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 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

Grass 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.

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, indiangrass, big bluestem). A producer must adjust the necessary cash flow for crops that have a time lag to reach full production potential.

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

	Crop Yield			Grower Price		
	Low	High	Average	Low	High	Average
Crop	----------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

Seed lots sold as variety not stated (VNS) will have similar crop yield but, generally will sell a lower price than certified seed.

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

	Crop Yield			
	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 3. Ryegrass Profit Potential and Breakeven Price Based on Low and High Seed Yield and Price Paid to the Grower in 2006/09 in Northern Minnesota.

Projection	Ryegrass	Ryegrass	Ryegrass	Ryegrass
Yield/acre	300	300	1,500	1,500
Price/pound	$0.35	$0.65	$0.35	$0.65
Gross Income	$105	$195	$525	$975
Total Cost	$282	$282	$282	$282
Profit/acre	$-177	$-87	$243	$693
Profit Margin	-63%	-31%	86%	246%
BEP	$0.94	$0.94	$0.19	$0.19

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 ryegass, 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 loose $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 of last seasons all time highs 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 loose 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 are 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.

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).

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

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, and often times, 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, usually at a lower price, depending upon market conditions and demand.

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.

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

	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

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.

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

	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

*Forage analysis are presented on a dry matter basis

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 conduced 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?

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

	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

Source: AURI BG = bluegrass, RG = ryegrass

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.

Table 8. Custom rate charges for gathering and transporting straw.

	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

Data taken from 2009 Iowa Custom rate Survey.

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.

Table 9. Dry matter production of various cool and warm season grasses at University of Minnesota, Crookston in 2008.

Crop	Type of Grass	Biomass Yield
		tons/acre
Smooth bromegrass	Cool	7.22
Reed canarygrass	Cool	7.25
Timothy	Cool	4.65
Canada wildrye	Cool	6.35
Slender wheatgrass	Cool	6.75
Switchgrass	Warm	5.43
Big bluestem	Warm	3.35
Little bluestem	Warm	2.38
Indiangrass	Warm	2.90

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.

APPENDIX A: 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 manufactures 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.

APPENDIX B: 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 scaley 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 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.

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 debearded (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 access 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. 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 (*Peronspora 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.

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.

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 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 ¾ pint/acre in the spring of the year. Dicamba is important in 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.

PRODUCTION REGION

The Kentucky bluegrass seed production areas in Minnesota are located in northwest part of the state. Roseau and Lake of the Woods counties account for 94% of the acreage and 92% of the production.

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 in 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 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 ¾ pint/acre in the fall of the year. Dicamba is important in 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 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 is 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 course 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.

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 in 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 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 ¾ pint/acre in the fall of the year. Dicamba is important in 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 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.

GEOLOGY AND TOPOGRAPHY

The entire area was influenced by the activities of the continental glaciers in 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 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.

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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

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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 kill susceptible weeds in advanced growth stages.

Diseases

Timothy has very few diseases that limit seed production.