NEW BRUNSWICK SOIL AND CROP IMPROVEMENT ASSOCIATION INC.

ANNUAL REPORT 2017

Enhancing soil and crop sustainability

TABLE OF CONTENTS

President's Report – John Best

Thank you all for coming to the 39th Annual General Meeting and Technical Workshop of the New Brunswick Soil and Crop Improvement Association. I would also like to take this opportunity to thank our members who support our association year after year. Together, we are making strides toward environmentally sustainable agriculture. Another Thank- You is extended to the government of New Brunswick Department of Agriculture Staff who have supported us over the years.

In today's society and economy, we have to continue to grow not only our business but our skill set in order to stay profitable. In today's economy, margins are tighter than ever which requires businesses to work smarter and more efficiently in order to remain in business. With changes in our climate, new opportunities are arising that are allowing us to grow crops that were not possible to be grown be here before and achieve higher yields on existing crops. With these changes comes the ability to expand our businesses by allowing us to strive towards realizing new export opportunities.

The future looks promising due to these changes and New Brunswick Soil and Crop has the skills and resources to assist producers in achieving these goals. May you all have a successful 2018 growing season and we look forward to serving you in the future.

General Manager Report – Leigha Sandwith

NBSCIA started the year with its Annual General Meeting and technical workshop, held in Moncton and hosted by Moncton Soil & Crop

The six candidates competed for the 2017 Farm of the Year: Riverview Orchard, Andrew & Jennifer Lovell, Central; Crop Exchange, Murray Culberson, Carleton County; Miller Farms, Kier & Joan Miller, Kings County; Boudreau Meat Market, Guy Boudreau & Family, Chignecto; Grant's Brook Farms, Mike Bouma, Northshore; W.A Farms, Tony & Ryan van de Brand, Moncton.

The 2017 New Brunswick Soil and Crop Improvement Association Farm of the Year was Miller Farms from Kings County. Congratulations to the Miller's and to all the participants. Pioneer graciously sponsored the award.

Staffing of two vacant agologists positions commenced throughout the year. The positions were filled.

Joan Parker - Northshore

Samuel Ouellette - Chignecto

NBSCIA was involved in a number of projects in 2017. We were the applicant for the NB Field Crop Germplasm Evaluation, which Peter Scott was the project lead. Walter Brown was project lead on the Forage Cultivar Development Trial.

Ron Smtih was the project leader for Rhodiola Rosea cultivars for biomass production in New Brunswick.

We also had a project led by Art McElroy of PhytoGene Resources, which explored the potential of finding reed canary grass species in NB, which are better suited for biomass.

Another project that NBSCIA was involved in was the Improved Forage Quality and Quantity through the use of new mixtures. This project was very large and included 30 participates across the province. The coordinators and summer students collected soil and forage samples throughout the season.

Jesse Chiasson was lead on a project using mustard as a biofumigant to increase strawberry replant vigor and plant productivity in northern New Brunswick. The objectives of this project were to reduce soil born pests and diseases, increase plant vigor and enhance berry production.

The department of Agriculture's Enabling Agriculture Research and Innovation funding funded all of these projects.

We also had projects fall under the Environmental Management Planning funding such as NBSCIA Agricultural Geomatics Support Services and Soil health—Organic Health benchmarking, both led by Ray Carmichael.

NBSCIA has an associate membership with the Atlantic Grains Council and a membership with the Soil Conservation Council of Canada.

Peter Scott also led a project under the Advancing Agriculture Program, Developing Industrial Hemp as a new crop in New Brunswick.

Many training and speaker sessions were hosted throughout the year under the Developing Management Skills program across the province.

NBSCIA also took part in third party research projects throughout the year.

Company Description

New Brunswick Soil and Crop Improvement Association Inc. (NBSCIA) is comprised of a diverse group of producers from across the province who are committed to pioneering advanced soil and crop practices in New Brunswick. New innovative approaches are developed through research for economic and environmental sustainability.

The Association is an organization dedicated to providing leadership in the development, management, and sustainability of soils and crops in New Brunswick. Our objectives can be summarized by the following five goals:

1. To develop, demonstrate and promote environmentally and economically sound agricultural practices as they relate to soils and crops in New Brunswick.
2. To provide New Brunswick farmers with services and resources necessary for the sound development and management of soils and crops in New Brunswick.
3. To encourage greater public awareness of the importance of a viable agricultural industry, and the vital role which effective soil and crop management play in achieving that objective.
4. To be a respected and positive influence on the government with respect to matters relevant to the NBSCIA and its members.
5. To develop and manage operating funds necessary to meet the goals of NBSCIA.

Historical Background

NBSCIA was founded 37 years ago in the Sussex area under the guidance of the department of agriculture staff in the late 1970's. The first local was established in the Sussex area and the provincial organization was constituted in 1978. The NBSCIA initially focused on education and the demonstration of new technology – this continues to be an important part of what the organization undertakes. It stressed soil and crop management practices, conducted tours to various locations in Canada and New England, and brought in experts to speak on new technologies, etc. These activities were primarily undertaken at the local level.

The NBSCIA has two objectives identified in its constitution:

1. To encourage the development and expansion of the activities of local associations in New Brunswick in the field of soil and crop improvement; and
2. To encourage the improvement of soil and crop management in the Province of New Brunswick.

Association Strengths

- A network of agrologists throughout the province to provide professional agronomy service to individual farm members and local organizations.
- NBSCIA has a long history of involvement in soil and crop research, information, education and policy support.
- Its membership represents farmers in almost all commodity sectors and regions in the province.
- NBSCIA is regarded as an objective, independent collaborator for research, testing and reporting results.
- The Association is uniquely qualified to represent the interests of farmers and other rural residents when contending with non-farm soil and water management issues.
- NBSCIA has demonstrated ability to be a credible partner with like-minded private sector firms.

Board, Committees and Employees

Board Executive

President – John Best
Vice President – David Goodine
Secretary/Treasurer – David Waddy

Directors

John Riordon
Ellen Gammon
Shawn Paget
Dean Acton
Ryan van de Brand
Brian Walker
Sheldon Moore
Tyler Coburn
Fred Anderson

Research Committee

Shawn Paget, Dean Acton and David Goodine

Employees

Gerry Gartner - Executive Director

Coordinators:

- Ray Carmichael – Carleton County
- Nadine Simpson – Kings County
- Samuel Ouellette - Chignecto
- Joan Duivenvoorden – Northshore
- Monic Thibault – Moncton
- Leigha Sandwith – Central

Research Coordinator:

- Walter Brown

Local Reports

Kings County Soil & Crop – Nadine Simpson, Agro-environmental Agrologist

This year, producer uptake on group events, such as field days and plot tours were up, and the individual services with the most uptake were crop yields using portable scales, soil sampling, GPS work and mapping, Environmental Farm Plans, and fertilizer recommendations. A producer survey revealed interest in pest management, pre-audit assessments; geo referenced mapping as well as other new service interests. Newsletters were sent around to members quarterly.

Requests for on farm demos and variety trials, comparing quality and yields continues to be well received so we will continued to collaborate with government personal and other associations at local farms with those who wish to partake in research projects, such as the forage project, AGC projects, GETT corn trials, and 4R projects.

Weather monitoring proved to be a useful tool to members. The weather station in Millstream was monitored and data used to send GDD, CHU and Rainfall accumulation to producers.

Collaboration with the SCCC on the Soil your Undies Campaign was a success. 6 producers in the local area participated in the campaign by burying cotton underwear in their soil to assess the soil activity on their farm. The MLA and MP participated on Soil Conservation Week by burying a pair of underwear and this event was in the local Kings County Record and on social media as well, with NBSCIA's collaboration. There are plans to participate in this Campaign again in 2018.

A forage field day was planned and executed on August 8th, with our best turnout yet of 107 people, including some new producers never out to prior NBSCIA events. This showcased forage equipment as well as a discussion on wood ash as a soil amendment. An evening session on field peas was held in Sussex on July 17th as well as a Corn Plot tour and BBQ on September 26th. Our Farm of the Year dinner was held in October at Gastolf old Bavarian Restaurant.

I continued to learn new mapping programs and started completing emergency response plans for producers with our newly created template that we developed.

Chignecto Soil and Crop – Samuel Ouellette – Agro-Environmental Agrologist

In September and October, my work mostly consisted of collecting soil samples for the Organic Matter benchmarking project in the Northshore region. I had the chance to meet and greet 7 producers while doing theses samples. A producer I met while doing OM samples, asked to do 6 soil samples and additionally asked for assistance about compensation for crop damage by wildlife (bear). I contacted DNR and NBSCIA agrologists and finally he got the help needed by the person I contacted at DNR. Before my relocation to Chignecto in mid-October, I assisted Melanie Bos with OM samples, soil samples, manure sample and manure spreader calibration. I did 27 soil samples from interested producers that I called beforehand and I also did a hay sample for Dean Acton. I am currently working with the Chignecto local's 2017 Farm of the Year, Guy Boudreau, for the presentation of our local banquet of 2018. Organizing a banquet can be a difficult task so I gladly volunteered to help during the event. I plan to collaborate with Monic for the implementation of weather stations in the South East region of NB this winter. Since the list of members seems not to be standardized, I plan to organize it with the new membership of 2018.

In summary, my work plan is to learn as much as possible from fellow agrologists and to solidify relations between the agrologist-producers in my region. I have individuals that are interested in having soil samples done this spring and I do my best to make sure producers know who I am and that I participate in local events.

Central Soil and Crop – Leigha Sandwith – Agro-Environmental Agrologist

The year started out with a successful Annual General Meeting at the Riverside resort. We were unable to hear from our guest speaker, George Larazovits, due to an ice storm in Ontario that prohibited him getting in on time. However, we did get an update on the forage mixtures project from Research Coordinator, Walter Brown and learned about feed quality from David Dykstra at the meeting. We selected a new director as well as four delegates to attend the NBSCIA AGM in Moncton.

February was busy with NBSCIA AGM planning and organizing. I attended a 4R nutrient course put on by Fertilizer Canada and Steve Watts. The NBSCIA AGM went off without a hitch and the participants really enjoyed themselves at the meeting. March, I was working part- time for soil and crop keeping communications open and prepping for the field season ahead.

In April, I attended the NBIA AGM in Fredericton and started back to work full time mid- April. At April's board meeting, we discussed plans and projects for Central Soil and Crop for the summer months. May was busy with soil sampling, planting of trials, getting the weather stations up, and running.

June started with the harvest of forage mixture project plots as well as planting grasses and legumes at Richmond Corner. Individual producer calls were low in June but I did soil sample and rented the no- till drill to a new member. I also attended a Kubota demo day at John Schuttenbelds, this turned into a knowledge-filled day. I worked with another coordinator on an action plan for a producer who needed assistance with weed control in his pastures. July seemed to come and go every quickly. I began second cut sampling on the forage fields in the project, did some GPS and Mapping work. I attended a session in PEI on IPM training put on by A&L Labs. A hemp field day was held in Carleton County and later in the month, we had a twilight meeting at our Oat plots in Lakeville Corner, which was a success.

August started with a tour of the germplasm project in Hartland, tissue sampled orchards, and worked on putting together quotes for bulk fuel tanks. I was invited to the Apple Growers Meeting and learned more about their industry. Fall soil sampling began. The Central Soil and Crop Hop & Malt barley Tour took place on the 22nd, we had about 15 people come up and even some potential new members. The day was very informative.

I made a survey that was sent to the majority of NB producers and collected results from approximately 50 participants. The survey gave us an idea of what producers were looking for in the future from Soil and Crop. I also worked on putting together the NB Forage and Grain Competition that took place at the NBEX. We had a record number of participants and our booth was very well displayed with the addition of a Kubota tractor and balers. Kubota sponsored the competition which helped pay for the forage and grain analysis, booth space and promotional items. 3rd and 4th cut forage samples were taken for the forage project. Lots of Soil Sampling and feed sampling. Coburn's hosted a Corn boil & BBQ for Central Soil and Crop. I arranged for Pat Toner to present on Orchard Fertility and Ray Carmichael on pH levels in Central. The rest of the fall blurred together with soil sampling, plant counts for the forage project, harvested GETT plots and plots at Richmond Corner and began to plan for NBSCIA AGM. Sponsorship letters were sent out and a location confirmed. A Central Board meeting was held in November to discuss AGM topics and dedication award recipient. I attended Geomatics meetings with the government as well as CAP meetings.

Carleton County Soil and Crop – Ray Carmichael – Agro-Environmental Agrologist

The delay from the NBDAAF contractor to deliver GIS compatible weather data from the PAT weather station network continues. No data additional date was made available during this period. Attended meeting with the principals involved from SNB and NBDAAF on Dec15.

A Soil Health-Organic Matter Bench Marking project is ongoing with initial samples being collected. The Soil Health Bench Marking project proposal with Dr David Burton Dal AC to support this as a service activity was declined in August, due to lack of Growing Forward 2 funding. A request to reconsider was submitted and conditional approval given Sept 15. However there was insufficient time to meet the stipulations and get the project running in 2017. The offer was declined.

Preparation of support documentation for crop management checklists, IPM and in field scouting, for various crops continued. A review of the potential use and application of wood ash as a liming agent was prepared and awaits final preparation.

Provide soil fertility orientation to Melaine Boss

The two GETT corn hybrid trials and three Corn Emergence Flag Test were harvested and report drafts prepared. An in-field soybean row spacing assessment was completed and a report prepared.

All samples for the Soil Health-Organic Matter Bench Marking project EMP17-001 were assembled and shipped to SGS for analysis. Results have been received and reporting is under way. All reports will be forwarded with the DMSP17-028 Crop Production Management Assessment Project.

Work continued on documentation for the NMP/fertilizer recommendation spread sheet and FertiPlan with Monic and Joan.

Report and financial summary for EARI14-028-4 – Selection of Reed Canarygrass for Biomass Production was prepared and forwarded to NBSCIA administration.

Members submitted approximately 145 soil samples for analysis to PEIAL.

North Shore Soil and Crop – Joan Duivenvoorden – Agro-environmental Agrologist

The year started under the care of William McCallum. As it turned out conditions didn't align for an AGM of the Miramichi Soil and Crop in the winter. However the North East Soil and Crop was able to get together and have an interesting day.

Some new members were added to the roster including sheep, field crops and beef.

Grants Brook Farm was chosen to represent the area as the Farm of the Year candidate. They have many interesting new projects. There was a great gathering of farmers in September on the farm for a BBQ and tour. Thanks for the great afternoon!

Our farms continue to be involved in several projects:

- There were 7 farms involved in the Forage Mixture Project.
- The Rhodiola project continues as multiple plant samples are experiencing the north eastern climate of NB.
- A trial of Spearmint proved itself hardy to the region with a limited amount of winter heave.
- A Hemp evaluation project was conducted on two local farms with Global Hemp Group and Gaetan Chiasson.
- A 4R evaluation is continuing.

In September the coordinator reins were passed on to Samuel Ouellette and then in late October Joan (Parker) Duivenvoorden returned to the position.

In Miramichi there continues to be an 8ft Vredo notill seeder to rent, a ditcher and a subsoiler.

Moncton Soil and Crop – Monic Thibault – Agro-environmental Agrologist

In 2017, the Moncton Soil & Crop Improvement Association had 19 members.

The Annual General Meeting Banquet was held at the St. James Gate in Dieppe on January 19th. The night started with Walter Brown of NBSCIA did a presentation on the ongoing Improved Forage quality and quantity through the use of New Mixtures project, updating producers on how the trial was going. He also presented a few results on other ongoing projects. This was followed by presentation from the Moncton Soil & Crop Farm of the Year nominee W.A. Farm ltd. Ryan van de Brand spoke about their farming and hog operation. Congratulations to the van de Brand family for their nomination!

It was the 3rd and final year of the forage project which took place on 3 farms in the area. A Genetic Environment Tape Trial (GETT) looking at different corn hybrid variety was also conducted. Samples were also taken for the soil OM project looking to compare different analysis methods.

On farm services during the year included soil sampling, tissue sampling, help with EFP, fertilizer recommendation and mapping. Planning for the provincial Annual General Meeting was also a task undertaken.

Research Project Reports

Crop Production Management Assessment

Ray Carmichael

Project Summary: NBSCIA members participated in various crop production management assessments to demonstrate the benefits of crop production management assessment tools such as soil analysis, planting temperature, depth and speed, emergence time and counts, nutrient and pest management, and yield.

Project Objectives:

To increase the knowledge of local producers on the value of intensive crop production management starting with seed selection through to harvest.

Project Deliverables:

The deliverable for this project is a baseline crop production management tool (checklist) for producers in New Brunswick

Project Details:

Improving crop production and environmental sustainability is essential for New Brunswick producers as they are always looking to better their bottom line. The New Brunswick Soil and Crop Improvement Association works with producers to establish and promote a good working relationship while helping evaluate their crop productivity. The NBSCIA Soil Health and Crop Productivity crop checklists have been developed to provide a reference and process description to aid economically viable and environmentally sustainable crop production. The checklists include soil analysis, planting temperature, depth and speed, emergence time and counts, nutrient and pest management, and crop yield. All items on the checklist have a direct impact on the maximum economic yield of the crop.

NBSCIA members provided access and cooperated with NBSCIA agrologists to undertake the crop assessment and test the functionality of the checklists. All data was given to the producer at the end of year and the collective results were shared at local meetings, published in the NBSCIA Newsletter and posted on the NBSCIA web page.

A number of various crop assessment techniques were undertaken that were of interest to the co-operating growers for a particular crop and are reported herein.

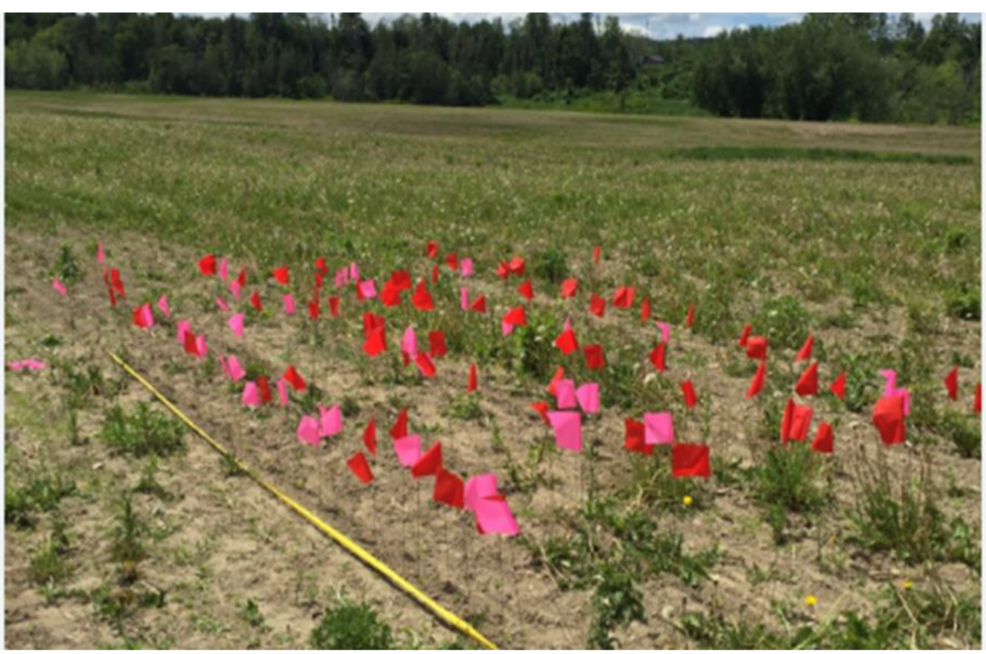
<u>**Corn Emergence Flag Test**</u>

Uniform emergence is one key to maximizing corn yields. To conduct an emergence test, different colored flags are placed beside each emerged plant in a row every 24 hours or less if possible. Setting up a strip for each row of the planter will also help check how well the planter is adjusted. Of course the more sites the better the results. Return every 12 hours and put a different colored flag by any newly emerged plants. Repeat this process with different colored flags until all the plants in the row section have emerged.

This test helps to show how uniformly corn is emerging, which is the first step to achieving a good stand and maximum yields. Uniform emergence typically increases yield results by five to nine percent according to a University of Michigan Study. Plants that emerge one day after the first plants have broken the soil surface will yield 5% less; plants emerging two days late will lose 8% of their yield; those appearing three days later will lose 14%; and plants emerging four days late yield almost 40% less.

Peter Johnson, Real Agriculture notes that the research reinforces the theory that even emergence has a greater impact on yield than even plant spacing, but it also highlights the importance of proper soil conditions at planting. However, in some trials plants that emerged on Day 1 actually yielded less than plants that emerged later. “Emergence is important, but that microclimate you create around the seed really makes a big difference.” Johnson notes that where there is poor seed-to-soil contact, plants can fall behind and loose yield as the season progresses. Having adequate downforce on the planter to ensure seeds are planted at an even depth is just one management practice to help growers promote even emergence. Poor soil conditions can undo even the best laid management plans. “It’s important to get them all up on the same day, but make sure the soil is in the right condition, so the plants don’t change as they go through the growth stages. It’s not just the emergence.”

Corn emergence flag tests as described above and illustrated below were established on three farms. Within the budget limits the number of plants emerging daily were recorded and the kernels per cob were counted to provide an estimate of comparative yields for each day of emergence. Yield estimate was based on 87,000 kernels in a 56 lb bushel @22% moisture.



At two of the three sites the first emerged plants were not the highest yielding plants (Table below). This is consistent with the observation reported by Johnston. Of interest is the fact that the planter in Site 2 was fitted with a seed firming attachment that may have provided greater uniformity in emergence. This is an unreplicated observation undertaken as a proof of concept for a corn emergence service evaluation service by NBSCIA agrologists.

CORN EMERGENCE/FLAG TEST

Site 1		1-Jun	2-Jun	3-Jun	
		Day 1 PM	Day 2 PM	Day 3 PM	
Plants Emerged					
End of Day		60	112	45	
% Emerged End of Day		28	52	21	
Plants per Acre		**32800**			
Total Kernels/cob		381	390	375	
	% of 100	98	100	96	
Estimated Yield (bu/ac)		144	147	141	
Estimated Yield (T/ac)		3.7	3.7	3.6	

Site 2		6-Jun	7-Jun	8-Jun	15-Jun
Plants per Acre		**31500**			
Total Kernels/cob		454	436	444	317
	% of 100	100	96	98	70
Estimated Yield (bu/ac)		164	158	161	115
Estimated Yield (T/ac)		4.2	4.0	4.1	2.9

Site 3		29-May	30-May	31-May	1-Jun
Plants Emerged End of Day		70	79	77	30
% Plants Emerged End of Day		27	31	30	12
Plants per Acre		**32000**			
Total Kernels/cob		447	471		419
	% of 100	95	100		89
Estimated Yield (bu/ac)		164	179		154
Estimated Yield (T/ac)		4.2	4.6		3.9

NBSCIA GETT™ Corn Hybrid Trial

Seed tape is common in gardening as a product for planting that has seeds embedded right into it. It's most commonly used for planting tiny seeds like carrot that are difficult to space in the garden. Maizex is currently the only major corn seed company making use of the concept for infield corn hybrid performance evaluations. A Genetic Environment Tape Trial (GETT™) is an efficient approach to enable in-field seed testing right down to the row. Different hybrids can be compared and evaluated in fields and under different management practices with minimal financial risk or time commitment. Such an approach could enable NBSCIA to facilitate more corn hybrid comparisons in the numerous micro-climates within New Brunswick.

The objective of this project is to compare the maturity of corn hybrids at various locations in New Brunswick and evaluate the GETT™ technology as a method for undertaking additional hybrid performance evaluations in future years.

For the 2017 season Maizex prepared five-four row tape sets to be deployed by NBSCIA agrologists. Two locations (Sites 1 & 2) with recommended grain corn hybrids were established in Carleton County and one in Chignecto. The Chignecto site was harvested as silage October and the results reported in Table A, below. The Moncton location was established May 22, but abandoned due to poor establishment. The Kings County site did not get established due to rain on the day of planting and the biodegradable tapes "melted" or stuck together and would not deploy.

The results for the three sites harvested are reported the table below. Site 1 is typically a lower CHU area than Site 2.

NBSCIA/ Maizex GETT Evaluation

		Site 1 Grain		Site 2 Grain		Site 3 Silage	
CHU	Hybrid	% Moist @ Harvest	DM (T/ac)	% Moist @ Harvest	DM (T/ac)	% DM	Wet Yield (tonne/ac)
2150	MZ1340 DBR	40.4	2.0	28.5	3.2	27.7	19.2
2300	MZ1624 DBR	42.2	1.9	24.2	3.9	28.2	25.6
2250	MZ1482 R	36.6	2.3	23.1	3.5	25.1	20.8
2300	MZ1633 DBR	40.8	2.2	24.9	3.0	25.3	26.2

2200	E47A17R	39.3	2.1	22.7	3.1	28.4	24.6
2400	E50P52R	42.2	1.9	22.4	2.9	25.5	24.6
2275	PS2210VT2P RIB	37.3	2.3	25.5	3.0	36.4	25.0
2350	A4939G2 RIB	38.7	2.5	21.8	3.6	25.0	24.3
2325	E49A12	41.4	1.8	22.4	3.6	28.5	25.0
2475	A5095G2 RIB	43.6	2.3	24.2	3.5	25.6	24.0
2350	DKC30-07 RIB	38.5	1.7	20.0	3.1	30.6	27.5
2450	DKC32-12 RIB	39.4	2.2	27.4	2.7	36.2	28.2
2450	MZ2311 DRB	49.0	0.9	37.6	1.0	23.6	24.3
2550	MZ2333 DRB	52.3	1.2	31.2	2.9	25.0	22.4
2500	MZ2495 DRB	47.0	1.8	31.1	3.2	25.8	24.6
	Average	41.9		25.8		27.8	24.4

Soybean Row Spacing

The optimal population and row spacing for soybeans has been and continues to be a major topic of discussion among producers. The debate is heightened by contrasting opinions from the major seed suppliers. Some promote wide row spacing using appropriate (bushy) varieties, which potentially improves air flow and reduces white mold infection. Others maintain that selecting less susceptible varieties and other management such as fungicides can be equally as effective. There is limited data available for New Brunswick to support either claim.

Data in the table below illustrates the potential yield differential from two adjacent soybean fields. The data also shows the importance of sample replication. Conclusions from a single comparison (gray shaded columns) would provide an exact opposite from the average of nine randomly selected sample sites. Although 31% more of the plants in the 16” rows were infected with white mold, on average this row spacing demonstrated a 34% increased yield over the 32” row spacing.

Given the particular weather extremes experienced this past summer, this limited observation indicates that additional work is required to provide a valid recommendation for soybean row spacing across multiple years.

DMSP17-028 Crop Production Management Assessment -Soybean Row Spacing				
# of 4 sq.ft. Samples Collected	9		1	
Row Spacing	!6 "	32" s	16"	32"
Plants/sq. ft.	6	4	8	4
% of plants with mold	38	7	61	19
Pods/sq ft	108	71	87	97
Yield %	100	66	90	100
Plants / ac.	279,510	154,880	337,590	174,240

Critical Weed Free Period

Research from the 1980s demonstrated that a corn crop’s ultimate yield drops 0.5-3.3 bushels per day when weeds are present, depending on how early in the growth cycle the weeds appeared and how long the weeds were left growing. Dr Clay Swanton, University of Guelph has recently confirmed the communication mechanism between corn, soybeans and neighboring plants such as weeds. Corn plants grown next to weed plants exhibited decreased synthesis of chlorophyll, decreased carbon dioxide assimilation, decreased sucrose levels, an altered root structure, decreased growth rate, changed leaf structure and an explosion of free radicles in the cells. Essentially this work proved that plants experience physiological stress when surrounded by other plants. This stress causes an energy imbalance that results in toxic molecules of oxygen called free radicles. Competition is not about light, water or nutrient competition. It's about causing an energy imbalance in plant cells that is not visible to the naked eye. Plants look totally normal on the outside, but are screaming on the inside.

The presence of weeds causes stress that results in rapid and irreversible yield loss. The impact of stress early in the development of the crop determines its growth trajectory for the rest of the season. Even if the weeds are removed, the final yield will never come back to 100% even though the plant has the whole growing season ahead of it. *Source: Dr. Clay Swanton, University of Guelph.*

This work has practical implications for the timing of herbicide applications and the use of cover crops. Plants are not able to differentiate between a "farmer approved" neighbors. The move to selective post emergent herbicides (Round-up, Liberty Link , for example) from the older pre-emergent products has resulted in "lazy" management practices with potentially significant yield losses in corn and soybeans , as illustrate below.

Critical Weed Free Period-Soybeans

Critical Weed Free Period-Corn

EMP17-001 Soil Health-OM Bench Marking Report

Ray Carmichael, NBSCIA Agrologist

PROJECT SUMMARY

Much attention is directed at improved soil and crop health, particularly within the potato rotation to enhance environmental sustainability. Not only must crop production be managed in an environmentally sustainable manner, farmers must insure economically viable production of all crops that meets minimum grade and nutritional requirements for a specific market use.

Soil health assessments are comprised of three basic criteria chemical, physical and biological. Numerous in-field and laboratory techniques have been developed to quantify and describe components of each of the criteria. Soil organic matter, commonly a factor reported or associated with typical soil chemical analysis is unique in that it is a primary measure of soil health based on the determination of organic carbon in the soil. Organic matter is difficult for laboratories to measure directly, so they usually measure total organic carbon.

A significant end product of organic matter decomposition (mineralization) is nitrogen. Mineralization is a microbial process in which soil microorganisms break down soil organic matter. Nitrogen mineralization from soil is influenced by soil organic matter content, texture, aeration, temperature, and moisture.

The objective of this project was to establish comparative benchmarks for soil organic matter as estimated by three laboratory techniques available to NB producers and provide a reference or an indication of the soil health, nitrogen mineralization and carbon sequestration for GHG reduction.

Seventy five soil samples were collected by NBSCIA Agrologists and forwarded to SGS Agri-Food Laboratories. The samples were prepared for analysis, then split and an exact duplicate forwarded to PEI Analytical Laboratories for a comparative loss on combustion determination. SGS completed a modified Walkley-Black extraction and loss on ignition estimate of soil organic matter

Organic matter values reported from a Wakley-Black procedure are 1.2% to 1.9% lower than those reported from total combustion and loss on ignition respectively. A point of interest from the data is that on average the organic matter values from the Carleton area are higher than the Provincial average.

PROJECT INTRODUCTION

With 2015 being declared *The International Year of the Soil* combined with the *Drive for 45* initiatives by McCain's, much attention has been directed at improved soil and crop health, particularly within the potato rotation. Not only must crop production be managed in an environmentally sustainable manner, farmers must insure economically viable production of all crops that meets minimum grade and nutritional requirements for a specific market use.

Soil health assessments are comprised of three basic criteria chemical, physical and biological. Numerous in-field and laboratory techniques have been developed to quantify and describe components of each of the criteria. Crops grown in healthy soils are heathier and better able to resist insects and diseases than those growing in less than optimal conditions. Soil organic matter, commonly a factor reported or associated with typical soil chemical analysis is unique in that it is a primary measure of soil health based on the determination of organic carbon in the soil.

Organic matter is difficult for laboratories to measure directly, so they usually measure total organic carbon. The terms soil organic carbon and soil organic matter are often used interchangeably. The two are related, but aren't the same:

- Organic carbon is the carbon component of soil organic matter (SOM). On average, SOM contains 58% carbon, which means that organic carbon can be converted to SOM using a factor of 1.72 (Organic matter (%) = Total organic carbon (%) x 1.72). However this can vary with the type of organic matter, soil type and soil depth and method used to measure soil organic carbon. Conversion factors can be as high as 2.50, especially for subsoils
- SOM is different from total organic carbon in that it includes all the elements (hydrogen and oxygen, and nutrients such as nitrogen, phosphorus, sulphur, potassium, and many more).
- Carbon is added to the soil by the process of photosynthesis: carbon dioxide is "fixed" by plants (and certain microbes). The fixed carbon makes it way to the soil through crop residues as well as root exudation. The process for greenhouse gas reduction through carbon sequestration.

The Atlantic Advisory Committee on Soil Resource Management Pub.1-89 recommends a 3.5-5% soil OM for potatoes

A significant end product of organic matter decomposition (mineralization) is nitrogen. Mineralization is a microbial process in which soil microorganisms break down soil organic matter. This process requires a conducive soil environment — soil temperature and water content are critical. This process happens regardless of how much nitrogen is applied. Applying extra nitrogen will not stop this release of nitrogen. Nitrogen is released as ammonium and nitrifies to the nitrate-nitrogen form as soil organic matter mineralizes. Nitrogen mineralization from soil is influenced by soil organic matter content, texture, aeration, temperature, and moisture.

The NBSCIA has conducted numerous evaluations and demonstrations of the various tools and procedures to assess soil healthy, crop productivity and greenhouse gas mitigation (http://www.nbscia.ca/id27.html). The contribution of nitrogen from soil organic matter can be substantial, depending on soil and climatic conditions, past manure or compost applications, and previous crop rotations. Soils with high organic matter content generally have higher soil nitrogen mineralization than soils with low soil organic matter content. The NB Fertility Guide (2001) provides estimates for available nitrogen from soil organic matter mineralization based on the reported % soil organic matter.

PROJECT OBJECTIVE

To establish comparative benchmarks for soil organic matter as estimated by three laboratory techniques available to NB producers as a reference or an indication of the soil health, nitrogen mineralization and carbon sequestration for GHG reduction.

PROJECT DELIVERABLES:

Deliverables for this project will be:

- equations to interpret three available soil organic matter determination methods for reference to historical values reported in NB literature
- a final report documenting the project results and recommended protocols

SITUATIONAL ANALYSIS

Organic matter in soil is captured carbon. The natural sequestering of carbon that happens in the soil under various production practices means the agriculture industry is part of the solution to New Brunswick's challenge to reduce greenhouse gas emissions. Soil organic matter is a common constituent or factor affecting the physical, chemical, and biological assessment of a soil and is routinely available with typical soil chemical analysis.

The closure of the NBDAAF and shift from a modified Walkley-Black extraction to a total combustion method has caused significant confusion amongst agricultural stakeholders. The magnitude of which is illustrated in the following table.

OM From Geo-reference Sample Points				
Field & NBDAAF Date	# of sample points	NBDAAF Walkley-Black	PEI-Leco (2014)	Dif.
Field 1 (2008)	33	2.2	3.6	1.4
Field 2 (2008)	10	2.6	3.6	1.0
Field 3 (2008)	11	2.6	3.9	1.3
Field 4 (2008)	13	2.1	3.4	1.3
Field 5 (2008)	8	2.9	4.0	1.1
Field 6 (2008)	16	2.7	4.0	1.3
Field 7 (2010)	13	1.7	3.2	1.5
TOTAL	104	2.4	3.7	1.3
			Average;	**1.3**
		NBDAAF	Cornell	
NBSCIA (Joan Parker)	24	3.5	4.7	**1.2**

Adding to this confusion is a third organic matter estimation, loss on ignition used by a number of commercial laboratories providing service to New Brunswick producers, therefore a consistent interpretation of the reported values from the different laboratory estimates is critical.

The significantly inflated organic matter estimates as reported have not been correlated to the historical values and consequently makes it impossible to speculate on soil organic matter improvements from a change in rotation, tillage or other production management. Soil organic matter estimates are also a critical component of nitrogen credit or mineralization from the previous crop, commonly referenced in nutrient management planning fertilizer recommendations from the NB Fertility Guide. Soil organic matter is the single most important soil property that the farmer has influence over through crop production management

Higher soil organic matter levels translate into higher yields, more consistent yields, and higher profit in the long run. Soil organic matter is the most easily monitored as a component of a regular soil sample analysis.

PROJECT DETAILS

Seventy five soil samples were collected by NBSCIA Agrologists and forwarded to SGS Agri-Food Laboratories where the samples were prepared for analysis (dried, ground, sieved) then split and an exact duplicate forwarded to PEI Analytical Laboratories for a comparative loss on combustion determination. SGS completed a modified Walkley-Black extraction and loss on ignition estimate of soil organic matter.

SGS Wakley-Black Organic Matter; Sample is digested using Dichromate and Sulfuric acid and run against glucose standards and the % transmittance read to determine % organic carbon. The conversion factor to estimate soil organic matter is %OC x 1.8= %OM.

SGS Loss on Ignition Crucible and sample are dried at 102 C for 2 hours, weight recorded placed in muffle furnace and at 425 C for 18 hours. Record the weight of the ash. Place a weighed sample of CaCO3. Calculate the % of the ash with respect to the dry weight of the sample. There should be no weight loss for the CaCO3. OM is reported as % weight loss of the sample. No correction factor is applied.

LECO TrueSpec Elemental Analyzer is designed to measure carbon by combustion at a minimum operating temperature of 950C for pyrolysis of the sample in 99.9% pure oxygen. Carbon dioxide is a product of combustion at high temperatures. It is mixed with pure oxygen and purged through the CO2 IR detector where it absorbs IR energy. The energy at the detector is measured and is proportional to the Carbon concentration in the sample. Carbon is then converted to equivalent organic matter by the following formula; Organic Matter (OM) = C x F, were C = percentage of Carbon and F = 1.72.

The NB (OM) reported is based on a regression from 125 samples to convert Wakley-Black values as determined above to match values reported by the NB Agricultural Laboratory. The conversion is NB (OM) =(OM*.8334)-.5774. At the time it was noted that NB soils contained fractions of stone that when ground would remain in the sample and this was speculated to be a cause of the difference. The converted values may better reflect OM referenced in the older NB literature.

RESULTS

A summary of the organic matter values are reported in the Project EMP17-001 Soil Health-OM Benchmarking Table below, with corresponding adjustment factors to historical NBDAAF values and Walkley-Black. Of the three methods employed the Walkley-Black exhibited the lowest standard deviation value on average at 1.04.

Modifications of the Walkley-Black method accounts for variations among labs and underscores the need to standardize or understand whatever procedure is followed and the correction factor applied to the organic carbon value reported.

Most methods for OM determination are essentially estimates of organic carbon and a correction factor is usually applied to the result to improve the correlation to other methods or local historical values. It is important to note that SGS Agri-Foods does not apply a correction factor to the organic carbon value reported. This can partially explain why on average the organic matter reported is .6% higher than by total combustion.

A point of interest from the data is that on average the organic matter values from the Carleton area are higher than the Provincial average. This would suggest that the intense- potato rotations is not as damaging as popularly thought.

						Adjustment Factor To NBDAAF			Adjustment Factor To Wakley-Black	
Location	Sample #	NBDAAF_ OM	WB_ OM	Ash_ OM	Comb_ OM	NBDAAF -WB	NBDAAF- Ash	NBDAAF- Comb	WB- Ash	WB- Comb
Provincial Average	75	2.7	3.9	5.7	5.1	-1.2	-3.1	-2.4	-1.9	-1.2
Provincial STDDEV		0.83	1.04	1.97	2.04	0.21	1.25	1.34	1.10	1.20
Average %						-32	-54	-48	-32	-23
Carleton Average	14	2.9	4.2	6.0	5.6	-1.3	-3.1	-2.7	-1.8	-1.4
Carleton STDDEV		0.89	1.11	1.63	1.85	0.22	0.83	1.10	0.68	0.96
Average %						-31	-51	-48	-30	-25
Kings Average	18	2.3	3.5	5.0	4.2	-1.2	-2.7	-1.9	-1.5	-0.8
Kings STDDEV		0.68	0.85	1.63	1.49	0.17	1.12	0.93	1.03	0.82
Average %						-33	-54	-45	-31	-18
Moncton Average	12	2.7	3.9	6.0	5.0	-1.2	-3.3	-2.3	-2.1	-1.1
Moncton STDDEV		0.72	0.92	1.48	1.64	0.20	0.82	1.04	0.66	0.91
Average %						-32	-56	-47	-35	-22
Central Average	12	2.7	4.0	6.3	5.6	-1.2	-3.6	-2.9	-2.3	-1.7
Central STDDEV		1.06	1.32	3.07	3.29	0.26	2.08	2.37	1.86	2.18
Average %						-31	-57	-52	-37	-30
Chignecto Average	12	2.6	3.8	5.1	4.9	-1.2	-2.5	-2.3	-1.3	-1.1
Chicnecto STDDEV		0.67	0.86	1.45	1.55	0.19	0.80	1.01	0.63	0.89
Average %						-32	-50	-48	-26	-22

Northshore Average	7	3.1	4.4	6.9	5.8	-1.3	-3.9	-2.7	-2.5	-1.3
Northshore STDDEV		0.96	1.18	2.08	2.05	0.22	1.18	1.19	0.98	1.01
Average %						-30	-56	-47	-36	-23
NBDAAF_OM=	**Historical NB value**									
WB_OM=	**Modified Walkley-Black**									
Ash_OM=	**Loss on Ignition**									
Comb_OM=	**LECO Loss on Combustion**									

References:

RECOMMENDED SOIL TESTING PROCEDURES FOR THE NORTHEASTERN UNITED STATES, Northeastern Regional Publication No. 493, 3rd Edition http://extension.udel.edu/lawngarden/soil-health-composting/recommended-soil-testing-procedures-for-the-northeastern-united-states/

Chapter 8, Recommended Soil Organic Matter Tests, Schulte, E.E and Bruce Hoskins, Recommended Soil Testing Procedures for the Northeastern United States, Revised 10/2009

CONCLUSIONS

Results from this project highlight the importance of understanding the precise procedure and correction factors employed by various labs when comparing organic matter values from different labs. Organic matter values reported from a Wakley-Black procedure are 1.2% to 1.9% lower than those reported from total combustion and loss on ignition respectively.

EARI 14-028 Selection of Reed canarygrass for Biomass Production

Art McElroy, Phytogene & Ray Carmichael

Project Summary

Reed canarygrass has excellent potential for biomass production, given its high yield potential and good adaptation to a wide range of environments in New Brunswick. The main market for biomass is as a dedicated feedstock for sustainable, environmentally friendly energy production, whether by direct burning, 'wood' pellets, ethanol or others.

Reed canarygrass could be produced throughout the province of New Brunswick, including short-season areas and poorly drained soils where conventional cash crop production is not feasible. However, a low-input management system is necessary to make such production economically feasible. This includes a single annual harvest, sustained production over several years, and the use of legumes as a nitrogen source.

The main obstacle encountered in reed canarygrass production is that stands become sod bound and non-productive after just a couple years. The objective of this project was to identify genotypes that could be incorporated into cultivars with high biomass yield potential, sustained over a number of years, and that thrive without the application of expensive nitrogen fertilizer.

Two hundred genotypes were evaluated in a 2-rep nursery near Williamstown, NB, from 2014 to 2017. They were identified in 3000-plant nursery, from a previous project, as having superior yield potential. The original germplasm was selected from 111 native stands in New Brunswick, Nova Scotia, Ontario and Québec, as well as some selections from the commercial cultivar, Venture.

Most genotypes, though very vigorous in the first years, showed signs of becoming sod bound by 2017, and some died out completely. However, others exhibited sustained production, and associated well with the companion white clover crop. Mature material from 14 plants were analyzed for fibre composition.

The objective of identifying superior clones was achieved. These selections exhibit good yield potential, but more important, can sustain production under low-input management without becoming sod bound.

The genotypes identified will be incorporated into a new cultivar by PhytoGene Resources Inc., and pedigreed seed will be available to New Brunswick producers.

Introduction

In recent years, uncertainty in long term supplies of fossil fuels and the associated increasing costs, coupled with environmental requirements to reduce greenhouse gas emissions have stimulated interest in utilizing biomass (forest and agriculture) to produce renewable energy fuels. Dedicated agricultural feed stocks, such as purpose-grown reed canarygrass, can abate greenhouse gas emissions by increasing carbon storage in the landscape, as well as by displacing fossil fuels in combustion applications

Market testing by Chaleur Green Energy Co-Operative Ltd has also identified animal bedding, horticultural mulch and industrial absorbents as viable economic opportunities, in addition to the use of agriculture biomass for solid fuel. The restructuring in the forestry industry has significantly reduced the availability of sawdust and wood shavings as a traditional source of bedding for poultry, dairy cattle and horses, as sawmills focus on wood pellets as a viable market alternative to pulp mills and heating plants for by-products, such as shavings and sawdust. It is conceivable that grass pellets could take over the market for bedding applications since the fuel quality of wood pellets for residential heating makes it a premium product.

In the 2011 Census of Agriculture New Brunswick reported 41,976 acres of tame or seeded pasture, 56,169 acres of natural land for pasture and 142,484 acres of all other tame hay. Numerous anecdotal observations suggest that much of this land is abandoned or otherwise underutilized and could certainly be brought into a more productive state, with a suitable biomass species such as reed canarygrass.

Exploiting these biomass opportunities in Atlantic Canada requires a sustainable supply of high quality, low-cost feedstock with consistent chemical and physical properties. This in turn creates market opportunities economic viability of purpose grown feedstock hinges on a combination of input costs and crop value. Chaleur Green Energy Co-Operative Ltd is undertaking a processing and marketing initiative to increase crop value. What remains is an undertaken to reduce input costs for the grower, while maximizing crop yield.

Reed canarygrass has emerged as the most suitable species for biomass feedstock production in Atlantic Canada. It has very high yield potential, is well adapted to the cool growing conditions of the region, and can thrive on a wide range of soil types, from poorly drained clays to light, drought-prone sands and loams.

Currently available varieties were all selected for forage production, under a 2- or 3-cut system, under high fertility, and for short-term rotations. Most were developed in Minnesota; none were selected in Atlantic Canada.

Agricultural biomass must be produced under low-input management in order to be economically viable. Specifically, the grass should thrive on nitrogen (N) fixed by an associated legume in order to avoid the high cost of N fertilizer. It must produce high yield under a single-cut regime in order to minimize harvest costs. In addition, it must also persist and maintain high productivity over several years in order to amortize establishment costs over a longer period. It is evident that more appropriate varieties, selected in the region and with these characteristics, are necessary to increase productivity and thereby reduce the cost of the primary product.

To address this need, PhytoGene Resources Inc. established a reed canarygrass breeding nursery near Sackville, NB (on the Tantramar Marsh) in 2013 in order to develop varieties adapted to Atlantic Canada and that would meet the need of the emerging biomass industry. The 3000-plant nursery consists mostly of germplasm collected from vigorous native stands in Nova Scotia, New Brunswick, Ontario and Quebec.

The primary reason for using native stands is to establish a very diverse germplasm pool – an essential element of plant breeding – and to obtain plants with high yield potential under low N conditions. N is actively taken up from the soil by grass plants – they have to 'catch it' – and this process is under genetic control. Recent research has shown that some genotypes have a better capacity to take up soil N than others. It is thought that grass varieties selected under high N conditions may have lost some of the genetic potential for efficient soil-N uptake, particularly under relatively low N conditions.

Local agrologists and producers have noted that reed canarygrass biomass yield often declines dramatically after about three production years as the fields become sod-bound. This phenomenon is easily recognized, but poorly understood. The number of fertile tillers is greatly reduced – with a direct, negative effect on yield – due to a combination of intra-plant tiller competition and for local producers, but the high C:N ratio. Studies suggest that autotoxicity may also be a factor. Remedial action includes the application of N fertilizer, N application plus some tillage, or plowing and re-seeding.

The purpose of this project is to extend the scope of the current breeding initiative to address the current production limitation. It is necessary to evaluate clonal performance (potential parents for a new variety) over a longer period (four years) in order to identify those that have less propensity to becoming sod-bound and which maintain high yield potential over several years.

Project Objective

The objective is to evaluate the sustained production potential under low input management of 200 elite reed canarygrass genotypes under New Brunswick conditions.

Project deliverable

Superior genotypes will be selected from the NB nursery and incorporated into a polycross to generate a new variety.

Material and Methods

A total of 200 superior genotypes were selected from the 3000-plant nursery established by PhytoGene Resources near Sackville, NB in 2013. These plants exhibited excellent vigour with strong, tall culms, sustained productivity over two years and disease resistance. The final evaluation was made in October 2014. The selected plants were dug up, divided and established Oct. 22 in a 2-rep nursery near Williamstown, NB. The plot area had been seeded to white clover prior to transplanting.

The nursery was maintained from 2014 to 2017 by mowing between plants during the season, and then cutting off all material at the end of each season. No fertilizer or pesticides were applied. Notes were taken on survival and plant vigour each year, and heading notes were taken in 2015.

Samples from 14 mature plants were taken in September 2017. These, along with a composite sample from a polycross of the initial 2014 selections, were analyzed for neutral detergent fibre (NDF), acid detergent fibre (ADF) and ash.

Results & Discussion

Establishment of the nursery was excellent – over 95% survival and the white clover established well.

Most plants showed excellent vigour in 2015, indicating that there was sufficient nitrogen available from the white clover to support good growth. About 25% were judged to have particularly good biomass potential.

By early June, 2016, the proportion of very vigorous plants had dropped significantly, to less than 10%. Many of the superior plants identified the previous year showed typical signs of being 'sod bound': there were fewer flowering culms and although there were new tillers on the outer edge of the plant, the centre part was extremely weak and in some cases dead. Other plants were still very vigorous, indicating that nutrients – particularly nitrogen – were not limiting.

It was also noted that white clover and weeds such as dandelion were mostly absent from centre part of the weak plants. In the more vigorous clones, there appeared to be a good symbiosis between the reed canarygrass and the clover.

The decline in productivity of some plants was even more pronounced in July, 2017. Approximately 25% of the plants were completely dead or had only minimal growth. Winter injury is ruled out as a contributing factor: all the plants in the nursery had survived winter conditions the previous (Sackville) and current nursery, and exhibited very good vigour.

The results are consistent with a hypothesis of allelopathy and autotoxicity causing a decline in productivity. Some of the most vigorous plants in 2015 were non-productive by 2017, while others that were rated from fair to very good in the first year continued to thrive. The appearance of the affected plants was similar to the sod bound fields observed in New Brunswick prior to the initiation of this project.

The most important observation is that there appears to be genetic variation for this trait: while most plants show signs of auto-toxicity after a few years, some remain productive and continue to associate well with a companion legume crop. The best plants at the end of the trial originated from nine different geographic locations, indicating that genetic diversity has been maintained for new variety development.

The fourteen plants selected for quality analysis exhibited fair to very excellent vigour in 2015 and early 2016, but continued to produce flowering culms – the most important component of biomass yield - by August 2017.

The levels of acid detergent fibre (ADF) ranged from 31.5% to 42.1% (all on a dry matter basis). ADF is a lignin-cellulose complex that has the highest energy value. There were no obvious differences in leaf content of the samples, so the variation observed is primarily due to inherent differences in stalk composition. Although the samples are single observations (ie. non-replicated), there appears to be significant genetic variation to permit selection of higher AFD strains.

Neutral detergent fibre (NDF) ranged from 58.9% to 74.4%. This is the structural part of the plant, which includes ADF and hemicellulose. Therefore, approximately two thirds of the plants are made up of structural material. The correlation between ADF and NDF was 0.95 indicating that selection could be made for either parameter.

The NDF results indicate that over a quarter of the biomass harvested is soluble material, i.e. not structural. The soluble portion consists of short-chain carbohydrates, protein and fat (of which there would be very little) and ash. Therefore, there should be enough soluble carbohydrates for ensiling, which could be a more practical harvest/conservation option (as opposed to drying) in the autumn New Brunswick climate.

The ash content ranged from 3.06% to 4.94%. This is a substantial range, and since no obvious differences in leaf content were noted, it suggests that selection for lower ash content should be possible.

The values off all three parameters were similar to those of mature plants from a polycross nursery of the original eight selections from the Sackville nursery, except for ash content, which was 9.28% in the polycross. There may have been some soil contamination which lead to this very high value.

Conclusion

The project reached its objectives: it identified a number of reed canarygrass genotypes, from a diverse genetic backgrounds, which have good biomass yield potential under low-input conditions, and which can sustain production over several years.

The obstacle to current reed canarygrass biomass production was identified as fields becoming sod bound, with non-economic yields, after just a few years. The performance of most genotypes in this study was consistent with that observation. However, it is clear that there is genetic variation for allelopathy and/or autotoxicity, making it possible to select strains with improved yield potential, sustained over several years under low-input management. Elite parental clones have been identified and will be incorporated into new cultivars.

It is also evident that genetic variation exists for fibre content, opening the possibility of developing cultivars with high yield potential and superior fibre quality.

Required Next Steps

The next step is to incorporate these elite genotypes into new cultivars. Each will be vegetatively propagated (five propagules each) and established in a polycross nursery. An equal amount of seed from each propagule (to be harvested in 2018) will be bulked to establish a Breeder Seed Block.

Syn-1 seed (from a polycross) of the original eight genotypes identified in the first project has harvested in 2017 and will be established in a Breeder Seed block in 2018.

Communications

The most important communication will be the eventual release of new cultivars.

A summary of the results will be presented at the NBSCIA annual meeting in February 2018.

EARI 13-027 NB Field Crop Germplasm Evaluation Report 2013-2018

Peter Scott
Crop Specialist – Cereal and Oilseeds

Enabling Agriculture Research and Innovation (EARI) Program projects were prepared, submitted and approved annually on behalf of the New Brunswick Soil & Crop Improvement Association (NBSCIA). This research work in evaluating cereal and oilseed varieties is a continuation of the variety development partnership between NBSCIA and New Brunswick Department of Agriculture, Aquaculture and Fisheries (NBDAAF) since the mid 1990's. NBSCIA has been supportive and financially benefits from this variety testing work and partnership with NBDAAF. NBSCIA continues to assure that these variety development activities continue that support the field crop value chain from plant breeding through to livestock feed and farm sustainability. This activity is an important conduit to producer access to new and emerging crop germplasm that is best suited to New Brunswick agronomic conditions.

The **Field Crop Germplasm Evaluation** (EARI 13-27) project over the five year program period tested a total of **685** varieties or hybrids for genetic traits and potential under NB conditions. The crops under test included: 2 row barley, 6 row barley, spring wheat, winter wheat, oats, canola, camelina, soybeans and corn. All field crop testing of cereals and oilseeds were conducted at a Hartland test site using donated land from Covered Bridge Farms Ltd. In addition, corn hybrid evaluations were conducted at two locations, typically Sussex and Carleton County. Winter wheat evaluations have declined recently due to the delay in seed availability that is not early enough for NB locations. Without this generous and accommodating service by farm cooperators this work would be much more difficult.

Small grain variety testing results are published annually and data is utilized in producing variety guides accessible to producers via the NBDAAF website. In addition to the variety guides for small grains and corn additional trial performance listings are provided for soybean and canola.

In addition to variety evaluations a couple fertility management and population trials were conducted that included milling oats, corn and soybeans. Due to the large numbers in variety tests only a few management trials can be conducted each year. Special acknowledgements are made to Anthony Smith and Stephen Clain in their dedication to this important work and the several summer student assistants.

Assessment of Biomass Production and Bioactive Component Profiles of *Rhodiola Rosea* Cultivars from Maritime Locations Compared With Cultivars from Northern Canadian and European Seed Sources

Ron Smith and Stewart Cameron

Summary

This report provides a brief overview of the highlights for the project EARI14-018 "Assessment of biomass production and bioactive component profiles of *Rhodiola rosea* cultivars from maritime locations compared with cultivars from northern Canadian and European seed sources." Work completed in fiscal 2017-18 is briefly described. A detailed report of the work compiling results over the past four years is under preparation and will be submitted in March 2018.

Over the past four years, we have collaborated with the Alberta Rhodiola Rosea Growers Organization (ARRGO). Based on these collaborations and regular discussions, as well as the early results from this project, recommendations on the opportunities for *Rhodiola rosea* (roseroot) as a crop for New Brunswick are presented.

Introduction

Rhodiola (*Rhodiola rosea* L.), previously known as *Sedum roseum* and commonly called roseroot, golden root, or arctic root, is an innocuous perennial herb that looks like a common garden Sedum. Growing along rocky shores in Atlantic Canada, this plant contains a number of compounds that have medicinal properties similar to those in ginseng. Like ginseng, roseroot is a powerful "adaptogen" (provides a general boost to the body's natural immune system). Its recorded use as a medicinal plant (the roots are used) dates back to 1748 in Scandinavia. It has been used to increase physical endurance, work productivity, and resistance to high altitude sickness, as well as in treating fatigue, depression, anemia, impotence, gastrointestinal ailments, infections, and nervous system disorders. Although there are over 200 species of rhodiola worldwide (of which a small number have been used traditionally), to date only *Rhodiola rosea* has been found to contain all of the major compounds that have been shown to provide the health benefits listed above.

World demand for rhodiola is growing rapidly. Most of the global supply of root biomass comes from wild populations, so a major emerging problem is to meet raw material requirements for the growing industrial use. The largest populations subject to intensive collection are in south Siberia, and natural populations there are severely threatened. Likewise, rhodiola has been reported as a threatened medicinal plant in a number of other countries due to over-harvesting. Populations in eastern Canada are scattered and generally the number of individuals in any given area is relatively small, so large-scale commercial harvesting would quickly become unsustainable and certainly not economical. Only one major Canadian group, the Alberta Rhodiola Rosea

Growers Organization (ARRGO), a farmers' cooperative is currently cropping and processing rhodiola at significant scale.

The main objective of this research project is to identify native rhodiola plants that grow well and produce high levels of the compounds that provide the medicinal benefits that are in demand. The ultimate goal is to provide a 'new' crop for New Brunswick farmers. We are also working with ARRGO to both gain from their knowledge and experience, but also to provide help to western producers in the areas of perennial crop production and genetic testing and selection.

Highlights of results from 2017-2018

A Rhodiola clone bank was established in 2017 at Cody's NB. A total of 264 plants, representing 167 different clones, were planted. The clone bank plants had been grown in pots for 2 years in the greenhouse/nursery. The planting was done in June, and there had not been sufficient time to properly acclimate the plants from the greenhouse to field conditions. Therefore, temporary shade was provided to reduce sun scalding. (Figure 1). Based on a fall count, initial survival was over 90 percent, despite the exceptionally dry summer and that no irrigation was applied.

Figure 1. Clone bank plants from the nursery were transplanted from pots through water-permeable fabric as per the field tests. Two Brazilian students on a work / study program assisted with this and other project work.

In the field tests, both open-pollinated seed and clonal trials are in place. The clone bank represents all of the plant material from the sites identified in 2014. Once superior families (seedlots) and individuals are identified, these parental clones will be used as sources of both vegetative material for clonal propagation and as parents for further breeding.

In addition to regular manual weed removal and general site maintenance, the first plant harvests for biomass and bioactive analyses were completed in the fall of 2017. A short summary of some of the initial findings are presented.

There was significant variation in growth among seedlings within families and among populations (seed sources). Similar variability was seen for seedlings from the Alberta and Quebec seedlots. Since all of the seed used in these trials is of open-pollinated origin, this is likely not surprising. However, there are no published scientific papers that report on the variability in growth within families, within populations, or among populations for Canadian Rhodiola rosea against which we can compare these findings with.

For total root dry weight, there was a high level of variation in growth among families (15 fold difference among different families) and a 30 fold difference between the best and the worst individuals. The high level of variation supports the premise that crop improvement should be possible through selection and breeding of the best individuals from good families. Once the results from analysing the levels of bioactives has been completed and integrated with the biomass results, crop yield (amount of bioactives per hectare) can be calculated. The goal will be to find fast growing plants that produce high levels of bioactives. The combined analyses results will be included in the final report in March.

The growth of the plants in this project compares very favorably with that reported in the literature (see Figure 2).

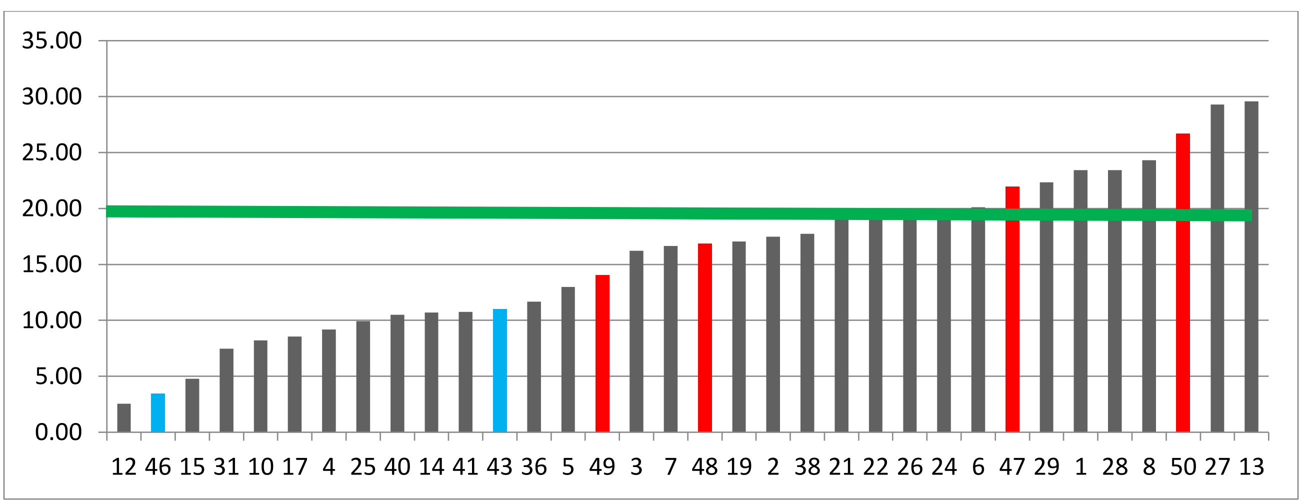


Figure 2. Mean total root dry weights (g) by seedlot. Each bar is the mean of 2 to 4 plants. Red bars are Alberta seedlots and light blue, northern Quebec seedlots. The horizontal line across the graph is the mean root dry weight of 8 Alberta plants aged four (one year older), but planted in New Brunswick at the same time as the other seedlots.

In addition to seed that was sown with the maritime and Quebec sources, two different groups of plants were obtained from Alberta. These plants represented the main commercial seed source currently being grown as well as a newer line that has been identified as being more productive than the first (planted in 2015 and 2016 respectively). Seedlings from both were planted in the two test sites.

NOTE: Alberta currently uses a different nursery system from what was used in this project. Specifically the seedlings we obtained were produced in what we would call an outdoor unheated greenhouse system. They use a rigid plastic ‘star’ shaped container. Multiple seeds are sown to ensure that as many container cells as possible are full at time of planting. This results in many cells have multiple plants. These are grown for two years outside under shelter before planting.

Plants in our project were produced using jiffy peat containers in the greenhouse. Seed was sown and germinants thinned to a single seedling per container (see details in year 1 report). The goal of adopting this production system was to try to produce seedlings in one year that were comparable in size and vigor to those produced in two years using an outdoor container seedling system. Initial results indicate that this goal was achieved.

As a small side study, eight plants were harvested for the field, washed and individual plants weighed separately. The total root dry weight per container cell (=planting spot in the field) was close to the same regardless of the number of plants originally in the cell. For cells with multiple seedlings, inter-plant competition resulted in smaller individual plants at the time of outplanting. It needs to be determined what effect(s) if any this may have on long-term (5 year) growth and yield. Details on this side study are included in the final report.

Results from analyses of the levels of bioactives from the plants sampled in 2017 were not available at the time of writing this report. Rather than focusing on experiments to optimise analytical methods, Dr. Duff Sloley in Alberta was consulted and a method chosen that was deemed appropriate and functional. These results will be reported in the final report.

Work on developing tissue culture protocols continued. Much of the effort in 2017 focused on developing a method to reliably induce embryonic callous from leaf segments and refining methods to sterilise leaf tissue. A significant breakthrough was achieved in late 2017 with the initiation of shoot-like cells. Details on this are provided in the final report. This is significant because this is the first critical step in obtaining ‘true’ plantlets from leaf tissue. Plantlets obtained previously were most likely produced when small amounts of meristematic tissue were collected when leaves were removed from shoots.

Moving Forward

Commercial growers in Alberta still face a number of challenges related to growing the crop more efficiently. Four of the main challenges continue to be:

1) Weed control

2) Crop improvement (improved genetic stock)

3) Optimizing crop yield with respect to:

a) Growth and yield (nutrition)

b) Levels of bioactives

4) Control of pests

At present, there are no herbicides registered for use with roseroot. We conducted a literature review of the potential options for reducing the costs associated with manual weed control in roseroot plantations (see report year 1). We have also been peripherally involved with ARRGO who, working with the PMRA, helped establish minor-use pesticide trials in 2016 in Alberta. In addition to this, ARRGO is looking to test one or more mechanical weeders. New mechanical weeders, such as the Rippa, from the University of Sydney in Australia, are starting to employ new technologies not previously available which may allow for mechanical weeding around perennial crop plants like Rhodiola. ARRGO continues to be very supportive in sharing information.

Identifying elite genetic stock is arguably the main objective of this project. However, we collaborated with ARRGO in designing a sampling trial to help them identify elite individuals in their existing plantations. This trial is underway. The results from this project will contribute to improving both crop improvement and crop yield (challenges 2) and 3) above. When the results from the tissue culture techniques being developed in this project become operational, this will be invaluable for both New Brunswick and Alberta growers for scaling-up the production of elite clonal lines as they are identified.

Through the ongoing collaborations with ARRGO, we continue to test commercial seed sources from Alberta. This strengthens the work in the New Brunswick project and allows us to accurately evaluate the relative competitiveness of New Brunswick crops.

Additional Commercial Opportunities

ARRGO has been active in partnering to develop new uses and products for roseroot as well as in finding new customers. They have a well-established network of customers and contacts. This is an area that we in New Brunswick can benefit from greatly by continuing our partnership with ARRGO. From a global supply perspective, the following points warrant mentioning:

1) Wild harvesting has severely depleting native stocks throughout Eastern Europe.

2) Roseroot product from some Asian sources has proven to be problematic due to issues such as adulteration. ARRGO follows the Canadian Herb Spice and Natura Health Products Coalition (CNHSC) Good Agriculture Collection Practices (GACP) program. This program is recognized by the Canadian Food Inspection Agency (CFIA). Training and certification for this GACP program is readily available to potential growers in New Brunswick and Ron Smith is a certified instructor.

Production and processing under this type of program is increasingly being demanded by customers to reduce concerns over product quality.

3) ARRGO does not currently have sufficient supplies of biomass to meet the current 'growing' demand. NOTE: Agriculture Canada conducted a detailed market analysis of the potential for Rhodiola rosea and concluded that this will likely be the case at least for the short and medium term. ARRGO is willing to work with New Brunswick growers. This represents a significant opportunity for the foreseeable future as we can tap into established markets.

4) With increasing products (and corresponding customers with these different product lines), there is also an opportunity to diversify crops to meet the demand for different bioactives. It is yet to be determined what competitive advantages that the broad genetic base from the maritime populations represent.

5) Certified organic roseroot is in short supply. This is a niche that New Brunswick is particularly well-placed to participate in given that there are a lot of smaller growers looking for high-value specialty crops.

Conclusions and Recommendations

Early field performance results for Rhodiola are promising. However, the two-year field performance reported here is not sufficient to reliably make selections upon which to develop commercial crops. A minimum of three additional years of research (maintaining and measuring the existing field trials) is required. Likewise, there is considerable more research required to complete the development of the tissue culture protocols that can be used to quickly upscale elite plant material once it is identified.

ARRGO continues to demonstrate a willingness to partner with New Brunswick. ARRGO is incorporated in Alberta and it will require some significant work for growers in New Brunswick to formally become members. However, we have an initial informal working agreement that, should there be a strong interest in New Brunswick to grow Rhodiola, ARRGO would be open to work towards bringing those growers into full membership benefits. This represents an opportunity to truly develop a cooperative national program. NBSCIA could be a logical partner for ARRGO with this crop. At this time, ARRGO does not have the tissue culture or the genetics expertise they need to advance their program. This partnership truly does represent a mutually beneficial one for growers in both provinces.

Acknowledgements

The financial support from the New Brunswick Department of Agriculture, Aquaculture and Fisheries and Agriculture Canada through the Growing Forward 2 program is gratefully acknowledged.

We also wish to extend our sincere thanks and appreciation to the following individuals and their respective organizations for their help, encouragement and support over the past 4 years:

- Gerry Gartner (Susannah Banks), New Brunswick Soil and Crop Improvement Association
- Joan Parker, Northshore Agro-Environmental Club
- Edouard Daigle, Daniel Mazerolle, Parks Canada, Fundy National Park
- Kathleen Dugay, NB Power, Point Lepreau
- Nelda Radford, Dorthy Peters, ARRGO
- Kwesi Ampong-Nyarko
- Dr. Duff Sloley
- Christoph Steinrath, ARRGO
- Sean Blaney and James Churchill, Atlantic Canada Conservation Data Centre
- John Letourneau and Laurie Yeates at Natural Resources Canada, Atlantic Forestry Centre
- Alain Cuerrier, Montreal Botanical Gardens
- Mr. George Northrup, Cody's New Brunswick
- Lucas de Freitas Fialho and Clarissa Gusmao, Brazil
- Samantha and Brad Longard
- Mike and Linda Copage
- Eric and Jane Hadley
- Chris Dickie, NB Dept. Agriculture, Aquaculture and Fisheries
- Faculty of Forestry & Environmental Management, Wood Science & Technology Centre, University of New Brunswick

Dan Flemming has provided invaluable technical assistance in all elements of this project. A special thank you Dan! We would not have been able to do this without you!

Last but not least we want to thank our spouses for supporting us as we continue to be distracted in our respective retirements. Thank you Elaine (Stew) and Liz (Ron).

NB Forage Cultivar Development Trials: Project EARI13-028-5

By Walter Brown, NBSCIA Research Coordinator

2: PROJECT OBJECTIVES:

The primary objectives are:

1. To identify new forage cultivars that are superior in productivity, persistence, quality and disease resistance that New Brunswick livestock producers can excess to keep their operations profitable.
2. To identify mixtures of new forage cultivars that will provide high forage yields and the quality to meet the livestock feed requirements.
3. To identify management systems that can put a supply of high quality forage into storage on the farm.

3: PROJECT BACKGROUND:

The evaluation of new varieties, cultivars and hybrids has been recognized by the directors of the NBSCIA as an important role in the long term health of the livestock feed industry in the province. The Maritime Regional testing system that the province of New Brunswick has been involved in has provided strategic information on crop performance, quality, environmental benefits and new opportunities for NB agriculture. This has been accomplished by identifying winter survival issues in perennial forages, earlier maturing high yielding corn hybrids and new crops such as canola and soybean to name a few.

Improved forage quality increases the animal response to the addition of cereal and protein supplementation of the livestock diet. In NB we have the ability to produce high quality forages which can reduce the reliance on cereals to supplement the ruminant diet. Having access to the best genetics of the most suitable forage species is a crucial step in managing the forage supply chain on the farm. Since harvest costs are the same regardless of the quality of the forage, the dollar value of the forage increases as the quality increases.

Both climatic and soil conditions in NB are unique and have proven over time that we have to use mixtures of forage species to remove the effects of winter injury. Mixtures improve the forage quality as well as livestock performance. With many forage mixes available in the market place NB livestock producers require the assessment of mixtures that can fill their forage needs and are economical to establish and manage. Part of the process is currently being accomplished with project EARI15-042 “Improved Forage Quality and Quantity through the use of New Mixtures”.

4: PROJECT DELIVERABLES:

1. ***To provide yield and winter survival data from the Maritime Forage Cultivar trials established in New Brunswick.***

2. To provide yield and management data on the 3 different forage mixtures established in project EARI15-042.

3. To look at yield and quality data on some of the new highly productive grasses species and legume mixtures to identify what role they can play on NB farms.

5: PROJECT DETAILS:

Three new Regional Forage Cultivar Evaluation trials were established in 2014 at the Richmond corner site the period of 2014-2017. All forage evaluations are conducted under a randomized complete block design with three replications. This test included three species, 14 Alfalfa, 12 Tall Fescue and 4 Meadow Fescue cultivars listed in appendix 1. They were evaluated on winter survival and total dry matter yields in 2016 and 2017 on all three species.

In the first harvest year it was determined that the trials did not survive the winter to a sufficient level for harvesting as they were reestablished in 2015 and the first harvest year was in 2016.

The task of summarizing the yield of perennial crops requires special attention. Each plot in the Atlantic forage trials has a cropping record over three years with multiple harvests each year (unless a site is replanted or lost due to establishment failure or winter kill). Two statistics are used in these reports to summarize the yield of each cultivar: **mean annual yield** (MAY) and **relative persistence** over cropping years. While MAY is well known and used, relative persistence requires an explanation.

Plant count is often used to measure how well cultivars survive over cropping years. The change in a cultivar's yield over three (two or four) cropping years, relative to the check, also indicates how well a cultivar survives over years. Given the seasonal mean yields, the ratio of the last to first seasonal yield (***Ri***) is calculated for each plot. Seasonal yields do depend on the weather, so the ratios have no reliable meaning in and of themselves. Their relative values, however, can be compared one with each other. If one cultivar is defined as the standard (one which has been evaluated over several years and has proven to be consistent) then **relative persistence** for the cultivar ***i*** can be defined as LOG10 (**Ri/Rstd**).

The log transformation is used to improve the distributional properties for analysis by the ANOVA procedure. After analysis, the mean log ratio can be back-transformed to a meaningful scale. In our presentations, the mean log ratios are back-transformed to the percentage scale, with an approximate SEM that depends on the magnitude of the percent difference.

The column labelled *% Persistence* in the combined year report is a relative measure (to the standard) in percentage units. If the standard has the same yield in the final year as in the first crop year, then *% Persistence* for each cultivar will be the percentage change; i.e., the final-year yield relative to the first-year yield. A value of 10% would indicate that the final year yield was 10% more than the first year yield. In general, *% Persistence* is the percent change in final year over the first **relative to the ratio in the standard**. If the final/first year yield ratio for a cultivar is less than the standard, the resulting negative *% Persistence* indicates a less persistent cultivar.

6: PROJECT RESULTS:

Cultivar Evaluation - The forage cultivars are compared to standard cultivars within their species that has been evaluated over several years and has proven to be consistent and their standing in relation to that cultivar are expressed as "% change from the standard" .

ALFALFA:

The combined results of the data gathered in 2016 and 2017 on the Alfalfa cultivars are presented in table 1. The plots were harvested three times in 2016 but only twice in 2017 due to the extended period with little or no precipitation. The yields are evaluated on both the first cut yield and the total dry matter yield for the season. The mean yield for the first cut over 2 years was 6.07 t/ha and the total dry matter yield was 9.81 t/ha. All the cultivars exceeded the yield of the check cultivar, AC Caribou over the two harvest years.

Table 1: Alfalfa Dry Matter Yields (Means) Relative to the Standard AC Caribou for Years 2016-2017.

Year Harvested	Cut #1	Cut #2	Cut #3		
2016	x	x	x		
2017	x	x			
Combined Years Cultivar	1st Cut DM Yld (t/ha)	Mean %Change from Std	Mean Annual Yld (t/ha)	%Change from Std	Year %Diff Persist
55Q27	6.20	14.2	10.90	28.0	1.5
GS-11-08	6.54	20.5	10.50	23.3	5.5
Algonquin	6.15	13.4	10.33	21.2	-12.6
54Q14	6.39	17.7	10.16	19.3	8.5
AAC-Nikon	6.05	11.5	9.99	17.2	0.7
Actis	5.77	6.3	9.90	16.3	-8.0
GS-14-06	6.04	11.3	9.87	15.9	8.9
Cornerstone	6.09	12.2	9.76	14.6	10.3
GS-11-03	6.30	16.1	9.76	14.6	6.1
Magnum VI	6.06	11.6	9.76	14.5	-2.0
55V50	6.22	14.6	9.62	13.0	12.0
GS-14-05	5.80	6.9	9.62	12.9	11.0
GS-14-01	5.95	9.7	8.65	1.6	24.7
AC Caribou	**5.43**	**0.0**	**8.52**	**0.0**	**0.0**
Mean	6.07		9.81		4.4
SEM(df=26)	3		1.00		6.64

The final column in the table contains the persistence of the cultivar over the life of the plots. It is explained in the summary of yield and relative persistence. It is relative to what occurred due to weather and other factors in this group of plots. This calculation is completed on all cultivars in the Maritime Regional Forage Cultivar evaluation trials.

TALL FESCUE:

The Fescues plots were cut on the same schedule as the Alfalfa. Two standards were used in the Tall Fescues, Kora and HyMark and the cultivars will be evaluated against each of these cultivars. In 2017 the Tall Fescue was severally affected by the drought experiences in much of Southern New Brunswick and we were able to get only one cut off the plots.

The combined data for 2016 and 2017 Tall Fescue cultivars are contained in table 2, with Kora as the standard cultivar and table 3 with Hymark as the standard cultivar. The mean first cut yield for the Tall Fescue is 6.07 t/ha and the Mean Annual Yield (MAY) is 8.72 t/ha. Four cultivars were better than Kora and one cultivar was better than Hymark.

Table 2: Tall Fescue Dry Matter Yields (Means) Relative to Standard Cultivar Kora.

Year Harvested	Cut #1	Cut #2	Cut #3		
2016	x	x	x		
2017	x				
Combined Years Cultivar	1st Cut DM Yld (t/ha)	Mean %Change from Std	Mean Annual Yld (t/ha)	%Change from Std	Year %Diff Persist
PPG-FTF-105	7.30	5.7	9.40	4.5	-7.3
Hymark	7.31	5.9	9.40	4.5	-5.8
Bardurum	6.85	-0.8	9.10	1.2	-8.8
Barcarella	6.96	0.8	9.02	0.3	-6.8
Kora	**6.90**	**0.0**	**9.00**	**0.0**	**0.0**
Bar FaFL118701	6.37	-7.7	8.67	-3.6	-4.3
Bariane	6.87	-0.5	8.64	-4.0	-9.6
Cajun II	6.81	-1.4	8.62	-4.2	-10.8
PPG-FTF-104	6.47	-6.3	8.62	-4.2	-15.0
BarElite	6.22	-10.0	8.19	-9.0	-11.6
PPG-FTF-101 (Teton II)	6.25	-9.5	8.17	-9.2	-8.0
Cowgirl (QS-CG)	6.12	-11.4	7.83	-13.0	2.2
Mean	6.70		8.72		-7.3
SEM(df=22)	3		1.06		8.62

Table 3: Tall Fescue Dry Matter Yields (Means) Relative to Standard Cultivar HyMark.

Years Harvested	Cut #1	Cut #2	Cut #3		
2016	x	x	x		
2017	x				
Combined Years Cultivar	1st Cut DM Yld (t/ha)	Mean %Change from Std	Mean Annual Yld (t/ha)	%Change from Std	Year %Diff Persist
PPG-FTF-105	7.30	-0.2	9.40	0.0	-1.5
Hymark	**7.31**	**0.0**	**9.40**	**0.0**	**0.0**
Bardurum	6.85	-6.4	9.10	-3.2	-3.1
Barcarella	6.96	-4.8	9.02	-4.0	-1.0
Kora	6.90	-5.6	9.00	-4.3	6.2
Bar FaFL118701	6.37	-12.9	8.67	-7.8	1.7
Bariane	6.87	-6.1	8.64	-8.1	-4.0
Cajun II	6.81	-6.9	8.62	-8.3	-5.3
PPG-FTF-104	6.47	-11.6	8.62	-8.3	-9.7
BarElite	6.22	-15.0	8.19	-12.9	-6.1
PPG-FTF-101 (Teton II)	6.25	-14.6	8.17	-13.1	-2.3
Cowgirl (QS-CG)	6.12	-16.4	7.83	-16.8	8.6
Mean	6.70		8.72		-1.5
SEM(df=22)	3		1.06		8.62

MEADOW FESCUE:

The Meadow Fescue was harvested on the same schedule as Alfalfa and Tall Fescue plots. Pardel was the standard for the Meadow Fescue and the yield of all Meadow Fescue cultivars were compared to its yield. In the Meadow Fescue the mean yield in the first cut was 6.60 t/ha and the mean annual yield was 8.58 t/ha. All three test cultivars exceeded the mean annual yield of Pardel.

Table 5: Meadow Fescue Dry Matter Yields (Means) Relative to Standard Cultivar Pardel.

Year Harvested	Cut #1	Cut #2	Cut #3		
2016	x	x	x		
2017	x				
Combined Years Cultivar	1st Cut DM Yld (t/ha)	Mean %Change from Std	Mean Annual Yld (t/ha)	%Change from Std	Year %Diff Persist
BOR20614	6.86	8.8	8.78	6.0	16.4
Cosmonaut	6.74	6.8	8.73	5.4	4.0
Preval	6.48	2.8	8.52	2.9	-5.0
Pardel	**6.31**	**0.0**	**8.28**	**0.0**	**0.0**
Mean	6.60		8.58		3.5
SEM(df=6)	3		0.53		5.54

FORAGE MIXTURES ON-FARM:

The three forage mixtures planted in the project EARI15-042 "Improved Forage Quality and Quantity through the use of New Mixture", alfalfa, meadow brome, tall fescue and meadow fescue; red clover, timothy, meadow fescue and tall fescue; and triple mix were planted in an eight block and three rep configuration at Richmond Corner.

The Alfalfa mixture was made up of 25 kg Caribou alfalfa, 25 kg Magnum VI alfalfa, 8 kg of Fleet meadow Bromegrass, 8 kg of Preval meadow fescue, 8 kg of Kokanee tall fescue, and 1 kg of Fabio annual ryegrass. The Red Clover mixture was made up of 15 kg Juliet red clover, 15 kg Will red clover, 20 kg Richmond timothy, 11.75 kg Preval meadow fescue, 11.75 kg Kokanee tall fescue, and 1.5 kg Fabio annual ryegrass. This resulted in the Alfalfa mixture being 70% legume and 30% grass by seed numbers while the Red Clover mixture was 21% legume and 79% Grass similar to the Triple Mix.

Table 6: 2016-Forage Mixture Yield and Quality in a 2 vs 3 Cut Management Program.

	2 Cuts			3Cuts		
Mixture	DM Yield t/ha	Milk kg/tone	Milk kg/ha	DM Yield t/ha	Milk kg/tone	Milk kg/ha
Alfalfa	8.11 a	2729 a	10,806 a	9.59 a	4398 a	13,087 a
Red Clover	8.01 a	2669 a	10,123 ab	8.42 b	4383 a	11,292 b
Triple Mix	7.37 a	2564 a	9,266 b	6.78 c	4300 a	9,049 c

In 2016 these three mixtures were harvested in either a two or three cut program. The response of yield and quality of the two systems indicated a response to increased yield and quality, in table 6, for the 3 cut over the 2 cut program. In the 2 cut program the first cut was 10 days later than the first cut taken in the 3 cut program. The mixtures with Red Clover and Triple Mix kept pace with the Alfalfa in the two cut program but had significantly less yield in the 3 cut program. There was no significant difference in quality between the three mixtures measured as Milk in kg/tone of forage due to the fact that there was less leaf loss in the Red Clover compared to the leaf loss by Alfalfa as it nears maturity. The Milk in kg/ha follows the Dry Matter yield of the forage reflecting the higher yields of the Alfalfa and Red Clover mixtures compared to Triple Mix.

In 2017 the plan was to harvest the mixtures in 2 and 3 cut program on the same reps used in each program in 2016. The first cut went according to plan however with the lack of sufficient precipitation from June until mid-September the plans for second and third cuts did not occur. Legume plant counts were taken in the spring to compare the impact of the 2 and 3 cuts, in table 7, on the forage stand from the previous season. The cutting program had no impact on the Alfalfa population with both stands having over 10 plants/m² however the Red Clover population was significantly reduced by the 3 cuts in 2016. The first cut dry matter yields in 2017 were basically equal for all three mixtures as was the quality. The plots that were destined for 2 cuts were harvested about 10 days later than the ones where 3 cuts were planed which would account for the slight yield difference.

Table 7: 2017-Forage Mixture Yield, Quality and Legume Population in First Cut.

	2 Cuts (2016)			3Cuts (2016)		
Mixture	DM Yield t/ha	Milk kg/tone	Legume Plants/m²	DM Yield t/ha	Milk kg/tone	Legume Plants/m²
Alfalfa	3.93 a	1368 a	10.25 a	3.73 a	1378 a	10.75 a
Red Clover	3.84 a	1322 a	8.25 a	3.23 a	1378 a	5.75 b
Triple Mix	3.59 a	1314 a	7.25 a	3.23 a	1377 a	4.50 b

In 2017 we managed to get a second cut off the Alfalfa mixture but regrowth was not sufficient for a third cut of Alfalfa or a second cut of the Red Clover or Triple Mix. Both sets of plots were harvested at the same time. The dry matter yield and quality yield in kg/ha of Milk, in table 8, were statically equal however the Milk kg/tone was statistically lower in the plots that would have been harvested 2 cuts in 2016. Although the plots that were identified to be cut 3 times had 10 days more growth the yield was lower, although not significant, which could be attributed to the dry conditions. That group of plots however had a higher forage quality in Milk kg/tone which is difficult to explain because the forage was older at harvest time.

Table 8: 2017-Forage Mixture Yield, Quality and Milk Yield in Second Cut.

	2 Cuts in 2016			3 Cuts in 2016		
Mixture	DM Yield t/ha	Milk kg/tone	Milk kg/ha	DM Yield t/ha	Milk kg/tone	Milk kg/ha
Alfalfa	6.14 a	2504 b	7723 a	4.64 a	2879 a	6479 a

Established Grass-Legume Mixtures used on Farm:

Alfalfa grass mixtures were established at the Richmond Corner site on June 2nd 2017 to be harvested once in the establishment year. These mixtures mirrored the Alfalfa mix being used in the On-Farms Forage Quality project with a simpler grass-legume mixture and also included a new Low Lignin Alfalfa. They struggled all summer to establish and began to show some promise of possible winter survival late in September. They were clipped once early in the summer for weed control only.

7: CONCLUSIONS:

The Forage Cultivar Evaluation trials resulted in a number of Alfalfa, Tall and Meadow Fescue cultivars that show improved dry matter yields over what is presently being used on New Brunswick farms. A number of the Alfalfa cultivars also have excellent levels persistence which should improve their winter survival.

The plots following the On-Farm Forage Quality mixtures have demonstrated that in these mixtures the alfalfa is superior to Red Clover and Triple Mix in yield but not in forage quality. The ability of forage to stand a 3 cut program will produce more forage and with the improved quality produce more milk per acre.

The Red Clover mixture in this trial had a significantly lower plant population than what is being practiced on farms in New Brunswick which may have led to the Red Clover population being so low in the second production year. We will have to look at mixtures with higher Red Clover seed numbers in the mixture to see if the plant populations required for a good stand can be achieved in the second and third production years.

One side bar of the 2017 harvest year which has been expressed often to me this year is that regardless of the level of fertility and management put into a crop we have no control over the weather and without sufficient moisture we do not get good yields.

Evaluation of Nitrogen Source on Grain Corn

Walter Brown, NBSCIA Research Coordinator
And Cavendish Agri Services

2: PROJECT OBJECTIVE:

To establish plots at the NBSCIA forage site in Richmond Corner to evaluate the response of ESN and Super U as a Top Dress nitrogen source for Grain Corn.

3: PROJECT BACKGROUND:

Protected Urea products that have the potential to reduce or eliminate the loss of nitrogen through volatilization have become available for crop production. Their selling point is that because the product is protected from environmental influence, more of the actual nitrogen gets delivered to the crop which should impact the crop yield. Two products, ESN and Super U were compared with Urea and Ammonium Nitrate for response on Grain Corn.

ESN is a slow release nitrogen (N) fertilizer product made of polymer coated urea granules. The Super U is a proprietary formulation that combines a urease inhibitor and a nitrogen stabilizer in one ready-to-use granular fertilizer. These two products should delay the release of nitrogen further out in the corn's growth cycle closer to the time when the plant reaches its maximum nitrogen requirement. This then should result in higher grain yields.

Along with the three urea sources and ammonium nitrate we also used two other common nitrogen products that are being used to replace ammonium nitrate because of the increased restrictions being placed on that product. One product is a 50/50 blend of urea and ammonium sulphate and the second is a blend of ammonium nitrate and ammonium sulphate.

4: PROJECT DETAILS:

The corn was planted on May 24th by a NBSCIA member who plants grain corn as one of his rotation crops. The corn hybrid was Elite E47A17R, the hybrid that the producer had used to finish out his corn acreage. The 2x2 band was a blend of 15.6-13.5-16-8Mg applied at 365 kg/ha. The nitrogen top dress was applied on July 7th at 92 kg/ha of N to bring the total nitrogen to 150 kg/ha. Weed control was 2.5 l/ha Glyphosate in the fall of 2016 and 2.5 l/ha at the 5 leaf stage in 2017. Seeding rate was 86,500 seed/ha, the plots were harvested and shelled on October 24th and the plant population at the harvest was 77,800 plants/ha.

5: RESULTS:

In samples taken in 2016 the soil organic matter is on the high side for most soils in the area which gave the potential for an excess of nitrogen available for mineralization through the growing season. The level of Phosphorus and Potassium in the soil was high to high plus, shown in table 1, the pH was good and the Ca:Mg ratio was less than desirable probably because of a high usage of Dolomitic limestone in past years.

Table 1: Soil Analysis of Soybean Site.

% O.M.	pH	P_2O_5	K_2O	Ca	Mg	Zn	S
8.2	6.3	231H+	150H	991 M+	251H+	1.7	14

Using the fertility requirements from the NBDAAF Fertiplan program the requirement for Nitrogen, P2O5 and K2O was 150, 30 and 50 kg/ha. The fertilizer application rates are shown in table 2. The top dress applications of the Nitrogen products are represented as both the product rate and the actual N rate which when added to the band fertilizer gave an actual N rate of 148.8 kg/ha. The P2O5 and K2O rates were applied in the band which exceeded the requirements from the soil analysis.

Table 2: Nutrients Applied Through Fertilizer Treatments.

Treatment	Product (kg/ha)	N applied (kg/ha)	Band N (kg/ha)	Total N (kg/ha)	P_2O_5 (kg/ha)	K_2O (kg/ha)
ESN	215	92	56.8	148.8	49.1	58.2
Urea	200	92	56.8	148.8	49.1	58.2
Super U	200	92	56.8	148.8	49.1	58.2
AN	270	92	56.8	148.8	49.1	58.2
AN & AS	450	92	56.8	148.8	49.1	58.2
Urea & AS	270	92	56.8	148.8	49.1	58.2

Although the soil preparation was somewhat rough because of the heavy sod it did not affect the corn germination which was about 90%. The one negative for the 2017 crop year was the lack of moisture with the precipitation for the area being under 40% of the 30 year normal. We did however get approximately 15 mm of precipitation several days after the top dress fertilizer was applied.

The plots were harvested on October 24th by hand picking 17.5 feet of one of the middle rows of each plot. The corn was taken to the NBDAAF site in Fredericton for shelling and dried using the AAFC facilities. The data collected was moisture at harvest and yields which were calculated at 15.5% moisture are shown in table 3 and there was no significant difference in grain yield or moisture due to the nitrogen source.

Table 3: Agronomic Data for Grain Corn N Source.

Treatments	Yield t/ha @ 15.5 %M	Moisture %
ESN	9.19 a	28.12 a
Urea	9.18 a	28.19 a
Super U	8.88 a	28.71 a
AN	8.62 a	29.08 a
AN & AS	8.82 a	28.99 a
Urea & AS	9.06 a	29.78 a

6: CONCLUSIONS:

There were no differences in yield and grain moisture at harvest due to the nitrogen source. From the results of this trial the most economical source of nitrogen is the one with the lowest cost per unit of N. The lack of moisture in 2017 would not lead to any significant leaching of nutrients at this site and the high Organic Matter would probably have limited any potential response to the application of nitrogen. The protected nitrogen fertilizers could possibly have some advantage in lighter soils more prone to leaching in years with higher precipitation rates.

Evaluation of Top Dress Nitrogen on Grain Corn

By Walter Brown, NBSCIA Research Coordinator
and Hartland Agro Mart

2: PROJECT OBJECTIVE:

To establish plots at the NBSCIA forage site in Richmond Corner evaluating the response of 5 Top Dress nitrogen rates on Grain Corn.

3: PROJECT BACKGROUND:

Research has shown that corn grown in a rotation following an alfalfa crop on dairy farms have adequate nitrogen available to meet the needs of a crop of silage corn. At the NBSCIA forage site in Richmond Corner a large area had been used for various legume and/or grass evaluation trials from 1990 to 2005. The vegetation was run down, very uneven and had some perennial weeds due to the lack of management since the trials were ended in 2010.

The area received an application of roundup prior to being ploughed in the fall of 2016. Extensive soil testing in August of 2016 revealed some interesting things about the site. The pH and organic matter levels were high as was the P2O5 and Magnesium levels. The levels of K2O and Calcium were lower but still at reasonable levels.

In the spring of 2017 a local Soil and Crop member planted two blocks of grain corn to prepare the site for trials in 2018 of which we had no detailed plan for but lots of ideas. We had plots identified for one block of 4 reps but the second block was open.

4: PROJECT DETAILS:

The corn was planted on May 24th by a NBSCIA member who plants grain corn as one of his rotation crops. The corn hybrid was Elite E47A17R, the hybrid that the producer had used to finish out his corn acreage. The 2x2 band was a blend of 15.6-13.5-16-8Mg applied at 365 kg/ha. The nitrogen top dress was applied on July 7th at 92 kg/ha of N to bring the total nitrogen to 150 kg/ha. Weed control was 2.5 l/ha Glyphosate in the fall of 2016 and 2.5 l/ha at the 5 leaf stage in 2017. Seeding rate was 86,500 seed/ha, the plots were harvested and shelled on October 24th and the plant population at the 8 leaf stage was 77,800 plants/ha.

5: RESULTS:

In samples taken in 2016 the soil organic matter is on the high side for most soils in the area which gave the potential for an excess of nitrogen available for mineralization through the growing season. The level of Phosphorus was high while the Potassium in the soil medium shown in table 1. The pH was good while the Ca:Mg ratio was less than desirable probably because of a high usage of Dolomitic limestone in past years.

Table 1: Soil Analysis of Soybean Site.

% O.M.	pH	P_2O_5	K_2O	Ca	Mg	Zn	S
7.8	6.6	191H+	60 M	1211 M+	292 H+	1.4	14

Using the fertility requirements from the NBDAAF Fertiplan program the requirement for Nitrogen, P2O5 and K2O was 150, 30 and 100 kg/ha. The fertilizer application rates are shown in table 2. The top dress applications of the Nitrogen products are represented as both the product rate and the actual N rate which when added to the band fertilizer gave actual N rates ranging from56.8 to a high of 200.8 kg/ha. The N rates were chosen to reflect some of the high rates being recommended on grain corn fields in New Brunswick. An application of NK21, a periled fertilizer duct containing Nitrogen and Potassium at 21%, was used to add K2O to one of the plots as we were low in this nutrient across the plot site.

Table 2: Nutrients Applied Through Fertilizer Treatments.

Treatment	Product (kg/ha)	N applied (kg/ha)	Band N (kg/ha)	Total N (kg/ha)	P_2O_5 (kg/ha)	K_2O (kg/ha)
Control	0	0	56.8	56.8	49.1	58.2
40-0-0-5S	165	66	56.8	122.8	49.1	58.2
40-0-0-5S	285	114	56.8	170.8	49.1	58.2
40-0-0-5S	410	164	56.8	200.8	49.1	58.2
NK21	545	114	56.8	170.8	49.1	196.7

Although the soil preparation was somewhat rough because of the heavy sod it did not affect the corn germination which was about 90%. The one negative for the 2017 crop year was the lack of moisture with the precipitation for the area being under 40% of the 30 year normal. We did however get approximately 15 mm of precipitation several days after the top dress fertilizer was applied.

The plots were harvested on October 24th by hand picking 17.5 feet of one of the middle rows of each plot. The corn was taken to the NBDAAF site in Fredericton for shelling and dried using the AAFC facilities. The data collected was moisture at harvest and yields which were calculated at 15.5% moisture are shown in table 3. In this trial there was no significant difference in grain yield or moisture due to the rates of nitrogen applied or the additional potassium applied in the NK21. This can probably be attributed to the Organic Matter levels of the plot and the lack of precipitation over the summer however it is difficult to determine which had the most effect.

Table 3: Agronomic Data for Grain Corn N Top Dress.

Treatments	Total N (kg/ha)	Yield t/ha @ 15.5 %M	Moisture %
Control	56.8	8.45 a	28.46 a
40-0-0-5S	122.8	8.34 a	26.24 a
40-0-0-5S	170.8	8.37 a	26.61 a
40-0-0-5S	200.8	9.20 a	29.64 a
NK21	170.8	8.68 a	29.61 a

6: CONCLUSIONS:

There were no differences in yield and grain moisture at harvest due to any additional application of nitrogen over that applied in the band. Although the addition of Potassium did have a higher grain yield than the plot with the same nitrogen rate without potassium the grain yield or moisture was not significant.

Improved Forage Quality & Quantity Through the use of New Mixtures

By Walter Brown, NBSCIA Research Coordinator
In Partnership with
Milk 20/20
NB Cattle Producers Association
NBDAFA
Dairy Farmers of New Brunswick
Dalhousie Facility of Agriculture
Agriculture and Agri Food Canada

2. Project Background:

Forages play a vital role in all ruminant animal nutrition. High quality forage is the most cost effective and environmental friendly way to feed ruminant animals. Producer in NB are continually struggling to improve their bottom line and the production of high quality forage is one way to do this. Improved forage quality reduces the need for the addition of cereals to the livestock diet in order to meet the nutritional needs of the animal. Since harvest costs are the same regardless of the quality of the forage, the dollar value of the forage increases as the quality increases. In NB we have the ability to produce high quality forages and since we are not self-sufficient in cereal livestock feed. To reduce the need to truck in cereals to supplement the ruminant diet, we should be making maximum use of forages. The maximization of the potential value that forages can provide to the ruminant animal is critical to the long term sustainability of NB livestock farms.

The NB dairy industry is at a critical point. The Bootstrap report concluded that only 1/3 of NB dairy farms are profitable and that higher forage costs due to lower yields and lower quality of the forage grown is the key problem. As a testament to the importance that the industry is currently placing on forages, Milk 20/20, NB Cattle Producers and NBSCIA have formed a forage initiative group which has come up with two projects to look at the use of legume and grass mixtures as a means of improving forage quality and quantity.

This project simply looked at the selection of species. Producers were asked to grow one of two forage mixtures, one for well drained soils and one for more poorly drained soils. The seed mixtures were planted in 2015 on 29 farms and the forage was evaluated in 2016 and 2017 for quality and nutrient content using NIR analysis. The NBSCIA Agrologist assisted with the plot identification, soil sampling, data collection, fertility recommendations and plot establishment.

Many factors contribute to the production of high quality forage including the species selected. Bélanger, et al. 2014) identified the “legume-grass mixtures generally provide more consistent forage yield than monocultures”. They also found that some mixtures performed better under grazing conditions while others performed better under mechanical harvesting. Giles Bélanger and Yousef Papadopoulos, both with AAFC, determined the forage mixtures that should be used in this project.

3. Project Objectives:

The objectives of this project were to engage producers in trying improved forage mixtures through field scale research plots that tested an alfalfa mix or a red clover mix against a standard triple mix and the current mixture being used on the farm. The selected fields were broken into two categories, well drained lighter soils and heaver soils that are more poorly drained.

The mixture identified for dry ground with a pH of 6.5 or better contained alfalfa, meadow brome, tall fescue and meadow fescue. The mixture was made up of 25 kg Caribou alfalfa, 25 kg Magnum VI alfalfa, 8 kg of Fleet meadow Bromegrass, 8 kg of Preval meadow fescue, 8 kg of Kokanee tall fescue, and 1 kg of Fabio annual ryegrass.

The mixture identified for wet ground with a pH of at least 6.0 contained red clover, timothy, tall fescue and meadow fescue. This mixture was made up of 15 kg Juliet red clover, 15 kg Will red clover, 20 kg Richmond timothy, 11.75 kg Preval meadow fescue, 11.75 kg Kokanee tall fescue, and 1.5 kg Fabio annual ryegrass.

In 2015 29 farms established the one of the test mixtures along with the triple mix and the farm mix the same field. In 2016 and 2017 the plots were harvested following the harvest management of the participating farms. Statistical analysis of the data gathered over the two years was completed by Dr Nancy McLean of Dalhousie Facality of Agriculture.

4. Project Details:

Year 1, 2015:

In the establishment year the participating farms were supplied with a “test mixture” and “triple mix” and the farms were to supply the “farm mixture”. There were no special requirements for being involved outside of expressing an interest to increase their forage yield and looking at new forage mixtures to compare with what they are presently using. Due to changes in the working status of a number of NBSCIA club Agrologists the mixtures planted on the participating farms varied from the original plan in both plot and farm numbers. By the fall of 2015 the mixtures had been established on 29 of the 30 farms that had agreed to participate in the project.

Year 2 and 3:

The harvest protocol established for the project was to randomly select 8 ½ m² quadrates out of each of the plots on the participating farms. This gave a total harvest area of 4 m² and the 8 sample points would give a sufficient data points for completing statistical analysis for each of the forage mixtures across the participating farms. From the 8 forage samples a representative sample was collected, identified with a unique farm and mixture code and frozen in preparation for shipping to the lab.

The samples were shipped to Cumberland Valley Analytical Laboratory in Pennsylvania for a detailed analysis. The analysis identified a number of quality perimeters such as Dry Matter, Crude Protein, Calcium, Phosphorus, Magnesium, Sodium, Potassium, Iron, Manganese, Copper, Zinc, ADF, NDF, NEL, NEG, NEM, TDN, ADF-N, Crude Protein Digestibility, Adjusted Crude Protein, Soluble Protein, Soluble Protein as % of Crude Protein, Non Structured Carbohydrates, Relative Feed Value, Relative Feed Quality, UIP, Lignin, Starch, 24 hr NDF-D, 30 hr NDF-D, NFC, Fat, Ash and Sugar.

In the first harvest year soil samples were taken from each of the plots to have current soil samples on all the plots.

In the second harvest year plant counts were completed on the mixtures giving a per cent of legume, grass and weeds in the forage stand. Soil samples were also taken and were mechanically separated in an attempt to assess the physical makeup of the soil. The Summer Research Assistant working on the project used the data for her 4th year honors project at Dalhousie Facility of Agriculture.

5: Results:

With the assistance of the NBSCIA Agronomists and a Summer Research Assistant two and three cut harvests, to mirror the farms practices, were completed on the farms. The farms where all harvests sample were not collected ranged from taking a cut before the Agronomist could get there to collect the samples to a poor stand that could not supply a sample that would give reasonable yield. The range of yields was quite wide which was to be expected from the number of farms involved. In 2017 the Summer Research Assistant used the data gathered on the project for her 4th year Honors project. This resulted in a detail analysis of this data in her project report is available on request.

In 2017 the farm numbers were reduced to 22 farms with complete harvests on 18 farms. Two farms were missed due to an Agrologists leaving for other employment during the first harvest. The other miss data was again cutting the field prior to the Agrologist getting to the farm to sample the plots. Weather was also more of a factor in 2017 with the long period with little or no precipitation. The data in table 1, the monthly precipitation at Fredericton for 2016 and 2017 how short the rain fall was in 2017. This covered the Province from Woodstock South to Sackville and up the North Shore.

Table 1: Monthly precipitation for Fredericton, New Brunswick 2016 and 2017.

Month	2016 Precipitation (mm)	2017 Precipitation (mm)
May	56.7	158.1
June	92.9	59.8
July	80.5	37.4
August	103.0	26.5
Total	**333.1**	**281.8**

Government of Canada. 2016 and 2017.

The timing of the forage cuts were very similar in both 2016 and 2017, presented in tables 2 and 3, with those harvesting Alfalfa beginning slightly earlier than those harvesting the Red Clover. The farms taking 3 cuts of Alfalfa were earlier starting their harvest and the range of the first harvest dates were over a shorter period. For the farms following a 2 cut harvest in both Alfalfa and Red Clover the starting date were a few days later and the range was longer. In the case of Red Clover this is where the beef and sheep farms were involved and they did not have the same drive for higher quality forage.

Table 2: Harvest dates in 2016.

	Red clover 2 cuts	Alfalfa 2 cuts	Alfalfa 3 cuts
Farms (n)	9	5	8
1st cut average	June 14	June 11	June 2
1st cut range	June 1-20	June 6-15	May 31- June 3
2nd cut average	July 14	July 14	July 8
2nd cut range	July 4-Aug. 9	July 14	July 4-20
3rd cut average	-	-	August 21
3rd cut range	-	-	August 15-29

In 2017 the impact of dry weather had a significant impact on the dates of the 2nd cut and the number of farms doing a 3rd cut. This was largely from most producers waiting for some more volume in the 2nd cut and the lack of volume to take that 3rd cut.

Table 3: Harvest dates in 2017.

	Red clover 2 cuts	Alfalfa 2 cuts	Alfalfa 3 cuts
Farms (n)	9	10	3
1st cut average	June 10	June 6	June 6
1st cut range	June 2-15	May 28-June 8	June 3-7
2nd cut average	August 3	July 19	July 19
2nd cut range	July 5-August 30	July 10-31	July 18-19
3rd cut average	-	-	August 22
3rd cut range	-	-	August 8-29

Dr. Nancy McLean, Department of Plant, Food and Environmental Sciences at Dalhousie Facility of Agriculture, completed the statistical analysis of the data gathered in 2016 and 2017. The next several tables contain the statistical analysis of both yield and quality of the three mixtures over the two production years.

Table 4: Alfalfa yield and milk per tonne for each cut (combined 2- & 3-cut) 2016

Treatment	1st cut	2nd cut	3rd cut
	Dry matter yield (t/ha)		
Test Mix	3.0a	2.0a	1.4a
Farm Mix	2.7ab	2.0ab	1.3ab
Triple Mix	2.6b	1.4b	0.9b
	Milk yield (kg/t dm forage)		
Triple Mix	1620a	1560a	1570a
Farm Mix	1570ab	1560a	1480ab
Test Mix	1530b	1510a	1450b

In 2016 there were enough farms completing three cuts of the Alfalfa to make a statistical analyses of yield and quality for each cuts. That analysis is presented in table 4. In dry matter yield the test and farm mixes were statistically equal in yield while the Alfalfa mixture was statistically better to the triple mix. As for quality in the 1st and 3rd cut forage the Triple mix was statistically better than the Alfalfa mixture while in the 2nd cut they were all equal. The fact that the quality of the triple mix was higher may be explained through fact that the Red Clover leaves stay on the plants once they mature while Alfalfa plants are prone to leaf losses as they approach maturity.

Table 5: Seasonal 2-cut alfalfa and red clover dry matter forage and milk yields 2016

Treatment	Alfalfa		Red clover	
	Forage dm (t/ha)	Milk (t/ha)	Forage dm (t/ha)	Milk (t/ha)
Test	4.3	6.3	5.0	7.5
Triple Mix	4.0	6.3	4.3	5.8
Farm Mix	3.7	5.7	4.4	6.7

Table 5 contains the seasonal yield and quality data, expressed as “Milk in t/ha” of all the farms where two cuts were taken in 2016. The yield and quality of the test mixture, triple mix and farm mixture were not statistically different. The yield of the Red Clover is higher than the Alfalfa test mixture because of the wider harvest window in the first cut. Some of the first cut Red Clover yields were higher than the Alfalfa first cut but were taken about two weeks later.

Table 6: Seasonal 3-cut alfalfa dry matter forage and milk yields 2016

Treatment	Forage dm (t/ha)	Milk (t/ha)
Test	6.8a	10.8a
Farm Mix	6.2ab	10.2ab
Triple Mix	4.9b	8.1b

Table 6 contains the seasonal dry matter yield and quality on the farms which harvested 3 cuts in 2016. Statistically the Alfalfa and the farm mixture are equal in yield and quality mainly because on the farm mixture is also an Alfalfa based mixture. The triple mix is statistically equal to the farm mixture but is not equal to the Alfalfa mix. This table shows the advantage of the 3 cut harvest program using Alfalfa in producing higher forage yield and quality.

Table 7: Seasonal 2-cut alfalfa and red clover dry matter forage and milk yields 2017

Treatment	Alfalfa		Red clover	
	Forage dm (t/ha)	Milk (t/ha)	Forage dm (t/ha)	Milk (t/ha)
Test	3.67a	7.4a	3.19a	4.9a
Triple Mix	3.49a	6.5a	2.78a	4.4a
Farm Mix	3.46a	6.7a	2.98a	4.6a

a-b means followed by the same letter within columns are not significantly different according to Fisher's protected LSD test at $\alpha = 0.05$.

In 2017 weather had a major impact on forage production in much of New Brunswick and turned the results obtained in 2016 on its ear. In 2017 most of the farms struggled to obtain two cuts of forage with only three farms completing three cuts. With insufficient data on farms with a 3rd cut statistical analyze was only completed on farms completing two cuts. There were no statistical difference in yield and quality in all the forage mixtures, shown in table 7. The Red Clover mixture had a lower dry matter yield than the Alfalfa mixture mainly because of the timeframe of the first cut. In 2017 a delay in taking the first cut resulted in regrowth falling into the time frame when the effect of the early June moisture had disappeared and the second cut came in the dry conditions experienced in late July and August.

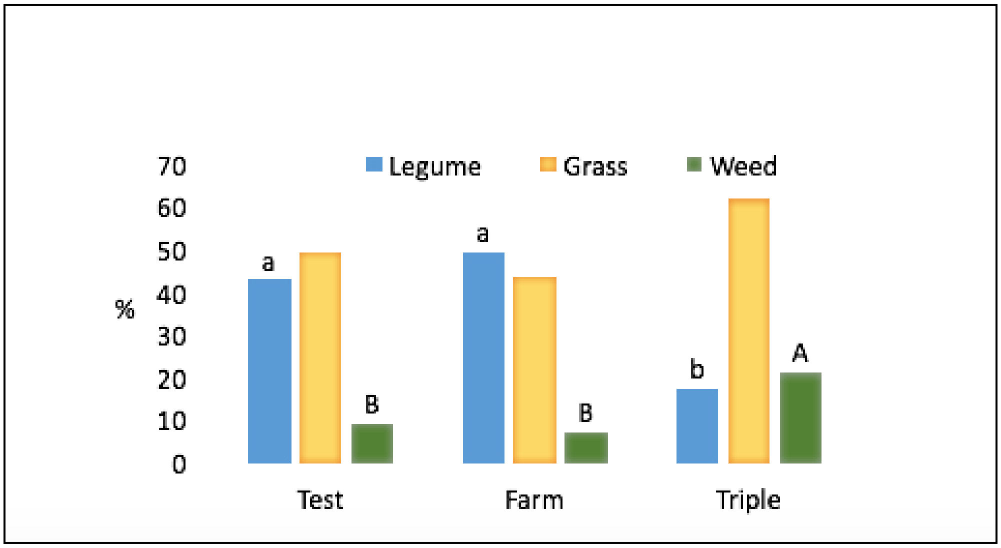


Fig 1: Alfalfa forage mixture composition by percentage. Means with the same letters are not significantly different according to Fisher's protected LSD test at α= 0.05.

Plant counts were taken to establish the plant composition of the test mixture, farm mixture and the triple mix stands and are presented in figures 1 and 2. In the Alfalfa mixtures in figure 1 the legume counts were between 45 and 50% the stand and grasses were in the same range. The stands were generally strong resulting in low weed numbers. The Red Clover in the triple mix was lower as a percentage of the stand allowing more room in the stand and a higher percentage of weeds. In the Red Clover plots, figure 2 the legume counts were 30% with grass making up 60 to 65% of the stand. Weeds also were a large percentage of the Red Clover based stands.

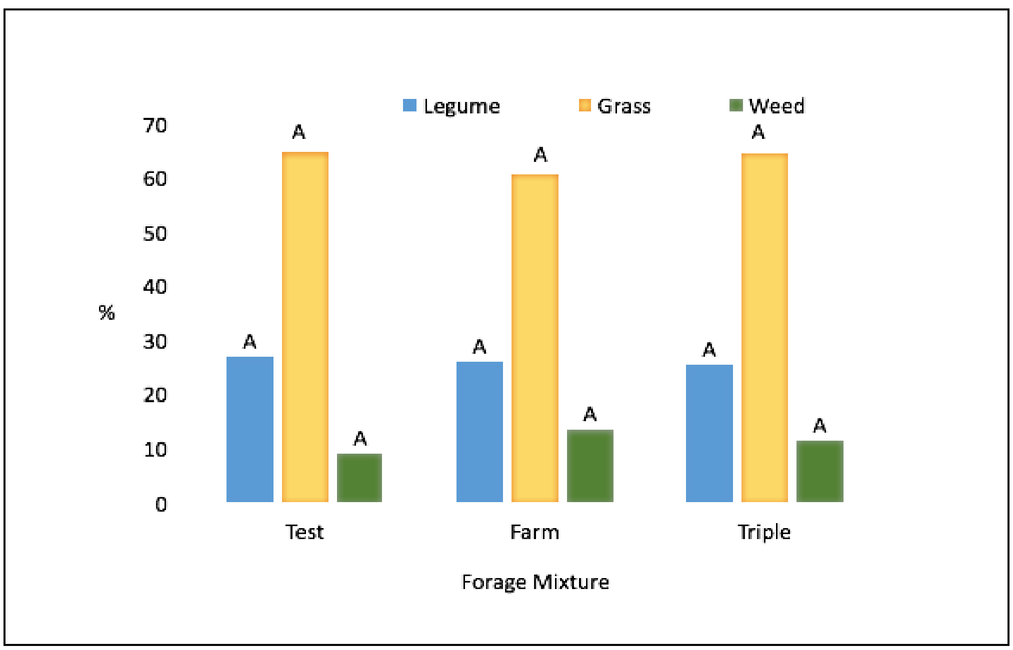


Fig 2: Red clover forage mixture composition by percentage. Means with the same letters are not significantly different according to Fisher's protected LSD test at α= 0.05

6: Conclusions:

There were some interesting findings that came out of this work in both harvest years. The forage quality of all three forage mixture was closer than anticipated. When harvested in a two cut program there was no difference in any of the mixtures with the yield and quality of Triple Mix equaling that of the Red Clover and Alfalfa at a lower seed cost.

In a three cut program the Alfalfa and the farm mixtures had superior yield and quality compared to the triple mix. The third cut of Alfalfa yield was an additional 1.5 t/ha of dry matter and "Milk in t/ha" was also an additional 1.5 t/ha. This extra yield and quality can have a significant impact on forage acreage required to meet a herds feed requirements and milk produced.

The weather impact on forage production was also evident in 2017. On the Alfalfa plots the dry matter yield was reduced by 0.63 t/ha and the Red Clover yield was even larger at 2.4 t/ha. On the farms using Alfalfa the quality was very close to that of 2016. The project needs another two years of data to bring the results into a three to four year forage rotation. The additional project years should also give us a better appreciation of the effect of climate having the four production years.

Evaluation of Rootwin Plus on Soybean and Alfalfa

By Walter Brown, NBSCIA Research Coordinator
For Sylvar Technologies Inc., 2017

2: PROJECT OBJECTIVE:

To establish plots at the NBSCIA forage site in Richmond Corner to evaluate the effectiveness of Rootwin Plus Inoculant on Soybean and Alfalfa.

3: PROJECT BACKGROUND:

Soybean, *Gylcine max* and Alfalfa *Medicago sativa,* plants in the legume family are commonly grown on New Brunswick livestock and crop farms. Legumes host Rhizobia bacteria which establish nodules on the plant root. The nodules contain bacteria have the ability to fix nitrogen from the air and supply that nitrogen to the host plant thereby reducing the requirement for nitrogen from a fertilizer source.

Each legume species has a strain of Rhizobia bacteria that is unique to that particular species and will not work efficiently on other legume species. Rootwin Plus contains a strain of rhizobium strain with high nodulation and N fixing abilities along with T-Gro which provides a synergistic combination enhancing root growth and nodulation.

4: PROJECT DETAILS:

The Soybean plots were planted on May 30th using common, uninoculated soybean seed. The T-Grow and Rhizobia inoculant was mixed 50g of the Rhizobia, 10g T-Grow and 200ml of water. The solution was then applied to the soybean seed so that the seed was covered with the inoculant but was dry enough to go through the seeder.

The two controls were planted first, the uninoculated control, then the peat based inoculant and the seeder was cleaned and other grain plots were planted to assist in cleaning the planter for the T-Grow plots. The r plots were 2.4x7 meters in size and planted at 370,000 plants/ha. Roundup was used for weed control at the 2-3 trifoliate stage.

The Alfalfa plots were planted on June 6th using a common alfalfa with Meadow and tall fescue as the grass in the mixture. Again the T-Grow and Rhizobia inoculant was mixed 50g of the Rhizobia, 10g T-Grow and 200ml of water. The alfalfa seed was mixed with the solution and the grass seed was added after to dry the seed to where it would go through the seeder.

Again two controls were used in the trial, an uninoculated control and a peat based inoculant. The same procedure was used for the alfalfa plots with the two controls were planted first, the uninoculated control, then the peat based inoculant and the seeder was cleaned and other forage plots were planted. The plots were 2.4x7 meters in size and the seeding rate was 10 kg/ha of alfalfa and 5 kg/ha of the grass mixture. The plots were clipped at the 3rd trifoliate stage of the alfalfa for control of annual weeds.

5: RESULTS:

Soybean:

The plot area was soil sampled in late summer and Roundup was applied at 2.5 l/ha prior to ploughing in November of 2016. This area had been in forage plots since 2002 and the sod was heavy. Due to the time that the site had been in forage the sod content was somewhat higher than desired. The analysis of the section where the T-Grow plots were located is in table 1.

Table 1: Soil Analysis of Soybean Site.

% O.M.	pH	P_2O_5	K_2O	Ca	Mg
8.2	6.2	212 H	137 M+	977 M+	234 H+

The soil organic matter is on the high side for most soils in the area which would result in an excess of nitrogen available for mineralization through the growing season. The level of Phosphorus and Potassium in the soil was marginal but would meet the requirements of the soybean crop. While the soil preparation was somewhat rough because of the heavy sod it did not affect soybean germination which was about 87%. Roundup was applied again in the spring at the 2-3 trifoliate stage as the only weed control. The one negative for the 2017 crop year was the lack of moisture with the precipitation for the area being under 40% of the 30 year normal.

The plots were harvested on October 13th using a Hege plot combine. Total plot weights were taken and a sample of was sent to PEI Analytical Laboratory for a grain analysis giving dry matter, per cent protein, and test weight. The statistical analysis of the resulting data is shown in table 2. While the soybean inoculated with the T-Grow had the highest yield and test weight the only area where there was a significant difference among all three treatments was in the protein. The lack of moisture through the season had a significant impact on the yield in the plots. The farm yields of soybean on most of the farms in the surrounding community were hard pressed to exceed 1.5 t/ha.

Table 2: Agronomic Data for Soybean.

Treatments	Yield t/ha @ 14 %M	Moisture %	Protein %	Test Wt. kg/hl
Control	1.82 a	12.40 a	33.48 b	75.90 a
Peat Inoculant	2.07 a	12.64 a	36.06 a	75.95 a
T-Grow	2.27 a	12.04 a	35.31 a	76.55 a

Alfalfa:

The area where the Alfalfa T-Grow plots were planted will be left in forage for the next three years allowing us to obtain data as to the benefit of the inoculant. The soil in that area differed from the soybean site, as shown in table 3, and most of the nutrients were at a reasonable level for forage for potassium and calcium.

Table 3: Soil analysis of the Alfalfa Site:

% O.M.	pH	P_2O_5	K_2O	Ca	Mg
6.6	6.3	114 M+	89 M	898 M+	226 H+

Due to the lack of precipitation from June until mid September the plots were very slow getting established. However there was a good stand of alfalfa and grass across all plots and there should be a good opportunity to evaluate the T-Grow over the next 2 to 3 years.

6: CONCLUSIONS:

While the soybeans did show some response to the T-Grow in yield and test weight the difference was not significant. In both the soybean and alfalfa plots the lack of precipitation during the summer did have an effect on the crop with plant growth being somewhat less then desirable. More testing is needed to give a better appreciation of the crop response to T-Grow with more favorable precipitation levels.