hazelnuts were established at Dream of Wild Health, a native-American youth project in Hugo.

The best hazelnut bushes were harvested for yield data at five sites, and tracked performance at another 18 sites, either by flagging bushes that appeared to be exceptional or by collaborating with growers to collect data.

The work from this project was presented at four field days.

Funding was secured to continue this work through Oct. 2010, with two state-level grants of \$30,000 and \$40,000.

We wrote a total of eight grant proposals. Besides the three which were funded, one is still pending. The NCR-SARE grant will be \$175,000 for three years, starting in Oct. 2010. If funded, the Minnesota portion of the collaborative USDA-NIFA Specialty Crop Grant will be \$235,073 for five years, starting in Oct. 2010

Field Days and Seminars

Lois Braun presented this work at four field days in 2008 and 2009.

Sept. 13, 2008—Norm Erickson's annual Field Day, Lake City, MN. Gave a powerpoint presentation on both mound layering and stem cuttings. ~ 30 people

July 27, 2009—3rd Crop Walk and Talk at Seven Mile Creek Park near Mankato. Showed the mound layering work there. ~ 12 people in attendance

August 11, 2009—John and Terry Cuddy Farm near Maiden Rock, WI. Spoke about mound layering. ~ 40 people in attendance

Sept. 26, 2009—Norm Erickson's annual Hazelnut Field Day, Lake City, MN. Hosted a tour stop at a mound layered bush. ~ 30 people in attendance.

The first biennial Upper Midwest Hazelnut Conference is planned for March 12-13 in LaCrosse, Wisconsin.

Grant Proposals Written

During the 2008-2009 project period, our cooperators wrote or co-wrote eight grant proposals for continuation of this work.

Funded:

Hazelnuts as a Multifunctional New Crop for Minnesota – to the Minnesota Agricultural Experiment Station’s Rapid Agricultural Response Fund

Oct. 1, 2009 – Sept. 30, 2010, \$30,000.

Developing Native and Native-European Hybrid Hazelnut Germplasm and Agronomics for Minnesota – to the MDA Specialty Crop Block Grant Program

Nov. 1, 2009 – Oct. 31, 2010, \$40,000.

Developing Hazelnut Germplasm for the Upper Midwest – to the North Central Region SARE, submitted Oct. 30, 2009. Requested \$175,000 for three years.

Pending:

Developing Native and Native-European Hybrid Hazelnut Germplasm and Agronomics for the Upper Midwest – with collaborators in Wisconsin to the USDA-NIFA’s Specialty Crop Research Initiative, submitted Jan. 14, 2010. Requested \$235,073 for five years for Minnesota portion alone.

Not funded:

Development of Hybrid Hazelnuts as a Biofuel Feedstock for Minnesota -- to the U of M’s Institute on Renewable Energy and the Environment (IREE), submitted Nov. 2008.

Designer Fuels: Linking Biofuel Production and Utilization – to the U of M’s Institute on Renewable Energy and the Environment (IREE), submitted Nov. 2008.

Developing Native and Native-European Hybrid Hazelnut Germplasm and Agronomics for the Upper Midwest – to the USDA-NIFA’s Specialty Crop Research Initiative, due April 15, 2009 – failed to be submitted due to a clerical error.

Hazelnuts as a Multifunctional New Crop for Minnesota – to the Legislative and Citizen’s Committee on Minnesota Resources (LCCMR).

Assessment of Biomass Yield and Energy Value in Established Native Polyculture and

Woody Plantings in Minnesota Landscapes

The interest and use of woody and grass-based feedstocks for biofuel, bioenergy, and bioproducts is increasing because of the growing demand of alternative energy sources due to rising fuel cost. The Energy Independence and Security Act (EISA), investments in lignocellulosic biorefineries by the Department of Energy (DOE) and commercial entities, as

well as many other markets, security and policy drivers, have increased public interest in harvesting non-grain biomass from the lands. These non-grain-based biomass include grasses and woods. This interest is positive because it is creating investment and entrepreneurial opportunities in many rural communities.

This study was conducted to determine biomass production, chemical composition, and energy content of selected hybrid poplar clones and native grasses established in polyculture systems in Minnesota landscape to address the information needs of biomass producers and biomass technology users.

Utilizing Sustainable Crop Production Principles to Establish Local Ecotype and Native Perennial Grasses for Bioenergy Production

This Field Study was conducted by Luverne and Mary Jo Forbord, owners and operators of Prairie Horizons Farm and their partners: the US Fish and Wildlife Service, Chippewa River Watershed Project, Minnesota Department of Natural Resources and the Institute for Agriculture & Trade Policy. The Field Study examined various sources and rates of nutrient applications for sustainable biomass production.

Field study:

- Establish and maintain native perennial plants on 40 acres of farmland in row crops.
- Collect data on the sustainable establishment of native perennial grasses for biofuel production.
- Collect data on the sustainable establishment of native local ecotype grasses and forbs.
- Compare inputs, costs, yields, quality and sustainability of grasses, and grasses with forbs, under various agronomic treatments.
- Keep a photo journal to document progress and demonstrate comparative results throughout two growing seasons.
- Assess and test the feasibility of marketing the grass harvest to each of 3 local emerging biomass markets: University of Minnesota-Morris, Chippewa Valley Ethanol Cooperative, and Fibrominn.
- Harvest for seed and markets sought to test the feasibility and income potential of selling local ecotype seed.
- Plan, publicize and host on-farm research plot demonstration tours in 2008 and 2009.

Future Direction

Perennials are thriving on 40 acres where there were none previously. Our questions about sustainable biomass production methods are beginning to find answers. Certainly even more questions have arisen

throughout the years of the field study and demonstration, but we also have more people engaged and interested now in helping find the answers. For example, we want to further evaluate environmental impact of biomass harvesting in our system. We are currently seeking funding to refine our research, using rigorous scientific methods. Dr. Sharon Weyers and Dr. Margaret Kuchenreuther, Associate Professor of Biology at the University of Minnesota, Morris, MN, along with other cooperating researchers are writing proposals to assist in developing management techniques to produce the outcomes we desire: maintenance of a diverse stand of prairie grasses and forbs that enhances the ability of their farm to support wildlife, protection of the quality of their soil, and a sustainable and profitable harvest of biomass.

GOAL 4: DEVELOP A STATEWIDE MODEL THAT IS TRANSFERABLE TO OTHER PARTS OF THE NATION.

OBJECTIVE I: THE RC&D COUNCILS IN MN WILL DOCUMENT ALL WORK AND WILL WORK WITH NRCS TO CREATE MATERIALS/HANDBOOK (INCLUDING COST/BENEFIT ANALYSIS) NEEDED TO TRANSFER PCWL TO OTHER AREAS OF THE NATION BY DECEMBER 2009.

This objective is complete. 1600 copies of the handbook titled "Productive Conservation on Working Lands: A Guide to Growing and Marketing Perennial Conservation Crops" have been printed and roughly 1,500 copies have been distributed nationally to RC&D councils, legislators and project cooperators. The handbook is also available online at: <http://threeriversrcd.org/Projects/Productive-Conservation-on-Working-Lands/>

OBJECTIVE J: THE RC&D COUNCILS IN MN WILL WORK WITH THE NATIONAL ASSOCIATION OF RC&D'S TO DISSEMINATE PROJECT INFORMATION TO 375+ RC&D'S IN THE NATION .

This objective is complete.

OBJECTIVE K: THE RC&D COUNCILS IN MN WILL PROVIDE ONGOING EDUCATION AND REPORTS TO SECURE STATE & FEDERAL FUNDING FOR A LARGER SCALE DEMONSTRATION PROJECT.

We were unable to secure funding for the PCWL program as a whole. Other federal conservation programs such as EQIP and BCAP are currently offering greater incentives for establishing perennial vegetation than PCWL was able to offer.

LESSONS LEARNED:

CROP ESTABLISHMENT

During beginning of this project, we saw conditions such as record highs in the commodity grain prices that made selling the idea of planting perennial crops very difficult. Fortunately, through targeted advertising and direct communication with Soil and Water Conservation District and NRCS staff across the state, we were able to enroll 975 out of our goal of 1000 acres. Our participating cooperators were able to complete 837 acres before the end of this grant. We achieved a good geographic distribution of projects across the state and there were a good variety of crops represented. With the assistance of funds from this project Minnesota producers have increased the diversity of native grasses, forbs and flowers grown for seed in this state. The increased supply of these seeds will improve access to quality local ecotype seed mixes for habitat restoration and biomass plantings.

Crop establishments were not limited to native grasses though. While the overall acreage of PCWL crops was dominated by native prairie species, there were several small acreage projects that established berry bushes, hazelnuts and hybrid poplar plantings.

There were several surprises and lessons learned during the course of this grant. In the beginning of this project it was expected that the majority of the acres of crop establishment projects would be in the northern part of the state and would primarily consist of woody biomass plantings. What happened in practice was the majority of acres wound up being plantings of native prairie species. In retrospect, this made sense.

Farmers in traditionally row crop dominated areas are reluctant to plant trees on ground previously devoted to crops such as corn, soybeans and wheat. Several factors account for this reluctance. One of the biggest factors is the 3-10 year delay between planting woody crops and the first harvest. This delay poses an unacceptable risk to most farmers. Another problem we discovered with woody biomass was that companies utilizing the biomass are unwilling to forward contract prices for biomass. This price uncertainty scares off even more producers.

There was a loan program authorized by the Minnesota State legislature called the Advance Agro-forestry Loan Fund. This fund was developed to provide an advance loan for producers of hybrid poplar trees to help cover their expenses while their trees reach maturity in 10-15 years. Unfortunately due to very strict wording in the legislation this loan fund was available only to growers of hybrid poplars. In addition, the terms of the advance loan were seen as unfavorable by many producers. As a result very few producers took advantage of this fund. The original PCWL budget called for using \$200,000 in these loan funds for matching the federal funds from the Conservation Innovation Grant Program. Since very few producers were interested in planting hybrid we were unable to utilize any of these state funds for matching the federal portion of our grant.

Fortunately we were able to recruit many producers who were interested in planting native grasses for seed and biomass production. Many of these producers established native prairie flowers and forbs that are in very short supply. As a result the seed costs for these plants are quite high. In many cases the seeds were harvested by hand from established native prairie remnants. In other cases the producers started the native prairie plants in a green house to ensure their successful establishment. With the labor intensive techniques used to ensure the success of these plantings, also came high establishment costs.

In contrast, farmers planting native grasses have a relatively wide choice of marketing opportunities, and shorter turnaround between planting and harvest. When looking to market their native prairie crops, farmers have the choice between focusing on seed production, biomass for energy, livestock fodder and even landscape mulch.

Productive Conservation on Working Lands:

A Guide to Growing and Marketing Perennial Conservation
Crops in Minnesota

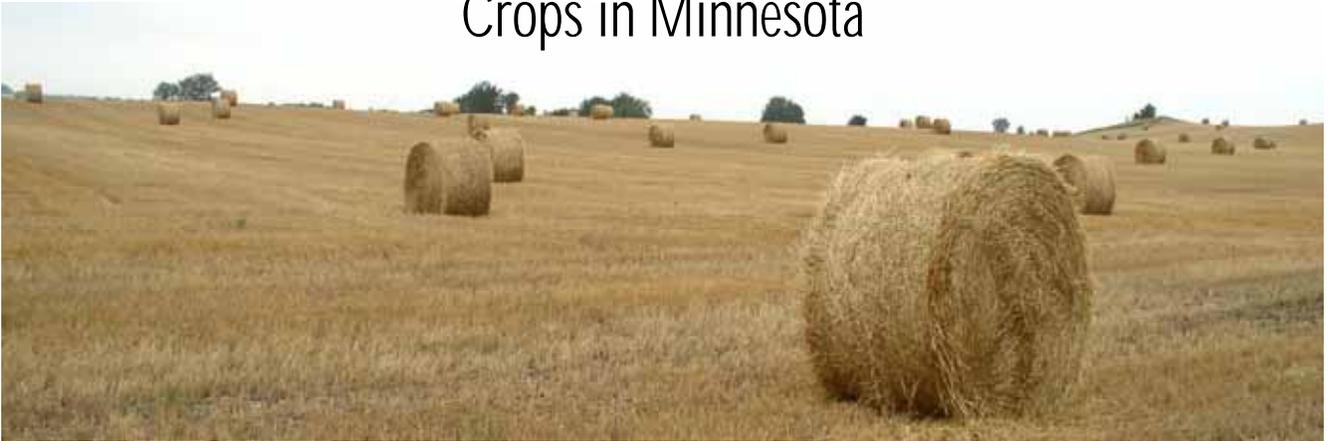


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PCWL Partners

The success of PCWL would not have been possible without the cooperation of a diverse group of agencies, organizations and businesses. These groups included federal, state, county, private and non-profit organizations. Some of these organizations included: Minnesota Natural Resource Conservation Service, Minnesota Association of Resource Conservation and Development Councils, Minnesota Association of Soil and Water Conservation Districts, Scott County Soil Water Conservation District, Winona Soil Water Conservation District, Rural Advantage, Pembina Trail RC&D, WesMin RC&D University of Minnesota, University of Minnesota Extension, Minnesota Department of Natural Resources, Minnesota Department of Agriculture, Institute of Agriculture and Trade Policy, Minnesota Turf Seed Growers Association, Minnesota Native Landscapes, and Kaste Seed.

Introduction



*Prairie Blazing star
established with
assistance from PCWL*

This project was made possible through the Natural Resource Conservation Service Conservation Innovation Grant (CIG) program. Conservation Innovation Grants (CIG) is a program intended to stimulate the development and adoption of innovative conservation approaches and technologies. The CIG program uses local contributions to leverage Federal investment in environmental enhancement and protection. One of the key aspects of CIG is to enable conservation to work in conjunction with agricultural production. Under CIG, Environmental Quality Incentives Program (EQIP) funds are used to award competitive grants to non-Federal governmental or non-governmental organizations, Tribes, or individuals. CIG enables NRCS to work with other public and private entities to accelerate technology transfer and adoption of promising technologies and approaches to address some of the Nation's most pressing natural resource concerns. CIG will benefit agricultural producers by providing more options for environmental enhancement and compliance with Federal, State, and local regulations.

PCWL was a demonstration program that provided incentives to reduce the economic, environmental, and social risks to the farmers growing new alternative conservation crops for energy and emerging industry. The concept of Productive Conservation seeks to simultaneously develop the market demand, agronomic knowledge and supply of crops that are able to provide environmental benefits for society. In order to do this over the long term without ongoing subsidies, the crops must be capable of providing a positive revenue stream for the farmers involved. In the long run the goal of the productive conservation approach is to provide sustainable environmental benefits by demonstrating the viability of productive conservation crops.

Historically conservation and production agriculture have been largely separated on the land. In the mind of the producer and in federal farm policy, conservation on agricultural land is often thought of in terms of taking land out of production. In a conventional farm operation, land not suitable for row crop production is often referred to as waste land and sometimes enrolled in one of the many state and federal conservation easement programs or simply neglected.

PCWL deals with working lands conservation by using perennial crops to reduce soil erosion and water pollution. By replacing annual row crops with perennial crops in targeted environmentally sensitive areas, we will see environmental and economic benefits. Environmental benefits will come in the form of reduced soil erosion, improved wildlife habitat, and atmospheric carbon sequestration.

PCWL addresses the problem of perennial crops profitability with a three tiered approach. The three tiers of PCWL include: market development, supply development and agronomic knowledge. By conducting market studies with the help of many project cooperators and partners, we investigated innovative ways PCWL crops can be marketed. When we look beyond the traditional bulk commodity model of marketing, we are opening a whole array of market opportunities for Minnesota producers.

While marketing is a vital component of a viable perennial crop industry, there will be no market without supply. This is where the crop establishment component of PCWL comes in. Unlike annual row crops, many perennial crops take anywhere from three to five years to establish and reach full production. By offering a \$150 per acre incentive to assist Minnesota farmers with establishing these perennial crops, we reduce the risk to producers and jump start the supply side of these markets. We enlisted many partners statewide to recruit landowners interested in planting perennial crops. By attending many conferences, meetings and trade shows we were able to recruit projects with good geographic distribution from Martin County near the Iowa border to Kittson County near the Canadian border. With the help of local conservation professionals, producers completed the PCWL crop establishment application. This application detailed the location, crop and soil conditions of the project. This detail allowed the PCWL Technical Committee to review each project ensuring the crop was appropriate to the region and the project had a high probability of success.

In order to address the lack of agronomic knowledge concerning these crops, we have worked with many cooperators and project partners to complete field demonstrations. These demonstrations on how perennial crops can benefit from increased agronomic management. In many cases perennial crops have been grown previously for wildlife habitat, but we are looking at these crops from an agricultural perspective. The balance we are trying to strike here is between production and environmental concerns. If we only look at maximizing yield and production, we may very well negate any environmental benefit gained from perennial crops. However if we only consider environmental factors, production may fall to the point where these crops become un-profitable. In either scenario, the point of Productive Conservation is lost.

PCWL Producers

PCWL producers that participated in the crop establishment portion of this program represented a diverse mix of Minnesota farmers. There were small acreage farmers who added native berry bushes to make homemade jam and preserves to sell at area farmers markets, along with conventional corn and soybean farmers who were interested in diversifying their farm to include native prairie plants or hybrid poplar trees. The common theme amongst these producers is a desire to leave the land in better shape than they found it.

Why Perennial Crops?

Perennial crops offer several benefits over annual row crops when planted on what is generally considered marginal land. Perennial crops have deep root system which allows them to access moisture and nutrients deeper in the soil profile. This reduces the need for fertilization and irrigation

in comparison to nutrient and water hungry annual crops. Perennial crops also eliminate the need to disturb the soil with annual tillage. This allows natural soil structure to re-develop, increasing water infiltration and reducing runoff. This also helps build soil carbon content, which has the multiple benefits of sequestering carbon and improving soil fertility. Unlike annually planted crops, perennial crops reduce soil erosion by providing year round ground cover which reduces the erosive energy of wind and rain. When used in filter strips along riparian areas, native grasses have been shown to not only filter runoff, but they aide the breakdown of some pesticides before they reach the water.

Crop Establishment

In order for perennial crops to develop into mature markets, industry needs a steady and relatively predictable supply. This is a major balancing act we must perform in the early phases of these crops. Farmers are provided little financial incentive to plant perennial crops that have questionable market demand. On the other side markets are difficult to establish without a steady supply of raw materials. This is the problem the PCWL crop establishment program sought to address. By offering up to \$150 per acre as an incentive for producers to establish innovative perennial crops, we are lessening the financial risk to these progressive farmers.

When the PCWL Technical Committee was debating which perennial crops would be eligible, they decided to give the farmer as much latitude as possible. At the same time, the Technical Committee reserved their oversight abilities to ensure the crops selected are appropriate for the local climate and soil conditions. Among the goals of the crop establishment program was to achieve good geographic distribution of projects and to enroll a good variety of crops. These goals helped us demonstrate the viability of PCWL across Minnesota, from near the Iowa border in the south to the northern border with Canada with a wide variety of crops.

Field Demonstrations

Until very recently, perennial crops have been viewed as either insignificant niche crops or as a conservation tool, as in the Conservation Reserve Program. Neither status garnered much in attention as to the agronomic concerns of these crops. As interest in producing perennial crops on a field scale increases, the need for information increases as well. The field demonstrations conducted for PCWL examined native grass establishment for biomass production as well as the energy value of several native grass mixes and short rotation woody crops. This work complimented the continuing development of the biomass based energy industry. By examining how commonly planted prairie seed mixes can contribute to the developing cellulosic ethanol industry, we hope to be able to sustainably use those established resources to provide some of our energy needs. With the funding from this project we were able to develop valuable information to assist Minnesota farmers in the transition to Productive Conservation.

Market Studies

In order to assist producers of PCWL crops, we conducted a series of studies on a broad range of markets. Perennial crops are a diverse group and have uses varying from biofuel to food for human consumption. This diversity makes marketing these crops challenging. As a result the studies our partners conducted looked at a wide range of marketing options for perennial crops. One of our partners examined the value of the biomass component of grasses grown for turf seed can benefit producers in North Western Minnesota. In keeping with the innovative spirit of this program another

study looked at developing agritourism enterprises as a means to add market value to many perennial crops. The final market study for this program detailed the ways landowners and farmers can be compensated for the valuable ecosystem functions their perennial crops provide. These functions are better known as carbon sequestration, flood prevention and pollinator habitat. These are all essential services provided by perennial crops, but currently there is little to no value placed on these services.

The Future of PCWL Crops in Minnesota

As agriculture moves toward a production model that is sustainable in the long term, perennial crops will begin to develop significant market niches. Perennial crops have inherent costs and benefits, but the thing to remember is that perennial crops are an important part of a robust, resilient and sustainable agricultural system. Many people forget that only a generation ago; soybeans were just coming into their own as a commodity crop. It was only after decades of breeding, research and farm program support that soybeans became the widely planted commodity crop that it is today. It is for this reason that support and research funding for alternative crops is so important. By diversifying the crop rotation to include perennial crops, we will be able to build soil rather than lose it to erosion.

Productive Conservation Cost Versus Benefit

While it is very important to be able to measure the benefits of any conservation program, the traditional tools of a strictly economic cost/benefit analysis would be insufficient to capture many of the benefits offered by perennial crops. Economic analysis examines only the specific costs and benefits associated with a specific program or practice. There is little or no accounting for benefits such as biological diversity, wildlife habitat, carbon sequestration and ground water recharge. This is due to the complexity of natural ecosystems, and how difficult it is to assign dollar values to the various components of these systems. There has been significant work done in recent years attempting to assign a monetary value to environmental services provided by various conservation practices. These works will likely continue as the idea of ecosystem services becomes more mainstream and the valuation of these services becomes more refined. You will read much more about the concept of ecosystem service payments in the section detailing the PCWL market study titled “Development of an Ecological Commodity Payment Package [ECoPayPack] Program”

The Productive Conservation Crops

Since PCWL is largely a program driven by the innovation and ideas of local producers, the PCWL Technical Committee allowed significant flexibility in choosing which crops would qualify for the PCWL crop establishment incentive. Due to the significant geographic and climactic distribution of PCWL projects, we were unable to use a simple one size fits all process to approve crops. Crops that thrive in the southern tier of Minnesota Counties can be significantly different than the northern counties. Additionally, there can be significant differences in precipitation patterns from the eastern to the western sides of Minnesota. In order to site these crop establishments as effectively as possible, applications were evaluated on the basis of local soil conditions, market potential and proximity, as well as long term plans of the producers.

Below is a list of the variety of crops established with the assistance of this program.

Native Grasses and Forbs:

Virginia Wild Rye
Canada Wild Rye
Side Oats Gramma
Little Blue Stem
Big Blue Stem
Green Needle Grass
Prairie Cord grass
Blue Grama
Indian Grass
Prairie Cord grass
Purple coneflower
Lead Plant

Woody Perennials:

Hazelnut
Hybrid Poplar
Hybrid Willow
Hazelnuts
Nanyberries
Elderberries
Red Currants
June berries
Wild Plums
Blackberries

Hazelnuts for Productive Conservation in Minnesota

The following information is based on the writings and work of Lois Braun, University of Minnesota Research Fellow. Lois Braun is the principal investigator for a PCWL field demonstration examining the propagation of a hazelnut bushes in Minnesota.



New shoots on 2nd year mound with wires

Familiar to many people, especially in culinary circles- the European hazelnuts, *Corylus avellana*, produce large round nuts found in nut mixes and in many chocolate confections.

Unfortunately these European Hazelnuts are not winter hardy in Minnesota. Due to their origins in the Mediterranean region of Europe, production of these hazelnuts has been limited in the United States to the mild climate in the Pacific Northwest, primarily in Oregon.



Rich Handeen and Sarah packing sawdust

But there are two wild species of hazelnuts that are hardy in Minnesota. The American hazelnut (*Corylus americana*) is widespread in the Eastern half of the United States, whereas the beaked hazelnut (*Corylus cornuta*) is found further north into Canada. Both species are shrubs found in the understory of the savannah or in open woods, often near the margins of wetlands. Their nuts are borne in clusters and enclosed in papery green husks. The beaked hazelnuts

get their name from the beak or snout shape of this husk. The nuts of the wild species are tiny—only about the size of a pea, as compared to the size of a spherical dime for European hazelnuts.

The hazelnuts Braun has been working on are hybrids between the European and American hazelnut species. The American species confer hardiness to Minnesota's harsh winters, and tolerance to a common disease that would kill European hazelnuts, while genes from the European hazelnuts increase the nut size.



Rooted Hazelnut cutting



Lois Braun discussing hazelnut propagation at 2009 field day

The question of why we should research the production of hazelnuts in Minnesota may come up. In many areas of Minnesota the agricultural landscape is dominated by the production of corn and soybeans. By developing hazelnuts as an alternative crop for Minnesota, we are adding diversity to an agricultural landscape. This diversity has many benefits including water quality improvements, reduced soil erosion, and benefits for wild life.

There are multiple benefits to woody perennial crops such as hazelnuts. They require no tillage once they are established, and require much lower inputs for weed control and fertility than crops such as

corn and soybeans. This reduces soil erosion and the potential for contamination of surface and ground water by herbicides, fertilizers and sediment. Low inputs also keep production costs low. Because hazelnuts are ideally suited for planting on steep slopes, in riparian zones, and other places that are inappropriate for annual tillage, they offer growers a way of making a profit from land that would otherwise be idle, at the same time maintaining or enhancing the ecological value of this land. They can be used in windbreaks, to reduce winter heating costs around a homestead; as shelterbelts, to protect livestock or crops from strong winds; as living snowfences, to reduce drifting snow along highways; or to protect sensitive lake and river shores, all while generating income for growers. Many producers recommend planting low-growing perennial mixes of grasses and legumes between the hazelnut rows, which further enhances their value for stopping erosion, building soil organic matter, and supporting a complex and resilient ecosystem. Finally, they make great wildlife habitat, and the nuts are favored by a wide range of animals—especially squirrels.

Marketing hazelnuts poses unique challenges. While many people are familiar with hazelnuts due to its popular use as a candy and coffee flavor, there are currently no commercial buyers or processors. With established consumption patterns, Minnesota grown hazelnuts would likely receive a warm welcome from regional consumers. Hazelnuts are high in protein, healthy mono-unsaturated fatty acids, and Vitamins B and E. They offer a healthy addition to the selection of locally produced foods. As for culinary uses, hazelnuts can be eaten straight, baked into cookies, sprinkled on salads, or ground into a peanut-butter like sandwich spread. The oil has properties virtually identical to olive oil, for use in cooking and in lotions. Some people even consider hazelnut oil a viable option for a biodiesel feedstock.

After detailing the benefits of growing hazelnuts in Minnesota, a discussion of the drawbacks and obstacles to hazelnut production is in order. Currently, hybrid hazelnuts available from nurseries are all seed-propagated. Being seed propagated, these plants have a wide range of genetic diversity. While this diversity is beneficial in the wild, when growing a crop for production this diversity becomes a problem. When propagated by seed, the resulting offspring will have a wide range of nut production characteristics. Some of the plants will reach peak production in 2-3 years while others won't produce significant amounts of nuts for 5 years. The solution to this problem is to vegetatively propagate the hazelnut bushes. Unlike apple trees and grape vines, traditional grafting doesn't work with hazelnuts due to the fact they are multi-stemmed bushes. When grafted, new shoots will keep coming up from the rootstock and overwhelm the grafted shoot.

Currently the only viable option for establishing hazelnuts is by planting seedlings. The problem with planting seedlings is, even if the seeds came off a spectacular bush, the resulting offspring most likely will not be as productive. Some may be as good as the mother plant, some may be better, but most will not. They'll be as diverse as a litter of stray kittens. It is very difficult for a commercial grower to manage a crop in which plants that are three feet tall are right next to ones that are ten feet tall, or in which some nuts mature in mid-August and others in mid-September.

The objective of this study is to find methods of propagating hazelnuts vegetatively so that growers can count on a consistent crop. So far, mound layering has proven to be the best method, but it can only produce a few new plants from each parent plant, and is hard work. Hazelnut stem cuttings don't root well, and tissue culture is expensive, at least to start. The end goal is the hope we can offer Minnesota growers a productive and reliable new crop option.

Below is a list of nurseries in our region that sell them:

Red Fern Farm
13882 I Ave.
Wapello, IA 52653
(319) 729-5905
www.redfernfarm.com

New Forest Farm
P.O. Box 24,
Viola, WI 54664
608-627-8733
E-mail for a price list: forestag@mwt.net

Badgersett Research Corporation
18606 Deer Road
Canton, MN 55922
www.badgersett.com

Norm Erickson,
1303 NE 5th Ave, Rochester, MN 55906,
Home 507-282-7365,
Cell 507-319-4085,
norme2@charter.net

Seedlings come as small “tubelings”, which are actively growing, or as larger bare-root dormant seedlings. Seedlings grown a little longer in larger containers usually have better survival, but are more expensive. Some growers have found that they can increase the survival of the small tubelings by transplanting them into larger pots in June, keeping them in a nursery setting over the summer, then transplanting them outdoors in August or early September. Detailed advice on growing hazel nuts is available at <http://www.extension.umn.edu/Agroforestry/components/hybrid-hazelnuts.pdf>

Although hazelnuts need a fair amount of attention during the first year or two, once they are established they require very little care. They do best on rich high organic matter soils, but can be grown on poor soils. Just be sure to test the soil and correct any deficiencies first. Be especially sure to amend for deficiencies of P and K before planting, because it is very difficult to add these nutrients later. Nitrogen requirements are very low for the first few years and can easily be supplied from the soil or from compost. Composted manure may be all that is necessary to keep them productive once they start bearing nuts. Weed control, watering, and protection from wildlife are important during the establishment phase. If you have only a few it is easy to weed and water them by hand. Mulching reduces the need for both of these. By the third year, hazelnut roots should be deep enough that they can compete against weeds on their own pretty well. After this they should only need watering if it's exceptionally dry or if they are on sandy or other droughty soils. Chicken wire cages are effective protection from wildlife, and can be removed after two winters. Bushes will start producing in about their fourth year, but don't reach full productivity until about year eight. At that time your biggest challenge will be getting to the nuts before the squirrels do! But if you don't, take pleasure in having done your part to keep Minnesota's wildlife well fed!

The funding Lois Braun received from PCWL to develop propagation techniques for hazelnuts allowed her to secure an additional \$245,000 to continue her work. Hazelnuts show real potential to be a viable crop in Minnesota and the upper Midwest. Their high oil content can be used in a variety of applications, making marketing a new crop slightly less daunting. A perennial oilseed crop would make a great addition to many marginal and environmentally sensitive lands.

Utilizing Sustainable Crop Production Principles to Establish Local Ecotype and Native Perennial Grasses for Bioenergy Production

This Field Study was conducted by Luverne and Mary Jo Forbord, owners and operators of Prairie Horizons Farm and their partners: the US Fish and Wildlife Service, Chippewa River Watershed Project, Minnesota Department of Natural Resources and the Institute for Agriculture & Trade Policy. The Field Study examined various sources and rates of nutrient applications form sustainable biomass production.

Goals of the Forbord Biomass Field study:

- Establish and maintain native perennial plants on 40 acres of farmland in row crops.
- Collect data on the sustainable establishment of native perennial grasses for biofuel production.
- Collect data on the sustainable establishment of native local ecotype grasses and forbs.
- Compare inputs, costs, yields, quality and sustainability of grasses, and grasses with forbs, under various agronomic treatments.
- Keep a photo journal to document progress and demonstrate comparative results throughout two growing seasons.
- Assess and test the feasibility of marketing the grass harvest to each of 3 local emerging biomass markets: University of Minnesota-Morris, Chippewa Valley Ethanol Cooperative, and Fibrominn.
- Harvest for seed and markets sought to test the feasibility and income potential of selling local ecotype seed.
- Plan, publicize and host on-farm research plot demonstration tours in 2008 and 2009.

Project Activities:

Establishment

On June 24, 2008, Plot 1 of approximately 10 acres was seeded to a hand-harvested mix of native local ecotype grasses and forbs procured from less than 58 miles from the site. Included in the mix were Big bluestem, Indian grass, Side Oats Grama, Little Bluestem, Switch grass, Prairie dropseed, purple prairie clover, leadplant, white prairie clover, coneflower, sunflower, aster, rough blazing star, golden alexander, bergamot, and other native local ecotype species as documented in Appendix A. Plot 2 of approximately 30 acres was planted to native grasses and forbs on June 25, 2008.



Maintenance

In 2008 and 2009, mechanical and hand clipping was done as needed to maintain stand quality and control weeds. No herbicide was used on any plot after the initial field preparation with glyphosate prior to planting. 2008 and 2009 growing seasons were both extremely dry, with replenishing rains falling in October of 2009. Variable treatment was delayed because of slow growth and lack of stand vigor, likely from insufficient rainfall combined with weed pressure. Fertilization earlier than the 2010 growing season would likely have proliferated weed growth at the expense of the native stand.

The 2010 growing season was one of periodic, sufficient rainfall and a very promising increase in stand diversity and vigor on Plot 2. Plot 1 (native local ecotype) did not respond as vigorously, and is “weedier” than Plot 2. Plot 1 was grazed as a base treatment, which proved to be beneficial, but the cattle selected away from a large infestation of absinthe, or wormwood. It is unknown whether or not the absinthe was in the hand harvested seed mix. The absinthe was swathed as a means of control. No additional harvest was possible in 2010. As of August 30, 2010, Plot 1 is showing much more native plant growth and fewer weeds.

Soil Tests and Analysis

The USDA Agricultural Research Services Soils Lab collaborated with our study to provide comprehensive soil analysis. We are continuing this collaboration until 2012 and hopefully thereafter. Principal investigator has been Dr. Sharon Lachnicht Weyers, Research Soil Scientist, USDA Agricultural Research Service, North Central Soil Conservation Research Laboratory, Morris, MN. The major objective of the USDA-ARS corollary study is to determine how land use and landscape position affects nitrogen availability. This information will support analyses that can help predict how land use changes, including a move towards bioenergy, may affect sustainability of agronomic production in our region. The study has four phases:



Field site establishment.

- GPS mapping to determine landscape features and establish sampling protocols.
 - Establishment of sample areas: Each parcel will be divided into sampling units based on high, mid and low elevation positions on the landscape.



Baseline soil sampling.

- In the fall, soil cores 0-1m (where possible; we expect at least 60 cm deep) will be taken:

- Soil will be processed and analyzed for total C, organic C, inorganic C, total N, mineral N, potentially mineralizable N, and P.

Periodic soil sampling.

- Soil samples with a hand held coring device 2cm dia. to 30 cm depth (when possible) will be taken at randomized locations within each sampling unit, per field site at most once a month after spring thaw, during the growing season, and until harvest or plants senesce for winter.
 - Soils will be processed and analyzed for available mineral N and P.

Data analysis and interpretation.

- Information on GPS and soil and water analysis will be shared as the data is compiled.
- This information will be used in whole-farm nitrogen balance assessments.
- Presentations will be made during the process and annual and final reports will be prepared.

Base Treatment: Manure

In May of 2010, all plots were sufficiently weedy that a control method needed to be employed. Due to our whole farm experience with cattle, it was evident from the timing of the weed flush in May that controlled grazing would yield the best results for weed control and favor the native stand, without compaction. We discussed the use of grazing with Dr. Sharon Weyers, and she concurred that in light of current plot conditions, grazing would be a good choice for a base treatment. We estimated the grazing utilization rate for our herd of 62 cattle using an equation from the Grazing Systems Planning Guide by Blanchet, Moechnig, and Dejong-Hughes:



$$(\# \text{ of animals}) \times (\text{average weight}) \times (\text{daily utilization rate}) = \text{daily forage requirement}$$

Daily utilization rate = 0.04. This figure is used because livestock need to have access to approximately 4% of their live weight in forage (2.5% intake, .5% trampling loss, and 1% buffer). For 62 head rotationally grazing at uniformly timed intervals for 14 days, we determined the yield at .64 tons per acre (see Appendix E). From the source referenced above, “60-80% of the nitrogen, 60-85% of the phosphorus, and 80-90% of the potassium are excreted in urine and feces. Manure also contains many micronutrients needed by pasture plants. If manure is evenly distributed throughout the paddocks, fertility can almost be maintained through natural nutrient recycling”.

Variable Treatment: Commercial Fertilization

Plot 2 was sub-divided into 3 parcels in preparation for the 2010 trials as mapped in Appendix C:

1. Manure by grazing only
2. Half rate commercial fertilizer
3. Full rate commercial fertilizer

We checked several sources for fertilizer recommendations for mixed native grass stands, but were unable to find consistent recommendations. We also consulted with the scientists involved in our study, and ultimately decided on a full rate of 60-20-60-10 based on our research and what was recommended and available from Glacial Plains Cooperative in Benson, MN, where we purchased the fertilizer. The application was accomplished by Luverne Forbord on June 14, 2010. The fertilizer analysis, variable rates and costs are documented in Appendix E.

Harvest

By visual observation, there were noticeably more thistles where commercial fertilizer was applied, and significantly more at the full rate than the higher rate. No other appreciable qualitative differences were noted across the variable treatment plots.

Quantitative differences are evaluated in Appendix E, along with a financial analysis of the variable treatments. For the 2010 harvest, we found that profitability per acre was adversely affected by using commercial fertilizer. These results are confounded by a number of factors, including a relatively new and therefore low yielding stand in terms of perennial establishment, weather conditions, lack of information about fertilizer rates and nutrient availability for deep rooted perennials, and numerous other unanswered questions. We are planning to continue our analysis into the future to see if our initial results will be supported with results from subsequent years.



Marketing

In 2008, three potential procurers of biomass were emerging: University of Minnesota Morris, the Chippewa Valley Ethanol Cooperative, and Fibrominn. Each was developing processing facilities that will require biomass for energy production. Luverne Forbord serves on the Feedstock Committee at Chippewa Valley Ethanol Cooperative, where a price of \$55 per ton was considered the going rate for delivered biomass. In recent communications with Joel Tallaksen, Ph.D., Biomass Gasification Project Coordinator, West Central Research and Outreach Center, University of Minnesota, Morris, MN and Andy Zurn, Plant Engineer, Chippewa Valley Ethanol Company, Benson, MN they described the status of markets and contracts for perennial biomass at their respective plants. Currently, Fibrominn is not accepting perennial grasses, but instead using wood as a source of biomass to mix with poultry litter for generating electricity. The spokesperson at Fibrominn stated that a grass trial had been performed, but the grass needed to be ground before they would accept it, and that \$55 per delivered ton would not be a price they would consider for biomass in an acceptable form at this time.

In summary, biomass procurement and gasification has met with significant processing and financial challenges over the past three years, resulting in no current biomass market for perennial grasses at any of the three facilities. We found that employing grazing and hay usage by cattle to be a necessary risk management strategy in our attempt to reach emerging biomass markets.

In regard to native seed harvest, an e-mail from Kevin Kotts, MN Department of Natural Resources, Glenwood, MN dated August 6, 2010 about harvesting and selling native prairie seed indicates that a market may be developing for native seeds harvested from private lands, but the market has not yet developed. It is most likely that seeds from Plot 1 will be more marketable earlier than Plot 2, due to seed origin less than 58 miles from the planting site.

Through changing economic conditions and the course of this field study, our cattle have become our sole outlet for biomass utilization. Other markets remain on the horizon, perhaps a bit more distant than they seemed three years ago. Though the well-documented additional benefits of mixed native perennials to wildlife, water quality, carbon sequestration, soil building and protection, landscape aesthetics and preservation have not yet been met with economic reward, we remain hopeful that economic value of these important services will materialize in future years.

Publicity and Demonstration



The first field day for PCWL was held on August 22, 2008 at Prairie Horizons farm near Benson. Presentations were delivered by the following people: Mark Lindquist- Mn DNR Biofuel Program Manager, Luverne Forbord- Prairie Horizons, Farm Owner, Sharon Weyers- USDA ARS Research, Soil Scientist, Joel Tallaksen- U of M West Central Research and Outreach Center Gasification Project Director, Andy Zern- Chippewa Valley Ethanol Company

Engineer, Gary Wyatt- U of M Extension, and Mary Jo Forbord- Sustainable Farming Association of Minnesota Executive Director, Prairie Horizons Farm Owner.



Future Direction

Perennials are thriving on 40 acres where there were none previously. Our questions about sustainable biomass production methods are beginning to find answers. Certainly even more questions have arisen throughout the years of the field study and demonstration, but we also have more people engaged and interested now in helping find the answers. For example, we want to further evaluate environmental impact of biomass harvesting in our system. We are currently seeking



funding to refine our research, using rigorous scientific methods. Dr. Sharon Weyers and Dr. Margaret Kuchenreuther, Associate Professor of Biology at the University of Minnesota, Morris, MN, along with other cooperating researchers are writing proposals to assist in developing management techniques to produce the outcomes we desire: maintenance of a diverse stand of prairie grasses and forbs that enhances the ability of their farm to support wildlife, protection of the quality of their soil, and a sustainable and profitable harvest of

biomass.

The field demonstrations funded by PCWL addressed complimentary aspects of producing perennial crops. The Forbord study examined methods to maximize yield on native grasses, but the following field study looked at composition of several biomass crops to determine their chemical composition and potential energy content. This information is important because there have been many acres already established under various other conservation programs. Understanding how these crops will fit into established and developing industrial processes such as cellulosic ethanol and biomass gasification will aid industry with incorporating biomass into their fuel mix of the future.

Assessment of Biomass Yield and Energy Value in Established Native Polyculture and Woody Plantings in Minnesota Landscapes

Introduction

The interest and use of woody and grass-based feedstocks for biofuel, bioenergy, and bioproducts is increasing because of the growing demand of alternative energy sources due to rising fuel cost. Recent legislation such as the Energy Independence and Security Act (EISA) as well as investments in lignocellulosic biorefineries by the Department of Energy (DOE) and commercial entities have increased public interest in harvesting non-grain biomass from the lands. This non-grain-based biomass includes grasses and woods. This interest is positive because it is creating investment and entrepreneurial opportunities in many rural communities.

Minnesota has a vast tract of land planted with grasses enrolled through Conservation Reserve Programs (CRP). Further, about 25,000 acres of land alone is planted with short rotation woody crops such as hybrid poplar (*Populus* spp) in West-Central region of Minnesota on privately-owned lands. Such plantations have a potential biomass energy value. Biomass from grasses and from short rotation crops offers potential to achieve the requirement of the EISA. The 2007 Energy Independence and Security Act requires that 60% of renewable fuels should come from advanced biofuels such as cellulosic ethanol. With all this demand for cellulosic ethanol, information about biomass is increasing. Wood-energy producing companies in Minnesota for instance demand information on productivity and energy content of potential biomass feedstock suitable for their energy production systems.

Short rotation woody crops (SWRC) such as hybrid poplars are ideal feedstock for energy because such species could generate significant amount of biomass and provide a plethora of ecological services. Similarly, perennial grasses such as switchgrass, for instance, offer several conservation benefits compared to high-intensity row crops, which is why they may be more suitable in some regions and on some landscape positions (Blanco canqui, 2010). By virtue of their perennial nature, these crops reduce the frequency of, and potential degradation associated with tillage. Similarly, perennials also capture solar radiation for a longer portion of the year compared to annual species (Baker et al., 2007). Switchgrass (*Panicum virgatum*), an herbaceous perennial being evaluated as bioenergy feedstock, has higher root density than annual crops (e.g., corn – *Zea mays* L.) or even alfalfa (*Medicago sativa* L.) (Johnson et al, 2007).

Incorporating such perennial systems can help stabilize soils, thus reducing erosion, improving water quality, increasing and improving wildlife habitat, and sequestering SOC (soil Organic Carbon) (Johnson et al., 2007). Much research has been conducted regarding clonal production of hybrid poplars as well as productivity assessment of perennial grasses as affected by agronomic practices; however, there is insufficient information available on the biomass production and energy conversion potential of hybrid poplar and perennial grasses. Further, grassland owners are looking for alternative sources of income after the CRP contract expires. CRP areas show promise in generating biomass for energy. Biomass from these lands would produce significant amount of energy both liquid fuel and steam gas. To effectively develop plans for the power and heat production systems of the biorefinery, information on productivity and energy value from such species is necessary. Several energy-producing companies in Minnesota often fail in their biomass conversion process/technology for energy (e.g., gasification systems) because of species compatibility issues with the gasifier system as an example. This study

was conducted to determine biomass production, chemical composition, and energy content of selected hybrid poplar clones and native grasses established in polyculture systems in Minnesota. This study aims to address the information needs of biomass producers and biomass technology users.

Results and Discussion

Biomass Production

Biomass production of hybrid poplar between 1995 and 1997 plantings did vary. Similarly, the amount of biomass produced between clones planted in the same year differed significantly. At the end of the 14-year growing season, the total amount of biomass production of NM6 clone was 11.46 ton ha⁻¹, which is almost similar to the biomass production of the same clone made by Zalesny (2007) in other locations of the Midwest, USA. For D105 clone, the amount of biomass produced was slightly lower (8.2 ton ha⁻¹) but showed significant difference from that of NM6 (Figure 3). A similar trend was also observed on the productivity of hybrid poplar clones planted in 1997. At the end of 12-year growing season, NM6 exhibited total biomass production of 7.5 ton ha⁻¹, while DN34 was 5.5 ton ha⁻¹. Biomass production of the latter (DN34) was slightly lower compared to previous measurement in other location (e.g., 7.08 tonha⁻¹) (Zalesny, 2007). The amount of biomass production among CRP sites also varied significantly. Site 4 had the highest amount of biomass produced such as 3.2 ton acre⁻¹, which is 73% higher compared to the amount of biomass produced in Site 2 (0.8 ton acre⁻¹). Planting record showed that Site 4 was planted with 5 grass mixes while Site 2 was planted with 4 grass mixes. Biomass production in Site 1 (monoculture switchgrass) was also comparable (statistically similar) with Site 4. Biomass production in Site 3 (5 grass/13 forbs mix) was also different from the other CRP Sites (1.59 ton acre⁻¹). Cumulatively, we also noted an improvement in biomass production of CRP lands that were harvested in Spring. The re-growth of biomass significantly increased the amount of biomass by 40-50%. The re-growth was harvested in Fall 2009.

Energy Content

Chemical composition examined included cellulose, hemicelluloses and lignin. On weight per dry basis, about 40% of chemical composition of hybrid poplar is cellulose while about 20% is hemicellulose. Lignin is comprised of about 28% of the overall chemical composition of the wood. A similar trend was also observed in terms of chemical composition of grassland biomass. Across Sites, about 38% of the chemical composition of grassland biomass is made up of cellulose. Unlike hybrid poplar, the lignin content of grassland biomass is much lower compared to hemicellulose. This is very important information that indicates the quality of the grass. Grass with less lignin is better for livestock and it has greater potential for ethanol energy production. Cellulose and hemicellulose are primarily used in the chemical conversion process to generate energy such as cellulosic ethanol.

Our study also showed that energy content (i.e., British Thermal Unit - btu) of hybrid poplars ranges from 16,000 – 18,000 btu kg⁻¹ of wood, which is slightly higher compared to the btu of grasses that ranged from 14,000 to 15,800 btu kg⁻¹. We also noted that btu value between hybrid poplar differed from each other. However, it did not translate to variation in the amount of ethanol (gallon per dry ton of wood) that could be produced using the NREL ethanol production calculation online tool. Except for DN34 clone planted in 1997, there was no variation in ethanol yield between NM6 and D105 in the 1995 plantings. Based on our study, ethanol production of hybrid poplar is estimated to be between 103 - 108 gallons per dry ton of wood. When ethanol production was examined between years, results also showed no differences exist between ethanol yield potential of NM6 planted in 1995 with NM6

clone that was planted in 1997. This result indicates that hybrid poplar could be harvested as early as the end of the 12-year growing season, or even earlier, if the sole purpose of planting is for biomass production for energy.

During harvesting, slash is left behind the logging site due to unavailability of market for its use. Slash is comprised of 20% of total biomass per tree. To understand how much gallons of ethanol could be derived from slash, our study shows that at least 90-100 gallons of ethanol could be generated for every ton of biomass. Assessment of ethanol production in different parts of the tree also showed variation among them, with tree trunk (base) had the highest ethanol yield and slash had the lowest.

Our study also showed differences in the ethanol production potential of grasses planted in different CRP lands. Site 4 (5 mix grasses), showed that it could generate at least 113 gallons per dry ton biomass while a monoculture switchgrass could produce at least 108 gallon of ethanol per ton. Site 2 and Site 3 exhibited the lowest amount of gallon of ethanol that could be produced per dry ton. Species differences within grassland area could explain the variations in ethanol production (Gillitzer, 2009) among sites. Although Sites 2, 3 and 4 composed of mix grasses, Site 4 exhibited the highest potential of ethanol production per ton of biomass primarily in part of the abundance of C4 species (plants that have higher photosynthetic pathways).

As presented, grassland areas could be a good source of biomass for ethanol production. Our study also showed that energy values derived from grasses vary based on time. Re-growth (strips harvested in Spring and allowed to grow in Summer but harvested in Fall) showed greater potential for ethanol production despite insignificant differences in btu between re-growth and fall (virgin cut) harvest. This result indicates that harvesting the area could be a management tool that promotes more biomass production leading towards greater ethanol production.

Conclusion

There are apparent roles of biomass from woods and grasses for energy. Our study showed that biomass from short rotation woody crops (e.g., hybrid poplar) and grassland areas could significantly contribute in the required amount of biomass materials for biomass-burning facilities in Minnesota or any facilities in Minnesota producing cellulosic ethanol from woods or grasses. The biomass production of 11 ton ha⁻¹ at the end of growing cycle of hybrid poplar could translate to approximately 1,000-1,300 gallon of cellulosic ethanol per hectare (or approx. 500 gallons per acre or 73,481,781 btu acre⁻¹). Further, our results also showed the same amount of energy could generated regardless of hybrid poplar clones.

On the other hand, given that biomass production from grassland area is 3.8 ton acre⁻¹ as it was found in our study such biomass could translate to approximately 450 gallons of ethanol. Our study also showed that biomass production in grassland area could be enhanced if such area is harvested at least once. About half of the amount of biomass could be added to the overall biomass production in CRP areas resulting in greater amount of gallons of ethanol produced if harvesting or mowing is done. However, care should be given full consideration before harvesting the area. Management goal or long term commitment of the landowner should be given full consideration before harvesting is going to be employed. Results of our study would also be very useful for biomass-using facilities in Minnesota. Often time, these facilities require information about biomass feedstock such as energy contents. These values that we generated could serve as tools in decision-making of these facilities as to what feedstock is to be employed that is compatible to their operation.

Marketing Productive Conservation Crops

Conventional grain crops have well established marketing channels across the country. A major obstacle to the establishment of PCWL crops is the lack of market opportunities. There are currently markets for these crops, but the burden is on the producer to seek these markets out. This can be a time consuming task for the producer as well as the buyer, who often must search wide geographic areas in order to source steady supply for their needs.

Fortunately for conservation minded producers, public policy has been slowly shifting. This move toward recognizing not only the value extracted from the land that PCWL crops provide, but also recognizing the value of the ecological services these crops provide. Depending on location and the specific crop, these ecological services may include: carbon sequestration, ground water recharge, and wild life habitat, filtration of excess nutrients and degradation of pesticides. These benefits are very real and valuable to society and as such should hold some monetary value. Taking this viewpoint requires a new concept of what crop marketing can be. As an example - on farms that utilize agro-tourism, the view and experience provided by a perennial crop such as a diverse native prairie may exceed the value of the crop as biomass. Now add the value of ecological service payments such as carbon credits, wetland banking and phosphorus credits and the profitability of a perennial crop may exceed the profit from a traditional corn and soybean rotation.

Admittedly these unconventional marketing practices are not suited to every farm. However they are worth developing as one tool among many in the conservation tool box. If farmers and landowners have more marketing options they are more likely to reserve select environmentally sensitive land for perennial crops.

One of the most challenging aspects of developing productive conservation crops as viable agricultural alternatives is not the production, but the marketing of the crops. Since there is little infrastructure currently developed to harvest, store and market these crops, the innovative producers growing these crops are forced to come up with unconventional marketing channels for their crops.

When marketing a niche agricultural product it is important to understand the market potential for the product. Many of these niche markets can be easily flooded as production methods are improved. As a hedge against this, wise producers seem to be focusing on crops with multiple potential markets. As an example, some PCWL producers are growing native grasses for seed, forage and biomass. Others are adding agro-tourism enterprise to their existing operation. By using agro-tourism as another possible on-farm enterprise, the farmer can increase revenue without purchasing or renting more acreage. Innovation and creativity are common characteristics of PCWL producers. Producers of PCWL crops show a willingness to develop new and unconventional market opportunities for their crops. This is essential to maximizing returns. The key here is to remain open to new ideas and consider how and if they could be successfully integrated into your farm.

Marketing Minnesota's Fields and Forests:

Research on the Potential for Developing a Farm Stay Database and Joint Marketing Program in Minnesota



Community-University Partnership Supported by:
Wadena Agricultural Alternatives
Three Rivers Resource Conservation and Development Council
– Productive Conservation on Working Lands
University of Minnesota Extension
Center for Urban and Regional Affairs

Introduction

Agritourism is growing in popularity throughout the United States, and this farm-stay study provides a starting point for the development of more agritourism opportunities in Minnesota. Farm-stay is an overnight, paid, guest accommodation situated on five or more acres of working lands. This report provides an initial understanding of the potential of farm-stay in Minnesota as a form of agritourism activity that might potentially boost rural economies. This study is a community-university supported initiative with major funding from the Productive Conservation on Working Lands (PCWL) program of Three Rivers Resource Conservation and Development, the University of Minnesota Extension, and the Center for Urban and Regional Affairs. Other project partners include the Center for Integrated Natural Resource Agricultural Management (CINRAM), and the Sustainable Farming Association of Central Minnesota.

Agriculture is the second largest industry in Minnesota. It generates \$55 billion in economic activities for the state and supports 367,000 jobs (MN Dept. of Agriculture, 2007). There are 79,300 farms in Minnesota occupying 27.4 million acres or 54% of Minnesota's total land area (MN Dept. of Agriculture, 2007). As the second largest industry in Minnesota, agriculture is extremely important to every Minnesotan, particularly those in rural areas. However, small family farmers are looking for ways to diversify their income and ensure profit long into the future. Agritourism has been suggested as one way to diversify their income. In general, agritourism is the practice of attracting tourists to an area used primarily for agricultural purposes (Blacka et. al., 2001).

Tourists' dollars are spent throughout the Minnesota economy on shopping (25%), recreation (25%), food (24%), lodging (19%) and transportation (11%) (Explore Minnesota Tourism, 2008). Minnesota

hosts 41 million annual person-visits, and this tourism supports more than 240,000 Minnesota jobs and contributes 10.5 billion to the gross state product (Explore Minnesota Tourism, 2008). Tourism is distributed throughout Minnesota with the Twin Cities Metro area receiving almost half (45%) of tourists, and the rest relatively evenly distributed throughout the North Central/West (21%), Northeast (16%) and Southern (19%) districts (Explore Minnesota Tourism, 2008).

Considering the large impact that both agriculture and tourism have on the state of Minnesota, expanding agritourism opportunities may be an important boost to both economies. In 2008 the Center for Urban and Regional Affairs (CURA), through its Community Assistance Program (CAP), with major funding from the Productive Conservation on Working Lands (PCWL) of the Three Rivers RC&D, supported a research project to explore agritourism opportunities in Minnesota, particularly the concept of creating a network of “farm stays” to be cooperatively marketed. The project included three key phases:

1. Complete a through exploration of farm stays currently operating in Minnesota and create a database,
2. Create a questionnaire and survey currently operating farm stays and interested farms or accommodation facilities that may meet the profile of a farm stay,
3. Complete site visits and phone interviews to develop case studies of currently operating farm stays.

Methods

Database

An exhaustive search of farm stays in Minnesota was completed and a database was created. First, a list of websites related to accommodations or agriculture were compiled. Those websites that contained individual listings of family owned tourist facilities or agriculture businesses were included. Secondly, an email describing the project was sent to all individuals that listed an email address with their contact information. The email was tailored to the specific website where the information was found.

Questionnaire

An online questionnaire was developed based on previous farm stay research and the goals of the Minnesota Farm stay research project. The questionnaire was developed by the researcher, with assistance from project investigators and collaborators. Questionnaire sections included property, farm stay relationship, accommodations and demographics. The survey was a census of all respondents to the database inquiry email. The farm stay questionnaire was distributed using Zoomerang, an online survey website. The survey period was from October 27, 2008 through November 13, 2008.

Throughout the survey period, a total of 33 people were contacted and 17 surveys were completed for a response rate of 51.5%. A total of 3 surveys were unusable, and thus, 14 questionnaires were used for analysis. While the response rate is relatively high, the number of total responses is less than twenty so the data is not large enough to draw statistical evidence from and the information should

be used with caution. Nevertheless, the information is a good first start in better understanding farm stays in Minnesota.

Case Studies

Based on preliminary assessment, four facilities were chosen for case studies to showcase already existing successful farm stays, or facilities with exceptional potential for future farm stay development. Two of the four facilities were contacted via a 30-minute phone interview. In addition, Kent Scheer of Agricultural Alternatives in Wadena, Minnesota completed three site visits.

Results

Database

Based on the research conducted, a total of 30 farm stays were identified. A further 14 sites were identified that have accommodations, some farm activities, and are interested in developing a farm stay. Eleven websites were identified as reference material for farm stays.

Questionnaire

Demographics

More than two thirds (71.4%) of respondents were female and reported an average age of 57.8 years (Table 2). All of respondents were white (100%) and of non-Hispanic or non-Latino background (100%). Respondent residences are distributed throughout Minnesota, with one respondent from Northern Iowa.

Property

The size of respondents' property varied substantially. While the average size was 153.9 acres, the greatest percentage of respondents (42.9%) indicated property of less than 50 acres (Figure 2). More than half (57.1%) of respondents indicated that the primary function of their property is a Bed & Breakfast. Respondents also indicated that the primary function of their property is a farm/ranch (35.7%) or a hobby farm/ranch (7.1%).

Qualitative analysis of responses to attractions of respondents' property reveals that a wide variety of cultural, historical, and environmental activities are available to tourists.

Respondents most frequently noted hiking, canoeing and forest/prairie land as attractions of their property. Farms and sustainable agriculture were also frequently mentioned.

Farm Stay Relationship

Nearly two thirds (38.5%) of respondents indicated an interest in developing a farm stay (23.1%) or maybe developing a farm stay (15.4%). Another one sixth (15.4%) of respondents indicated that they are already conducting a farm stay. Almost one quarter (23.1%) indicated that they are not interested in developing a farm stay at this time.

The majority (69.2%) of respondents indicated that they are interested in participating in a cooperative effort with other farm stays to jointly market their facilities. One quarter (23.1%) of respondents were not interested and another one tenth (8.3%) were not sure.

Qualitative analysis of responses to respondents definition of a farm stay reveal that overnight accommodations on a farm where guests can observe farm activity or participate in farm chores is central to the idea of a farm stay. About half of respondents specified an opportunity to observe farm activities while the other half specified interaction with farm chores. About one third specified an overnight stay. Food is also an important aspect of a farm stay as hearty breakfasts and family style meals were mentioned.

Respondents listed numerous challenges for developing or operating a farm stay. Qualitative analysis of their responses suggests that marketing and licensure are the two greatest challenges in developing or operating a farm stay. Other common themes were bringing people into their home and a lack of time.

Respondents also listed numerous rewards for developing or operating a farm stay. Qualitative analysis of their responses suggests that meeting new people and sharing their knowledge of farms as the greatest rewards. Respondents were particularly interested in educating guests about the importance of small family farmers on local communities and rural American values. The opportunity to gain a supplementary income was only mentioned once.

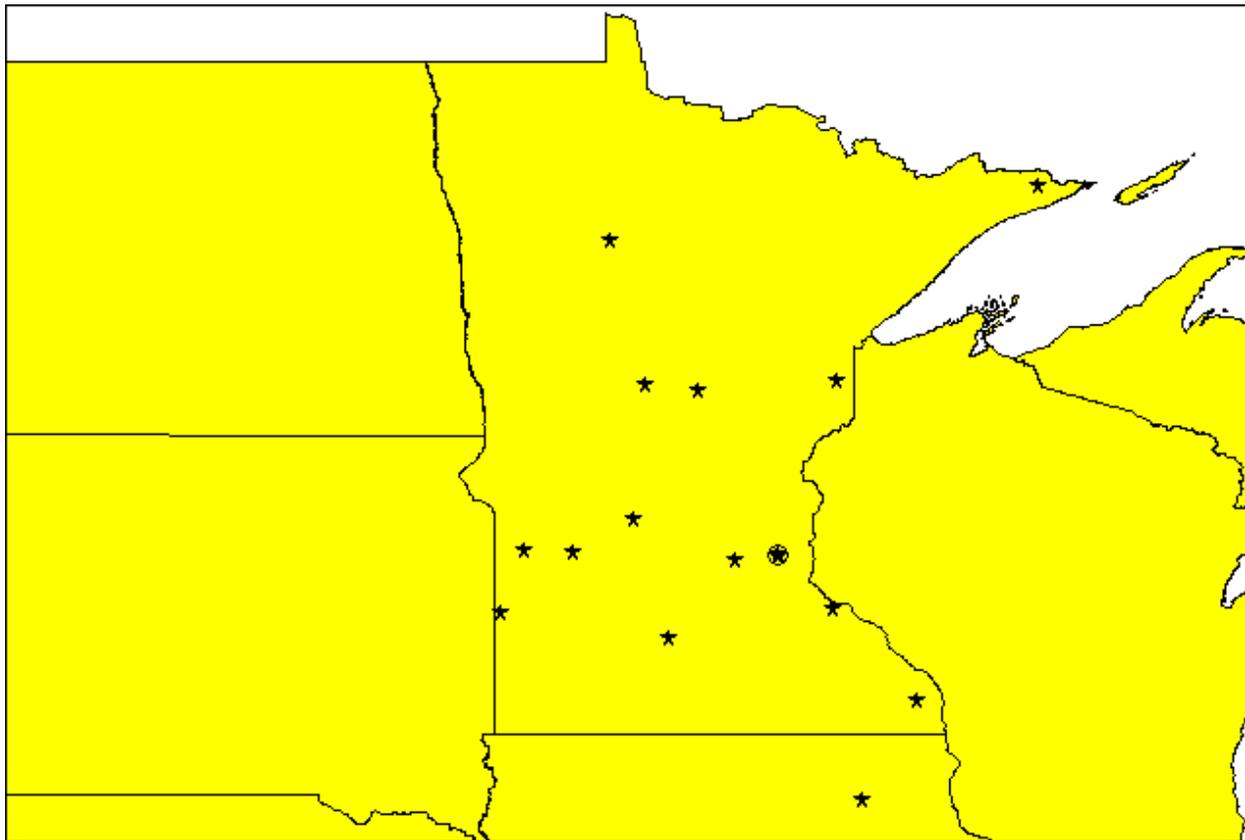


Figure 1. Regional map of respondents to an email survey among Minnesota farm stay database participants, 2008 (n=14).

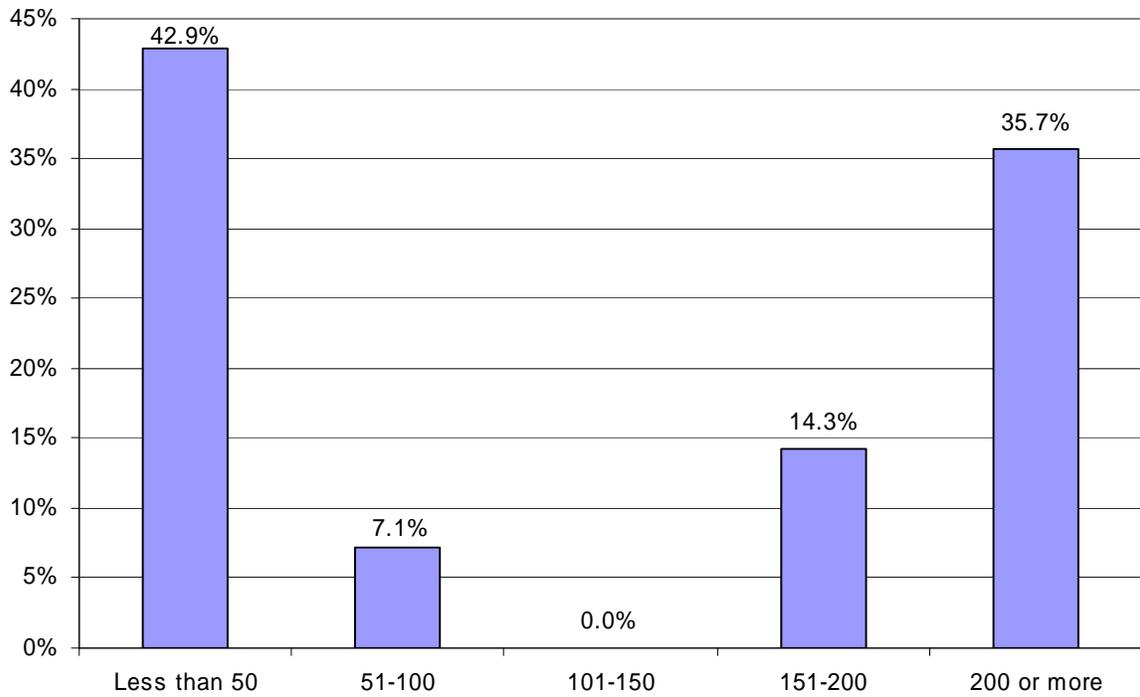


Figure 2. Size in acres of property of respondents to an email survey among Minnesota farm stay database participants, 2008 (n=14).

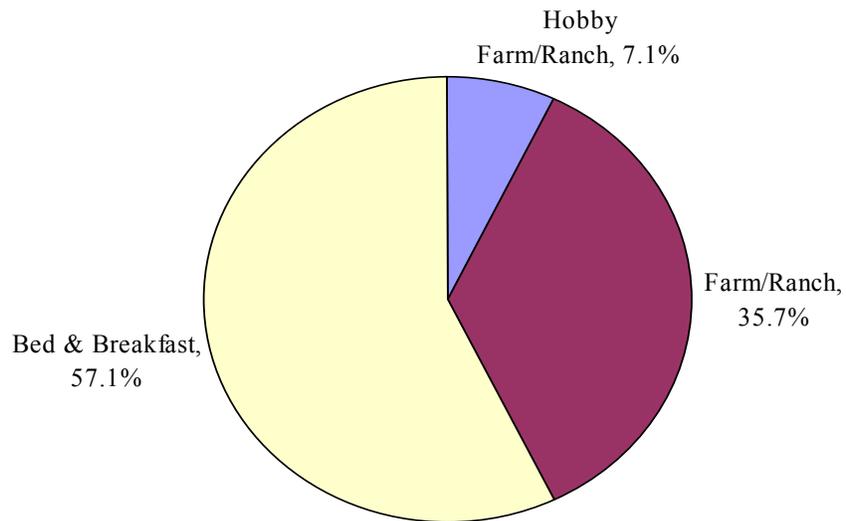


Figure 3. Description of primary function of property by respondents to an email survey among Minnesota farm stay database participants, 2008 (n=14).

Accommodations

One third (33.3%) of respondents indicated that accommodations at their facility are located in their own home (Table 3). About one fourth (23.8%) of respondents indicated that accommodations at their facility are located in a building separate from their home. A converted, existing building is used by one fifth (19.0%) of respondents and a specially built, dedicated guest structure is used by one sixth (14.3%) of respondents for accommodations. A small percentage (9.5%) indicated that they have camping at their facility. Accommodation capacity is generally small but varies substantially from site to site. Respondents most commonly (33.3%) indicated their capacity to be between 3-4 or 9-10 guests (Figure 5). Respondents less frequently (16.7%) reported capacities of 1-2 or greater than 10 guests. Qualitative analysis reveals that most guest rooms include a private bath and half also include a fireplace. Most facilities highlight breakfast or some other type of food during the stay as an important amenity.

Respondents most frequently charge a “mid-range” price for a one night stay at their facility with one third (35.7%) of respondents charging between \$51-100 and one third (35.7%) charging between \$101-150 for a one night stay (Figure 4). “Low-end” facilities priced from \$0-50 are offered by 14.3% of respondents. “High-end” facilities priced from \$151-200 and \$200 or more are offered by 7.1% of respondents, respectively. Half (50%) of respondents reported an occupancy rate of 0-25% (Figure 8). One quarter (25%) reported an occupancy rate of 26-50% and one quarter (25%) reported an occupancy rate of 51-75%. Increasing price of accommodations and increasing occupancy rate were highly correlated (.72). More than half (58.3%) of respondents indicated that their occupancy rate meets their goals (Figure 9). One third (33.3%) of respondents indicated that their occupancy rate is below their goals. Less than one tenth (8.3%) noted that they do not have an occupancy goal.

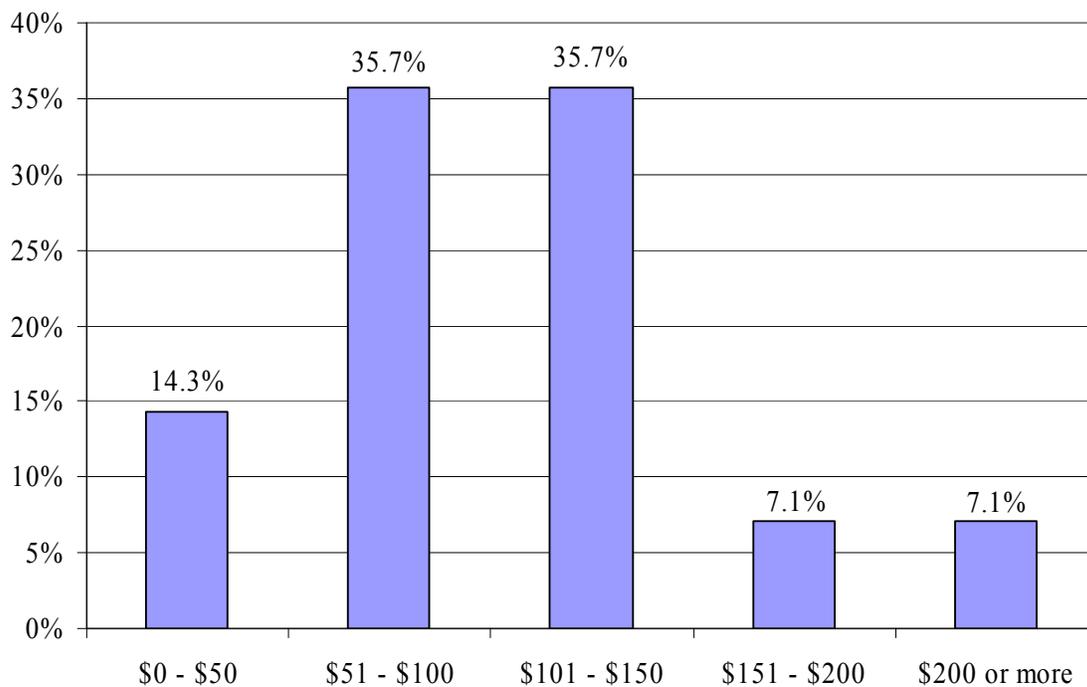


Figure 4. Accommodation fee for one night stay by respondents to an email survey among Minnesota farm stay database participants, 2008 (n=14).

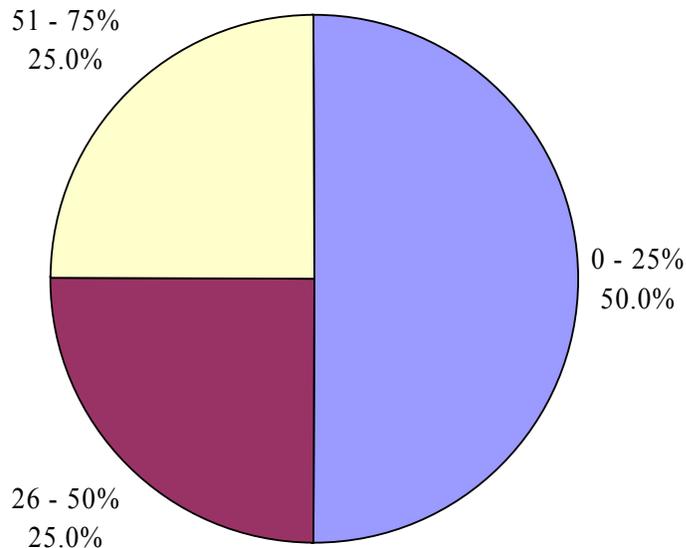


Figure 5. Accommodations occupancy rate by respondents to an email survey among Minnesota farm stay database participants, 2008 (n=8).

Respondents are evenly split regarding the work load of a tourist facility. About one third (36.4%) indicated that the impact of accommodations on their family work load is comfortable (Figure 6). About one third (36.4%) indicated they are stretched, but manage accommodations on their own. Finally, about one third (27.3%) hire out workers for or because of the accommodations offered.

Analysis of respondents marketing practices reveal that marketing is primarily directed towards tourists living 100-300 miles from the destination, particularly in the Twin Cities Metro area. Respondents market to a variety of clientele with interests in green travel, local foods, nature activities and farm experiences, among others. Some respondents noted that they do not market to specific groups. More than half (53.8%) of respondents indicated that they do not offer any type of package or discount for their facility. About one third (30.8%) do provide a package or discount and about one sixth (15.4%) offers a package or a discount depending on special circumstances.

Regarding revenue from accommodations, respondents were fairly polarized. More than half (58.3%) of respondents indicate that 0-25% of their annual revenue comes from accommodations (Figure 7). On the other hand, one third (33.3%) indicated that 76-100% of their income comes from accommodations and about one tenth (8.3%) indicated that 51-75% of their income comes from accommodations.

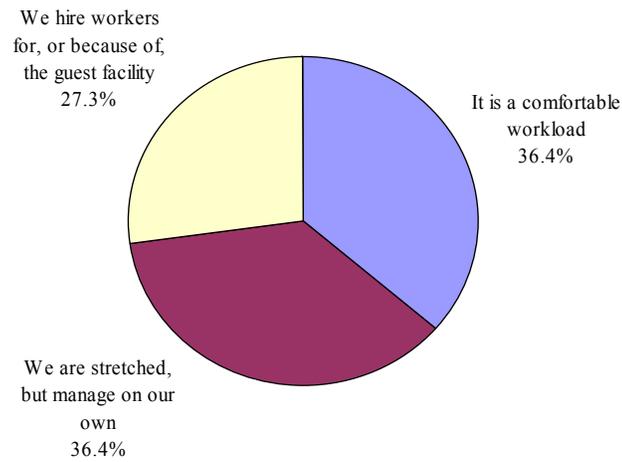


Figure 6. Impact of accommodations on family workforce by respondents to an email survey among Minnesota farm stay database participants, 2008 (n=11).

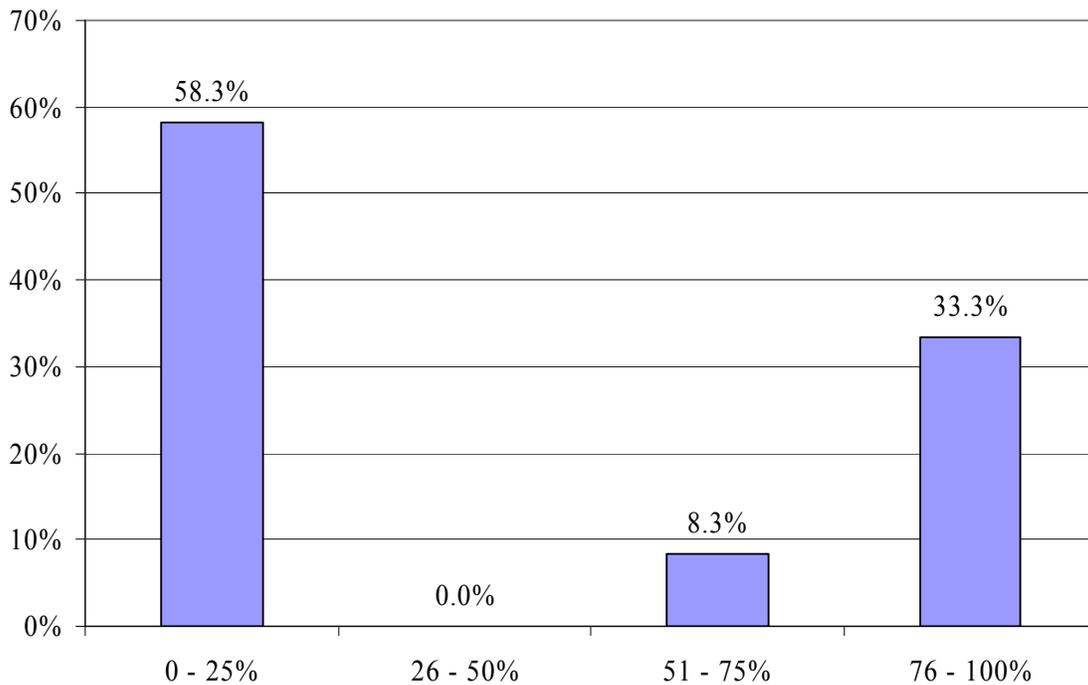


Figure 7. Percentage of annual revenue that comes from accommodations by respondents to an email survey among Minnesota farm stay database participants, 2008 (n=12).

Case Studies

Analysis of the two interviews completed by the author and the three site visits completed by Kent Scheer reveals several themes related to farm stays. Currently operating farms have a strong focus on education related to organic farming, general farm operations and traditional rural life. Farm stay accommodations are generally simple, located in the farm stay family's home, or in an old farm building that has been remodeled to provide accommodations. Farm stay operators are interested in connecting with other farm stays for educational and marketing purposes through a website, newsletter and/or brochures.

Discussion

Agritourism is growing in popularity throughout the United States and the 2008 farm stay research project provides a starting point for the development of more agritourism opportunities in Minnesota, particularly in the area of farm stays.

An exhaustive search of currently operating farm stays in Minnesota reveals that there are relatively few operating farm stays in Minnesota. This may indicate a lack of interest among farmers; however, it seems more likely that few people have learned about this opportunity. To further develop farm stays in the future, research on farmer interest will be beneficial. Educational materials distributed to small farmers will also highlight the potential for farm stays as a means of diversifying their income, meeting new people, and sharing their traditional rural life. Research will also help define consumer interest in farm stays. While past research is limited, McIntosh & Bonnemann (2006) found that visitors to WWOOF (World-Wide Opportunities on Organic Farms) farms were attracted to the rural nature of the experience, opportunity to learn about organics, personal meaningfulness of the experience, and the element of sincerity of the experience. Research such as this, related to farm stays, will help to form a basis for target marketing.

Current farm stays can benefit from increased targeted marketing. In both the survey and case studies, farm stay operators noted that they do not market to a specific audience or do not market in general. Furthermore, half of respondents have an occupancy rate of less than 25% and one third indicate their occupancy rate is below their goal, indicating that improved marketing may help them increase their occupancy rates so that they better meet their goals. Further research regarding accommodation price and occupancy rate is warranted. Higher accommodation prices are highly correlated with occupancy rate indicating that guests may prefer a more luxurious farm stay experience rather than a rustic, albeit more realistic, experience.

In addition, many respondents indicated marketing as one of the biggest challenges in operating a farm stay. This research supports a joint marketing program, such as a website (developed by Agricultural Alternatives) listing Minnesota farm stays as a way to increase knowledge of and patronage of farm stays. Since many farm stays do not offer any sort of discount, one suggestion may be to offer discounts if patrons learn of the facility through the farm stay website.

A clearly defined farm stay definition will help farmers interested in beginning a farm stay, as well as possible tourists, better understand the type of accommodation experience provided. A clearly defined farm stay definition has yet to be uncovered. The current working definition used in this research is:

“A working farm, market garden, forest, or orchard of at least five acres which provides overnight accommodations for paying guests, but receives at least 25% of its gross income from the sale of agricultural, horticultural, or forestry products” (Kent Scheer).

This definition may need to be adjusted over time but serves as a good starting place for farmers interested in beginning a farm stay and for tourists interested in visiting a farm stay. A definition, such as this one, should be included in the farm stay website. It may also be helpful to hold a workshop, or create a blog if meeting in person is not possible, of farm stay website members to work together to develop an agreed upon definition. Finally, while it may not be relevant for the definition, considering a large proportion of respondents included food in their definition of a farm stay, it may be appropriate to include food in a deeper description of farm stays or when marketing.

Education is a major component of a farm stay. Many respondents indicated that educating guests about organic farming, general farm practices and rural life were important to them. In fact, the social benefits of a farm stay may be a more important and greater benefit than any economic benefit derived from farm stays. Farm stays that were interviewed also suggested creating a farm stay network so that farmers can learn from each other. Including educational information related to accommodations, marketing, licensure and other relevant information would greatly enhance the farm stay website. In the future, a handbook for developing farm stays may be developed. This handbook will certainly aid farmers in entering the business. Current handbooks for developing a Bed & Breakfast in Minnesota and for developing Agritourism in Virginia have already been created. Using these guidebooks as references may help in developing a Minnesota farm stay handbook.

While education is a major component of a farm stay and interaction with farm activities is often mentioned as an important aspect of the experience, it will be important for farmers to understand the liability risks associated with guests assisting in farm chores. Collecting eggs or weeding a garden may have few risks but feeding animals or operating machinery will entail significantly greater risk. Farm stay operators must be aware of the risk they are taking on and properly insure themselves against liability.

While surveys and case studies provide the ability to better understand market potential, due to the limited number of respondents in this study the research should be used with caution. It cannot be considered statistically accurate, but still provides an opportunity to understand trends. Future research capturing a larger sample is advised. Regarding case studies, Valerie Shannon of Money Creek Buffalo Ranch and Mary Doerr of Dancing Winds Farmstay Retreat are strongly recommended for future interviews.

Farm Stay Interview Summaries

Triple L Farm and Bed & Breakfast phone interview with Joan Larson, Owner

Triple L Farm and Bed & Breakfast is located in Southwest Minnesota in Hendericks. The home is an original farm house that has now been converted to a Bed & Breakfast, co-habitated by the owners of the farm. The property contains the farm house, large barn, 2 cottages and 283 acres of rented farm land. Thirty acres of the farm land is in the Conservation Reserve Program (CRP) and the remaining area is used for growing corn and soybeans.

Triple L provides a variety of accommodations. Four rooms are licensed for Bed & Breakfast style accommodations within the home; however, only one of the rooms is currently being used for that purpose. The room currently used for accommodations has a private entry, private bath, queen size bed and furnished breakfast. Triple L also has two relatively primitive bunkhouses. Each room sleeps 4, has a refrigerator, microwave, hot plate and access to an outhouse or a bathroom with shower in the home.

The primary target market for the Bed & Breakfast style accommodations are families, primarily from the Twin Cities. Triple L actively encourages children and does not charge additional for children. The bunkhouses typically attract hunters who find the CRP land to be good for hunting. Triple L also promotes hiking and biking around the farm land, yard games for entertainment, and swings and hammocks for relaxation. Many guests come to Triple L because they have never been to a farm before and are looking for a “back home” experience. Triple L is near Westbrook where guests can visit actual sod houses. Bunkhouse guests also look forward to the chance to use an outhouse and to experience an “upgraded Little House on the Prairie” experience.

Triple L has great potential as a marketing site for farm stays. Although there are not any direct opportunities to work on a farm, the site is located directly in the middle of farming country and guests can see farming going on all around them. Triple L also has a large garden that could be used to serve local foods or possibly solicit help from guests with.

Triple L’s busy season coincides with hunting season where they have about 50% occupancy. The rest of the year, their occupancy rate is around 10-20%. They are extremely interested in marketing their facility as a farm stay. Currently it is marketed through BedandBreakfast.com, Explore Minnesota, word of mouth and the internet.

Dwelling in the Woods, phone interview with Patricia Woods, Director

The primary purpose of Dwelling in the Woods is to provide an opportunity for retreat. Dwelling in the Woods is located in Northern Minnesota and is surrounded by forest. While much of the retreat atmosphere takes into account the natural surroundings, there is very little, if any, agriculture. The greatest potential would be the large garden that is kept in the summer, which services about 30% of guests’ food. They also host several volunteer days throughout the summer when volunteers can help with environmental and facility maintenance. Dwelling in the Woods is most interested in continuing to maintain its retreat focus, but is interested in supporting surrounding farms in the area if a farm stay program is developed.

Dwelling in the Woods primarily markets through “Define the Divine” and other retreat websites. Explore Minnesota, Word of Mouth and newspaper articles are also important in their marketing. Their busy season is the fall and winter, with January being the busiest month. Their max capacity is 18 people and they have 8 hermitages (i.e. cabins). Guests at the facility are primarily middle-income, women, and Twin Cities residents. Dwelling in the Woods is a non-profit organization that relies on donations to keep the cost of the accommodations low.

The Dwelling is situated on 140 acres of managed forest land near McGrath Minnesota. The clientele served ranges from writers, to church groups, to yoga groups, to individuals. The facility has been in operation for 20 years. Its stated purpose is to provide a place for people to heal, and though it has a spiritual orientation it is completely non-denominational in nature.

The daytime and meal seating capacity is 26 people with overnight accommodations for 18. Buildings are designed to house two with a few having a higher capacity. Each has a bathroom. General interior decor is described as simple. While the typical visitor attends either with an organized group or alone, The Dwelling is fully able to accommodate families with children, though this is only a minor fraction of its clientele. The average customer is a female between 40 and 60 years of age. A three day stay is normal with weekends being filled throughout the year, though vacancies are common during mid-week. Fall and winter are the busiest seasons.

Amenities offered include massage, meditation, spiritual direction, a library, a walking labyrinth, forested hiking trails, and two mandatory quiet days. Staffing is three to four full-time (chef, director, manager, maintenance) and several part-time employees. Also, an extensive volunteer labor pool is cultivated and necessary, with eight volunteer workdays scheduled annually.

Their forest land is extensively managed including recreational trail maintenance, bud-capping, planting, logging and firewood harvest. This is a not-for-profit organization and the board of directors numbers 12 members from all over the state. As for providing referral to other retreat facilities, they have an occasional and informal relationship with a retreat in Little Falls, and "each visitor becomes an ambassador for the Dwelling".

Moonstone Farm

Moonstone Farm is not far from Montevideo, Minnesota. It is a family farm specializing in the production of organic beef. The owners also have a long-standing educational mission to facilitate awareness on organic and local foods issues for the region. Their farm offers internship opportunities to young people throughout the world through their connection with the WWOOF international organization.

The guesthouse is a small, separate building which was originally remodeled to house visiting friends and family. When it matured into a commercial rental the owners made a commitment to do this both right and legally. Therefore, it is licensed and subject to inspections at an annual cost of \$160. Their water is also annually tested.

Further, they have insurance coverage supplemental to their standard homeowner's policy.

Occupancy: last year every weekend from April through October was booked. This is without advertising, and merely by relying on referrals from friends and customers. In this way, they are found by the right kind of people and experience no problems or issues with their visitors.

Clientele: most come for the quiet, for rural beauty, and for "pastoralism". They may have writing or artwork to accomplish in a setting which facilitates focus. Some also have an early link with farming, having been raised on a farm. Finally, a few of the overnight guests are customers who come specifically to buy Moonstone beef.

Labor Base: the farm stay impact on family labor is appropriate. It requires about one hour of work following each stay, and this includes such things as doing laundry and cleaning the shower. It is wise to do this preparation immediately since one never knows when a call may come requesting accommodations. This also presents the only slight obstacle related to the farm stay, which is that at the time arrivals are expected it is necessary for someone to be at or near the house.

Though Moonstone routinely has summer interns their quarters and their work are separate from the "Broodio" farm stay.

Helpful services: things which would be helpful to them would be a professional brochure of farm stays with good color photos of each; an e-newsletter for Minnesota farm stays; and a means of exchanging tips and experiences with each other.

Earthrise Farm

Earthrise Farm is a very diversified and alternative farm operation founded by two sisters on their old, home-place near Madison, Minnesota. It has been in operation for 13 years.

Facets of Earthrise include a CSA, organic eggs and fowl production, an internship program, a library, a space for meetings, an educational component and facility, and a retreat capability for limited overnight guests.

There is a strong spiritual orientation to this farm stay, though it is completely non-denominational and encouraging of all religious pursuits. The sisters have a personal specialization in teaching "the new cosmic story from western science", and they maintain a connection with their mother house in Mankato which also has sisters who are a great resource for gardening.

Helpful Services: they would encourage a new farm stay organization to take the role of cataloging the teaching skills of all its members so that those skills could be traded within the group. Also, to create and provide a list of others with relevant teaching skills.

As a side note; the three best known sustainable farm operations in this area provide a wonderful benefit to their interns by gathering them all together for regular events tailored to these youth. Therefore, the suggestion is that all internships within a farm stay organization should also be noted, so that this benefit might be extended.

References

Blacka, Aaron; Pierre Couture, Charles Coale, John Dooley, Andy Hankins, Ann Lastovica, Brian Mihalik, Charlotte Reed, Muzzo Uysal (2001). *Agri-Tourism*. Retrieve from <http://www.ext.vt.edu/pubs/agritour/310-003/310-003.html#L2> on 12/09, 2008. Virginia Cooperative Extension.

Explore Minnesota Tourism (2008). *Tourism & the Economy*.

McIntosh, Alison J. and Susanne m. Bonnemann (2006). *Willing Workers on Organic Farms (WWOOF): The Alternative Farm Stay Experience?* Journal of Sustainable Tourism 14(1): 82-99.

Minnesota Department of Agriculture (2007). *Minnesota Agriculture: The Foundation of Minnesota's Economy*.

Websites searched for farm stays

Name

Address

Community Supported

<http://www.landstewardshipproject.org/csa.html>

Agriculture

Couch Surfing Project <http://www.couchsurfing.com/>

Green Routes <http://www.greenroutes.org/>

Land Stewardship Project <http://www.landstewardshipproject.org/>

Minnesota Bed & Breakfast Association <http://www.minnesotabedandbreakfasts.org/>

Minnesota Buffalo Association <http://mnbison.org/>

Minnesota Grape Growers Association http://mngrapes.org/?page_id=23

MN Grown Directory <http://www.mda.state.mn.us/food/minnesotagrown/directory.htm>

The Hospitality Club <http://www.hospitalityclub.org/>

World Nomads <http://www.worldnomads.com/>

Farm Stays Identified

Name	City	State	Website
Acorn Ridge Farm	Staples	MN	
August Earth	Hutchinson	MN	
Camphill Village Minnesota	Sauk Centre	MN	http://www.camphillvillage-minnesota.org/
Carmel Apple Orchard Inn	Staples	MN	
Dancing Winds Farmstay Retreat	Kenyon	MN	http://www.dancingwinds.com/about.html
Dream Acres	Wykoff	MN	
Earthen Path Organic Farm	Lake City	MN	
Earthrise Farm	Madison	MN	http://www.earthrisefarmfoundation.org/index.html
Four Columns Inn	Janesville	MN	http://www.fourcolumnsinn.net/
Gardens of Eagan	Farmington	MN	
Green Island Preserve and	Wadena	MN	

Retreat

Hand N Home Farm	South Haven	MN	
Hawkeye Buffalo Ranch	Fredericksburg	IA	http://www.hawkeyebuffalo.com/
Hungry Point Inn	Welch	MN	http://www.hungrypointinn.com/
Kara Kahl Farm	Houston	MN	
Kitty Ridge	Winona	MN	http://www.farmwinona.org/
Money Creek Buffalo Ranch	Houston	MN	http://www.buffalogal.com/
Moonstone Farm	Montevideo	MN	http://www.prairiefare.com/moonstone/index.html
Natures Nest Bed & Breakfast	Montrose	MN	http://www.naturesnestfarm.com/index.htm
Northern Light Farm	Solway	MN	
Philadelphia Community Farm	Osceola	WI	http://philadelphiacommunityfarm.org/
Round Barn Farm B&B*B	Red Wing	MN	http://www.roundbarnfarm.com/
Springside Farm Stay			
Steven Pines Farm			
Sweet Retreat, A Bed & Breakfast Inn	Alexandria	MN	http://www.sweetretreatbandb.com/
The Women's Environmental Institute	North Branch	MN	http://www.w-e-i.org/
Triple L Farm Bed & Breakfast	Hendricks	MN	http://lllfarmbb.com/Home.html
White Earth Land Recovery Project Farm	Ponsford	MN	
Whiteley Creek Homestead	Brainerd	MN	http://www.whiteleycreek.com/
Country Gardens on Lake Mina	Alexandria	MN	

Other Farm Activities

Name	City	State	Website
Gale Wood Farms	Minnetrista	MN	http://www.threeriversparkdistrict.org/parks/galewoods.cfm
Nitty Gritty Dirt Farm	Harris	MN	http://www.landstewardshipproject.org/cs.a.html#nitty
Poplar Creek Guesthouse Bed & Breakfast	Grand Marais	MN	
The Bohemian Bed & Breakfast	New Ulm	MN	
Round Barn Farm B&B	Red Wing	MN	
The William Sauntry Mansion	Stillwater	MN	
TC Davis Manor B&B	Farmington	MN	
Afton House Inn	Afton	MN	
Historic Dayton House	Worthington	MN	
Bird House Inn B & B	Excelsior	MN	
Home in the Pines Bed & Breakfast	Duquette	MN	
Spicer Castle Inn	Spicer	MN	http://www.spicercastle.com/
North Creek Community Farm	Prairie Farm	WI	http://www.northcreekcommunityfarm.com/
The Dwelling in the Woods	McGrath	MN	http://www.thedwellinginthewoods.org/index.html

Reference Websites

Name	Website
Rural Bounty	http://www.ruralbounty.com/
A Lancaster County, PA Farm Stay	http://www.afarmstay.com/

Leaping Lamb Farm Stay	http://www.leapinglambfarm.com/
Pennsylvania Farm Vacation Association Inc.	http://www.pafarmstay.com/
Italy Farm Stay	http://www.italyfarmstay.com/
Farm Stay and Ranching	http://www.infohub.com/travel_packages/farm_stay_ranching.html
Canter Berry Trails Apple Ranch	http://farmstay.us/
Montana Bunkhouses	http://www.montanaworkingranches.com/
Rustic Vacations	http://www.rusticvacations.com/
Tennessee Agritourism	http://tnvacation.com/agritourism/
Agri-Tourism - Virginia Cooperative Extension	http://www.ext.vt.edu/pubs/agritour/310-003/310-003.html

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Marketing Grasses for Conservation

A Guide for Growers in Northwest Minnesota

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INTRODUCTION TO GRASS SEED PRODUCTION IN NORTHERN MINNESOTA

Grass seed crops have been raised in northwest Minnesota for several decades. The supply and demand curve for grass seed crops is similar to other crops (corn, wheat, soybeans). In times of short supply, the demand rises as does the price. Conversely, in times of excessive production, demand weakens, and prices fall. An additional risk associated with grass seed crops if market demand is weak, not only will crop movement come to a halt the crop cannot be sold. For example, if a grower has wheat in the bin and decides to sell, the farmer can haul to the elevator and get paid, even if the price is below the breakeven cost of production. For the grass seed crops this option doesn't exist. If market demand is weak the crop will stay in storage, as it has no place to move, and the producer cannot sell this crop until the market demand improves. This lack of a market can place tremendous cash flow demands on producers who have grass seed to sell in times of weak grass seed demand.

The sales and prices of grass seed crops in the early-to-mid 2000's have, for the most part, been strong. Several reasons for this strength include:

- Native and other grasses included in CRP mixtures and other conservation program requirements
- Requirements for grasses (both native and others) in re-vegetation projects, mine reclamation, road construction and rights-of-ways
- Short supply of many native and other grass species which lead to spikes in prices
- Tight margins in grains and livestock prices have producers looking for profitable alternatives

- Many producers have strong interest in any new crop that can be produced with a profit potential

Northern Minnesota can produce grass seed from both cool and warm season grasses. Due to the climate however, cool season grasses are better adapted to the area than warm season grasses. Warm season grasses generally take at least one, maybe two additional years to establish and produce seed compared to cool season grasses.

Cool season grasses include:

Kentucky bluegrass

Perennial ryegrass

Timothy

Tall Fescue

Warm season grasses include:

Big Bluestem

Indiangrass

Prairie cord grass

Switchgrass seed yields and prices paid to the grower can vary widely (Table 1). The data in Table 1 is an estimate of crop yields and the range of prices paid to the grower in northern Minnesota. How is possible that grass seed crops are so variable in yield potential? Environmental conditions, frost, winterkill, too much rain, too little rain, heat during seed set and wind all can cause significant reductions in grass seed yield potential. In addition, crop protection products are limited for use in grass seed crops. Weeds not controlled and allowed to grow with the grass seed crops will reduce seed yield and quality of harvested seed.

	Year 1	Year 2	Year 3	Average
Crop	-----Percent-----			--#/acre--
Ryegrass	100	0-50	0	750
Bluegrass	25-75	100	100	250
Timothy	100	100	100	300
Tall Fescue	100	75	50	400
Big Bluestem	40	100	100	175
Indiangrass	20	80	100	150
Switchgrass	40	100	100	300

Table 1. High, low and average yields and prices paid for selected certified grass seed crops raised in northwest Minnesota during 2005-2009

Crop	Crop Yield			Grower Price		
	Low	High	Average	Low	High	Average
	-----Pounds/acre-----			-----Dollars/pound-----		
Bluegrass	75	700	250	0.65	1.25	0.85
Timothy	150	600	300	0.30	0.90	0.65
Tall Fescue	200	550	400	0.60	0.80	0.70
Reed Canary	50	550	200	0.70	1.80	1.10
Indiangrass	50	250	150	2.25	7.50	3.75
Switchgrass	200	500	300	0.50	3.00	1.50

Table 2. Percent seed yield, after the initial establishment year, from selected grass seed crops raised in northwest Minnesota.

Grass seed crops will vary in the time requirement to reach its full yield potential (Table 2). The information in Table 2 is based on the crop yield potential the first year after establishment. For example, perennial ryegrass stands can be established by using three different seeding methods; direct seeding in the late summer, under seeded with spring wheat, or no-till seeded after wheat harvest. The ryegrass crop must overwinter to produce seed (similar to winter wheat) and ryegrass is harvested the second year after establishment. In Minnesota conditions, perennial ryegrass reaches the full yield potential in the first year after the establishment year. Other crops have a yield depression the first or second year after establishment (bluegrass, indiagrass, big bluestem). A producer must adjust the necessary cash flow for crops that have a time lag to reach full production potential.

How much money can be made in grass seed crops with high yields and prices? As an example, the low and high yields and price paid for perennial ryegrass is listed in Table 3. If top end yields are produced (1,500 pounds/acre), even with a low price of \$0.35/pound the grower would realize a profit of \$243.00/acre (profit margin of 86%). If perennial ryegrass price was high, \$0.65/pound, the grower would realize a profit of \$693/acre (profit margin of 246%).

Significant money can also be lost in grass seed crops. For example, if low yields and low prices are received for perennial ryegrass, the result is a negative profit margin (Table 3). If a year's production is 300 pounds/acre with \$0.35/pound the grower would lose \$177/acre and have a negative profit margin of 63%. Even if the price was high, (\$0.65) with low production, results in a negative profit margin of \$87/acre and a negative profit margin of 31%.

Other grass seed crops follow a similar pattern with high yields and high prices. Lucrative profit margins can be made. However, with low yields and low prices, grass seed crops have the potential for significant financial losses to the grower. The potential profit margin for grass seed crops is the primary reason for the interest in growing grass seed crops.

RISK MANAGEMENT

The management of risk is an important consideration in any crop production enterprise. First and foremost, it's critical a producer; 1) identify the risks associated with the production of a grass seed crop, and 2) have a detailed management plan to minimize risk. Some risks cannot be controlled, weather and markets, are two examples. Often times we spend too much time in areas of no control that we limit the time spent on things which we have control.

Other risks are within our control and management plans should be in place to address these risks. As an example crop production risks include:

- What is the fertility requirement of the crop?
- What is the best soil type?
- Are pest control options available?
- What are the costs?
- When to plant and harvest?
- What is a reasonable yield goal?

In crop production one method to improve the cash flow is to improve the production per unit area. The other area is cost control. A production management plan for grass seed crops should outline strategies that maximize yield potential and produce high quality seed production with cost constraints will greatly improve the chance of a successful grass seed enterprise.

Too often, marketing plans if written at all, are one of the last management plans written. In production agriculture we spend time the most time and resources to maximize production (bushels or pounds). A marketing plan is critical to the success of any crop production enterprise. However, it's even more important in the grass seed crops due to the extreme volatility of market demand and price. It's always tempting to chase the "hot commodity" only to be disappointed when the high price of last year is now the low. In the marketing plan make sure to review production contracts compared to open market for the grass seed crops. In addition, establish a good relationship with seed conditioners and marketers. These contacts will be a valuable resource in the marketing of any grass seed crop.

CURRENT MARKET

The grass seed market is not immune to the state of the global economy. The current economic downturn has a negative impact on the marketability of grass seed crops. In a years' time we have seen a range in commodity prices from last season's all time high to this year of loan rate or below. The grass seed crops have seen a similar roller coaster in prices. Today's low prices should serve as a reminder that markets have been hot and cold in the past and will, no doubt, be hot and cold into the future. Grass seed growers must have a long term time horizon (suggested 5 years) to make a profit in times of opportunity and challenges. Grass seed growers that are always chasing the hot market will lose out on much of the opportunities and will suffer more of the challenges and difficulties.

Several principles reinforced in this marketing guide:

- Grass seed crops can be profitable in northern Minnesota
- Grass seed markets are volatile
- Grass seed yields and prices are variable
- Grass seed producers must have a long term horizon to maximize profit potential
- Grass seed crops are not created equal
- Limited production and marketing information for grass seed crops

This guide is a first step in the process to gather information that will help grass seed producers be more profitable.

FUTURE CONSIDERATIONS

Grass seed crops in northern Minnesota have a varied history. Kentucky bluegrass seed has been raised in Roseau and Lake of the Woods counties of northwest Minnesota since the 1950's. In fact, the variety 'Park' was released by the University of Minnesota in the late 1950's and is still in production today. Contrast this with perennial ryegrass seed, which has been raised at a commercial level only since the early 2000's. Over the years, several grass seed crops have been in and out of favor. What is the next grass seed crop on the horizon? It's probably safe to say that nobody knows for sure. In addition to the turf, landscape and lawn markets grass seeds are used to establish forage crops for livestock, highway rights of way projects and various land reclamation projects. Grasses may be important in other markets well into the future.

Other benefits to grass seed crops:

- The "green movement" will lead to more grasses on the landscape
- A potential biomass crop for energy production
- A potential value added enterprise with straw after grass seed harvest
- Grasses are an important component in conservation programs
- Whole plants can be sold into the ornamental market

To be successful the grass seed industry must continue to develop linkages between producers, seed conditioners, marketers (both domestic and export), researchers, and the consumer. Hopefully, this marketing guide will serve as a small step to share current knowledge of the grass seed industry in northern Minnesota with the goal to have a successful and vibrant grass seed industry into the future.

ECONOMICS OF GROWING PERENNIAL GRASSES

An enterprise budget lists the estimated cost of production. The economic data for Kentucky bluegrass and perennial ryegrass was gleaned from farmers, processors, lenders and the Farm Business management (FBM) program at Northland College in Thief River Falls. Data is northern Minnesota averages for 2009.

PRODUCTION COSTS FOR KENTUCKY BLUEGRASS AND PERENNIAL RYEGRASS SEED

Kentucky bluegrass and perennial ryegrass projected income and expenses for the 2010 crop are presented in Table 4. Crop budget figures are based on average crop yields and projected 2010 prices paid to the

growers in northern Minnesota. This data represents the average costs and returns to produce a Kentucky bluegrass and perennial ryegrass seed crop in northern Minnesota.

Crop Income	Kentucky bluegrass	Perennial ryegrass
Yield/acre	250 #	750 #
Price/#	\$0.75	\$0.40
Total Return/acre	\$187.5	\$300.00
Direct Expenses		
Seed	\$2.00	\$12.00
Fertilizer	\$63.00	\$63.00
Crop Chemicals	\$18.00	\$60.00
Crop Insurance	\$4.00	\$4.00
Fuel and Oil	\$13.00	\$17.00
Repairs	\$18.00	\$18.00
Custom Hire	\$10.00	\$10.00
Rouging		\$10.00
Land Rent	\$45.00	\$45.00
Machinery Lease	\$1.25	\$1.25
Drying		\$0.25
Operating Interest	\$12.00	\$12.00
Miscellaneous	\$1.00	\$1.00
Total Direct Expenses	\$187.25	\$253.50
Indirect Costs	\$45.00	\$45.00
Total Expenses	\$232.25	\$298.50
Profit/acre	-\$44.75	\$1.50

Table 4. Kentucky bluegrass and perennial ryegrass seed crop budget for 2010 production in northern Minnesota

The information presented in Table 4 is the average yield and price to producers and will give an indication of the profitability of the grass seed crops raised in northern Minnesota. Total income was generated using the average price and yield figures listed in Table 1. The information for the direct expenses for the various crops was gleaned from area lenders, growers and seed conditioners. It was assumed that overhead expenses would be similar and would average \$45.00/acre.

Projections for the 2010 season suggest with average yields and prices, ryegrass will generate a small (\$1.50) positive profit margin. Kentucky bluegrass and other grass seed crops will have a negative net return/acre and profit margin. With average yields and prices one would ask why even consider raising a grass seed crop? The answer, if yields and prices are better than average significant money can be made (Table 1)

Grass seed crops are in a period of low prices and soft demand. However, just a few short months ago the price and demand for seed was much better. For example, the price/pound to the grower for Kentucky bluegrass was \$1.25 and perennial ryegrass was \$0.55. If we enter the 2009 prices into the crop budget in Table 4 the profitability picture is much better than it is today. For example, if we use the 2009 budgeted price for perennial ryegrass (\$0.55/pound) the total return is \$412.5 not the \$300 listed in Table 4. If we use

the 2009 budgeted price for Kentucky bluegrass we have a total return of \$312.5 not the \$187.5 listed in Table 4. By using a higher price (one that was available in 2009) Kentucky bluegrass generated a profit of over \$80/acre and perennial ryegrass returned \$159/acre to the grower.

MARKETING PERENNIAL GRASS SEED

Perennial grass varieties generally fall into two major categories; turf types and forage types. In the United States, the Pacific Northwest (PNW) region accounts for the majority of the grass seed production.

The grass seed crops can be classified as a specialty market. The quantity of grass seed sold each year will depend upon market demand. Market demand is variable from year to year and from one grass species to another. One year the demand will be strong for a specific grass seed crop and the next the demand can be weak to non-existent.

In Northern Minnesota, private business and grower cooperatives are responsible for the sales and marketing of grass seed. Grower associations work closely with private enterprises and area seed and conditioning plants to produce a high quality product. Once the seed is cleaned and conditioned, seed will be marketed. The timings of seed sales are based on market demand by the end user.

Grass seed producers have two primary marketing strategies: 1) Sell the crop into the cash market, or 2) Sell the crop with a contract. The current market determines the price in the cash market. The price paid for seed in the cash market is determined based on seed demand at the time of sale. In times of high demand, the market price generally is high and conversely in times of low demand the price paid for seed will be low. The price paid on the cash market generally has high volatility. Times between market high and lows can be months to years. Seed sales into the cash market carries high amount of risk. In times of high demand, seed can be sold for a relatively high price. However, in times of low demand the price paid is low. During these times of low demand, often the seed cannot be sold and will have to be stored for an extended period of time.

CONTRACT PRODUCTION

A production contract is an agreement signed between a seed company and the grower. In this contract, the grower agrees to produce a specific grass seed variety, at a predetermined price. Most production contracts are for certified production. The contract will outline the seed quality, expected delivery dates and payment terms. Field inspection is normally required for the certified seed production. It is very important for producers to understand the production contract before signing. Seed not meeting the specific grade listed in the contract may be purchased, but usually at a deeply discounted price. Seed lots not meeting contract standards may be marketable but usually at a lower price.

A grass seed production contract will reduce price risk and market volatility to the grower. An important consideration of a production contract; the seed produced generally can be sold in a timely manner. This allows a grower to estimate annual revenue, as the seed price is fixed and yield and delivery date can be estimated.

OPEN MARKET

Grass seed produced for sale in the open market carries more risk, but may have more reward (if it can be sold) than sales through a production contract. Grass seed sales in the open market occur when the demand

for a specific grass seed crop is high. When demand is high the price paid generally follows. Conversely, if the demand is low, not only is the price paid low but the seed may not be marketed or sold. Grass seed that cannot be sold will have to be stored by the grower. Market forces may require seed storage for several months or years. If a grower's financial position allows seed storage without revenue generation, the open market may offer opportunities. However, if seed sales are a significant portion of the annual cash flow, ryegrass sales on the open market may not be the best marketing strategy.

SEED CERTIFICATION

The Minnesota Crop Improvement Association (MCIA) is the official seed certification agency in Minnesota. MCIA conducts field inspections and laboratory tests to assure grass seed produced in Minnesota meets established certification standards. Seed grown under contract generally is sold as certified seed. Certified seed is produced under a set of seed certification standards. These standards assure seed buyers a consistent quality in each lot of seed purchased. Seed produced without certification is called "common seed" or variety not stated (VNS). The production of common seed generally carries more risk to the grower compared to certified seed. If market demand is high, common seed, (VNS) generally can be sold. However, if market demand is low, common varieties may have to be stored until market demand improves or be sold at a discounted price. Grass seed crops recently have adapted seed certification for "source identification" that in many instances parallels certification programs of grain and legume crops. Seed certification and source identification provides for the use of adapted grass species (biotypes) base on geography. Grass seed crops, both native and non-native, are tested by the same standard testing procedures for seed quality standards (e.g. germination and purity) as other seed crops.

Experienced grass seed producers are best suited to grow the "difficult" grass species, and novice growers should begin on a small scale with "easier" grass seed crops. Prior to the establishment of a new grass seed field, always visit with a reputable seed dealer or conditioner in your area. These businesses are involved in the seed industry and will help determine a "realistic" potential yield and future demand salability and value of the seed crop produced in the area.

SUMMARY

Money can be made in the production of grass seed crops in northern Minnesota. However, money has been and will be lost in the future due the volatility and market cycles of the grass seed market. The grass seed market offers good economic opportunities for producers in northern Minnesota. Success in the production of grass seed will require good knowledge of biology and adaptability of crops to the area, a willingness to learn new production techniques, have a good relationship with seed conditioners and have an active marketing plan for each grass seed crop produced. Although tempting, the grass seed business should not be looked at a "lottery, or get rich quick business". Too often, producers look at a crop when the price is high and get in just as the price plummets and the grass seed crop that had huge economic possibilities has been devalued to well below the cost of production.

Before entering a new crop enterprise it's a good idea to have a 5 year business plan developed. Components of this business plan will include potential crops, production information for each crop, additional capital and labor requirements and a detailed marketing plan. This business plan will be a good roadmap for this new grass seed enterprise.

VALUE-ADDED PERENNIAL GRASS PRODUCTS

A potential value added crop for perennial grass is the straw. The grasses are swathed prior to harvest. The seed is separated from the straw with a combine and the straw spread with straw choppers or dropped in windrows behind the combine. Once the straw is dropped to the ground it can be burned, baled or tilled into the soil. In Kentucky bluegrass, the majority of the straw is burned. Estimates for perennial ryegrass straw would be 50% baled, 30% burned and 20% tilled into the soil.

What is the quantity of Kentucky bluegrass and perennial ryegrass straw produced after the seed is removed by combines? The amount of straw produced varies by crop and management practice. Cutting height of the grass seed crop will have a significant impact on the number of bales/acre. The age of the bluegrass stand will impact the amount of straw produced. First year stands and old stands tend to produce less straw than the second to fifth year of production. In ryegrass, growth regulators can be applied to reduce plant height. This growth regulator will have a negative impact on the amount of straw produced/acre.

STRAW YIELD

Kentucky bluegrass and perennial ryegrass straw produced in a related study during the 2008 crop year is presented in Table 2. The data presented is the low, high and average for each crop. Stubble height averaged 6 inches for both crops. Producers in the yield study indicated that the amount of straw produced was about average for each crop and should give a representative quantity of straw production with current management practices. Straw yields were determined based on bale counts from bluegrass and ryegrass fields.

	Kentucky Bluegrass			Perennial Ryegrass		
	Low	High	Average	Low	High	Average
	-----tons/acre-----			----- tons/acre----- --		
Straw	0.5	1.75	1.0	0.75	3.25	2.75

Table 5. Low, high and average straw production from Kentucky bluegrass and perennial ryegrass fields in northern Minnesota

On average, straw production was 1.0 and 2.75 tons/acre for Kentucky bluegrass and perennial ryegrass, respectively (Table 5). Forage production is on an “as fed” basis and will be converted to dry matter equivalents for nutrient comparisons. The moisture content of the straw ranged from less than 10 to over 20%.

VALUE OF KENTUCKY BLUEGRASS AND PERENNIAL RYEGRASS FED TO LIVESTOCK

An assessment of Kentucky bluegrass and perennial ryegrass straw is presented in Table 6. Data presented is on a dry matter basis. Average moisture content was 13% for bluegrass and 22% for ryegrass. Crude protein

(CP) averaged 6.86% for Kentucky bluegrass and 5.17% for perennial ryegrass. The nitrogen content of the forage is calculated from the amount of CP in the forage. The relationship is CP = % nitrogen x 6.25.

	Kentucky Bluegrass	Perennial Ryegrass
Crude Protein*	6.86%	5.17%
Total Digestible Nutrients	45.51	49.56
Relative Feed Value	64.49	72.05
Phosphorus*	0.23%	0.19%
Potassium*	1.16%	1.09%
Ash Content	6.24%	5.98%
% Moisture	13	22

Table 6. Forage quality analysis for Kentucky bluegrass and perennial ryegrass straw

Forage quality will determine the value of a forage lot. Relative feed value (RFV) is a common measurement used to value forage. Forages are bought and sold based not only on quantity (tons) but on the forage quality. The USDA Hay Market News is a good source for forage price information as are local hay auctions. Dairy quality forage in the premium grade will have an RFV of over 170. Utility hay grades are forages with an RFV of less than 130.

The market for premium grade forage in large round bales in August 2009 ranged from \$87.50 - \$125/ton. Utility or grinding hay in large round bales range from \$33 to \$60/ton. Kentucky bluegrass and perennial ryegrass straw would be on the low end of the utility hay grade market and could potentially average \$20-\$40/ton.

The data indicate, on average, Kentucky bluegrass will produce 1.0 ton of straw/acre and perennial ryegrass 2.75 tons of straw/acre. If we use a local average value of \$30/ton for straw the value of Kentucky bluegrass will be 1 ton/ac x \$30/ton = \$30/acre. For perennial ryegrass the average production was 2.75 tons/ac x \$30/ton = \$82.50.

VALUE OF KENTUCKY BLUEGRASS AND PERENNIAL RYEGRASS AS A SOURCE OF BIOMASS

Biomass gasification is a process that converts a carbon source into carbon monoxide and hydrogen. This conversion process is accomplished in a reactor that converts the carbon material (biomass) at a high temperature with limited oxygen. The product of this reaction is a gas mixture called synthesis gas or syngas for short.

Preliminary research conducted by the Agricultural Utilization and Research Institute (AURI) suggests that Kentucky bluegrass and perennial ryegrass are excellent candidates as a source for biomass. Northern Minnesota has three grass seed cleaning plants that condition grass seed produced by local farmers. Laboratory testing by AURI indicates grass seed screenings and straw have potential as biomass crops (Table 7). Kentucky bluegrass and perennial ryegrass compared favorably to wood pellets in the production of energy (British Thermal Units - BTUs). The question yet to be answered is how do the laboratory results compare with a production scale gasifier?

	BG screenings	BG straw	RG straw	Wood pellets
Moisture	6.27	7.0	6.73	4.31
Ash	10.16	5.64	4.7	1.86
BTUs/ton	6,828	7,033	7,165	7,941

Table 7. Percent moisture, ash and energy content of various biomass sources.

COSTS OF BALING AND TRANSPORT OF GRASS STRAW

Kentucky bluegrass and perennial ryegrass straw are potential biomass crops and the straw will have to be gathered (baled) and transported to a gasification facility. What are the costs associated with straw? The information in Table 8 lists average costs of baling and moving the straw to the edge of a field. These estimates indicate that an average cost to bale and transport baled straw to the field edge would be \$18.40.

	Low	High	Average
	-----Dollars/acre-----		
Raking	1.50	10.00	5.70
Baling	7.00	14.00	9.70
Moving Bales	1.30	5.00	3.00
Total			18.40

Table 8. Custom rate charges for gathering and transporting straw

WHOLE PLANT BIOMASS POTENTIAL

Cool and warm season grasses have potential to be utilized as a source for biomass. Currently, a market has not been developed for plants to be produced strictly for biomass. This may be a potential market for grass plants in the future. How much biomass will grasses produce in a calendar year? The data in Table 9 lists the annual dry matter production of several grasses.

The data in Table 9 is biomass yields of cool and warm season grasses grown at the University of Minnesota Crookston (UMC). The above grass varieties were seeded and managed as a mono culture crop. Harvested grasses were cut twice, if cool season and once if warm season. In northern Minnesota conditions cool season grasses will grow in the spring and late summer and have a mid-summer slump in growth, while warm season grass growth is limited to the mid-summer months.

In 2008, biomass production of the various grasses ranged from 2.38 to 7.25 ton/acre (Table 10). The data suggests that biomass potential of the cool season grasses ranged from 4.65 to 7.25 and the warm season grasses from 2.38 to 5.43 tons/acre. This data gives an approximation of the biomass potential for grasses raised in northern Minnesota.

SUMMARY

Supply and demand control marketing of perennial grasses and the biomass market is still developing. Currently there are not any producers growing biomass for energy as the technology is not commercially available in northwest Minnesota. Into the future, producers may have small on-farm

gasification systems, or communities may have large scale gasifiers to produce heat, syn-gas, electricity or even nitrogen fertilizer.

Currently there is limited marketable exchange of biomass in the state. Some exchange has taken place and producers have earned between \$25-50/ton.

Still much to be done with growers for them to understand cost of production (including harvest and storage) before they can feel confident marketing their crop for biomass.

OTHER EFFORTS TO ASSIST PRODUCERS WITH DEVELOPING BIOMASS MARKETS

MINNEAPOLIS BIOMASS EXCHANGE

The Minneapolis Biomass Exchange is a free listing for producers seeking markets for their biomass. According to their website (<http://www.mbioex.com>) they 'are the Midwest's leading logistical biomass exchange solution, providing easy access to wood and agricultural residue producers, balers, transportation providers and buyers. The Minneapolis Biomass Exchange mission is three-fold: 1) Provide a better market opportunity for buyers and sellers, 2) Increase efficiencies by linking harvesters and transporters to buyers and sellers, and 3) Increase knowledge and reduce party risk through leading-edge technology.

FARM SERVICE AGENCY'S BIOMASS CROP ASSISTANCE PROGRAM (BCAP)

The Biomass Crop Assistance Program is a USDA Farm Service Agency program that provides financial assistance to producers or entities that deliver eligible biomass material to designative biomass conversion facilities. Eligible biomass owners, who are delivering to an approved facility and receiving payment from the facility, may apply for a "matching" BCAP payment from Farm Service Agency up to \$45/dry ton for up to two years of payments.

PERENNIAL GRASS SEED STAND ESTABLISHMENT

WHEN TO ESTABLISH PERENNIAL GRASSES FOR SEED PRODUCTION

Perennial grasses in Minnesota have been successfully established in the spring, summer and fall. Generally, cool season grasses are established in the spring or late summer and warm season grasses in the late spring. Cool season grasses can be established with a companion crop or direct seeded, while warm season grasses generally are direct seeded.

SEEDBED PREPARATION

Historically, small seeded grasses would be seeded into a soil that is free from soil clods and into a smooth, well-tilled seedbed. The rule of thumb; if the heel on your shoe leaves an indent of ½ to 1 inch the seedbed is fit for seeding small seeded grasses. The seed bed should have good moisture and free from emerged weeds. This is still a good recommendation for tilled soil as a smooth, firm, moist soil will promote seed germination and growth of seedling grasses.

In the last few years, equipment manufacturers have improved the technology of no-till drills which allow successful no-till establishment of grass seed crops. Seed placement, depth control and minimal side wall compaction are much improved with these "new generation" no-till drills. Weed control is

critical when seeding small grasses with a no-till drill. An application of Roundup or other non-selective herbicide prior to seeding will remove emerged weeds. Weed control is a critical step in no-till seeding. The seeding operation generally is later in no-till compared to conventional tilled soil. In either case, it's critical to have enough moisture for the seed to germinate, but not too much which promote soil diseases, will contribute to seed rot and will increase the mortality of the young grass seedlings.

One critical consideration is field selection. Hopefully, this grass seed crop will be in production for several years and should be as weed free as possible prior to seeding. Perennial weeds, especially grasses are difficult to manage in perennial grass seed crops. These perennial weeds not only compete with the grass seed crop for light, nutrients and moisture, but can lower the quality of the grass seed crop.

SEEDING DEPTH

Perennial grasses generally have small seeds. Seed placement is an important factor in successful grass seed stand establishment. Seeding depths should be in the 0.25 to 0.75 inch range. On average, optimum seeding depths will be in 0.25 to 0.5 inch. This is true for both tilled and no-tilled soil. One of the major causes of erratic grass seed stands is seed placed too deep in the soil.

SEEDING RATE

The recommended seeding rate will vary with the crop. Seeding rates for cool season grasses are: perennial ryegrass 5 to 8, bluegrass is 2 to 3, and timothy 1 to 2 pounds/acre. Seeding rate for warm season grasses are 3 to 5 pounds pure live seed/acre, based on 24 inch row spacing. In several agronomic crops a strategy to compensate for a marginal seed bed is to increase the seeding rate. This tactic is sometimes used in grass seed crop. However, if the seedbed is questionable at planting, it's usually is an uphill battle to get an acceptable stand of grass established.

ROW SPACING

The majority of the cool season grasses are seeded with seeding equipment used for small grains. As a result, the most common row spacing for cool season grasses is 6 to 7.5 inches. Perennial ryegrass and bluegrass have been successfully established by using a broadcast seeding method. The most common broadcast seeding method is a fertilizer spreader with 50 to 100 pounds of dry fertilizer as a carrier.

The recommended row spacing for many warm season grasses is two feet (24 inches). The seeding rate listed in the seeding rate section is based on two foot row spacing. If desired row spacing is less than two feet, the seeding must be adjusted. For example, if the desired row spacing is 1 foot, the listed seeding rate must be multiplied by 2 and if the desired row spacing is 3 feet the seeding rate must be multiplied by 0.75.

FERTILITY

A grass seed crop does not have a large nutrient demand in the establishment year. However, it's a good management strategy is to apply phosphorus and potassium needs for the first two years prior to seeding a grass seed crop. In the establishment year, grass seed crops have the lowest demand for nitrogen. A good management strategy, in the establishment year, is to limit the amount of nitrogen to what's required by the grass seed crop; this has a tendency to reduce the growth of unwanted plants and weeds.

In the year after establishment grass seed crops will have more demand for plant nutrition. Annual application of nitrogen will be dependent upon yield goal, but generally is in the 80 to 120 pound range. This nitrogen is applied as a single application in the fall (after the soil temperature is below 50 F) or a split application (fall and spring). Other plant nutrients are applied based on plant removal with the nitrogen.

CROP PROFILES:

WARM SEASON GRASS SEED PRODUCTION IN NORTHWEST MINNESOTA

PRODUCTION INFORMATION

Big bluestem (*Andropogon gerardii*), Indiangrass, (*Sorghastrum nutans*) and Switchgrass (*Panicum virgatum*) are warm season grasses raised for seed in northwest Minnesota.

Northern Minnesota currently raises less than a couple of thousand acres of warm season grasses for seed production. Seed yields range from 200-400 pounds/acre for switchgrass, 75-250 pounds for big bluestem and Indiangrass. Production cost for first year establishments of warm season grasses averages \$330 per acre. After the first year, annual production costs average \$300 per acre. Annual production costs for established warm season grasses average \$200 per acre.

Big bluestem is native to the United States and is found from Maine to Montana, south to Florida and New Mexico and into Mexico. Big bluestem is a native perennial warm-season bunchgrass. It can be distinguished from other warm-season grasses by blue coloration at the base of the culm and a purple, 3-part flower clusters that resemble a turkey's foot. The culms are erect, up to 8 feet tall, stout, and are usually covered with a blue-tinted waxy layer. Flowering takes place July through October. The foliage changes color seasonally and culms stay erect through the winter. Each culm is tan, hairless; with the nodes dark-colored, slightly swollen, and glaucous. The root system is fibrous and produces short rhizomes. Big bluestem is a bunchgrass as tight tufts of culms are produced from these rhizomes.

Indiangrass is a native grass adapted throughout the prairies of central and eastern United States. The growing range for Indiangrass is from the Northeast United States to South Dakota and down to Texas. Indiangrass is a perennial bunchgrass that will grow 3 to 5 feet tall. Indiangrass has short scaly rhizomes that mat together to form a dense sod. Indiangrass roots have been found to a depth of 6 feet in the ground. Indiangrass is adapted to coarse, fine and medium textured soils, although it grows best in deep, well-drained floodplain soils.

Switchgrass is a perennial grass native to North America. Switchgrass will grow to a height of 3 to 5 feet tall and is adapted to areas that receive at least 30 inches of rainfall a year. Switchgrass seedling can be distinguished from other native grasses by the dense patch of hairs at the point where the leaf blade attaches to the sheath. Switchgrass has a round stem and usually has a reddish tint. The switchgrass seed head is an open spreading panicle. Switchgrass foliage turns a yellow color in the fall. Switchgrass matures earlier than most warm-season grasses and will be the first warm season grass harvested.

PRODUCTION REGION

The primary perennial ryegrass seed production areas in Minnesota are located in northwest part of the state. Roseau and Lake of the Woods counties account for 79% of the acreage and 82% of the production. The geography for this production information is located in northwest Minnesota. Counties include: Beltrami, Kittson, Lake of the Woods, Marshall and Roseau. Cool season grass (Kentucky bluegrass, ryegrass, timothy and Reed canarygrass) seed production is also concentrated in these counties.

CLIMATE

Northwest Minnesota has a continental climate influenced by the continuous succession of high and low pressure areas moving from west to east across the region. The climate is characterized by wide temperature variation with moderate to heavy snowfall and summer rainfall patterns.

The average daytime temperature in the winter is 4.6 F and an average daily minimum of -6 F. In the summer, the average temperature is 63.9 F with the average daily maximum temperature of 76.7 F. Lowest recorded temperature was -48 F on February 18, 1966. Record high temperature was 101 F on August 18, 2003. The frost free growing season extends for approximately 102 days from May 20 to August 30.

The annual precipitation averages 20.6 inches which has varied from a low of 12 to a maximum of over 30 inches. Approximately 50% of the precipitation falls during the frost free period from June to September. The average annual snowfall is 35 inches with an average of 140 days each year with at least 1 inch of snow cover.

GEOLOGY AND TOPOGRAPHY

The entire area was influenced by the activities of the continental glaciers of the Wisconsin glacial age. As this ice melted approximately 8,500 years ago it formed glacial Lake Agassiz. When this glacial lake receded it left present day lakes (Lake of the Woods), lowlands, beach ridges and upland glacial till. Approximately 70% of the area is level with the soils made up of lacustrine material from glacial lake Agassiz and organic deposits. The remaining 30% of the soils are made up of material derived from glacial till which has a rolling, undulating topography.

This area is nearly void of topographic irregularities, and for the most part, consists primarily of a nearly level plain. Elevation levels range from 1,250 to 1,000 feet above sea level with 50% of the land lies between 1,000 and 1,100 feet.

SOILS

Due to the geology of the area, lake-derived silts and clays are the major soil types. Four general soil types dominate: fluvial deposits, lacustrine deposits that vary in thickness from a few feet to over 50 feet deep, glacial drift and peat bogs with depths to 20 feet. Water infiltration rates are slow due to the impermeability of the clay soils which lends to a high water table in most of the area.

GENERAL CROPPING PRACTICES

Warm-season grasses have been successfully established during May and June. Early planting is critical even though warm-season grasses do not germinate when soil temperatures are below 50 to 55 degrees Fahrenheit. Early establishment allows seedlings to develop good root systems before the

warm temperatures of summer which improves the ability of the warm- season grasses to compete with weeds.

Warm-season native grass seed typically contains higher percentages of dormant seed than cool-season grasses. One way to break dormancy is to chill seeds that have absorbed water. Planting early into cool soil will chill the seed and can cause dormant seed to germinate. Seeding into warmer soil in late spring can be helpful in controlling weeds. The first flush of weeds is allowed to germinate and then is killed by final tillage or contact herbicide just prior to planting. Ideally, this practice would result in the shortest period of bare ground and would get grass seedlings up as quick as possible to compete with other weeds.

Warm-season grasses traditionally are slow to establish because their chaffy, hairy seed is hard to handle using conventional grain drills, and their seedlings are poor competitors with weeds. Switchgrass seed is hard and slick and can be handled without special drills. However, the seeds of big bluestem and Indiangrass are light, fluffy and chaffy which will not flow very well through conventional drills. The seed can be de-bearded (a process which removes much of the chaff and hair from seed of big bluestem and Indiangrass) which allows them to be seeded using conventional equipment.

When seeding native warm-season grasses a recommendation is to seed based on Pure Live Seed (PLS). PLS, is the percentage of viable seed in a given seed lot. The calculation for PLS: multiply the purity percentage by the total germination percentage. For example, 95% purity multiplied by 85% total germination would equal a PLS of 80.75%. This means that out of every bulk pound of that bag of seed that you plant, 80.75% of it is actually seed of that tagged variety and has the potential to germinate.

INTEGRATED PEST MANAGEMENT

One of the advantages of warm season native grasses is the resistance to many diseases and a low incidence of insect pests. Field burning is a successful strategy to remove plant residue and help with pest control and improve seed yields.

Field burning will suppress insect and disease pests and help with weed control. Field burning suppresses or eliminates major diseases such as ergot, rust, powdery mildew, and leaf spot. Field burning will enhance the effectiveness of soil-active herbicides. Without economical alternatives to burning, pest problems and pesticide use is expected to increase.

INSECTS

Insect damage to grass seed crops will vary from year to year and with grass species. Crop scouting is essential to identify insect species, determine insect population levels and assess the level of potential economic damage. In addition, differences in climate conditions within the region affect grass and insect maturity. These factors result in unique insect problems and require careful assessment in each production site.

CUTWORM AND ARMYWORMS

Cutworms and armyworms frequently damage grass seed crops below and aboveground. Cutworms tend to feed on crowns and leaves of developing plants during fall, winter and spring months.

Armyworms generally feed on foliage in mid to late summer. Cutworms and armyworms are more effectively controlled when they are small and immature.

WEEDS

Perennial, annual, grassy, and broadleaf weeds cause major problems in grass seed production. Left uncontrolled, weeds would cause an economic loss of 50-100 percent to grass producers. Herbicides labeled for warm season grass seed are limited, but are important to control specific weeds on specific grass cultivars and grass species.

Weeds are best controlled post-harvest in the fall when fall moisture has stimulated weed germination and growth. If fall moisture is sufficient, weeds can be controlled in the spring. Crop residue removal by burning increases the effectiveness of fall-applied herbicides. Some of the most serious weeds affecting grass seed production include wild oats, quack grass, Canadian thistle, white cockle, dandelion, and green and yellow foxtail.

Weeds, especially noxious weeds, compete with the grass crop and contaminate the harvested grass seed. Weeds require higher processing costs to reduce the contamination to acceptable contract levels. Annual weeds such as wild oat, lambsquarters, pigweed, green and yellow foxtail and smartweed, compete in newly established grass seed crops and limit uniform grass establishment. At harvest, weeds interfere with threshing, reduce harvest efficiency, and increase mechanical damage to the grass seed.

CHEMICAL CONTROL OF WEEDS

Dicamba (Banvel, Banvel SGF, Clarity) – Dicamba is applied to about 80 percent of all grass seed acreage. Dicamba is important in controlling many broadleaf weeds not controlled by herbicides such as 2, 4-D. Dicamba usually is applied in the fall to control broadleaf weeds.

2, 4-D (several trade names) – 2, 4-D is applied to 80 percent of the grass seed acres. 2, 4-D provides cost effective control of many broadleaf weeds and provides the option of spring or fall weed control.

MCPA (MCPA) – MCPA is especially useful for controlling broadleaf weeds in newly established grass seed crops.

Bromoxynil (Buctril 4E) – Bromoxynil is applied to about 20 percent of the grass seed acres at a rate of 1-2 pints per acre. Bromoxynil is important because it can be applied anytime after grass seed emergence to control small broadleaf weeds.

Glyphosate (Roundup) – Glyphosate is applied to about 50 percent of the grass seed acres as a spot, rope wick treatment or applied in the spring before “greenup” of the warm season grasses.

Atrazine – Atrazine is applied to established stand alone or mixed with a broadleaf herbicide.

DISEASES

One of the advantages of warm season native grasses is the resistance to many diseases and a low incidence of insect pests. Field burning is a successful strategy to remove plant residue and help with pest control and improve seed yields. Several diseases have been identified to cause damage to warm season grasses including: rust, powdery mildew, silvertop, and leaf spot.

Silvertop (*Fusarium poae*)

This fungus is associated with silvertop, but only after physical damage to the plant has been done. Several insects including thrips, stem borers, and plant bugs cause physical damage and/or inject plant toxins during feeding. Affected seed heads die and bleach white, appearing to mature early, but do not set seed. Control of meadow plant bug and other insects with insecticides may reduce the incidence of the disease. Burning fields after harvest has reduced the incidence of this disease when caused by plant bugs.

Stem rust (*Puccinia graminis* subsp. *Graminicola*)

Rust fungi infect susceptible grass cultivars and cause moderate to severe damage if left uncontrolled. Fungi survive from season to season in infected foliage of most grasses and other host plants. Stem rust attacks fine-leaf fescues, bluegrass, and several other grass species. Moderately warm, moist weather conditions favor rust development. Dew for 10-12 hours also is sufficient for the spores to infect grass plants.

Powdery mildew (*Peronospora parasitica*)

All grass species are susceptible to powdery mildew, but is more severe on Kentucky bluegrass, and fescues. The casual fungus over-winters on infected plants and plant debris. Spore are dislodged easily and spread by wind. Severely infected grass stands can be destroyed by powdery mildew if left uncontrolled.

CHEMICAL CONTROL OF DISEASES

Propiconazole (Tilt) – Tilt is used in grass seed crop at an average rate of 4 oz/acre. Tilt offers protection against rusts, powdery mildew, and other incidental diseases. Tilt is especially useful for rust and leaf disease control.

PERENNIAL RYEGRASS SEED PRODUCTION IN MINNESOTA CROP PROFILE

PRODUCTION INFORMATION

Perennial ryegrass, (*Lolium perenne* L), also called English ryegrass, is native to Europe, Asia and North Africa. Perennial ryegrass is a cool season bunch grass ranging from two-to-three feet tall when fully headed. Perennial ryegrass is distributed world-wide and is of major importance for livestock forage production and the turf grass industry.

Perennial ryegrass seed production in Minnesota ranks 4th nationally and accounts for approximately 10% total production. In 2007, perennial ryegrass was raised on 12,390 acres in Minnesota with a total production over 8,800,000 pounds valued over \$4.4 million dollars.

Perennial ryegrass seed yields range from 400 to over 1400 lb per acre depending upon the variety and growing conditions. Over the last five years, the average perennial ryegrass seed yield was 700 pounds/acre.

In the establishment year, total direct production cost for perennial ryegrass will average \$70-\$100 per acre. In the production year, annual direct production costs will average \$260 and indirect costs on average add an additional \$45 per acre

Perennial ryegrass seed produced in northern Minnesota is cleaned, conditioned and marketed by grower associations and private business. RL Growers Association is a producer group made up of over 50 area ryegrass growers. Northern Excellence is a producer cooperative located in Williams, MN and Norfarm Seeds is a private company located near Roseau, MN.

Perennial ryegrass seed produced in this area is sold into the domestic (90%) and export (10%) market. The demand for perennial ryegrass seed ranges from pure seed to mixture products for individual consumers (lawn seed); commercial business (sports fields, golf courses, sod farms and landscape companies). Markets for perennial ryegrass seed also exist for pastures, hay and forage, erosion control projects, Conservation Reserve Program (CRP) and highway right-of-way projects.

GENERAL GROWTH HABIT

Perennial ryegrass grown for seed is classified as perennial crop. In northern Minnesota, perennial ryegrass acts like a biennial. In other words, the crop is seeded in the spring or fall and harvested the next summer. Perennial ryegrass and other cool season grass seed crops are well adapted to the climate in northern Minnesota. The local “microclimate” provides cool and wet weather which favors perennial ryegrass growth, development and seed yield. One of the unique characteristics of perennial ryegrass is the ability to produce tillers. This aggressive tillering capability gives perennial ryegrass the appearance of a sod-forming grass.

STAND ESTABLISHMENT

Perennial ryegrass can be established in the spring or late summer. Spring establishment with spring wheat accounts for approximately 30% of the acres. Late summer seeding into wheat stubble accounts for 70% of the acres.

Ryegrass seeded in the spring

In spring establishment, perennial ryegrass is seeded with a companion crop. Spring wheat is the preferred cereal crop. Barley appears to be too competitive and oats is a host to crown rust (see disease section). Depending upon the year, spring wheat seeding begins in late April and will be completed by the end of May.

Perennial ryegrass establishment is achieved with a wide range of planting equipment (air-seeders, press drills, hoe drills). Two keys to stand establishment are: 1) seeding accuracy/rate and, 2) depth control. In the last few years, the design of new planting equipment has improved both the accuracy of seed the drop and placement. Both are critical in a small seeded crop like perennial ryegrass.

Perennial ryegrass seeded without a companion crop (direct seeded) should be practiced only in late summer establishment, NOT spring seeding. Spring seeding, without a cover crop, produces excessive vegetative growth, which has a negative effect on winter survivability and seed production. Perennial ryegrass may be seeded at other times during the summer but a companion crop of small grain should always be planted.

Ryegrass seeded in late summer

Late summer seeding of perennial ryegrass seeded should be done between mid-August and the second week in September to allow for adequate plant development prior to winter. Perennial ryegrass can be established in late summer, after wheat or canola harvest or direct seeded into fallow

ground. When seeding ryegrass into fallow ground in late summer use wheat at 0.25 to 0.5 bu/acre as a cover crop. This cover crop helps catch snow which increases the chances of ryegrass winter survivability.

Perennial ryegrass seeded with a no-till drill into wheat or canola stubble has given a good results. No-till drills are used to seed ryegrass in the late summer after wheat harvest. Standing wheat stubble will provide a catch for snow which decreases the chances for ryegrass winterkill.

A critical step in stand establishment is a uniform spread of the wheat straw and fines. Chaff spreaders are used to assure a uniform spread of the fines as to not smother the ryegrass seedlings. Wheat straw may be baled and removed from the field.

HARVEST & STORAGE

Mature perennial ryegrass is swathed in mid-July into August and allowed to field cure for one-to-two weeks before harvest. Harvested perennial ryegrass seed is generally stored at the producer's farms until delivery to the seed cleaning and conditioning plants.

Timing of swathing and harvest are critical steps in obtaining optimum seed yield and quality. Cutting ryegrass too early can produce light green seed of lesser quality and yield. Waiting too long will increase ryegrass seed shattering and seed loss.

RESIDUE MANAGEMENT

After harvest, perennial ryegrass residues are removed by burning or baling. Approximately 50% of the perennial ryegrass fields are burned and 50% have the plant residue removed by baling. Bales are used for livestock feed or a mulch for highway and other seeding projects. If burning, producers are required to obtain an agricultural burning permit.

SEED CERTIFICATION

The Minnesota Crop Improvement Association (MCIA) is the official seed certification agency in Minnesota. MCIA conducts field inspections and laboratory tests to assure ryegrass seed produced in Minnesota meets established certification standards.

Perennial ryegrass seed grown under contract generally is sold as certified seed. Certified seed is produced under a set of seed certification standards. These standards assure seed buyers a consistent quality in each lot of seed purchased. A grower is paid not only on seed yield (#/A), but also seed quality. One successful management practice to improve seed quality is to establish perennial ryegrass in fields with low levels of perennial weeds and other volunteer grass crops.

For premium seed quality, there is zero tolerance for seeds of quack grass and wild oats in perennial ryegrass seed. Seed lots with the presence of these and other prohibited or restricted weeds will result in more crop cleanout (yield loss) and/or sharply reduced prices. Producers are encouraged to adopt a zero tolerance program for dealing with all weeds. Seed of other weeds such as foxtail barley, Canada thistle, volunteer ryegrass, annual bluegrass, timothy, red top, barnyard grass, pigeon grass (green & yellow foxtail) and cockle are difficult to remove and slow down the seed cleaning and conditioning process.

Dockage and cleanout are a cost, not only to the grower, but to the seed conditioner and processor. This cleanout has to be hauled from the plant for disposal. Anything that can be done to reduce the dockage level in the field will reduce expenses (additional storage and hauling fees) and will lower the percent dockage at the cleaning plant. Dockage and cleanout in perennial ryegrass can range from 10 to over 50%.

Seed produced without certification is called “common seed”. The production of common seed generally carries more risk to the grower compared to certified seed. If market demand is high, common seed generally can be sold. However, if market demand is low, common varieties may have to be stored until market demand improves or be sold at a discounted price.

INSECTS

Perennial ryegrass produced in northern Minnesota has limited insect pest problems. Grasshoppers and armyworms are the primary insect pest in ryegrass. In a given year, up to 30 percent of the grass seed acreage is treated with an insecticide.

WEEDS

Perennial and annual broadleaf weeds and grasses cause major problems in grass seed production areas of northern Minnesota. Left uncontrolled, weeds cause an economic loss of 50-100 percent to grass producers. Weeds cause damage in two ways: 1) competition with ryegrass for nutrients, sunlight and water which results in reduced ryegrass yields, and 2) reduced seed quality. Weed seeds contained in ryegrass will cause increased dockage and cleanout percentage at the cleaning plant. If weed seeds are in the primary noxious category, this seed lot may result in a product not saleable.

Each year, about 95 percent of all grass seed acres are treated with an herbicide. Some of the most serious weeds affecting grass seed production include; white cockle, common dandelion, volunteer bluegrass, quack grass, Canadian thistle, wild oats, barnyard grass, volunteer canola and mustards and volunteer timothy.

Weeds, especially noxious weeds, compete with perennial ryegrass and lower the marketability of the harvested grass seed. Ryegrass seed lots that contain weeds require higher processing costs to reduce the contamination to acceptable contract levels. Annual weeds such as wild oat, common lambs’ quarters, redroot pigweed mustards, and foxtails compete in newly established grass seed crops and limit uniform grass establishment. At harvest, weeds interfere with threshing, reduce harvest efficiency, and increase mechanical damage to the grass seed.

CHEMICAL CONTROL OF WEEDS

Dicamba (Banvel, Clarity) - Dicamba is applied to about 90 percent of all grass seed acreage at a rate of 0.5 to $\frac{3}{4}$ pint/acre in the spring of the year. The use of Dicamba is important for controlling many broadleaf weeds not controlled by herbicides such as 2, 4-D.

2, 4-D (several trade names) - 2, 4-D is applied to 95 percent of the grass seed acres at a rate of 0.5 to 1 pint. 2, 4-D provides cost effective control of many broadleaf weeds and provides the option of spring or fall weed control.

MCPA (MCPA) - MCPA is applied to about 15 percent of the grass seed acres at a rate of 0.5 to 1 pint/acre. MCPA is especially useful for controlling broadleaf weeds in newly established grass seed crops.

Quizalofop-P ethyl (Assure II) – Assure II is applied at rate of 8 to 10 oz/acre for the control of annual grasses and quack grass in 'Assure II tolerant' ryegrass varieties only. Assure II tolerant ryegrass varieties account for 25% of the market.

Glyphosate (Roundup) - Glyphosate is applied to about 50 percent of the grass seed acres as a spot or wicking treatment to control various weeds.

DISEASES

Uncontrolled diseases in ryegrass can reduce the quality and yield of ryegrass by 20-90 percent and cause problems in seed certification. In any given year, about 50-80 percent of grass seed acreage receives a foliar fungicide treatment for disease control. Leaf and stem rusts are the most common disease in ryegrass in northern Minnesota.

Perennial ryegrass varieties vary in the susceptibility to rust. However, none of the current ryegrass varieties have true resistance to crown or stem rust. Two species of rust (crown and leaf and stem), have been identified in perennial ryegrass fields in northern Minnesota.

Crown rust

Crown rust is caused by the fungus (*Puccinia coronata var. avenae*), which infects oats, barley, rye and other grasses (wild oat, quack grass, Bromegrass, and ryegrass). Rust will appear as small, bright orange pustules on the upper surface of leaves. Crown rust can overwinter in northern Minnesota, in addition to be carried into the area on southerly wind currents. To overwinter in Minnesota, crown rust must have buckthorn as an alternate host. Buckthorn is a common shrub in northern Minnesota.

Stem Rust

Stem rust (*Puccinia graminis Pers.*) can infect perennial ryegrass fields in northern Minnesota. It's thought the rust pathogen that infects ryegrass is carried to Minnesota on winds from the Gulf of Mexico. It appears stem rust does not overwinter in northern Minnesota. Research is ongoing to determine if stem rust can overwinter and infect perennial ryegrass.

Stem rust spreads rapidly with high relative humidity and moderate to high temperatures. In these conditions, this pathogen can reproduce every 7 to 10 days. If left unchecked, this disease can quickly consume the whole ryegrass plant. In favorable conditions, ryegrass fields should be scouted every 2 to 3 days for rust.

CHEMICAL CONTROL OF DISEASES

Propiconazole (Tilt) - Tilt is applied to 50-70 percent of the grass seed crop at an average rate of 3 oz/acre. Tilt offers protection against rusts, powdery mildew, and other incidental diseases.

Pyraclostrobin (Headline) - Headline is applied to 20 percent of the ryegrass seed crop at an average rate of 4 oz/acre.

Tebuconazole (Folicur) - Folicur is applied to about 15 percent of the grass seed crop at a rate of 3 oz/acre. Folicur controls rusts, powdery mildew, ergot, and other incidental diseases.

PLANT GROWTH REGULATORS

Growth regulators are used in perennial ryegrass seed production worldwide. In northern Minnesota, the experience with growth regulators in perennial ryegrass has been mixed. One year, growth regulators provide excellent results and in another year there may be no effects observed to increase ryegrass seed yield or a reduction in lodging. These mixed results suggest a complex interaction between growth regulator, environment, and ryegrass growth stage.

Trinexapac-ethyl (Palisade) - Palisade is applied as a growth regulator to 5% of the acres at a rate of 1 pint/acre.

Prohexadione (Apogee) - Apogee is applied as a growth regulator to 25% of the acres at a rate of 6 oz/acre.

KENTUCKY BLUEGRASS SEED PRODUCTION IN MINNESOTA CROP PROFILE

PRODUCTION INFORMATION

Kentucky bluegrass (*Poa pratensis* L.) seed production in Minnesota ranks 4th nationally and accounts for approximately 10% total production. In 2007, Kentucky bluegrass was raised on over 24,000 acres in Minnesota with a total production of 4,250,000 pounds valued over 5 million dollars.

Kentucky bluegrass seed yields range from 150 to over 400 lb per acre depending upon the variety and growing conditions. Over the last five years, the average Kentucky bluegrass seed yield was 225 pounds/acre.

The University of Minnesota conducts grass seed research on a 40 acre research farm north of Roseau, MN. Each year U of MN scientists evaluates two- to- three dozen commercial and experimental bluegrass varieties and experimental lines. The Kentucky bluegrass variety 'Park' is a University of Minnesota release and is grown on over 70% of the acres in the region.

In the establishment year, total direct production cost for Kentucky bluegrass will average \$70-\$100 per acre. In the production years, annual direct production costs will average \$180 and indirect costs on average add an additional \$45 per acre

The Kentucky bluegrass seed produced in the area is cleaned, conditioned and marketed by grower associations and private business. The Northern Minnesota Bluegrass Growers Association is a producer group made up of over 50 area bluegrass growers. Northern Excellence is a producer owned cooperative located in Williams, MN that cleans, conditions and markets Kentucky bluegrass seed. Two private companies also clean and condition seed produced by area growers (Norfarm seed and Habstritt Seed Company).

Kentucky bluegrass seed produced in this area is sold into the domestic (90%) and export (10%) market. The demand for Kentucky bluegrass seed ranges from pure seed to mixture products for individual consumers (lawn seed); commercial business (sports fields, golf courses, sod farms and

landscape companies). Other markets for Kentucky bluegrass seed include; pastures, hay and forage, erosion control projects, Conservation Reserve Program (CRP) and highway right-of-way projects.

GENERAL GROWTH HABIT

Kentucky bluegrass grown for seed is a perennial crop. Once established, a Kentucky bluegrass stand will be kept in production for 3 to over 10 years. Kentucky bluegrass yield, price, stand vigor, weed infestations and other crop pests will determine the duration of the bluegrass stand. Once established, a bluegrass stand will remain in production for an average of five years.

Kentucky bluegrass and other cool season grass seed crops are well adapted to the climate in northern Minnesota. The local “microclimate” provides cool and wet weather which favors Kentucky bluegrass growth, development and seed yield. Fall moisture is critical for Kentucky bluegrass growth, development and yield. Seed potential is determined in the fall the year prior to harvest. As a result, the plant must be in good health going into the winter.

STAND ESTABLISHMENT

Kentucky bluegrass is most often established in September with winter wheat as a companion crop. Fall plantings, when temperatures are cool and moist, generally favor a uniform bluegrass stand. The winter wheat harvested the following summer provides an important cash crop in the establishment year for bluegrass. Planting also can be done in May, under spring wheat, but this method of bluegrass stand establishment is more variable, especially during hot, dry environmental conditions of summer.

One of the critical steps in bluegrass stand establishment is a fine, uniform spread of the winter wheat straw, chaff and other fines. Wheat stubble may be left high (6 to 12 inches) at harvest to minimize chaff smothering of the bluegrass seedlings. In addition, combine chaff spreaders help with a uniform spread of wheat chaff and fines. Many times, in late fall, when bluegrass has grown through existing wheat straw, the remaining stubble is mowed short and the bluegrass left to grow and produce seed the following year.

Fall management operations are critical to maximize bluegrass seed potential. Broadleaf weed control should be completed by mid-September as the average killing frost in this region occurs in late September. Research has indicated bluegrass must have fertilizer applied in the fall to maximize seed production. The timing for fall fertilizer is mid-October when soil temperatures are below 50F. Fall fertilizer in bluegrass can be applied until freeze-up. However, fertilizer should not be applied to frozen ground or snow covered fields as these conditions increase the probability of off target movement of nitrogen.

HARVEST & STORAGE

Mature bluegrass crops are swathed in early to mid-July and allowed to field cure for one-to-two weeks before harvest. Bluegrass seed is generally stored at the producer’s farms until delivery to the seed cleaning and conditioning plants. Swathing and harvest are necessary steps to obtain high quality seed. Delay in swathing will cause seed shatter and yield loss. Bluegrass allowed to remain in the field too long will have increased harvest losses and lower seed quality

RESIDUE MANAGEMENT

After harvest, bluegrass crop residues are removed by burning. This burning process increases bluegrass yields by improving sanitation, suppresses diseases and insect pressure and tends to reduce pesticide inputs. At bluegrass harvest the straw is uniformly spread from the combine. A chemical desiccant, paraquat (Gramoxone Extra), may be sprayed on the bluegrass crop residue to promote an efficient burn. Extended periods of cloudy damp weather with high humidity and excessive bluegrass regrowth after harvest are conditions that may require the use of a desiccant. Prior to field burning, bluegrass seed producers must obtain an agricultural burning permit.

The removal of the old crop bluegrass residue is a critical step in the production of bluegrass seed. Bluegrass seed yield potential for the next year's crop is determined in the fall. The crown region and tillers must receive a daylight stimulus in order to produce seed the next year. Burning of the previous year's bluegrass residue will allow light to get to the crown region of the plant and stimulate the production of fertile tillers for next year's bluegrass seed heads.

INSECTS

Limited insect pests are a problem in Kentucky bluegrass. The Capsus bug, grasshoppers, armyworms are the primary insect pest in bluegrass. In a given year, up to 20 percent of the grass seed acreage is treated with an insecticide. Capsus bugs are generally not a problem in fields with a good burn the previous year. Army worm moths are blown into the region on upper level southerly winds, and in certain years, can create problems during harvest if not controlled.

Grasshoppers may also create production problems and it's important to monitor insect population during the growing season for potential problems.

Insect damage will vary with environmental conditions within the production region. Bluegrass cultivars vary in phenological development, and their susceptible growth stages may or may not coincide with damaging levels of insects. In addition, differences in climate conditions within the region affect grass and insect maturity. These factors result in unique insect problems and require careful assessment in each production site.

WEEDS

Perennial and annual broadleaf weeds and grasses cause major problems in grass seed production. Left uncontrolled, weeds cause an economic loss of 50-100 percent to grass producers. Weeds cause damage in two ways: 1) competition with bluegrass for nutrients, sunlight and water which results in reduced bluegrass yields, and 2) reduced seed quality. Weed seeds contained in bluegrass will cause increased dockage and cleanout percentage at the cleaning plant. If weed seeds are in the primary noxious category, this seed lot may result in a product not saleable.

Each year, approximately 90 percent of all grass seed acres are treated with an herbicide. Weeds are best controlled post-harvest in the fall when fall moisture has stimulated weed germination and growth. Crop residue removal by burning increases the effectiveness of fall-applied herbicides. Some of the most serious weeds affecting grass seed production include; white cockle, common dandelion, slough grass, volunteer bluegrass, quack grass, Canadian thistle, volunteer timothy and volunteer ryegrass.

Weeds, especially noxious weeds, compete with the grass crop and contaminate the harvested grass seed. Weeds require higher processing costs to reduce the contamination to acceptable contract levels. Annual weeds such as wild oat, common lambs' quarters, redroot pigweed mustards, and foxtails compete in newly established grass seed crops and limit uniform grass establishment. At harvest, weeds interfere with threshing, reduce harvest efficiency, and increase mechanical damage to the grass seed.

CHEMICAL CONTROL OF WEEDS

Dicamba (Banvel, Clarity) - Dicamba is applied to about 80 percent of all grass seed acreage at a rate of 0.5 to $\frac{3}{4}$ pint/acre in the fall of the year. Dicamba is important for controlling many broadleaf weeds not controlled by herbicides such as 2, 4-D.

Primisulfuron methyl (Beacon) - Primisulfuron is applied to about 20 percent of the bluegrass seed crop at a rate of 0.38oz /acre. Primisulfuron is currently used to control quack grass in newly established bluegrass crops.

2, 4-D (several trade names) - 2, 4-D is applied to 95 percent of the grass seed acres at a rate of 0.5 to 1 pint. 2, 4-D provides cost effective control of many broadleaf weeds and provides the option of spring or fall weed control. The amine formulations of 2, 4-D are commonly used. However, ester formulations are used in the spring to kill susceptible weeds in advanced growth stages.

MCPA (MCPA) - MCPA is applied to about 15 percent of the grass seed acres at a rate of 0.5 to 1 pint/acre. MCPA is especially useful for controlling broadleaf weeds in newly established grass seed crops.

Paraquat (Gramoxone) - Paraquat is applied, on average to 50% of the bluegrass acres at a rate of 2 to 4 pints. In wet rainy years, Paraquat is used on the majority of bluegrass acres and in dry year's limited acreage. Paraquat is used in bluegrass as a desiccant to aid the burning of bluegrass residue after harvest. Burning of bluegrass residue is an essential step in the management of bluegrass seed production as it helps with sanitation, reduces the incidence of insect and disease control and allows light to get to the crown area of bluegrass in the late summer and fall which signals the bluegrass plant and will stimulate seed production of bluegrass culms and tillers.

Glyphosate (Roundup) - Glyphosate is applied to about 50 percent of the grass seed acres as a spot or wicking treatment to control various weeds.

DISEASES

Uncontrolled grass diseases can reduce the quality and yield of the crop by 20-100 percent and cause problems in seed certification. In any given year, about 30-75 percent of grass seed acreage receives a foliar fungicide treatment for disease control. The cool, humid, and cloudy conditions in spring of northern Minnesota, favor development of powdery mildew, leaf spots and rust.

Silvertop

Silvertop is generally thought to be a physiological condition caused by the piercing sucking mouth parts of the Capsus bug. Control is usually acquired with a good fall field burn. In first year fields or where a field is not adequately burned, an insecticide may be required. Disease symptoms are very

obvious and close examination should be done to determine infestation levels before applying insecticides.

Powdery Mildew

All grass species are susceptible to powdery mildew, but is most severe on Kentucky bluegrass. The casual fungus over-winters on infected plants and plant debris. Spore are dislodged easily and spread by wind. Severely infected grass stands can be destroyed by powdery mildew if left uncontrolled.

CHEMICAL CONTROL OF DISEASES

Propiconazole (Tilt) - Tilt is applied to 40 percent of the grass seed crop at an average rate of 3 oz/acre. Tilt offers protection against rusts, powdery mildew, and other incidental diseases.

TALL FESCUE SEED PRODUCTION IN MINNESOTA CROP PROFILE

PRODUCTION INFORMATION

Tall fescue (*Festuca arundinacea*) is a long-lived, perennial bunchgrass introduced from Europe prior to 1900. It is adapted for use in pastures, hay, turf, and erosion control throughout humid parts of northern United States. Tall fescue is a deep-rooted, cool-season bunchgrass ranging from 1 1/2 to 6 feet tall. Tall fescue is considered a bunchgrass. However, the short, underground stems with heavy grazing or mowing will produce a sod. The roots of tall fescue are tough, coarse and have been found in the soil to a depth of 5 feet. The leaves of tall fescue are dark green in color with a pronounced mid-rib. Tall fescue leaves are relatively coarse and shiny. Tall fescue has a branched panicle-type heads which are 4 to 12 inches long. The seeds are borne three to five in a spikelet, and have a dark appearance because of a slight purple tinge on both the glumes and the caryopsis.

Tall fescue seed yields range from 200 to over 500 lb per acre depending upon the variety and growing conditions. On average tall fescue will yield 250 pounds/acre.

In the establishment year, total direct production cost for tall fescue seed production will average \$70-\$100 per acre. In the production years, annual direct production costs will average \$180 and indirect costs on average add an additional \$45 per acre

PLANT DESCRIPTION

Tall fescue is adapted to a wide range of climatic and soil conditions. Although best adapted to cool and wet climates with heavy soils, it will thrive on most other sites, except on light, sandy soils. It will tolerate poorly-drained conditions, and will survive in standing water for long periods of time during the winter when it is semi-dormant. Long submergence during its peak summer growth may be injurious. Tall fescue will tolerate moderate saline-alkaline concentrations when soil moisture conditions are favorable, and will also thrive on quite acid soils. Good fertility levels must be maintained for seed production and optimum forage production. A minimum of 15 inches annual precipitation is required to maintain this plant under dryland conditions.

Tall fescue has a tendency to "winterkill" in northern Minnesota especially, if snow cover doesn't last through the winter. Seedlings are slow to develop, requiring at least one full growing season to establish. Cattle may develop an ailment known commonly as "fescue foot" while grazing tall fescue infected with a fungal endophyte.

The toughness of this grass makes it an ideal cover for athletic fields and playgrounds. Other uses are for grass waterways, roadsides and other construction sites where a long-lived, tenacious, deep-rooted grass is needed. The extensive, deep root system helps to open up heavy soils and add organic matter. Tall fescue is also useful for grass roadways, waterways, and as a "trap" filter down slope from feedlots and manure storage sites.

GENERAL GROWTH HABIT

Tall fescue grown for seed is a short lived perennial crop. Once established, tall fescue will be in production for 2 to 3 years. Tall fescue yield, price, stand vigor, weed infestations and other crop pests will determine the stand duration.

Tall fescue and other cool season grass seed crops are well adapted to the climate in northern Minnesota. The local "microclimate" provides cool and wet weather which favors tall fescue growth, development and seed yield. Fall moisture is critical for tall fescue growth, development and yield. Seed potential is determined in the fall the year prior to harvest. As a result, the plant must be in good health going into the winter.

STAND ESTABLISHMENT

Tall fescue is most often established in the spring with wheat or barley as a companion crop. Tall fescue has also been successfully established with an August seeding. With August seeding first year seed production will generally be reduced compared to spring seeded tall fescue.

Fall management operations are critical to maximize tall fescue seed production. Broadleaf weed control should be completed by mid-September as the average killing frost in this region occurs in late September. Research has indicated tall fescue must have fertilizer applied in the fall to maximize seed production. The timing for fall fertilizer is mid-October when soil temperatures are below 50F. Fall fertilizer can be applied until freeze-up. However, fertilizer should not be applied to frozen ground or snow covered fields as these conditions increase the probability of off target movement of nitrogen.

HARVEST & STORAGE

Tall fescue is usually swathed during the late July or early August. Tall fescue seed is ready to harvest if a few seeds drop when the seed head is pulled gently between the thumb and forefinger. Ripe seed has a tendency to shatters. Harvesting can be done by direct harvesting or by swathing and combining from the windrow. Tall fescue seed will thrash easily and requires no additional treatment prior to cleaning. Tall fescue will produce seed for five years. However, the first two years of a stand generally are the most productive.

RESIDUE MANAGEMENT

After harvest, tall fescue crop residues are removed by baling the straw. Field burning may cause damage to the crown region of tall fescue and should be used only after local experience proves successful.

INSECTS

Tall Fescue has very few insect pests that limit seed production. Grasshoppers and armyworms can be a problem in isolated situations. New tall fescue stands are susceptible to grasshopper, wireworm or cutworm damage, especially if these insects were present in the field the previous years. If soil

moisture levels are medium to high this will usually improve the ability of grass seed crops to tolerate insect feeding damage. Grasshoppers can be a chronic pest of grass seed fields. Grasshoppers will eat plant leaves, stems and even timothy seed heads. Grasshopper damage in the establishment year may cause total destruction. Even a well established tall fescue seed field can be damaged by grasshoppers. Crop scouting and will determine if grasshopper levels have reached economic threshold levels.

WEEDS

Perennial and annual broadleaf weeds and grasses cause major problems in grass seed production. Weeds cause damage in two ways: 1) competition for nutrients, sunlight and water which results in reduced grass seed yields, and 2) reduced seed quality. Weed seeds contained in grass seed crops will cause increased dockage and cleanout percentage at the cleaning plant. If weed seeds are in the primary noxious category, this seed lot may result in a product not saleable.

Each year, approximately 90 percent of all grass seed acres are treated with an herbicide. Weeds are best controlled post-harvest in the fall when fall moisture has stimulated weed germination and growth. Crop residue removal by burning increases the effectiveness of fall-applied herbicides. Some of the most serious weeds affecting grass seed production include; white cockle, common dandelion, slough grass, volunteer bluegrass, quack grass, Canadian thistle, volunteer timothy and volunteer ryegrass.

Weeds, especially noxious weeds, compete with the grass crop and contaminate the harvested grass seed. Weeds require higher processing costs to reduce the contamination to acceptable contract levels. Annual weeds such as wild oat, common lambsquarters, redroot pigweed mustards, and foxtails compete in newly established grass seed crops and limit uniform grass establishment. At harvest, weeds interfere with threshing, reduce harvest efficiency, and increase mechanical damage to the grass seed.

CHEMICAL CONTROL OF WEEDS

Dicamba (Banvel, Clarity) - Dicamba is applied to about 80 percent of all grass seed acreage at a rate of 0.5 to $\frac{3}{4}$ pint/acre in the fall of the year. Dicamba is important for controlling many broadleaf weeds not controlled by herbicides such as 2, 4-D.

2, 4-D (several trade names) - 2, 4-D is applied to 95 percent of the grass seed acres at a rate of 0.5 to 1 pint. 2, 4-D provides cost effective control of many broadleaf weeds and provides the option of spring or fall weed control. The amine formulations of 2, 4-D are commonly used. However, ester formulations are used in the spring to kill susceptible weeds in advanced growth stages.

DISEASES

Tall fescue has very few diseases that limit seed production.

Powdery Mildew

All grass species are susceptible to powdery mildew, but is most severe on Kentucky bluegrass. The casual fungus over-winters on infected plants and plant debris. Spore are dislodged easily and spread by wind. Severely infected grass stands can be destroyed by powdery mildew if left uncontrolled.

CHEMICAL CONTROL OF DISEASES

Propiconazole (Tilt) - Tilt offers protection against rusts, powdery mildew, and other incidental diseases with an average use rate of 3 oz/acre.

TIMOTHY SEED PRODUCTION IN MINNESOTA CROP PROFILE

PRODUCTION INFORMATION

Timothy (*Phleum pratense*) is a short-lived, bunchgrass with a shallow, fibrous root system that extends to about 4 feet. Timothy has a bulb-like structure at the base of the plant called corms. These corms produce a mass of basal leaves and usually one leafy stem of 20 to 40 inches that will produce a seed head. All leaves are soft, light green and 2 to 6 inches long. Individual timothy shoots are typically biennial, but the plant maintains itself as a perennial through the development and growth of new shoots from bases of older culms.

Timothy seed yields range from 200 to over 500 lb per acre depending upon the variety and growing conditions. Over the last five years, the average timothy seed yield was 250 pounds/acre.

In the establishment year, total direct production cost for timothy seed production will average \$70-\$100 per acre. In the production years, annual direct production costs will average \$180 and indirect costs on average add an additional \$45 per acre

PLANT DESCRIPTION

Timothy is a cool season grass that can grow from 2 to over 6 feet tall. It is one of the first to sprout and begin growth in the spring. However, it is also one of the first cool season grasses to stop growing in the fall. Timothy stops growing early in the fall, loses its green color and turns a dull brown color.

The sturdy, often hollow stems can be up to 1/2 inch in diameter, with some reddish coloration near the top. The leaf blades are flat and hairless, 1/4 to 3/4 of an inch wide and up to 10 inches long. It has a prominent and transparent ligule up to 1/4 inch long and is rounded at the apex.

Timothy has compact panicle that is erect or slightly spreading from 3 to 16 inches long and the branches can be 1/2 to 1.5 inches long. The single flowers form dense clusters in late May into June. The inflorescence is green or purple which turns a tan color when mature. Each plant can produce over 600 seeds which ripen in late June into July and tend to shatter when ripe.

Timothy will grow on dry soils in upland habitats and in partial shade conditions of woodlands, but grows best in fertile, moist organic soils in full sun. Timothy can invade most types of wetlands including marshes, wet prairies, sedge meadows, fens, stream banks, and seasonally wet areas. It also grows well in disturbed areas such as ditch banks and spoil piles.

CLIMATE

Northwest Minnesota has a continental climate influenced by the continuous succession of high and low pressure areas moving from west to east across the region. The climate is characterized by wide temperature variation with moderate to heavy snowfall and summer rainfall patterns.

The average daytime temperature in the winter is 4.6 F and an average daily minimum of -6 F. In the summer, the average temperature is 63.9 F with the average daily maximum temperature of 76.7 F.

Lowest recorded temperature was -48 F on February 18, 1966. Record high temperature was 101 F on August 18, 2003. The frost free growing season extends for approximately 102 days from May 20 to August 30. The annual precipitation averages 20.6 inches which has varied from a low of 12 to a maximum of over 30 inches. Approximately 50% of the precipitation falls during the frost free period from June to September. The average annual snowfall is 35 inches with an average of 140 days each year with at least 1 inch of snow cover.

GENERAL GROWTH HABIT

Timothy grown for seed is a short lived perennial crop. Once established, timothy will be in production for 3 to 5 years. Timothy yield, price, stand vigor, weed infestations and other crop pests will determine the duration of the timothy stand. Once established, a timothy stand will remain in production for an average of five years.

Timothy and other cool season grass seed crops are well adapted to the climate in northern Minnesota. The local "microclimate" provides cool and wet weather which favors timothy growth, development and seed yield. Fall moisture is critical for timothy growth, development and yield. Seed potential is determined in the fall the year prior to harvest. As a result, the plant must be in good health going into the winter.

STAND ESTABLISHMENT

Timothy is most often established in the spring with wheat or barley as a companion crop. Timothy has also been successfully established with an August seeding. With August seedlings first year seed production will generally be reduced compared to spring seeded timothy.

Fall management operations are critical to maximize timothy seed potential. Broadleaf weed control should be completed by mid-September as the average killing frost in this region occurs in late September. Research has indicated timothy must have fertilizer applied in the fall to maximize seed production. The timing for fall fertilizer is mid-October when soil temperatures are below 50F. Fall fertilizer in timothy can be applied until freeze-up. However, fertilizer should not be applied to frozen ground or snow covered fields as these conditions increase the probability of off target movement of nitrogen.

HARVEST & STORAGE

Timothy is usually swathed during late July or early August. Timothy is ready to be swathed when heads are golden to the base. Timing of swathing is critical, if too early the seed will not ripen, too late seed has a tendency to shatter both result in significant seed yield losses. Rainfall can also cause yield losses, light rain after swathing cause minimal damages. However, heavy rains, especially if the swaths have been down for a week or more will result in significant seed shatter.

Timothy will be harvested in seven to ten days after swathing. If harvested during hot weather, seed may need to be spread thinly on a granary floor or placed in aeration bins. Once the seed is cool and dry, the seed will remain viable for several years.

RESIDUE MANAGEMENT

After harvest, timothy crop residues are removed by baling the straw. Timothy straw is a palatable feed source for livestock.

INSECTS

Timothy has very few insect pests that limit seed production. Grasshoppers and armyworms can be a problem in isolated situations. New timothy stands are susceptible to grasshopper, wireworm or cutworm damage, especially if these insects were present in the field the previous years. If soil moisture levels are medium to high this will usually improve the ability of timothy to tolerate insect feeding damage.

Grasshoppers can be a chronic pest of grass seed fields. Grasshoppers will eat plant leaves, stems and even timothy seed heads. Grasshopper damage in the establishment year may cause total destruction. Even a well established timothy seed field can be damaged by grasshoppers. Crop scouting and will determine if grasshopper levels have reached economic threshold levels.

WEEDS

Perennial and annual broadleaf weeds and grasses cause major problems in grass seed production. Weeds cause damage in two ways: 1) competition with timothy for nutrients, sunlight and water which results in reduced timothy yields, and 2) reduced seed quality. Weed seeds contained in timothy will cause increased dockage and cleanout percentage at the cleaning plant. If weed seeds are in the primary noxious category, this seed lot may result in a product not saleable.

Each year, approximately 90 percent of all grass seed acres are treated with an herbicide. Weeds are best controlled post-harvest in the fall when fall moisture has stimulated weed germination and growth. Some of the most serious weeds affecting grass seed production include; white cockle, common dandelion, slough grass, volunteer bluegrass, quack grass, Canadian thistle, and volunteer ryegrass.

Weeds, especially noxious weeds, compete with the grass crop and contaminate the harvested grass seed. Weeds require higher processing costs to reduce the contamination to acceptable contract levels. Annual weeds such as wild oat, common lambsquarters, redroot pigweed mustards, and foxtails compete in newly established grass seed crops and limit uniform grass establishment. At harvest, weeds interfere with threshing, reduce harvest efficiency, and increase mechanical damage to the grass seed.

CHEMICAL CONTROL OF WEEDS

Dicamba (Banvel, Clarity) - Dicamba is applied to about 80 percent of all grass seed acreage at a rate of 0.5 to $\frac{3}{4}$ pint/acre in the fall of the year. Dicamba is important for controlling many broadleaf weeds not controlled by herbicides such as 2, 4-D.

2, 4-D (several trade names) - 2, 4-D is applied to 95 percent of the grass seed acres at a rate of 0.5 to 1 pint. 2, 4-D provides cost effective control of many broadleaf weeds and provides the option of spring or fall weed control. The amine formulations of 2, 4-D are commonly used. However, ester formulations are used in the spring to kill susceptible weeds in advanced growth stages.

Diseases

Timothy has very few diseases that limit seed production.

Development of an Ecological Commodity Payment Package [ECoPayPack] Program

Non Market Valuation Survey

A non market valuation [NMV] survey was conducted for those environmental commodities that are only concepts or emerging interests and have no “real money” valuations at this time. NMV describes how value is assigned to features and services provided [ie, higher species of water fowl or song birds, recreational uses such as hunting and fishing, quality of life interests such as camping scenic byways and trails, etc.]. Members of the team collaborating on this component include Linda Meschke and Jeff Jensen- Rural Advantage; Jim Kleinschmit- Institute for Agriculture and Trade Policy; Dean Current – Center for Natural Resources and Agricultural Management; Wm. Easter- University of Minnesota; and Matthew Pham- Graduate Student, University of Minnesota who submitted the following report on the survey.

Results from Non Market Valuation Survey

to Estimate the Values of Environmental Services

A draft questionnaire was designed to address the research objectives developed under Rural Advantage’s work including the Madelia Project. In consultation with the ECoPayPack team, questions were developed and revisions made until everyone agreed on the survey's final content. Questionnaire pretesting took place over two weeks from July 6 to 17, 2009 by postal mail. After revising the survey to accommodate the recommended changes suggested by respondents taking the preliminary questionnaire, the final version was mailed on July 31, 2009. The returned questionnaires were collected during the period of July 31 through October 1, 2009.

A total of 2,500 surveys were mailed to respondents in Carver, Dakota, and Scott counties. By October 1, 2009, 725 respondents completed and mailed back the survey. The data analysis consisted of analyzing relationships between the respondents' willingness-to-pay (WTP) for improvements in recreational services as a result of the conversion to perennial grasses.

A summary of the average values and ranges for the WTP, number of visits, length of stay, demographic variables, recreational services, and environmental services are shown in Tables 1-4.

	WTP Before	WTP After	Number of Visits Before	Number of Visits After	Length of Stay Before	Length of Stay After
Average Value	\$0.85	\$2.43	0.133 visits	0.694 visits	0.106 days	0.360 days
Range	\$0-more than \$15	\$0-more than \$15	0-more than 5 visits	0-more than 5 visits	0-more than 2 days	0-more than 2 days

Table 1: Average Values and Ranges of Pre and Post-Perennial Grass Conversion for WTP, Number of Visits, and Length of Stay

	Age	Education	Household Size	Income	Sex	Distance From Madelia
Average Value	58.8 years	15.024 years	2.68 people	\$78,771	68.8% Male 31.2% Female	77.54 miles
Range	27-97 years	8-19 years	1-8 people	\$0.00 - more than \$100,000	Male or Female	50.4 - 91.6 miles

Table 2: Average Values and Ranges of Demographic Variables

Table 2 (continued)

	Property Value	Rent	Marriage Status	Employment	Farmland Ownership	Fraction of Income from Farming
Average Value	\$292,622	\$738.02	73.01% Married, 9.66% Single, 9.81% Widowed, 7.50% Divorced	51.93% Full Time, 9.87% Part Time, 6.72% Not Currently Employed, 31.47% Retired	93.98% None, 2.58% Own and Operate, 3.01% Own and Rent Out, 0.43% Lease from Others	0.98%
Range	\$0.00 - more than \$1,000.000	\$0.00 - more than \$1,500.00	Married, Single, Widowed, Divorced	Full Time, Part Time, Not Currently Employed, Retired	None, Own and Operate, Own and Rent Out, Lease from Others	0%-100%

Table 3: Average Interest in Recreational Services

	Hunting	Biking	Picnics	Hiking	Bird Watching	Photography
Average Interest	1.26	2.17	2.15	2.45	1.92	1.81

Table 3 (continued)

	Nature Walks	Wildlife Viewing	Camping	Horseback Riding	Nature Viewing
Average Interest	2.49	2.54	1.74	1.17	2.36

Note: The range of interest for all recreational services is from 0 (Not Interested) to 5 (Extremely Interested).

	Clean Water for Recreation	Safe Water for Drinking	Reduced Flooding/High Flows	Increased Plant Biodiversity
Average Rank	3.37	1.94	3.83	4.50

Table 4: Average Rank of Environmental Services

	Clean Water for Recreation	Safe Water for Drinking	Reduced Flooding/High Flows	Increased Plant Biodiversity
Average Rank	3.37	1.94	3.83	4.50

Table 4 (continued)

	Increased Animal Biodiversity	Global Climate Change Mitigation	Increased Green/Open Space
Average Interest	4.32	4.25	4.12

Note: The ranking scale for all environmental services is from 1 (Most Important) to 7 (Least Important).

Further analysis will be conducted to determine the strength each demographic variable or recreational service will have on a respondent's WTP and the number of visits a respondent would make to a recreational area. For example, Equation (1) will test the strength of each variable in explaining WTP for each respondent, denoted as i , before or after the perennial grass conversion:

$$WTP_i = \beta_{0i} + \beta_{1i} \text{rec} + \beta_{2i} \text{age} + \beta_{3i} \text{educ} + \beta_{4i} \text{hhsz} + \beta_{5i} \text{inc} + \beta_{6i} \text{sex} + \beta_{7i} \text{dist} \quad (1)$$

where rec represents whether or not a participant is interested in a recreational opportunity, $visit$ is the number of visits to a recreational area in Madelia, age denotes the respondent's age in years, $educ$ represents the number of years of education, $hhsz$ is the number of people living in the respondent's household, inc represents the respondent's 2008 gross household income, sex indicates male or female respondent, and $dist$ is the distance in miles the respondents live from the Madelia area based on zip codes. The recreational opportunities include hunting, biking, picnics, hiking, bird watching, photography, nature walks, wildlife viewing, camping/overnight stays, horseback riding, and nature

viewing. As shown in Table 3, wildlife viewing, hiking, nature walks, and nature viewing were the most favored activities.

The following pages include documents developed as part of the survey work. The first is the cover letter sent with the survey. The survey tool is attached as a separate document to this report. Printing and mailing the surveys was completed by Rural Advantage staff. As surveys were returned they were then given to Mr. Pham for compilation and analysis. Survey protocols were followed so the survey results would be statistically valid.



1243 Lake Ave. Suite 222

Fairmont, Minnesota 56031

507-238-5449

<http://www.ruraladvantage.org>

DENNIS BEISSEL

Friday, July 31, 2009

25162 HOGAN AVE

HAMPTON, MN 55031-9796

Dear DENNIS,

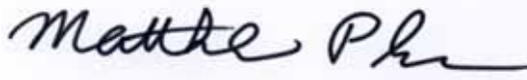
Rural Advantage, in collaboration with the University of Minnesota, Department of Applied Economics, is conducting a survey of Carver, Dakota, and Scott County residents to determine the value they would place on environmental and recreational services, including how much they would be willing to pay to utilize these services. The services will be provided by a project that will convert environmentally sensitive land from corn and soybean production to perennial grasses and agroforestry crops for bioenergy and other uses. You were randomly selected to tell us your opinion about the importance of these environmental services to you and what value you place on them.

Your feedback is highly respected since it will help us to determine the value of recreational and environmental benefits associated with the increase in grassland and perennial crop landscapes in Southern Minnesota.

The enclosed questionnaire is designed to only take 5-7 minutes of your time. Many questions are designed to be answered by simply circling or writing in a number. Some questions will ask you to refer to the pictures on the back of this cover letter. Responses to the survey will be kept in the strictest of confidence, and no individuals or individual responses will be identified in the survey. We will send you the overall survey results, upon your request at the end of the survey.

We hope you will help us. Please complete the enclosed survey and return it in the postage-paid envelope as soon as possible, but no later than August 31, 2009. If you have any questions, please contact Matt at 612-625-9722 or send an e-mail to pham0170@umn.edu. Thank you for your help with this important research.

Sincerely:



Linda Meschke

Matthew Pham

President, Rural Advantage M.S. Science, Technology, and Environmental Policy Candidate University of Minnesota

ENC

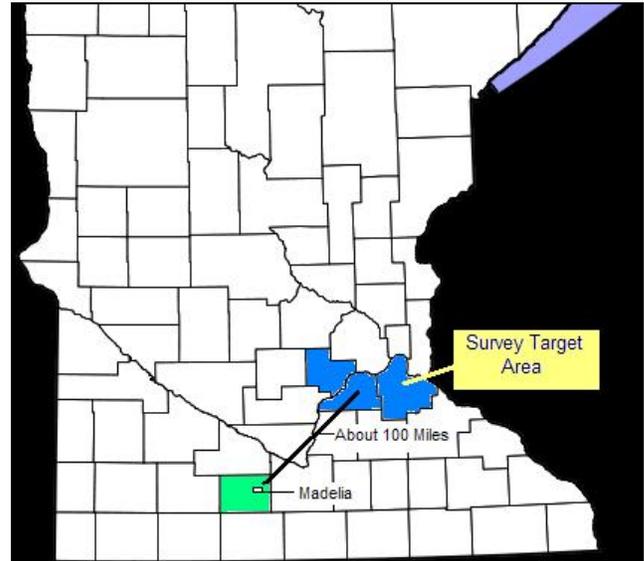
Rural Advantage is a nonprofit corporation based in Fairmont, Minnesota. Their mission is to promote the connections between agriculture, the environment and rural communities in order to improve ecological health, economic viability and rural vitality. Their objectives center around efforts to reduce agricultural nonpoint source pollution with major programming focused on the 3rd Crop Initiative, ECoPayPack development and building the Madelia Model concept. Contact Rural Advantage at 507-238-5449 or visit their website at www.ruraladvantage.org for more information.

Glossary

Perennial = A plant that lives for more than two years. They can be short-lived (only a few years) or they can be long-lived, as are some woody plants like trees. - *Wiki*

Biomass = Biomass is organic material made from plants and animals. Biomass contains stored energy from the sun. - *EIA, Energy Kids Page*

Bioenergy = Bioenergy technologies use renewable



A- Annual Row Crops in Spring



B- Perennial Grasses in Spring



C- Annual Row Crops in Fall



D - Perennial Grasses in Fall

Identification of Ecological Commodity Buyers

Identifying buyers of ecological value is a critical step in the development of payments for ecological services. If you do not have buyers, then incentives cannot be offered that add ecological value and assist in driving land management change. There are several *potential* buyers available and once our program has been developed to the point where we can offer something to the landowner we will be contacting them about official agreements that we can pass on to landowners making changes in their land management activities that add ecological value.

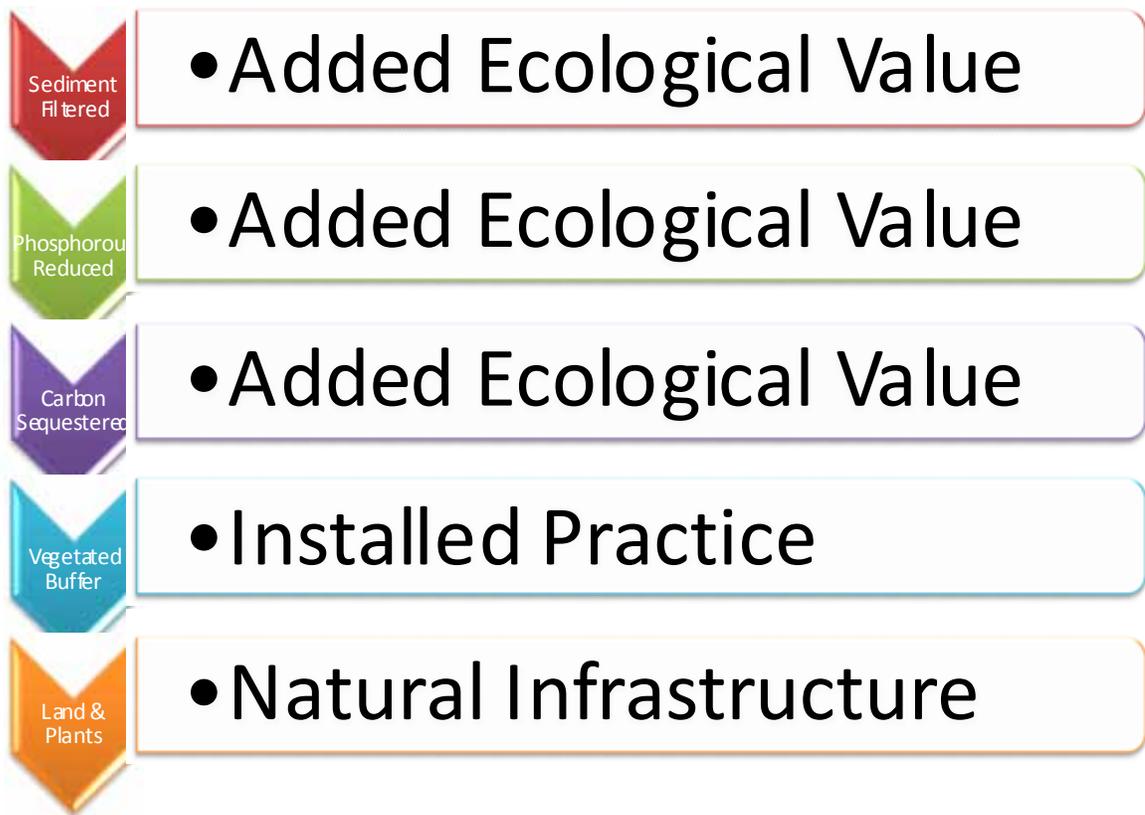
When someone purchases ecological services what are they paying for? This question comes up often. Many people feel they are paying for the land or the practice. Rural Advantage feels that what they are buying is the *ecological value* of doing certain land management activities. This is hard to conceptualize because as a society we have not monetized this value. There are many examples of societal benefits this value could represent such as:

- Improved stream quality due to sediment runoff reductions
- Reduced nitrogen levels in drinking water
- Reduced greenhouse gas emissions
- More carbon sequestered
- More pheasant's, ducks, deer, etc. due to improved habitat
- Increased number of pollinators due to habitat availability
- Reduced nitrogen, phosphorous or pathogen levels in surface water
- Quality of recreational areas improved
- Less species on the endangered or threatened list.



The following diagram is one way to conceptualize ecological value. The land and plants are the *natural infrastructure* and generally there may be [does not have to be] an easement or contract with the landowner, who agrees to manage it around a certain set of parameters such as not mowing it during nesting season. The *installed practice* is the land management activity you are doing to increase the ecological value from that particular piece of land. In this example, it is the establishment of pollinator habitat. Establishing new pollinator habitat will result in more pollinators which in turn results in better pollination of crops and increased yields. The *ecological value* is the increased number of pollinators and the resulting pollination. Theoretically, a buyer would desire and provide a payment for the added ecological value. The buyer may also pay for the practice and/or the land.

The following diagram illustrates where you may have multiple ecological values gained from a single practice. In this example of a vegetated buffer being installed, ecological value is provided through carbon sequestration, phosphorous reductions and sediment filtered. One buyer may be interested in buying all the ecological values or you might have three different buyers of these services.



Another factor that must be considered when trying to identify buyers is whether it is part of a regulated activity or is it voluntary. Regulated activities include water quality trading, air quality and wetland banking mitigation occurring at various levels now and with wellhead protection and storm water mitigation coming soon. Voluntary activities would occur when the buyer has no legal obligation to act. An example would be if Pheasants Forever, or some other wildlife group, would pay for quality wildlife habitat [the ecological value] that a landowner has developed for that purpose. Below is a litany of potential buyers for various ecological services. This is not intended to be a complete list, but rather a mechanism to show the scope of this emerging industry. Understand that these markets are emerging and there may or may not be developed programs for buyers at this time.

Ecological Service or Program	V or R*	Potential Buyer[s]
Carbon	V	Aragate [Iowa Farm Bureau] North Dakota farmers Union Carbon Credit MN Terrestrial Carbon Market US Forest Service Corporations with Social Responsibility Missions Socially Responsible Individuals Private Foundations
Greenhouse Gas Emissions	R	Xcel Energy Touchstone Energy Heartland Consumer Power District Alliant Energy Flint Hills Resources Murphy Oil Ashland Oil
Water Quality Trading P, N, Sediment, flow	R	Municipalities with WWTP Businesses with NPDES Permits
Nitrogen, Phosphorous, Sediment or Flow	V	Ag Corporations, Private Foundations, Socially Responsible Individuals
Habitat	V	Conservation Groups Conservation Related Retailers Conservation Related Corporations Specific Wildlife Species Organizations Private Foundations
Habitat- Endangered Species	R	US Fish & Wildlife Service

		USDA
		MN DNR
		MN Department of Agriculture
		Private Foundations
Habitat- Pollinators	V	Commodity Organizations for Crops Needing Pollinators [apples, strawberries, soybeans, etc.]
		Xerces Society
		Private Foundations
		Corporations with Social Responsibility Missions
		Socially Responsible Individuals
Aquifer Recharge	R	Municipalities with Wellhead Protection Plans
		Rural Water Programs
		Individual Home Owners
Water Storage	R	Source Water Communities
		Downstream Landowners
Water Storage	V	Downstream Landowners
		Great Lakes Commission

*Voluntary [V] or Regulatory [R] Market

Develop a Model ECoPayPack Program

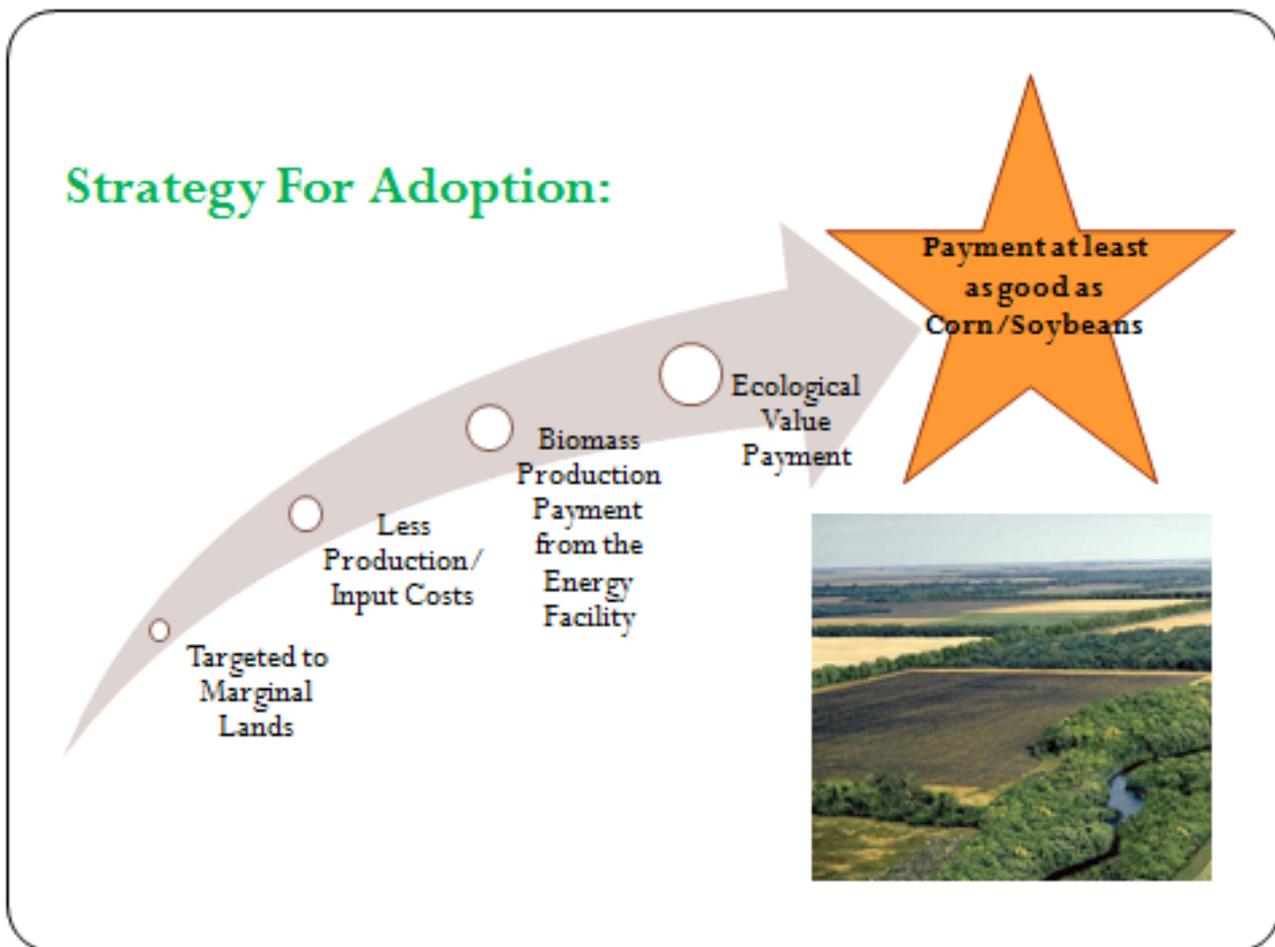
Rural Advantage has been working with advancing 3rd crops since their inception in 2003. One of the challenges of getting landowners and operators to change from their current cropping system to one that includes one or more 'new' crops is that there must be a market for that crop and it must be comparable to what they are getting from their current corn/soybean rotation. As the development of the Madelia Model occurred, we had a potential market, but was the economic return going to be enough to get growers to grow perennial biomass. The Madelia Model is a concept for rural economic development that uses a bio-refinery [utilizing perennial feedstocks] as a catalyst to create a market for perennial biomass and the accompanying economic development around such a system.

To address this issue, Rural Advantage developed the ECoPayPack concept to set up a system to provide payments for the ecological services provided by establishing 35,000 to 50,000 acres of perennials in south central Minnesota to supply a bio-refinery. This concept illustrates how perennial biomass crops can compete economically with corn and soybeans. While our main interest is around supplying native prairie mixes for bioenergy relative to the Madelia Model, this concept is readily transferable to other productive conservation on working lands crops across the state. This concept compliments the biomass production payment, from the energy facility, with an Ecological Commodity

Payment Package [ECoPayPack] that supplies a payment to the landowner based on the ecological services or public benefit provided when you convert from an annual crop to a perennial crop that is managed in a sustainable way. Once developed, this concept could easily be adapted to allow existing perennial plantings to receive a payment for the ecological services they provide.

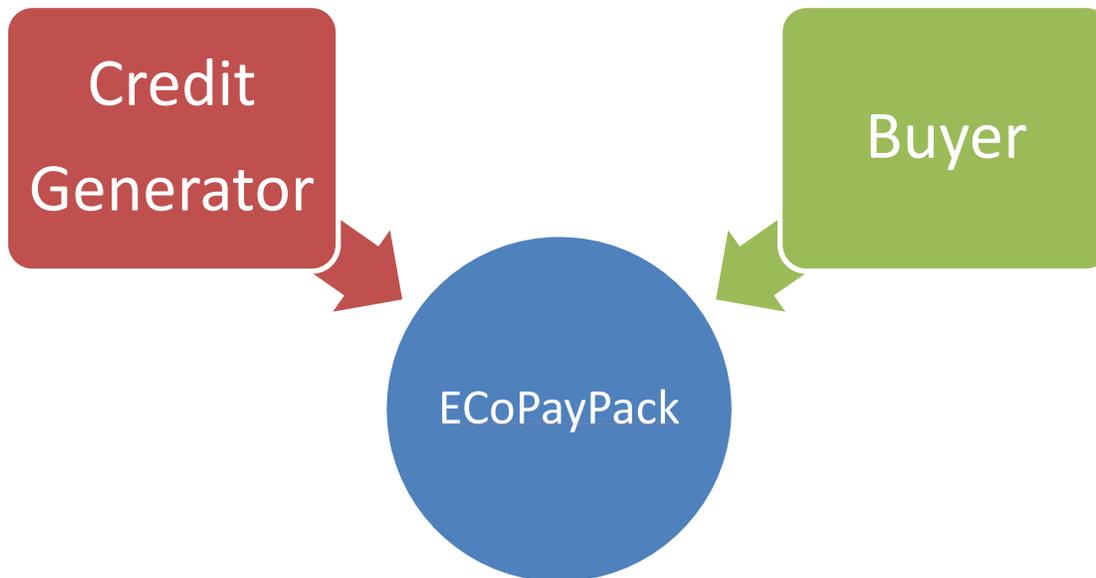
The ECoPayPack is a market based approach for an aggregator to “package” together payments for various ecological services and then pay out a single payment to the landowner. Ecological services that there are currently markets for include carbon, greenhouse gas emission reductions, nitrogen and phosphorous reductions, habitat improvement, sustainability standards, green space and aquifer recharge/ water storage.

The following chart illustrates this strategy for adoption that gets perennial bioenergy crops to compete economically with corn and soybeans.



Rural Advantage sees their role with the ECoPayPack as that of a ‘broker’ between the credit generator and the credit buyer. Rural Advantage feels there is significant opportunity to receive a payment for multiple ecological values depending on the specific land management activities a

landowner is willing to do. An individual landowner may not have the resources to identify, coordinate and enter into agreements with buyers on their own. In addition, buyers do not have the resources to identify and coordinate with landowners to develop appropriate land management changes. The chart below illustrates the base role of ECoPayPack a program of Rural Advantage.



Rural Advantage has partnered with the Conservation Markets of Minnesota [CMM], a project of the MN River Board. The goal of CMM is to establish a voluntary marketplace for ecosystem services transactions in the Greater Blue Earth River Watershed, Lower and Middle Minnesota Watersheds and the Sauk River Watershed. CMM is developing a framework and supporting policy to advance these markets. Rural Advantage has been partnering for the Lower and Middle MN areas. More information on this project is available at www.conservationmarketsofmn.org.

In order to accomplish the operation of ECoPayPack Rural Advantage will operate it as a program under Rural Advantage. As the program grows, it may be necessary to split off the program into its own entity. There are four main pieces to a successful program:

1. Program Framework and Policies
 - a. Develop policies, operation procedures, forms, credibility
2. Credit Generators
 - a. Identify, recruit, assure integrity, contracts, negotiate rates, develop longer term commitments
3. Credit Buyers
 - a. Identify, recruit, contracts, verify integrity, annual checks, 3rd party verifiers, payment procedures
4. Connecting Generators and Buyers
 - a. Market the program
 - b. Individually contact potential buyers

c. Identify and contact potential credit generators

Rural Advantage developed procedures and protocols focused toward a Pollinator Habitat Credit in order to work through the process and develop a credible program to be offered publically. We identified and worked with one landowner, Heidi Morlock of Belle Plaine [EQIP eligible]. Using up to \$1,000 of discretionary funds Rural Advantage has, we worked with Ms. Morlock to determine appropriate policies and procedures. Using our processes she has developed ½ acre of new pollinator habitat on her farm for one Pollinator Habitat Credit. Each ½ acre of pollinator habitat is worth one credit. We have not yet identified a monetary value per credit. We have been discussing this with our pollinator expert consultants and will be finalizing a decision this fall. For this pilot project we also paid for establishment costs.

In addition, we worked with a group of selected scientists, ecologists, pollinator experts and state and federal technical experts to review our protocol and advise of necessary changes. The following describes the processes we developed to offer the Pollinator Habitat Credit to potential credit generators. To date we have just been working with the one producer. When a credit buyer is secured, we would be in a position to offer the program to a broader audience. Attached to this report is a file titled "Pollinator Packet." This file contains the forms and materials we are using for the Pollinator Habitat Credit program. We will be following up the pollinator credit with additional programs for other ecological values. Similar processes will be followed in developing them.

To date we have had tremendous interest in the Pollinator Habitat Program. It seems to resonate well with the public. We have some potential funders who may have interest in being a buyer of some credits. We are unable to list those at this time as we are in a discussion stage and no commitments have been made. We hope to offer a program to credit generators in 2011.

Background on Pollinators

Bees and other native pollinators are a vital component of our ecosystem and food supply. It has been estimated that animals pollinate approximately 35% of all crops grown throughout the world. While managed honey bees comprise the lion's share of pollinator services, native pollinators are significant contributors. In the year 2000, native bees pollinated roughly \$3 billion worth of crops in the US. In many cases these crops are entirely dependent on bees and other invertebrates for pollination. For instance, sunflowers, apples, and alfalfa seed are completely dependent on pollinators with pumpkins, squash, and raspberries 80%-90 % dependent.



Providing good quality habitat is a straightforward way to attract and increase native bee populations. In addition to bees and other native pollinators, beneficial insects such as predatory beetles and parasitic wasps use the same habitat. A 2006 estimate put the value of natural control of pests by beneficial insects at \$4.5 billion annually.

Native pollinators generally have three needs: food and nesting habitat, as well as habitat protection from herbicides and insecticides. Providing these three things should result in greater numbers, as well as a wider diversity, of pollinators.

Forage Habitat –

Food for bees and other native pollinators comes from pollen produced by a wide array of locally adapted flowering plants. These include perennial forbs, native grasses, and woody shrubs & trees. The primary consideration for providing forage habitat is diversity. It is important to employ a diverse mix of species that bloom at different times ensuring a continuous food supply. Equally important is selecting plants that have diverse colors, flower sizes, and growth characteristics. Woody species such as American Plum, Chokecherry, and Pussy/Black Willow are excellent early season sources of food.

Nesting Habitat -

Nesting habitat typically comes in two forms; ground nests (70%) and wood tunnel nests (30%). Providing high quality foraging habitat with a wide diversity of perennials will also help with nesting habitat since untilled ground is a pre-requisite for many native pollinators. More specifically, bare dirt and direct sunlight. These conditions can be achieved through active management. Old brush piles can many times address the roughly 30% of pollinators that require old beetle tunnels as nests. Proximity of nests to food resources is an important consideration when planning nesting habitat. The average foraging range for native bees is anywhere from 50 feet to in excess of a ½ mile. Thus natural nesting habitat must be in close enough proximity to foraging habitat for pollinators to be present. Similarly, artificial tunnel nests, an option for landowners without natural nesting habitat, should be strategically placed close to food sources.

Habitat Protection -

Protection from herbicides and insecticides is important for the long-term health of native pollinator communities. This can be achieved through sound management decisions that minimize insecticide/pesticide use or provide for a buffer to mitigate deadly effects. Timing and the formulation of the insecticide/pesticide are two additional considerations that require management. Toxic substances should never be applied to plants in bloom. Targeting the application to those times when pollinators are not active is one technique that can reduce negative impacts.

The Rural Advantage ECoPayPack – Native Pollinator Credit is designed to establish high value habitat for native pollinators. To ensure this goal is met, participants must adhere to the following Performance Standards:

- Planting must maintain a diverse mix of at least 15 native species (preferably local ecotype) that must include at least three early, three mid, and three late flowering species and should comprise at least 75% of the pollinator habitat plot.
- Plants that produce toxic nectar will not be planted.
- Minimum grass seeding rate will be 5.0 PLS lb/acre and minimum forb seeding rate will be 2.0 PLS lb/acre with at least one forb being a legume. The mixture will result in a 50:50 grass to forb ratio based on seeds per square foot.
- At least one forb must be a legume.

- Plants must remain undisturbed and be available throughout the growing season.
- Monitoring for invasive species and plant community composition is required for on-going maintenance.

Rural Advantage/ ECoPayPack Pollinator Habitat Credit Materials [these forms are in an attached file named "Pollinator Package"] The forms are 95%+ completed.

ECoPayPack Form RA-1-2010, Native Pollinator Credit Application

This document is the initial program application outlining what specific ecological services the landowner/manager is interested in developing; as well as relevant location and personal information.

ECoPayPack Form RA-2-2010, Native Pollinator Credit Application

This document is the initial application that would be filled out for the specific Native Pollinator Habitat Credit. It describes the two options for earning native pollinator credits, as well as soliciting information useful in determining eligibility, and finally providing a brief synopsis of what the credit entails.

ECoPayPack Form RA-3-2010, Project Diagram Sheet [not included in packet]

This document provides additional detail as to the exact location of the proposed native pollinator site.

ECoPayPack Form RA-4-2010, Species Inventory List

The species inventory list has been developed to assist landowners with taking inventory of any existing species to determine qualification in an enhancement situation, as well as provide suggestions for new plantings on desirable species compositions. Species on this list came from a number of sources:

1. MN NRCS Biology Job sheet #16
2. Selecting Plants for Pollinators – a publication of the Pollinator Partnership and the NAPPC
 - A. Eastern Broadleaf Region
 - B. Prairie Parkland Region

ECoPayPack Form RA-5-2010, Management Plan

This describes the base management plan required to obtain a credit. Program requirements, specifications, establishment practices, site operation and maintenance are listed. The landowner could go beyond these minimum requirements. This is the real “meat on the bones” of the credit needing to provide integrity and assurance to the buyer. It is perhaps here more than anywhere else that we seek feedback on the program.

ECoPayPack Form RA-6-2010, Guidance Sheet

This document will be used for marketing the program and describes a little bit about what bees need providing context to some of the performance standards.

ECoPayPack Form RA-7-2010, Task Log

This document is a supplemental document that landowners/managers will use to document actions and tasks they have performed on the site.

ECoPayPack Form RA-8-2010, Verifier Log

This document is used by a 3rd party verifier to ensure compliance with the specifications laid out in the management plan.