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RAIN
RURAL AGRI-INNOVATION NETWORK

2016 Agricultural Research Summary

Compiled by Mikala Parr,
RAIN Research Technician Assistant

This document is a collection of the research notes summarizing results from field projects in 2016.

2016 RAIN Research Staff

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Research Note 2016-12-21

Keyline Plowing: Soil Nutrients and Grass Yield- 2016

Keyline plowing was developed in Australia in the 1940s and 1950s. The technique uses a specially designed subsoiler plow to create channels that work with the topography of a field to help redistribute water more effectively through the landscape.

Keyline plowing had no significant effect on soil nutrients or grass yield in 2016.

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In 2014 RAIN's Keyline Plowing Project was initiated to determine whether keyline pattern subsoiling would help with water distribution. The aim was to determine if the keyline technique had an impact on grass yield and the water content of soil throughout the field.

Soil Nutrients

In order to determine if the soil nutrients have been affected due to the keyline plow, samples were taken from both the high point and low point of every pasture involved. In general, the soil nutrients were not affected by plowing. The only significant difference was higher levels of zinc in the low lying areas. Zinc is held on the surfaces of clay, organic matter, and organic materials, but there did not seem to be a significant difference in the organic matter between high or low sampling sites, therefore the difference in zinc is likely due to natural variability and sample size.

The only way to change nutrients in the soil is to add nutrients or to change the pH. Some advocates for keyline plowing have claimed that it helps increase organic matter, but in this study that did not seem to be the case. Building organic matter is a gradual process that takes many years, and this project may not have had a long enough time span to see that kind of result.

Grass Yield

Grass yield was not significantly different between the keyline plowed treatment and the control. Grass growth is very dependent on the amount of available water in the soil. Keyline plowing is supposed to slow water movement from high to low areas and even out topography effects, but with the drought in 2016 it was difficult to determine if there was a practical benefit from this method of water management.

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Keyline Plowing and Soil Moisture

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There wasn't a compaction problem at the trial site and the use of a subsoiler was unnecessary. These factors may explain the lack of trends in the data

In 2015 a trial involving a keyline subsoiler plow was put in place. Subsoiling can sometimes increase a soil's water holding capacity by fracturing compacted layers (plow pans) and creating channels for water to infiltrate the soil. The keyline pattern runs across a slope – similar to contour cropping – and attempts to distribute water more evenly across the landscape using the plow channels.

Over summer 2016, data was taken in order to see the residual effects of the plow on soil water content. There was a weather station on the property that measured the water content of high and low spots in the field. Both the keyline plowed field and the control field were monitored for water content. When the data was received, it was graphed and analyzed.

There were three hypotheses going in to this study:

1. Keyline plowed at the top of a slope should hold more water than the control due to subsoiling;
2. Keyline plowed at the bottom of a slope should hold less water than control due to the keyline pattern upslope; OR
3. Keyline plowed at the bottom of the slope should hold more water than control due to subsoiling.

When the soil moisture data after each rainfall was graphed, we observed three trends:

1. Keyline plowed at the top of a slope had a lower moisture content than the control, but retains H_2O better – it took longer for water to drain away after a rainfall.
2. At moisture contents less than 0.26m^3 water per m^3 soil, keyline plowing at the bottom of a slope held less water than the control.
3. At moisture contents greater than 0.26m^3 water per m^3 soil, keyline plowing at the bottom of the slope held more water than the control.

Our observations do not support our hypotheses, so what is going on? There was not a compaction problem where the trial was located. The use of a subsoiler was unnecessary. This may explain why we saw no clear trends in the data.

This project was funded in part through *Growing Forward 2 (GF2)*, a federal-provincial-territorial initiative. The Agricultural Adaptation Council assists in the delivery of *GF2* in Ontario.

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Research Note 2016-09-30

Pasture Growth Summary 2016

This project was funded in part through *Growing Forward 2 (GF2),* a federal-provincial-territorial initiative. The Agricultural Adaptation Council assists in the delivery of *GF2* in Ontario.

Weekly pasture walks in Algoma using a falling plate meter. A falling plate meter is a tool that measures bulk density, and grass height to estimate pasture forage.

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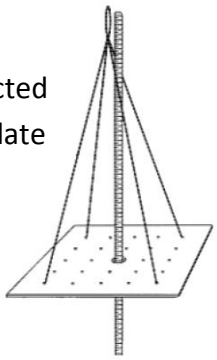
RAIN has been doing a weekly pasture walk starting on May 24th, 2016, and finishing on September 27th, 2016. During the walks, the grass was measured using a falling plate meter. The falling plate meter is a device used to estimate pasture forage yield. It measures bulk height, a combined measurement of grass height and sward density (thickness). For example, a tall thin grass stand may have the same bulk height as a short thick one. The plate is used by walking around the pasture, and in random spots gently placing the plate on the forage until the forage can support the plate. Then measure the height of the plate on the meter stick, and record. To create a good estimate, you need to be sure to take enough samples to calculate an average yield (RAIN used 10 samples per paddock). As well, make sure to choose your spots at random, and not just in spots that look productive, as that would not be an equal representation of the pasture.

Falling plate meter in the field



Constructed Falling Plate Meter

FedNor Canada

This could be used on the farm to give a farmer a better idea of what shape their pastures are in. It can help with management decisions by giving the farmer a better idea of when to take their cows out of a paddock as well as when to put them back in. This can extend the grazing season length and improve the overall health of a pasture. This practice could be a good thing to work into an every week routine. It may give the farmer an upper hand in managing their pastures by providing timely information rather than relying on end-of-season hay or silage yields.

Average Daily Growth – Summer 2016

Date	Kg DM/ha	Lbs. DM/ac
May 31st to June 7th	61.45	55.30
June 7th to June 14th	75.70	68.13
June 14th to June 21st	64.98	58.48
June 21st to June 27th	65.99	59.39
June 27th to July 5th	48.91	44.02
July 5th to July 12th	0	0
July 12th to July 18th	40.89	36.80
July 18th to July 26th	0	0
July 26th to August 2nd	0	0
August 2nd to August 9th	0	0
August 9th to August 16th	21.28	19.15
August 16th to August 23rd	0	0
August 23rd to August 31st	18.51	16.66
August 31st to Sept. 14th	2.74	2.46
Sept. 14th to Sept. 21st	18.11	16.29
Sept. 21st to Sept. 27th	24.06	21.65

FALLING PLATE METER

Mikala Parr

What is it?

The falling plate meter is a device created to estimate pasture forage yield. This device has a simple design, making it a cheap and easy piece of equipment. This device is meant to help determine the amount of edible grass within a pasture. It measures the bulk density; bulk density is a combined measurement of grass height and sward density (thickness). For example, a tall thin grass may have the same bulk height as a short thick one.

How is it used?

The plate is used by walking around the pasture, and in random spots gently placing the plate on the forage until the forage can support the plate. Then measure the height of the plate on the meter stick, and record. To create a good estimate, you need to be sure to take enough samples to calculate an average yield (RAIN used 10 samples per paddock). As well, make sure to choose your spots at random, and not just in spots that look productive, as that would not be an equal representation of the pasture.

How it's made

To make this falling plate meter you need is acrylic plastic, a meter stick, a drill, jigsaw (for middle hole) and some string. A square plate of the acrylic plastic measuring 0.22 inches thick and 12 inches square is recommended. In the middle of the plate, there needs to be a hole about 1.5 inches, so that the meter stick can go through. Then 24 small holes are drilled into the top, in 5 lines. These holes are to help you determine ground cover with thin stands of pasture. The meter stick and plate are then put together by the use of string or twine, see figure 2.

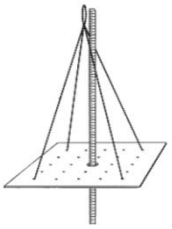


Figure 2: Constructed Falling Plate Meter

What you need to know

It is very important to calibrate your plate to your area. The RAIN field team has calibrated our falling plate meter; you can find our numbers on the next page. The page that the field team uses to collect the data is from New Zealand, there is a lot of ryegrass clover mix in their pastures and that is why it could not be applied to Algoma district. If you would like to create your own calibration for your region, you will need a square wire frame that just fits over the falling plate meter. Drop the wire to the ground exactly where the falling plate meter is and cut all of the grass within the square to ground level. You then need to weight the grass wet (or in the field) then dry the grass and re-weigh. Using these numbers, you are able to graph the bulk height against dry matter and determine a line of best fir for that relationship. The equation of that line will allow you to calculate dry matter yield.

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To know more

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Research Note 2016-11-03

Pasture improvement and the effects of Spanish River Carbonatite

Spanish River Carbonatite is a natural mineral fertilizer and soil conditioner used by organic and conventional farmers.

With two locations, both being measured separately, there was no significant difference in grass yield or in soil nutrients from applying SRC at 1000 lbs/ac

This project was funded in part through *Growing Forward 2 (GF2)*, a federal-provincial-territorial initiative. The Agricultural Adaptation Council assists in the delivery of *GF2* in Ontario.

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The pasture improvment demonstration and assessment was put into place to demonstrate the effects that Spanish River Carbonatite has on pasture. Spanish River Carbonatite (SRC) is a natural mineral fertilizer and soil conditioner used by organic and conventional farmers. It contains a wide spread of minerals that are mined from an ancient deposit in Sudbury.

SRC was applied to half of every paddock, at 1000 lbs/ac (1100 kg/ha), which was the recommendation from Boreal Agrominerals, to see if it would have an effect on the growth of the grass. Each half of the paddock was measured separately, but there was no siginificant diffrence in grass growth between the two. Across two locations, SRC made no significant difference in grass yield or in soil nutrients

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Grazing Management 2016

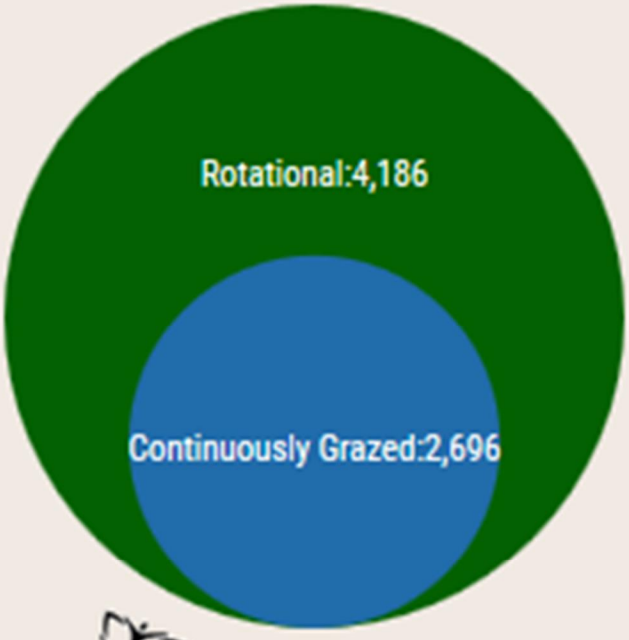
Soil Nutrients

The pasture improvement demonstration and assessment project was looking at the effects of transitioning from continuous grazing to rotational grazing management in pastures. Soil samples were taken in October 2016. When looking at the nutrient analysis, the only significant difference was sodium (Na). There was a significantly more Na in the continuous grazed areas in the pastures located in Laird. Sodium in the soil can naturally build up over time. Plus, with compaction from livestock, the sodium can be blocked from moving through the soil. Other than sodium, there were no other significant differences in nutrient levels across management systems. When comparing 2015 to 2016 nutrients, there again was no significant change.

Grass Yield

During this project, RAIN measured the continuously grazed and rotationally grazed grass separately. When adding the yields up over the whole season, it was clear that the rotational grazing produced a better yield. It has been well documented overgrazed grass does not yield well.

Grass Yield (kg DM/ha) 2016



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Research Note 2016-10-14

Nutritional Value of Trees: 2016

RAIN has partnered with Ontario Sheep and Marketing Agency to investigate whether fast growing coppiced trees can be nutritionally and economically viable fodder source for sheep.

Thanks to our farmers co-operators for their assistance with this project.

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In 2007 a short rotation woody coppice plantation was established by the Canadian Forest Service to assess the potential of fast growing willow and poplar for bioenergy. A section of this plantation was fenced off in 2015. The idea of this project was to determine if willow and poplar regrowth would be an adequate food source for sheep to browse on. The trial was designed to see if there were any preferences among the sheep between tree type or variety. The sheep were monitored over a one month period, and samples of re-growth were taken to determine the nutrient content. The sheep were provided with mineral supplement; MasterFeeds GoalMaker.

The chart (below) compares what the sheep need and what the trees provide. Iron, copper, manganese and zinc have a MTL (maximum tolerable level) to prevent toxicity. It was noted that the trees did not contain the maximum level, making them safe to eat. When looking at what the sheep do need, some of the trees contained more potassium, iron, manganese and zinc than required. Calcium, magnesium, sulphur and copper were all either within or above the recommended amount. Phosphorus was either below or within the levels, and only sodium was not present in high enough amounts for the sheep's diet.

Ewe maintenance requirement in diet that is 100% forages, based on DM content

		CP (%)	Ca (%)	P (%)	Na (%)	Mg (%)	K (%)	S (%)	Fe (ppm)	Cu (ppm)	Mn (ppm)	Zn (ppm)
		9.4	0.2-0.82	0.16-0.38	0.09-0.18	0.12-0.18	0.5-0.8	0.14-0.26	30 to 50	11 to 7	20 to 40	20 to 33
								MTL:	500	25	1000	750
Species	**Variety**	**CP (%)***	**Ca (%)**	**P (%)**	**Na (%)**	**Mg (%)**	**K (%)**	**S (%)**	**Fe (ppm)**	**Cu (ppm)**	**Mn (ppm)**	**Zn (ppm)**
Willow	Charlie	9.76	1.03	0.14	0.01	0.29	1.34	0.62	71.04	9.76	73.94	77.24
Willow	Pseudo	8.07	1.06	0.14	0.01	0.17	0.57	0.15	113.95	8.07	108.3	192.89
Willow	Hotel	8.97	1.48	0.09	0.01	0.37	0.57	0.28	60.05	8.97	159.14	183.49
Willow	India	16.6	1.27	0.16	0.01	0.37	0.88	0.66	165.46	16.6	566.55	319.53
Willow	SV1	11.56	1.67	0.25	0.01	0.24	1.11	0.59	140.75	11.56	426.31	244.51
Willow	SX61	12.7	1.48	0.18	0.01	0.16	1.69	0.43	79.8	12.7	169.74	261.88
Willow	SX64	11.26	1.34	0.21	0.01	0.16	1.67	0.44	109.2	11.26	258.5	213.7
Poplar	2293-19	18.35	1.22	0.18	0.01	0.3	1.34	0.61	53.6	18.35	79.95	175.39
Poplar	DN-136	17.13	1.19	0.17	0.01	0.33	2.18	0.95	91.45	17.13	104.19	189.04
Poplar	NM-06	12.8	0.87	0.14	0.01	0.22	1.38	0.44	61.46	12.8	79.16	162.51
Poplar	NM-01	14.88	0.7	0.16	0.01	0.18	1.87	0.23	66.35	14.88	114.44	152.14
Poplar	DN-34	7.86	1.32	0.12	0.01	0.24	0.48	0.14	129.1	7.86	66.8	202.31
Poplar	Brooks	15.84	1.12	0.21	0.01	0.39	2.15	0.9	138.49	15.84	58.25	242.14
Poplar	Green Giant	12.14	1.29	0.22	0.01	0.39	1.98	1.18	206.66	12.14	130.66	235.61

In conclusion, it seemed that the trees are a good source of nutrients and can supply an adequate amount, other than sodium. The best way to deal with lack of sodium is to supplement them with a salt lick. The best way to use trees as forage would be for dry ewes during the "summer slump" in pasture growth. While suitable as short-term forage, the leaves and young stems may not have enough indigestible fibre for optimal rumen health.

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REGEN FORESTRY

ONTARIO Sheep

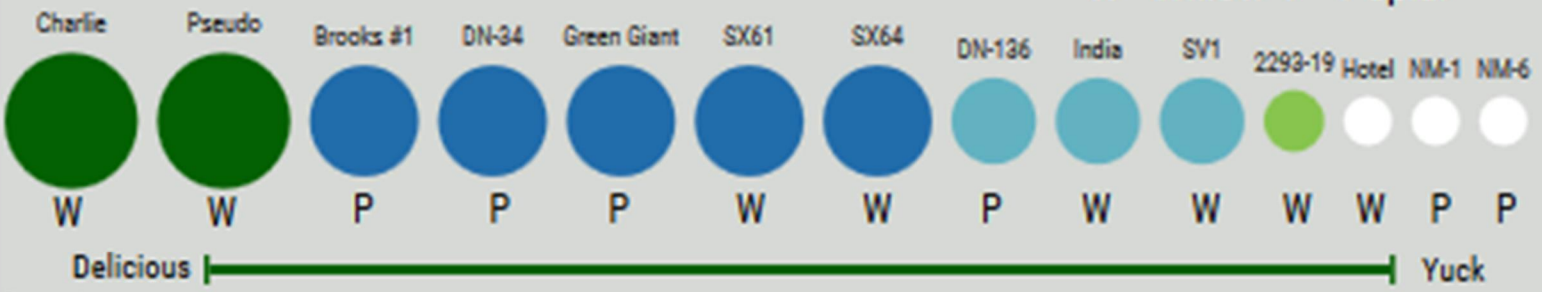
Sheep Preferences 2016

Method

Sheep were rotated through three paddocks planted with biomass-producing varieties of willow and poplar. The flock was monitored daily to determine how early and completely they browsed the new leaves and stems. The order and extent to which they ate each variety was noted, and ranked from most to least preferred. The ewes were given a mineral supplement the balance their tree based diet.The sheep were moved when forage was limited, and flock behavior changed, which was an average of 5.75 days.

Sheep Preference Ranking

W= Willow P= Poplar

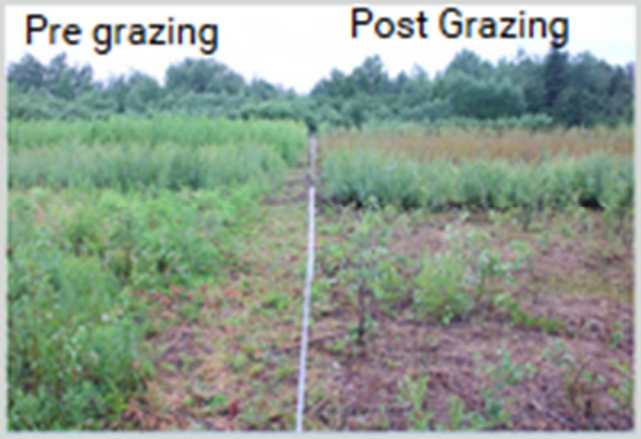


Results

When looking at the preferences, the varieties with similar genetics all seem to be grouped together:

- Charlie and Pseudo = Salix alba
- India and SV1 = Salix dasyclados
- DN-136 and DN-34 = Populus nigra
- Brooks #1, Green Giant, DN-136 and DN-34 = Populus deltoides

In addition, the trees with Populus deltoides genetics were much slower to grow back after being browsed.



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Sheep Preferences: 2015 vs. 2016

2015

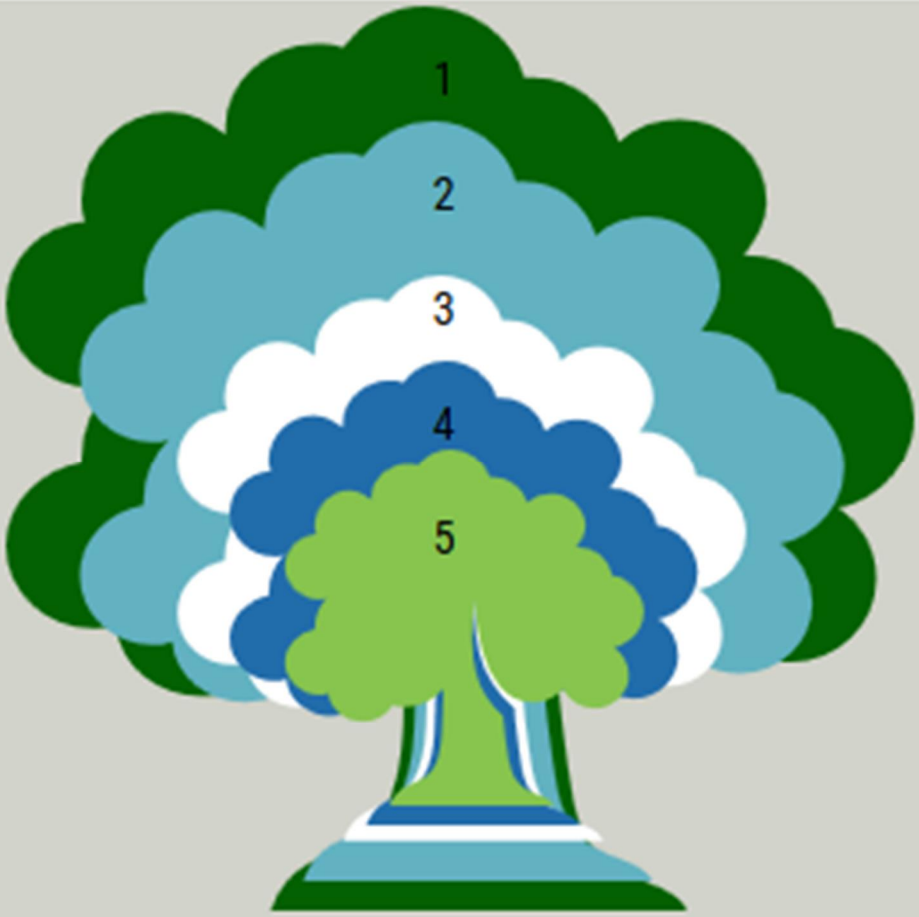
1
SX61 (Willow)
SX64 (Willow)

2
SV1(Willow)

3
Charlie (Willow)
Pseudo (Willow)

4
India (Willow)

5
2293-19 (Poplar)
DN-34 (Poplar)
DN-136 (Poplar)
Hotel (Willow)
NM-1 (Poplar)
NM-6 (Poplar)



2016

1
Charlie (Willow)
Pseudo (Willow)

2
Brooks #1 (Poplar)
DN-34 (Poplar)
Green Giant (Poplar)
SX61 (Willow)
SX64 (Willow)

3
DN-136 (Poplar)
India (Willow)
SV1 (Willow)

4
2293-19 (Poplar)

5
Hotel (Willow)
NM-1 (Poplar)
NM-6 (Poplar)

- Sheep clearly preferred willows over poplars
- Based on forage nutrient analysis, sheep seemed to prefer trees with higher calcium and avoid trees with higher copper contents

- A mineral supplement was provided to balance the diet
- Sheep no longer showed a clear preference of one tree genus over another; they instead preferred specific varieties consistently
- Based on forage analysis the sheep seemed to prefer trees with more NDFD (48hr), and selected against ADF-crude protein.

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ONTARIO Sheep MARKETING AGENCY

REGEN FORESTRY

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Research Note 2016-10-14

RFV vs. RFQ

RFV and RFQ are two different indices that let us compare different forages quickly. The RFQ has been created to overcome the weakness that the RFV has, such as the fact that two forages with the same RFV do not always perform the same. RFQ has proven to be the easier and more reliable index when looking at feed value.

Thanks to our farmers co-operators for their assistance with this project.

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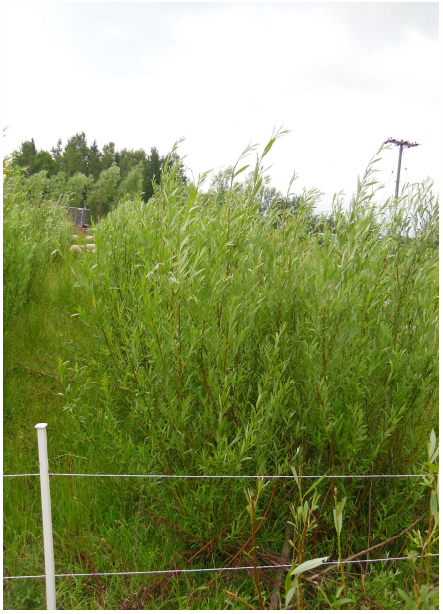
Relative Feed Value (RFV) vs. Relative Forage Quality (RFQ)

In 2007 a short rotation woody coppice plantation was established by the Canadian Forest Service to assess the potential of fast growing willow and poplar for bioenergy. A section of this plantation was fenced off in 2015. The idea of this project was to determine if willow and poplar regrowth would be an adequate food source for sheep to browse on. While suitable as short-term forage, the leaves and young stems may not have enough indigestible fibre for optimal rumen health. When the trees were analyzed, RFV and RFQ were taken into account. RFV and RFQ are two different indices that let us compare different forages quickly. RFV is a comparison to alfalfa, which is 100; other feeds may score higher or lower depending on their ADF and NDF contents, which are estimates of digestibility and dry matter intake. RFQ is a more robust calculation that factors in crude protein and fatty acid contents, as well as fibre.



Algoma Soil and Crop Improvement Association

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Cover crop to follow barley.

Underseeding vs. Broadcasting

The Algoma Soil and Crop Improvement Association conducted an on-farm assessment of establishment methods for a cover crop to follow barley.

Underseeding established better than broadcasting, and resulted in less weeds.

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The Algoma Soil and Crop Improvement Association conducted an on-farm assessment of establishment methods for a cover crop to follow barley. Located near Desbarats, the field was split into different treatments. Both areas were seeded with a forage mixture: 20% Timothy, 25% double cut red clover and 5% Alsike clover. The front of the field was broadcasted into the growing barley, and the back part of the field was underseeded at planting. After the barley came off on September 3rd, 2016, the field was observed to see which treatment established better.

Broadcasted -uneven stand establishment across area

- 0% bare ground
- 40% clovers , (red and alsike)
- 30% grass
- 20% stubble
- 10% weeds

Underseeded – even stand establishment

- 0% bare ground
- 70% clovers
- 10% grass
- 20% stubble
- 0% weeds

It was observed that underseeding was the better choice because the clover established much better and shaded the weeds out. With underseeding, there did seem to be more clover than grass in the establishment. Stand establishment was inconsistent throughout the broadcasted area. The clover was still the prominent component but there was a higher perentage of grass in broadcasting than in underseeding.

Broadcasted forage mix

Underseeded forage mix

Algoma Soil and Crop Improvement Association

Head to Head Barley Variety Trials

The Algoma Soil and Crop Improvement Association conducted an on-farm assessment of several varieties of feed barley. Farmers grew 6-row varieties AAC Mirabel, AC Encore, and HY621 and 2-row variety CDC Austenson.

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The Algoma Soil and Crop Improvement Association conducted an on-farm assessment of several varieties of feed barley. One location near Thessalon on River Road was comparing CDC Austenson and AC Encore. This field was underseeded with alfalfa, clover, and timothy. Both varieties were sprayed with Cobutox 625 and MCPA 500, and given 8-32-16 fertilizer. Across both varieties on 11 acres, yield averaged 26.35 bu/ac.

Variety	CDC Austenson	AC Encore
Plating Date	17/05/16	17/05/16
Harvest Date	First week of Sept.	First week of Sept.
Planting Rate	120 lbs/ac	120 lbs/ac
Height	46.6cm	61.7cm
Test Weight	42.74 lbs/bu	44.87 lbs/bu

Left: Encore Right: Austenson

Left: Mirabel Right: HY621

The second site on Government Road in Desbarats was comparing AAC Mirabel and HY621. Both HY621 and Mirabel were fertilized with 6-24-24 at 146lbs/ac. This plot was underseeded to a grass/clover mix at 12 lbs/ac.

Variety	AAC Mirabel	HY621-(6R)
Planting Date	13/05/16	13/05/16
Harvest Date	03/09/16	03/09/16
Planting Rate	106 lbs/ac	106 lbs/ac
Height	57.7cm	63.8cm
Test Weight	47.43 lbs/ac	49.29 lbs/ac
Yield	2760 lbs/ac (1.25 t/ac)	2800 lbs/ac (1.27 t/ac)